# Encinitas-Solana Beach Coastal Storm Damage Reduction Project

## San Diego County, California

## Volume IV (Appendices I through J)

**Appendix I** Air Quality Analysis
**Appendix J** Coordination Act Report

**U.S. Army Corps of Engineers**
**Los Angeles District**

April 2015

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# Encinitas-Solana Beach Coastal Storm Damage Reduction Project

## San Diego County, California

## Appendix I

## Air Quality Analysis

**U.S. Army Corps of Engineers**
**Los Angeles District**

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## List of Attachments

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# 1 Introduction

This technical appendix includes additional details on ambient air quality and existing air quality conditions not presented in **Section 4.6** of the Integrated Report. **Section 4.6** includes federal guidance and State regulations on Green House Gas (GHG) emissions that are applicable to the proposed action. CEQ guidance is discussed in the main report. This appendix includes additional details on regulations that address GHG emissions, but might not be directly applicable to the proposed action. In addition, modeling assumptions and outputs for the proposed action and alternatives are included in this appendix.

# 2 Air Quality

## 2.1 Ambient Air Quality

The California Air Resources Board (ARB) and the U.S. Environmental Protection Agency (EPA) focus on the following air pollutants as indicators of ambient air quality: ozone ($O_3$), carbon monoxide (CO), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less ($PM_{10}$), fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less ($PM_{2.5}$), and lead (Pb). Because these are the most prevalent air pollutants known to be deleterious to human health and extensive health-effects criteria documentation is available for these pollutants, they are commonly referred to as “criteria air pollutants.”

Health-based air quality standards have been established for these pollutants by ARB at the state level and by EPA at the national level. These standards were established to protect the public with a margin of safety from adverse health impacts due to exposure to air pollution. California has also established standards for sulfates, visibility-reducing particles, hydrogen sulfide, and vinyl chloride. A brief description of each criteria air pollutant including source types and impacts to health is provided below along with the most current monitoring station data and attainment designations for the project study areas. **Table 2.1-1** presents the California Ambient Air Quality Standards (CAAQS) and the National Ambient Air Quality Standards (NAAQS). **Table 2.1-2** presents San Diego County’s designation for both the NAAQS and CAAQS.

### *2.1.1 Ozone ($O_3$)*

$O_3$ is a colorless, odorless gas that primarily exists in the upper atmosphere (stratosphere) as the ozone layer and in the lower atmosphere (troposphere) as a pollutant. Tropospheric $O_3$ is a principal cause of lung and eye irritation in the urban environment. It is the principal component of smog, which is formed in the troposphere through a series of reactions involving reactive organic gases (ROG) and oxides of nitrogen ($NO_X$) in the presence of sunlight. Therefore, ROG and $NO_X$ are precursors of $O_3$. ROG and $NO_X$ emissions are both considered critical in $O_3$formation. Control strategies for ozone have focused on reducing these emissions from vehicles, industrial processes using solvents and coatings, and consumer products. $O_3$ concentrations are generally greatest in the summer, when atmospheric inversions are greatest and the presence of sunlight and heat is high.

**Table 2.1-1 National and California Ambient Air Quality Standards**

| Pollutant | Averaging Time | National[a] Primary[c, d] | National[a] Secondary[c, e] | California[b] Concentration[c] |
|---|---|---|---|---|
| Ozone | 1 hour | — | Same as primary standard | 0.09 ppm (180 μg/m$^3$) |
| | 8 hour | 0.075 ppm (147 μg/m$^3$) | | 0.07 ppm (137 μg/m$^3$) |
| Respirable particulate matter | 24 hour | 150 μg/m$^3$ | Same as primary standard | 50 μg/m$^3$ |
| | Annual arithmetic mean | — | | 20 μg/m$^3$ |
| Fine particulate matter | 24 hour | 35 μg/m$^3$ | Same as primary standard | No separate state standard |
| | Annual arithmetic mean | 15 μg/m$^3$ | | 12 μg/m$^3$ |
| Carbon monoxide | 8 hour | 9 ppm (10 mg/m$^3$) | None | 9 ppm (10 mg/m$^3$) |
| | 1 hour | 35 ppm (40 mg/m$^3$) | | 20 ppm (23 mg/m$^3$) |
| | 8 hour (Lake Tahoe) | — | — | 6 ppm (7 mg/m$^3$) |
| Nitrogen dioxide | Annual Arithmetic Mean | 0.053 ppm (100 μg/m$^3$) | Same as primary standard | 0.03 ppm (57 μg/m$^3$) |
| | 1 hour | 0.100 ppm | None | 0.18 ppm (339 μg/m$^3$) |
| Sulfur dioxide | Annual Arithmetic Mean | 0.03 ppm (for certain areas) | — | — |
| | 24 hour | 0.14 ppm (for certain areas) | — | 0.04 ppm (105 μg/m$^3$) |
| | 3 hour | — | 0.5 ppm (1,300 μg/m$^3$)[h] | — |
| | 1 hour | 75 ppb | — | 0.25 ppm (655 μg/m$^3$) |
| Lead[f] | 30-day average | — | — | 1.5 μg/m$^3$ |
| | Calendar quarter | 1.5 μg/m$^3$ | Same as primary standard | — |
| | Rolling 3-month average[g] | 0.15 μg/m$^3$ | | — |
| Visibility-reducing particles | 8 hour | No national standards | | Extinction coefficient of 0.23 per kilometer —visibility of 10 miles or more (0.07 to 30 miles for Lake Tahoe) because of particles when the relative humidity is less than 70%. Method: Beta attenuation and transmittance through filter tape. |
| Sulfates | 24 hour | | | 25 μg/m$^3$ |
| Hydrogen sulfide | 1 hour | | | 0.03 ppm (42 μg/m$^3$) |
| Vinyl chloride[f] | 24 hour | | | 0.01 ppm (26 μg/m$^3$) |

Notes: mg/m$^3$ = milligrams per cubic meter; $PM_{2.5}$ = fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less; $PM_{10}$ = respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less; ppm = parts per million; μg/m$^3$ = micrograms per m$^3$.

[a] National standards (other than those for ozone and particulate matter and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. For $PM_{10}$, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 μg/m$^3$ is equal to or less than 1. For $PM_{2.5}$, the 24-hour standard is attained when 98% of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact U.S. Environmental Protection Agency for further clarification and current federal policies.

[b] California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, suspended particulate matter—$PM_{10}$, $PM_{2.5}$, and visibility-reducing particles—are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

[c] Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based on a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

[d] National primary standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

[e] National secondary standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[f] The California Air Resources Board has identified lead and vinyl chloride as "toxic air contaminants" with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

[g] National lead standard, rolling 3-month average: final rule signed October 15, 2008.

[h] On June 2, 2010, a new 1-hour SO2 standard was established and the existing 24-hr and annual primary standards were revoked. To attain the 1-hr national standard, the 3-year average of the annual 99th percentile of the 1-hr daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain ineffect until implementation plans to attain or maintain the 2010 standards are approved. Note that the 1-hour national standard is in units of ppb. California standards are in units of ppm. To directly compare the 1-hr national standard to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.

**Source: ARB 2012a**

**Table 2.1-2 Air Quality Designations for San Diego County**

| Pollutant | | NAAQS Attainment Status | CAAQS Attainment Status |
|---|---|---|---|
| Ozone (O3) | 1-hour | ---- | Nonattainment (0.09 ppm) |
| | 8-hour | Nonattainment (0.075 ppm) | |
| Nitrogen Dioxide ($NO_2$) | 1-hour | Attainment (100 ppb) | Attainment (0.18 ppm) |
| | Annual Arithmetic Mean | Attainment (0.053 ppm) | Attainment (0.030 ppm) |
| Carbon Monoxide | 1-hour | Attainment (35 ppm) | Attainmetn (20 ppm) |
| | 8-hour | Attainment (9 ppm) | Attainment (9 ppm) |
| Sulfur Dioxide ($SO_2$) | 1-hour | Attainment (75 ppb) | Attainment (0.25 ppm) |
| | 24-hour | Attainment (0.14 ppm) | Attainment (0.04 ppm) |
| Respirable Particulate Matter ($PM_{10}$) | 24-hour | Attainment (150 ug/m$^3$) | Nonattainment (50 ug/m$^3$) |
| | Annual Arithmetic Mean | ---- | Attainment (20 ug/m$^3$) |
| Fine Particulate Matter ($PM_{2.5}$) | 24-hour | Attainment (35 ug/m$^3$) | --- |
| | Annual Arithmetic Mean | Unclassified (12.0 ug/m$^3$) | Nonattainment (12 ug/m$^3$) |
| Lead (Pb) | 30-day average | --- | Attainment (1.5 ug/m$^3$) |
| | Rolling 3-month average | Attainment (0.15 ug/m$^3$) | --- |

Source: San Diego Air Pollution Control District 2013 Annual Report.
http://www.sdapcd.org/info/reports/2013_annual_rpt.pdf. Accessed on November 17, 2014.

### *2.1.2 Particulate Matter (PM)*

PM is a complex mixture of extremely small particles and liquid droplets. PM is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. Natural sources of particulates include windblown dust and ocean spray. Some particles are emitted directly into the atmosphere. Others, referred to as secondary particles, result from gases that are transformed into particles through physical and chemical processes in the atmosphere.

The size of PM is directly linked to the potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects such as aggravation of respiratory and cardiovascular disease, lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems such as heart attacks and irregular heartbeat. Individuals particularly sensitive to fine particle exposure include older adults, people with heart and lung disease, and children. EPA groups PM into two categories, coarse PM or $PM_{10}$, and fine PM or $PM_{2.5}$, as described below.

Inhalable coarse particles ($PM_{10}$), such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter. Sources of coarse particles include crushing or grinding operations and dust from paved or unpaved roads. Control of $PM_{10}$ is primarily achieved through the control of dust at construction and industrial sites, the cleaning of paved roads, and the wetting or paving of frequently used unpaved roads.

$PM_{10}$ includes the subgroup of finer particles ($PM_{2.5}$), such as those found in smoke and haze, with an aerodynamic diameter of 2.5 microns or smaller. These finer particles pose an increased health risk because they can deposit deep in the lungs and contain substances that are particularly harmful to human health. Sources of fine particles include all types of combustion activities such as motor vehicles, power plants, wood burning, and certain industrial processes. $PM_{2.5}$ is the major cause of reduced visibility (haze) in California.

### *2.1.3 Carbon Monoxide (CO)*

CO is a colorless and odorless gas that, in the urban environment, is associated primarily with the incomplete combustion of fossil fuels in motor vehicles. Relatively high concentrations are typically found near crowded intersections and along heavily used roadways carrying slow-moving traffic. Even under the most severe meteorological and traffic conditions, high concentrations of CO are limited to locations within a relatively short distance (300 to 600 feet) of heavily traveled roadways. Overall, CO emissions are decreasing because of the Federal Motor Vehicle Control Program, which has mandated increasingly lower emission levels for vehicles manufactured since 1973. CO concentrations are typically higher in the winter; therefore, California has required the use of oxygenated gasoline in the winter months to reduce CO emissions.

In addition to regional CO emissions, localized CO emissions can be of concern. Vehicle traffic emissions can cause localized CO impacts and severe vehicle congestion at major signalized intersections can generate elevated CO levels, called “hotspots,” that can be hazardous to human receptors adjacent to the intersections.

### *2.1.4 Nitrogen Dioxide ($NO_2$)*

$NO_2$ is a gas that is a product of the combustion of fossil fuels generated from vehicles and stationary sources, such as power plants and boilers. $NO_2$ can cause lung damage. As noted above, $NO_2$ is a type of $NO_X$ and is a principal contributor to ozone and smog production.

### *2.1.5 Sulfur Dioxide ($SO_2$)*

$SO_2$ is a gas that is a product of the combustion of fossil fuels, with the primary source being power plants and heavy industry that utilize coal or oil as fuel. $SO_2$ is also a product of diesel engine emissions. The human health effects of $SO_2$ include lung disease and breathing problems for asthmatics. $SO_2$ in the atmosphere contributes to the formation of acid rain. In the Basin, there is relatively little combustion of coal and oil; therefore, $SO_2$ is less of a concern than in other parts of the country.

### *2.1.6 Lead (Pb)*

Lead is a highly toxic metal that may cause a range of human health effects. Lead anti-knock additives in gasoline represent a major source of Lead emissions to the atmosphere. However, Lead emissions have significantly decreased due to the near elimination of leaded gasoline use. Lead-based paint, banned or limited by EPA in the 1980s, is a health hazard when it deteriorates by peeling, chipping, or cracking; or generates lead dust when scraped, sanded, or heated.

## 2.2 Existing Air Quality

Ambient air pollutant concentrations in the SDAB are measured at 10 air quality monitoring stations operated by the SDAPCD. The closest and most representative SDAPCD air quality monitoring station to the project site is the Del Mar monitoring station, located at 215 9th St in Del Mar, CA. However, that monitoring station only collects data on concentrations of $O_3$. The closest monitoring station with complete data is the Escondido monitoring station, located at 600 East Valley Parkway in Escondido, California. The Escondido station is in an urbanized area located inland, and therefore, may not completely represent the existing conditions at the project site, especially for CO, $PM_{10}$, and $PM_{2.5,}$ which are pollutants attributable to local emission sources. Table 2 presents the most recent data over the past four years from the Del Mar and Escondido monitoring stations as summaries of the exceedances of standards and the highest pollutant levels recorded for years 2008 through 2010 as show in **Table 2.2-1**.

**Table 2.2-1 Ambient Air Quality Summary – Del Mar and Escondido Monitoring Stations**

| **Pollutant Standards** | | **2008** | **2009** | **2010** |
|---|---|---|---|---|
| **Carbon Monoxide (CO)** | | | | |
| National maximum 8-hour concentration (ppm) | | 2.81 | 3.24 | 2.46 |
| State maximum 8-hour concentration (ppm) | | 2.81 | 3.54 | 2.46 |
| State maximum 1-hour concentration (ppm) | | 5.7 | 5.2 | 4.6 |
| Number of Days Standard Exceeded | | | | |
| NAAQS 8-hour (>9.0 ppm) | | 0 | 0 | 0 |
| CAAQS 8-hour (>9.0 ppm) | | 0 | 0 | 0 |
| CAAQS 1-hour (>20.0 ppm) | | 0 | 0 | 0 |
| **Nitrogen Dioxide ($NO_2$)** | | | | |
| State maximum 1-hour concentration (ppm) | | 0.081 | 0.073 | 0.064 |
| Annual Average (ppm) | | 0.018 | 0.016 | 0.014 |
| Number of Days Standard Exceeded | | | | |
| CAAQS 1-hour | | 0 | 0 | 0 |
| **Ozone** | | | | |
| State max 1-hour concentration (ppm) | | 0.117 | 0.097 | 0.085 |
| National maximum 8-hour concentration (ppm) | | 0.078 | 0.084 | 0.072 |
| Number of Days Standard Exceeded | | | | |
| CAAQS 1-hour (>0.09 ppm) | | 2 | 1 | 0 |
| CAAQS 8- hour (>0.070 ppm)/ NAAQS 8-hour (>0.075 ppm) | | 11/3 | 3/1 | 2/0 |
| **Particulate Matter ($PM_{10}$)** | | | | |
| National maximum 24-hour concentration ($\mu g/m^3$) | | 82.0 | 73.0 | 42.0 |
| State maximum 24-hour concentration ($\mu g/m^3$) | | 84.0 | 74.0 | 43.0 |
| State annual average concentration ($\mu g/m^3$) | | * | 24.6 | 21.0 |
| Estimated Number of Days Standard Exceeded | | | | |
| NAAQS 24-hour (>150 $\mu g/m^3$) | | 0 | 0 | 0 |
| CAAQS 24-hour (>50 $\mu g/m^3$) | | 1 | 1 | 0 |
| **Particulate Matter ($PM_{2.5}$** | | | | |
| National maximum 24-hour concentration ($\mu g/m^3$) | | 44.0 | 78.3 | 48.4 |
| State maximum 24-hour concentration ($\mu g/m^3$) | | 44.0 | 78.4 | 52.2 |
| National annual average concentration ($\mu g/m^3$) | | * | 13.4 | 12.2 |
| State annual average concentration ($\mu g/m^3$) | | 12.4 | * | * |
| Estimated Number of Days Standard Exceeded | | | | |
| NAAQS 24-hour (>65 $\mu g/m^3$) | | 3 | 2 | 2 |

Notes:
* Data unavailable
ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter
Source: ARB 2011

# 3 Greenhouse Gases

This section describes the existing regulatory framework surrounding GHG emissions.

## 3.1 Federal Plans, Policies, Regulations, and Laws

### *3.1.1 Proposed Endangerment and Cause or Contribute Findings for GHG under the CAA*

On December 7, 2009, USEPA signed two distinct findings regarding greenhouse gases under section 202(a) of the Clean Air Act:

- **Endangerment Finding:** The Administrator finds that the current and projected concentrations of the six key well-mixed greenhouse gases—$CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, and $SF_6$—in the atmosphere threaten the public health and welfare of current and future generations.

- **Cause or Contribute Finding:** The Administrator finds that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the greenhouse gas pollution which threatens public health and welfare.

These findings do not themselves impose any requirements on industry or other entities. However, this action is a prerequisite to finalizing USEPA's proposed GHG emission standards for light-duty vehicles, which USEPA proposed in a joint proposal including the Department of Transportation's (DOT) proposed Corporate Average Fuel Economy (CAFE) standards on September 15, 2009. In April 2010, the DOT and USEPA established greenhouse gas emission and fuel economy standards for model year 2012-2016 light-duty cars and trucks. On November 16, 2011, the DOT and USEPA proposed stringent federal greenhouse gas and fuel economy standards for model year 2017-2025 passenger cars and light-duty trucks. In addition to the standards for light-duty vehicles, the DOT and USEPA announced standards to reduce GHG emissions and improve the fuel efficiency of heavy-duty trucks and buses on August 9, 2011.

### *3.1.2 Mandatory Greenhouse Gas Reporting Rule*

On September 22, 2009, USEPA published the Final Mandatory Greenhouse Gas Reporting Rule (Reporting Rule) in the Federal Register. The Reporting Rule requires reporting of GHG data and other relevant information from fossil fuel and industrial GHG suppliers, vehicle and engine manufacturers, and all facilities that would emit 25,000 MT or more of $CO_2e$ per year. Facility owners are required to submit an annual report with detailed calculations of facility GHG emissions due on March 31 for emissions in the previous calendar year. The Reporting Rule would also mandate recordkeeping and administrative requirements to enable USEPA to verify the annual GHG emissions reports. Owners of existing facilities that commenced operation prior to January 1, 2011, are required to submit an annual report for calendar year 2011.

## 3.2 State Plans, Policies, Regulations, and Laws

ARB is the agency responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the California Clean Air Act (CCAA).

### *3.2.1 Assembly Bill (AB) 1493*

AB 1493, signed in 2002, required that ARB develop and adopt by January 1, 2005, regulations that achieve “the maximum feasible reduction of greenhouse gases emitted by passenger vehicles and light-duty trucks and other vehicles determined by ARB to be vehicles whose primary use is noncommercial personal transportation in the state.”

In 2004, ARB adopted standards requiring automobile manufacturers to meet fleet-average GHG emissions limits for all passenger cars, light-duty trucks within various weight criteria, and medium-duty passenger vehicle weight classes (i.e., any medium-duty vehicle with a gross vehicle weight rating less than 10,000 pounds that is designed primarily for the transportation of persons), and beginning with the 2009 model year. For passenger cars and light-duty trucks, the GHG emission limits for the 2016 model year are approximately 37 percent lower than the limits for the first year of the regulations, the 2009 model year. Before the regulations could go into effect, US EPA had to grant California a waiver under the CAA, allowing California to regulate GHG emissions from motor vehicles within the state. USEPA granted the waiver in 2009.

In the fall of 2010, California accepted compliance with the federal GHG standards as meeting similar state standards as adopted in 2004, resulting in the first coordinated national program.

### *3.2.2 Executive Order S-3-05*

Executive Order S-3-05, signed in June 2005, proclaimed that the State of California is vulnerable to the impacts of climate change. Executive Order S-3-05 declared that increased temperatures could reduce the Sierra Nevada’s snowpack, further exacerbate California’s air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total GHG emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80percent below the 1990 level by 2050.

Executive Order S-3-05 directed the Secretary of Cal/EPA to coordinate a multi-agency effort to reduce GHG emissions to the target levels and to submit biannual reports to the Governor and the State Legislature describing progress made toward reaching the emission targets, impacts of global warming on California’s resources, and mitigation and adaptation plans to combat these impacts. The Secretary of Cal/EPA created the California Climate Action Team (CCAT), made up of members from various state agencies and commissions, which responsible for implementing global warming emissions reduction programs. CCAT is also responsible for reporting on the progress made toward meeting the statewide GHG targets.

### *3.2.3 Executive Order S-1-07*

Executive Order S-1-07, signed in 2007, establishes a goal that the carbon intensity of transportation fuels sold in California should be reduced by a minimum of 10percent by 2020. ARB identified this Low Carbon Fuel Standard (LCFS) as a discrete early action item under AB 32, and the final ARB resolution (No. 09-31) was issued on April 23, 2009.

# Attachment I1 Alternative EN-1A Emissions

EN 1A - Low Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 4.37 | 31.77 | 23.99 | | 1.61 | 1.48 | 3,796 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15,326.46 | 0.61 | 5.74 | 2.43 | 0.01 | 0.75 | 0.44 | 720 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.00 | 0.02 | 0.05 | 0.00 | 0.00 | 0.00 | 15 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 | 0.61 | 5.76 | 2.48 | 0.01 | 0.76 | 0.44 | 4,531 |
| Amortized Construction | | | | | | | | | | | | | | 906 |

EN-1A - High Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 4.69 | 34.10 | 25.75 | | 1.73 | 1.59 | 4,074 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15,326.46 | 0.65 | 6.07 | 2.57 | 0.01 | 0.80 | 0.47 | 761 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.00 | 0.02 | 0.05 | 0.00 | 0.00 | 0.00 | 15 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 | 0.65 | 6.10 | 2.62 | 0.01 | 0.80 | 0.47 | 4,851 |
| Amortized Construction | | | | | | | | | | | | | | 970 |

EN -1A - Low Sea Level

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 6.22 | 44.98 | 25.61 | 0.08 | 8.15 | 2.60 | 7,219.52 |
| On-Road Motor Vehicles | 0.10 | 2.03 | 0.61 | 0.01 | 0.11 | 0.06 | 797.79 |
| *Total On-Shore Emissions* | 6.32 | 47.01 | 26.22 | 0.09 | 8.26 | 2.66 | 8,017.32 |

EN-1A - High Sea Level

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 6.22 | 44.98 | 25.61 | 0.08 | 8.15 | 2.60 | 7219.52 |
| On-Road Motor Vehicles | 0.10 | 2.03 | 0.61 | 0.01 | 0.11 | 0.06 | 797.79 |
| *Total On-Shore Emissions* | 6.32 | 47.01 | 26.22 | 0.09 | 8.26 | 2.66 | 8,017.32 |

## Alternative EN-1A - Construction - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| *Off-road Mobile Sources* | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| *Fugitive Dust* | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-1A - Construction - Low Sea Level

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | | | 15,326.46 | 1.07 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | 6.28 | 0.88 | 15,326.46 | 1.07 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **11.84** | **111.42** | **47.17** | **0.15** | | | **10.45** | **4.71** | **15,326.46** | **1.07** | **lbs/day** |

Emissions Summary

| Project Length | Work Days |
|---|---|
| | 103 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 820,000 | 82 | 103 | 1,180,000 | 118 | 139 | ######## | 200 | 242 |
| HSL | 880,000 | 88 | 109 | 1,970,000 | 197 | 218 | ######## | 285 | 327 |

## Alternative EN-1A - Construction - Low Sea Level

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.21 | 2.49 | 0.86 | 0.00 | 0.07 | 0.07 | - | - | 388 | 0.0171 | tons |
| Loader | 1 | 12 | | 0.06 | 0.48 | 0.29 | 0.00 | 0.03 | 0.02 | - | - | 61 | 0.0053 | tons |
| Dozer | 2 | 12 | | 0.34 | 2.76 | 1.29 | 0.00 | 0.11 | 0.11 | - | - | 269 | 0.0276 | tons |
| | | | | 0.61 | 5.74 | 2.43 | 0.01 | 0.21 | 0.20 | | | 718.27 | 0.05 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.61 | 5.74 | 2.43 | 0.01 | 0.21 | 0.20 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.61** | **5.74** | **2.43** | **0.01** | **0.75** | **0.44** | **0.54** | **0.24** | **718** | **0.050** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **720** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative EN-1A - Construction - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 82.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 4.37 | 31.77 | 23.99 | 1.61 | 1.48 | 3,796 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-1A - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 103 | 41,200 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 28 | 40 | 560 | 105 | 41,520 | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-1A - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 103 | 41,200 | 0.00 | 0.019 | 0.05 | 0.00 | 0.00 | 0.00 | 15 | 14 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 28 | 40 | 560 | 105 | 41,520 | 0.00 | 0.02 | 0.05 | 0.00 | 0.00 | 0.00 | 16.05 | 14.60 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative EN-1A - Operations - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.08 | 0.47 | 0.44 | 0.001 | 0.02 | 0.02 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.21 | 1.58 | 0.80 | 0.002 | 0.06 | 0.06 | - | - | 239.08 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-1A - Operations - Low S

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
| | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.23 | 1.43 | 1.11 | 0.00 | 0.07 | 0.07 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.90 | 5.70 | 5.29 | 0.01 | 0.28 | 0.26 | - | - | 1,303 | 0.08 | lbs/day |
| Dozer | 2 | 12 | 5.08 | 37.85 | 19.21 | 0.06 | 1.51 | 1.39 | - | - | 5,738 | 0.46 | lbs/day |
| | | | 6.22 | 44.98 | 25.61 | 0.08 | 1.87 | 1.72 | | | 7,219.52 | 0.56 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 6.22 | 44.98 | 25.61 | 0.08 | 1.87 | 1.72 | 6.28 | 0.88 | 7,219.52 | 0.56 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **6.22** | **44.98** | **25.61** | **0.08** | | | **8.15** | **2.60** | **7,219.52** | **0.56** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 55 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 340,000 | 34 | 55 | 500,000 | 50 | 71 | 840,000 | 84 | 126 |
| HSL | 400,000 | 40 | 61 | 960,000 | 96 | 117 | ######## | 136 | 178 |

## Alternative EN-1A - Operations - Low S

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 | - | - | 4 | 0.0005 | tons |
| Loader | 1 | 12 | | 0.02 | 0.16 | 0.15 | 0.00 | 0.01 | 0.01 | - | - | 33 | 0.0020 | tons |
| Dozer | 2 | 12 | | 0.14 | 1.04 | 0.53 | 0.00 | 0.04 | 0.04 | - | - | 144 | 0.0115 | tons |
| | | | | 0.17 | 1.24 | 0.70 | 0.00 | 0.05 | 0.05 | | | 180.67 | 0.01 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.17 | 1.24 | 0.70 | 0.00 | 0.05 | 0.05 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.17** | **1.24** | **0.70** | **0.00** | | | **0.22** | **0.07** | **181** | **0.014** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **181** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

## Alternative EN-1A - Operations - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Operating Days Per Year | 34.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.47 | 3.47 | 9.95 | 0.08 | 0.07 | 1,730 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-1A - Operations - Low Sea Level Rise

**On-Road Construction Emissions**

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 55 | 22,000 | 0.02 | 0.55 | 0.25 | 0.00 | 0.05 | 0.02 | 251 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 1.48 | 0.36 | 0.01 | 0.06 | 0.04 | 547 |
| Total | 28 | 40 | 560 | 57 | 22,320 | 0.10 | 2.03 | 0.61 | 0.01 | 0.11 | 0.06 | 797.79 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-1A - Operations - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 55 | 22,000 | 0.00 | 0.015 | 0.01 | 0.00 | 0.00 | 0.00 | 7 | 6 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 28 | 40 | 560 | 57 | 22,320 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 7.45 | 6.78 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

## Alternative EN-1A - Construction - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-1A - Construction - High Sea Leve

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | | | 15,326.46 | 1.07 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | 6.28 | 0.88 | 15,326.46 | 1.07 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **11.84** | **111.42** | **47.17** | **0.15** | | | **10.45** | **4.71** | **15,326.46** | **1.07** | **lbs/day** |

| Project Length | Work Days |
|---|---|
| | 109 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 820,000 | 82 | 103 | 1,180,000 | 118 | 139 | ######## | 200 | 242 |
| HSL | 880,000 | 88 | 109 | 1,970,000 | 197 | 218 | ######## | 285 | 327 |

## Alternative EN-1A - Construction - High Sea Leve

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.22 | 2.64 | 0.91 | 0.00 | 0.08 | 0.07 | - | - | 411 | 0.0181 | tons |
| Loader | 1 | 12 | | 0.07 | 0.51 | 0.30 | 0.00 | 0.03 | 0.03 | - | - | 65 | 0.0056 | tons |
| Dozer | 2 | 12 | | 0.36 | 2.92 | 1.36 | 0.00 | 0.12 | 0.11 | - | - | 285 | 0.0292 | tons |
| | | | | 0.65 | 6.07 | 2.57 | 0.01 | 0.23 | 0.21 | | | 760.12 | 0.05 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.65 | 6.07 | 2.57 | 0.01 | 0.23 | 0.21 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.65** | **6.07** | **2.57** | **0.01** | **0.80** | **0.47** | **0.57** | **0.26** | **760** | **0.053** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **761** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative EN-1A - Construction - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 88.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 4.69 | 34.10 | 25.75 | 1.73 | 1.59 | 4,074 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-1A - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 109 | 43,600 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 28 | 40 | 560 | 111 | 43,920 | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-1A - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 109 | 43,600 | 0.00 | 0.020 | 0.05 | 0.00 | 0.00 | 0.00 | 16 | 15 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 28 | 40 | 560 | 111 | 43,920 | 0.00 | 0.02 | 0.05 | 0.00 | 0.00 | 0.00 | 16.95 | 15.42 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

# Alternative EN-1A - Operations - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.08 | 0.47 | 0.44 | 0.001 | 0.02 | 0.02 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.21 | 1.58 | 0.80 | 0.002 | 0.06 | 0.06 | - | - | 239.08 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-1A - Operations - High

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.23 | 1.43 | 1.11 | 0.00 | 0.07 | 0.07 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.90 | 5.70 | 5.29 | 0.01 | 0.28 | 0.26 | - | - | 1,303 | 0.08 | lbs/day |
| Dozer | 2 | 12 | 5.08 | 37.85 | 19.21 | 0.06 | 1.51 | 1.39 | - | - | 5,738 | 0.46 | lbs/day |
| | | | 6.22 | 44.98 | 25.61 | 0.08 | 1.87 | 1.72 | | | 7,219.52 | 0.56 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 6.22 | 44.98 | 25.61 | 0.08 | 1.87 | 1.72 | 6.28 | 0.88 | 7,219.52 | 0.56 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **6.22** | **44.98** | **25.61** | **0.08** | | | **8.15** | **2.60** | **7,219.52** | **0.56** | **lbs/day** |

| **Project Length** | **Workdays** |
|---|---|
| | 61 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 340,000 | 34 | 55 | 500,000 | 50 | 71 | 840,000 | 84 | 126 |
| HSL | 400,000 | 40 | 61 | 960,000 | 96 | 117 | ######## | 136 | 178 |

## Alternative EN-1A - Operations - High

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 | - | - | 5 | 0.0006 | tons |
| Loader | 1 | 12 | | 0.03 | 0.17 | 0.16 | 0.00 | 0.01 | 0.01 | - | - | 36 | 0.0023 | tons |
| Dozer | 2 | 12 | | 0.16 | 1.15 | 0.59 | 0.00 | 0.05 | 0.04 | - | - | 159 | 0.0127 | tons |
| | | | | 0.19 | 1.37 | 0.78 | 0.00 | 0.06 | 0.05 | | | 200.38 | 0.02 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.19 | 1.37 | 0.78 | 0.00 | 0.06 | 0.05 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.19** | **1.37** | **0.78** | **0.00** | | | **0.25** | **0.08** | **200** | **0.016** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **201** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

# Alternative EN-1A - Operations - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |

Operating Days Per Year 40.0

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.56 | 4.08 | 11.70 | 0.09 | 0.09 | 2,035 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-1A - Operations - High Sea Level Rise

### On-Road Construction Emissions

| | | | | | | Total Daily Emissions (lbs) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
| Worker Trips | 20 | 20 | 400 | 61 | 24,400 | 0.02 | 0.55 | 0.25 | 0.00 | 0.05 | 0.02 | 251 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 1.48 | 0.36 | 0.01 | 0.06 | 0.04 | 547 |
| Total | 28 | 40 | 560 | 63 | 24,720 | 0.10 | 2.03 | 0.61 | 0.01 | 0.11 | 0.06 | 797.79 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-1A - Operations - High Sea Level Rise

**On-Road Construction Emissions**

| | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 61 | 24,400 | 0.00 | 0.017 | 0.01 | 0.00 | 0.00 | 0.00 | 8 | 7 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 28 | 40 | 560 | 63 | 24,720 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 8.21 | 7.47 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

**San Diego 2015 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED | POP | VMT | TRIPS | ROG_RUNEX | CO_RUNEX | NOX_RUNEX | CO2_RUNEX | PM10_Total | PM2_5_Total | SOX_RUNEX | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (Miles/hr) | (Vehicles) | (Miles/day) | (Trips/day) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) |
| LDA | GAS | AllMYr | AllSpeeds | 1,169,183 | 42,600,783.75 | 7,361,743.79 | 0.045 | 1.290 | 0.136 | 302.103 | 0.047 | 0.019 | 0.004 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,466 | 179,216.55 | 31,712.66 | 0.038 | 0.215 | 0.576 | 315.879 | 0.072 | 0.043 | 0.004 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 172,849 | 6,187,162.79 | 1,061,257.19 | 0.075 | 2.505 | 0.269 | 357.183 | 0.048 | 0.021 | 0.004 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 210 | 6,179.81 | 1,102.01 | 0.066 | 0.312 | 0.691 | 314.863 | 0.099 | 0.068 | 0.004 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 423,444 | 16,224,268.59 | 2,675,454.93 | 0.037 | 1.498 | 0.192 | 432.459 | 0.047 | 0.019 | 0.005 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 187 | 5,978.69 | 1,021.81 | 0.046 | 0.252 | 0.690 | 323.109 | 0.080 | 0.050 | 0.004 | | |
| Average | | | | | | | 0.051 | 1.012 | 0.426 | 340.933 | 0.066 | 0.037 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED | POP | VMT | TRIPS | ROG_RUNEX | CO_RUNEX | NOX_RUNEX | CO2_RUNEX | PM10_Total | PM2_5_Total | SOX_RUNEX | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (Miles/hr) | (Vehicles) | (Miles/day) | (Trips/day) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) |
| T7 tractor | DSL | AllMYr | AllSpeeds | 2,454 | 392,614.49 | 0 | 0.296 | 1.343 | 8.984 | 1699.527 | 0.231 | 0.158 | 0.017 | | |

Source: EMFAC 2011

**San Diego 2020 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,261,438 | 46,436,329 | 7,971,039 | 0.03 | 0.10 | 0.83 | 244.16 | 0.05 | 0.02 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,897 | 203,726 | 36,279 | 0.02 | 0.39 | 0.13 | 265.72 | 0.06 | 0.03 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 186,176 | 6,674,684 | 1,134,440 | 0.04 | 0.17 | 1.56 | 297.84 | 0.05 | 0.02 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 226 | 8,187 | 1,308 | 0.03 | 0.45 | 0.17 | 259.42 | 0.07 | 0.04 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 450,141 | 17,355,693 | 2,832,803 | 0.02 | 0.11 | 0.93 | 364.76 | 0.05 | 0.02 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 199 | 7,528 | 1,228 | 0.02 | 0.47 | 0.14 | 280.32 | 0.06 | 0.03 | 0.00 | | |
| Average | | | | | | | 0.026 | 0.283 | 0.626 | 285.370 | 0.055 | 0.027 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,262 | 531,839 | - | 0.22 | 1.02 | 4.20 | 1553.04 | 0.18 | 0.11 | 0.02 | | |

Source: EMFAC 2011

## 2015 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0155 | 0.0486 | 0.0902 | 0.0001 | 0.0046 | 0.0042 | 11.0 | 0.0014 |
| | 50 | 0.0480 | 0.1641 | 0.1699 | 0.0003 | 0.0129 | 0.0119 | 19.6 | 0.0043 |
| | 120 | 0.0460 | 0.2377 | 0.3272 | 0.0004 | 0.0246 | 0.0226 | 38.1 | 0.0042 |
| | 500 | 0.1026 | 0.4261 | 1.2422 | 0.0021 | 0.0368 | 0.0339 | 213 | 0.0093 |
| | 750 | 0.1912 | 0.7702 | 2.3263 | 0.0039 | 0.0680 | 0.0626 | 385 | 0.0173 |
| Aerial Lifts Composite | | 0.0439 | 0.1837 | 0.2670 | 0.0004 | 0.0167 | 0.0154 | 34.7 | 0.0040 |
| Air Compressors | 15 | 0.0108 | 0.0466 | 0.0664 | 0.0001 | 0.0040 | 0.0037 | 7.2 | 0.0010 |
| | 25 | 0.0229 | 0.0681 | 0.1247 | 0.0002 | 0.0069 | 0.0064 | 14.4 | 0.0021 |
| | 50 | 0.0747 | 0.2360 | 0.2056 | 0.0003 | 0.0183 | 0.0168 | 22.3 | 0.0067 |
| | 120 | 0.0691 | 0.3182 | 0.4334 | 0.0006 | 0.0375 | 0.0345 | 47.0 | 0.0062 |
| | 175 | 0.0903 | 0.5019 | 0.7101 | 0.0010 | 0.0388 | 0.0357 | 88.5 | 0.0082 |
| | 250 | 0.0892 | 0.2803 | 0.9294 | 0.0015 | 0.0286 | 0.0263 | 131 | 0.0080 |
| | 500 | 0.1463 | 0.4915 | 1.4297 | 0.0023 | 0.0470 | 0.0432 | 232 | 0.0132 |
| | 750 | 0.2285 | 0.7595 | 2.2932 | 0.0036 | 0.0743 | 0.0683 | 358 | 0.0206 |
| | 1000 | 0.3551 | 1.1843 | 4.4558 | 0.0049 | 0.1239 | 0.1140 | 486 | 0.0320 |
| Air Compressors Composite | | 0.0773 | 0.3257 | 0.5175 | 0.0007 | 0.0357 | 0.0329 | 63.6 | 0.0070 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1220 | 0.0002 | 0.0047 | 0.0043 | 16.0 | 0.0017 |
| | 50 | 0.0234 | 0.2235 | 0.2240 | 0.0004 | 0.0075 | 0.0069 | 31.0 | 0.0021 |
| | 120 | 0.0376 | 0.4676 | 0.3736 | 0.0009 | 0.0160 | 0.0148 | 77.1 | 0.0034 |
| | 175 | 0.0618 | 0.7540 | 0.5364 | 0.0016 | 0.0198 | 0.0182 | 141 | 0.0056 |
| | 250 | 0.0681 | 0.3425 | 0.4900 | 0.0021 | 0.0144 | 0.0132 | 188 | 0.0061 |
| | 500 | 0.1118 | 0.5511 | 0.7692 | 0.0031 | 0.0236 | 0.0217 | 311 | 0.0101 |
| | 750 | 0.2212 | 1.0888 | 1.5301 | 0.0062 | 0.0466 | 0.0429 | 615 | 0.0200 |
| | 1000 | 0.3562 | 1.6528 | 4.9704 | 0.0093 | 0.1194 | 0.1098 | 928 | 0.0321 |
| Bore/Drill Rigs Composite | | 0.0673 | 0.5022 | 0.6138 | 0.0017 | 0.0200 | 0.0184 | 165 | 0.0061 |
| Cement and Mortar Mixers | 15 | 0.0074 | 0.0386 | 0.0464 | 0.0001 | 0.0019 | 0.0018 | 6.3 | 0.0007 |
| | 25 | 0.0251 | 0.0782 | 0.1456 | 0.0002 | 0.0074 | 0.0068 | 17.6 | 0.0023 |
| Cement and Mortar Mixers Composite | | 0.0088 | 0.0419 | 0.0545 | 0.0001 | 0.0024 | 0.0022 | 7.2 | 0.0008 |
| Concrete/Industrial Saws | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0782 | 0.2745 | 0.2652 | 0.0004 | 0.0206 | 0.0189 | 30.2 | 0.0071 |
| | 120 | 0.0892 | 0.4759 | 0.6249 | 0.0009 | 0.0486 | 0.0448 | 74.1 | 0.0080 |
| | 175 | 0.1340 | 0.8674 | 1.1593 | 0.0018 | 0.0585 | 0.0538 | 160 | 0.0121 |
| Concrete/Industrial Saws Composite | | 0.0835 | 0.3982 | 0.4921 | 0.0007 | 0.0374 | 0.0345 | 58.5 | 0.0075 |
| Cranes | 50 | 0.0853 | 0.2729 | 0.2235 | 0.0003 | 0.0202 | 0.0186 | 23.2 | 0.0077 |
| | 120 | 0.0800 | 0.3559 | 0.4822 | 0.0006 | 0.0415 | 0.0382 | 50.1 | 0.0072 |
| | 175 | 0.0919 | 0.4794 | 0.6684 | 0.0009 | 0.0378 | 0.0348 | 80.3 | 0.0083 |
| | 250 | 0.0925 | 0.2713 | 0.8284 | 0.0013 | 0.0286 | 0.0263 | 112 | 0.0083 |
| | 500 | 0.1393 | 0.4663 | 1.1812 | 0.0018 | 0.0426 | 0.0392 | 180 | 0.0126 |
| | 750 | 0.2358 | 0.7835 | 2.0490 | 0.0030 | 0.0729 | 0.0671 | 303 | 0.0213 |
| | 9999 | 0.8682 | 2.8913 | 9.2743 | 0.0098 | 0.2775 | 0.2553 | 971 | 0.0783 |
| Cranes Composite | | 0.1204 | 0.4395 | 1.0200 | 0.0014 | 0.0426 | 0.0392 | 129 | 0.0109 |
| Crawler Tractors | 50 | 0.1017 | 0.3087 | 0.2464 | 0.0003 | 0.0232 | 0.0214 | 24.9 | 0.0092 |
| | 120 | 0.1143 | 0.4774 | 0.6815 | 0.0008 | 0.0579 | 0.0533 | 65.8 | 0.0103 |
| | 175 | 0.1509 | 0.7384 | 1.0951 | 0.0014 | 0.0614 | 0.0565 | 121 | 0.0136 |
| | 250 | 0.1582 | 0.4614 | 1.3531 | 0.0019 | 0.0514 | 0.0473 | 166 | 0.0143 |
| | 500 | 0.2300 | 0.8352 | 1.8987 | 0.0025 | 0.0732 | 0.0673 | 259 | 0.0207 |
| | 750 | 0.4140 | 1.4936 | 3.4863 | 0.0047 | 0.1327 | 0.1221 | 465 | 0.0374 |
| | 1000 | 0.6278 | 2.3640 | 6.6574 | 0.0066 | 0.2075 | 0.1909 | 658 | 0.0566 |
| Crawler Tractors Composite | | 0.1415 | 0.5650 | 1.0059 | 0.0013 | 0.0594 | 0.0546 | 114 | 0.0128 |
| Crushing/Proc. Equipment | 50 | 0.1392 | 0.4644 | 0.4024 | 0.0006 | 0.0346 | 0.0318 | 44.0 | 0.0126 |
| | 120 | 0.1167 | 0.5646 | 0.7374 | 0.0010 | 0.0629 | 0.0579 | 83.1 | 0.0105 |
| | 175 | 0.1654 | 0.9559 | 1.2783 | 0.0019 | 0.0700 | 0.0644 | 167 | 0.0149 |
| | 250 | 0.1646 | 0.5171 | 1.6355 | 0.0028 | 0.0506 | 0.0466 | 245 | 0.0149 |
| | 500 | 0.2358 | 0.7790 | 2.1722 | 0.0037 | 0.0722 | 0.0664 | 374 | 0.0213 |
| | 750 | 0.3723 | 1.2184 | 3.5561 | 0.0059 | 0.1154 | 0.1062 | 589 | 0.0336 |
| | 9999 | 0.9726 | 3.0901 | 11.5626 | 0.0131 | 0.3225 | 0.2967 | 1,308 | 0.0878 |
| Crushing/Proc. Equipment Composite | | 0.1465 | 0.6549 | 0.9893 | 0.0015 | 0.0607 | 0.0558 | 132 | 0.0132 |
| Dumpers/Tenders | 25 | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Dumpers/Tenders Composite | | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0650 | 0.2683 | 0.2256 | 0.0003 | 0.0167 | 0.0154 | 25.0 | 0.0059 |
| | 120 | 0.0912 | 0.5102 | 0.5787 | 0.0009 | 0.0455 | 0.0418 | 73.6 | 0.0082 |
| | 175 | 0.1052 | 0.6653 | 0.7408 | 0.0013 | 0.0405 | 0.0372 | 112 | 0.0095 |

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1117 | 0.3431 | 0.8935 | 0.0018 | 0.0297 | 0.0273 | 159 | 0.0101 |
| | 500 | 0.1577 | 0.4964 | 1.1619 | 0.0023 | 0.0413 | 0.0380 | 234 | 0.0142 |
| | 750 | 0.2630 | 0.8225 | 1.9926 | 0.0039 | 0.0698 | 0.0642 | 387 | 0.0237 |
| Excavators Composite | | 0.1064 | 0.5248 | 0.7416 | 0.0013 | 0.0379 | 0.0349 | 120 | 0.0096 |
| Forklifts | 50 | 0.0324 | 0.1522 | 0.1324 | 0.0002 | 0.0092 | 0.0084 | 14.7 | 0.0029 |
| | 120 | 0.0345 | 0.2143 | 0.2326 | 0.0004 | 0.0174 | 0.0160 | 31.2 | 0.0031 |
| | 175 | 0.0486 | 0.3316 | 0.3442 | 0.0006 | 0.0189 | 0.0174 | 56.1 | 0.0044 |
| | 250 | 0.0518 | 0.1582 | 0.4040 | 0.0009 | 0.0133 | 0.0122 | 77.1 | 0.0047 |
| | 500 | 0.0724 | 0.2164 | 0.5170 | 0.0011 | 0.0185 | 0.0171 | 111 | 0.0065 |
| Forklifts Composite | | 0.0459 | 0.2200 | 0.3163 | 0.0006 | 0.0156 | 0.0143 | 54.4 | 0.0041 |
| Generator Sets | 15 | 0.0135 | 0.0658 | 0.0929 | 0.0002 | 0.0051 | 0.0047 | 10.2 | 0.0012 |
| | 25 | 0.0247 | 0.0831 | 0.1522 | 0.0002 | 0.0080 | 0.0074 | 17.6 | 0.0022 |
| | 50 | 0.0706 | 0.2465 | 0.2628 | 0.0004 | 0.0193 | 0.0178 | 30.6 | 0.0064 |
| | 120 | 0.0910 | 0.4811 | 0.6607 | 0.0009 | 0.0484 | 0.0445 | 77.9 | 0.0082 |
| | 175 | 0.1120 | 0.7350 | 1.0463 | 0.0016 | 0.0485 | 0.0446 | 142 | 0.0101 |
| | 250 | 0.1090 | 0.4148 | 1.3776 | 0.0024 | 0.0381 | 0.0351 | 213 | 0.0098 |
| Generator Sets - 500 hp | 500 | 0.1556 | 0.6639 | 1.9429 | 0.0033 | 0.0567 | 0.0522 | 337 | 0.0140 |
| | 750 | 0.2599 | 1.0718 | 3.2483 | 0.0055 | 0.0934 | 0.0860 | 544 | 0.0234 |
| | 9999 | 0.6582 | 2.3655 | 8.9789 | 0.0105 | 0.2325 | 0.2139 | 1,049 | 0.0594 |
| Generator Sets Composite | | 0.0640 | 0.2913 | 0.4717 | 0.0007 | 0.0268 | 0.0246 | 61.0 | 0.0058 |
| Graders | 50 | 0.0897 | 0.3082 | 0.2569 | 0.0004 | 0.0217 | 0.0200 | 27.5 | 0.0081 |
| | 120 | 0.1081 | 0.5230 | 0.6726 | 0.0009 | 0.0555 | 0.0511 | 75.0 | 0.0098 |
| | 175 | 0.1299 | 0.7319 | 0.9534 | 0.0014 | 0.0526 | 0.0484 | 124 | 0.0117 |
| | 250 | 0.1326 | 0.4046 | 1.1596 | 0.0019 | 0.0400 | 0.0368 | 172 | 0.0120 |
| | 500 | 0.1666 | 0.5739 | 1.3760 | 0.0023 | 0.0496 | 0.0456 | 229 | 0.0150 |
| | 750 | 0.3549 | 1.2133 | 3.0011 | 0.0049 | 0.1066 | 0.0981 | 486 | 0.0320 |
| Graders Composite | | 0.1277 | 0.5931 | 0.9795 | 0.0015 | 0.0489 | 0.0450 | 133 | 0.0115 |
| Off-Highway Tractors | 120 | 0.1905 | 0.7051 | 1.1159 | 0.0011 | 0.0952 | 0.0876 | 93.7 | 0.0172 |
| | 175 | 0.1870 | 0.8216 | 1.3703 | 0.0015 | 0.0771 | 0.0709 | 130 | 0.0169 |
| | 250 | 0.1489 | 0.4320 | 1.2644 | 0.0015 | 0.0520 | 0.0478 | 130 | 0.0134 |
| | 750 | 0.5975 | 2.5165 | 5.0885 | 0.0057 | 0.2047 | 0.1884 | 568 | 0.0539 |
| | 1000 | 0.9006 | 3.9378 | 9.2072 | 0.0082 | 0.3063 | 0.2818 | 814 | 0.0813 |
| Off-Highway Tractors Composite | | 0.1893 | 0.7244 | 1.5085 | 0.0017 | 0.0717 | 0.0660 | 151 | 0.0171 |
| Off-Highway Trucks | 175 | 0.1259 | 0.7559 | 0.8596 | 0.0014 | 0.0477 | 0.0438 | 125 | 0.0114 |
| | 250 | 0.1252 | 0.3702 | 0.9818 | 0.0019 | 0.0328 | 0.0301 | 167 | 0.0113 |
| | 500 | 0.1960 | 0.5949 | 1.4165 | 0.0027 | 0.0505 | 0.0465 | 272 | 0.0177 |
| | 750 | 0.3198 | 0.9645 | 2.3779 | 0.0044 | 0.0835 | 0.0768 | 442 | 0.0289 |
| | 1000 | 0.4873 | 1.4801 | 5.2216 | 0.0063 | 0.1505 | 0.1385 | 625 | 0.0440 |
| Off-Highway Trucks Composite | | 0.1924 | 0.5974 | 1.4932 | 0.0027 | 0.0516 | 0.0475 | 260 | 0.0174 |
| Other Construction Equipment | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0039 | 0.0036 | 13.2 | 0.0014 |
| | 50 | 0.0597 | 0.2506 | 0.2369 | 0.0004 | 0.0162 | 0.0149 | 28.0 | 0.0054 |
| | 120 | 0.0827 | 0.5202 | 0.6012 | 0.0009 | 0.0441 | 0.0406 | 80.9 | 0.0075 |
| | 175 | 0.0796 | 0.5864 | 0.6636 | 0.0012 | 0.0331 | 0.0305 | 107 | 0.0072 |
| | 500 | 0.1310 | 0.4963 | 1.1867 | 0.0025 | 0.0394 | 0.0362 | 254 | 0.0118 |
| Other Construction Equipment Composite | | 0.0768 | 0.3645 | 0.6392 | 0.0013 | 0.0264 | 0.0243 | 123 | 0.0069 |
| Other General Industrial Equipmen | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0786 | 0.2532 | 0.2077 | 0.0003 | 0.0191 | 0.0175 | 21.7 | 0.0071 |
| | 120 | 0.0987 | 0.4387 | 0.5864 | 0.0007 | 0.0521 | 0.0480 | 62.0 | 0.0089 |
| | 175 | 0.1083 | 0.5684 | 0.7866 | 0.0011 | 0.0448 | 0.0412 | 95.9 | 0.0098 |
| | 250 | 0.1050 | 0.3015 | 0.9812 | 0.0015 | 0.0312 | 0.0287 | 136 | 0.0095 |
| | 500 | 0.1931 | 0.5811 | 1.6702 | 0.0026 | 0.0569 | 0.0524 | 265 | 0.0174 |
| | 750 | 0.3208 | 0.9578 | 2.8569 | 0.0044 | 0.0959 | 0.0883 | 437 | 0.0289 |
| | 1000 | 0.4546 | 1.4023 | 5.2482 | 0.0056 | 0.1513 | 0.1392 | 560 | 0.0410 |
| Other General Industrial Equipmen Composite | | 0.1355 | 0.4843 | 1.1215 | 0.0016 | 0.0475 | 0.0437 | 152 | 0.0122 |
| Other Material Handling Equipmen | 50 | 0.1090 | 0.3501 | 0.2887 | 0.0004 | 0.0265 | 0.0244 | 30.3 | 0.0098 |
| | 120 | 0.0959 | 0.4271 | 0.5727 | 0.0007 | 0.0509 | 0.0468 | 60.7 | 0.0087 |
| | 175 | 0.1365 | 0.7201 | 0.9997 | 0.0014 | 0.0567 | 0.0522 | 122 | 0.0123 |
| | 250 | 0.1109 | 0.3211 | 1.0483 | 0.0016 | 0.0332 | 0.0306 | 145 | 0.0100 |
| | 500 | 0.1376 | 0.4182 | 1.2042 | 0.0019 | 0.0409 | 0.0377 | 192 | 0.0124 |
| | 9999 | 0.6190 | 1.8527 | 6.9410 | 0.0073 | 0.1995 | 0.1835 | 741 | 0.0558 |
| Other Material Handling Equipment Composite | | 0.1289 | 0.4698 | 1.0967 | 0.0015 | 0.0460 | 0.0423 | 141 | 0.0116 |
| Pavers | 25 | 0.0234 | 0.0780 | 0.1458 | 0.0002 | 0.0066 | 0.0060 | 18.7 | 0.0021 |
| | 50 | 0.1198 | 0.3421 | 0.2775 | 0.0004 | 0.0271 | 0.0249 | 28.0 | 0.0108 |
| | 120 | 0.1235 | 0.4969 | 0.7477 | 0.0008 | 0.0636 | 0.0585 | 69.2 | 0.0111 |
| | 175 | 0.1608 | 0.7707 | 1.2155 | 0.0014 | 0.0673 | 0.0619 | 128 | 0.0145 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1858 | 0.5585 | 1.6747 | 0.0022 | 0.0640 | 0.0589 | 194 | 0.0168 |
| | 500 | 0.2059 | 0.8113 | 1.8097 | 0.0023 | 0.0697 | 0.0641 | 233 | 0.0186 |
| Pavers Composite | | 0.1347 | 0.5203 | 0.7607 | 0.0009 | 0.0526 | 0.0484 | 77.9 | 0.0122 |
| Paving Equipment | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0037 | 0.0034 | 12.6 | 0.0014 |
| | 50 | 0.1023 | 0.2901 | 0.2367 | 0.0003 | 0.0231 | 0.0213 | 23.9 | 0.0092 |
| | 120 | 0.0969 | 0.3891 | 0.5874 | 0.0006 | 0.0503 | 0.0462 | 54.5 | 0.0087 |
| | 175 | 0.1254 | 0.6025 | 0.9549 | 0.0011 | 0.0528 | 0.0486 | 101 | 0.0113 |
| | 250 | 0.1140 | 0.3441 | 1.0498 | 0.0014 | 0.0394 | 0.0362 | 122 | 0.0103 |
| Paving Equipment Composite | | 0.1023 | 0.4234 | 0.6842 | 0.0008 | 0.0469 | 0.0431 | 68.9 | 0.0092 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washers | 15 | 0.0065 | 0.0315 | 0.0445 | 0.0001 | 0.0024 | 0.0022 | 4.9 | 0.0006 |
| | 25 | 0.0100 | 0.0337 | 0.0617 | 0.0001 | 0.0033 | 0.0030 | 7.1 | 0.0009 |
| | 50 | 0.0251 | 0.0970 | 0.1183 | 0.0002 | 0.0077 | 0.0070 | 14.3 | 0.0023 |
| | 120 | 0.0245 | 0.1416 | 0.1947 | 0.0003 | 0.0128 | 0.0118 | 24.1 | 0.0022 |
| Pressure Washers Composite | | 0.0133 | 0.0590 | 0.0799 | 0.0001 | 0.0049 | 0.0045 | 9.4 | 0.0012 |
| | 15 | 0.0111 | 0.0479 | 0.0683 | 0.0001 | 0.0041 | 0.0038 | 7.4 | 0.0010 |
| | 25 | 0.0309 | 0.0919 | 0.1682 | 0.0002 | 0.0094 | 0.0086 | 19.5 | 0.0028 |
| | 50 | 0.0855 | 0.2910 | 0.2982 | 0.0004 | 0.0228 | 0.0210 | 34.3 | 0.0077 |
| | 120 | 0.0949 | 0.4887 | 0.6710 | 0.0009 | 0.0508 | 0.0467 | 77.9 | 0.0086 |
| | 175 | 0.1158 | 0.7365 | 1.0489 | 0.0016 | 0.0502 | 0.0462 | 140 | 0.0104 |
| | 250 | 0.1088 | 0.3998 | 1.3270 | 0.0023 | 0.0376 | 0.0346 | 201 | 0.0098 |
| Pumps | 500 | 0.1686 | 0.6929 | 2.0163 | 0.0034 | 0.0603 | 0.0555 | 345 | 0.0152 |
| | 750 | 0.2872 | 1.1454 | 3.4529 | 0.0057 | 0.1018 | 0.0937 | 571 | 0.0259 |
| | 9999 | 0.8773 | 3.1134 | 11.7387 | 0.0136 | 0.3072 | 0.2826 | 1,355 | 0.0792 |
| Pumps Composite | | 0.0621 | 0.2825 | 0.4121 | 0.0006 | 0.0267 | 0.0245 | 49.6 | 0.0056 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1018 | 0.0002 | 0.0039 | 0.0036 | 13.3 | 0.0015 |
| | 50 | 0.0871 | 0.2754 | 0.2405 | 0.0003 | 0.0209 | 0.0192 | 26.0 | 0.0079 |
| | 120 | 0.0857 | 0.4000 | 0.5498 | 0.0007 | 0.0454 | 0.0418 | 59.0 | 0.0077 |
| | 175 | 0.1104 | 0.6166 | 0.8731 | 0.0012 | 0.0470 | 0.0433 | 108 | 0.0100 |
| | 250 | 0.1107 | 0.3575 | 1.0948 | 0.0017 | 0.0368 | 0.0339 | 153 | 0.0100 |
| | 500 | 0.1468 | 0.5595 | 1.3956 | 0.0022 | 0.0487 | 0.0448 | 219 | 0.0132 |
| Rollers Composite | | 0.0851 | 0.3979 | 0.5706 | 0.0008 | 0.0386 | 0.0355 | 67.1 | 0.0077 |
| Rough Terrain Forklifts | 50 | 0.0942 | 0.3551 | 0.3066 | 0.0004 | 0.0243 | 0.0224 | 33.9 | 0.0085 |
| | 120 | 0.0801 | 0.4260 | 0.5164 | 0.0007 | 0.0420 | 0.0387 | 62.4 | 0.0072 |
| | 175 | 0.1171 | 0.7240 | 0.8746 | 0.0014 | 0.0477 | 0.0439 | 125 | 0.0106 |
| | 250 | 0.1168 | 0.3650 | 1.0385 | 0.0019 | 0.0338 | 0.0311 | 171 | 0.0105 |
| | 500 | 0.1668 | 0.5337 | 1.3642 | 0.0025 | 0.0477 | 0.0439 | 257 | 0.0150 |
| Rough Terrain Forklifts Composite | | 0.0850 | 0.4577 | 0.5588 | 0.0008 | 0.0423 | 0.0389 | 70.3 | 0.0077 |
| Rubber Tired Dozers | 175 | 0.1942 | 0.8333 | 1.3944 | 0.0015 | 0.0790 | 0.0727 | 129 | 0.0175 |
| | 250 | 0.2209 | 0.6304 | 1.8273 | 0.0021 | 0.0762 | 0.0701 | 183 | 0.0199 |
| | 500 | 0.2932 | 1.2456 | 2.3951 | 0.0026 | 0.0985 | 0.0906 | 265 | 0.0265 |
| | 750 | 0.4423 | 1.8685 | 3.6712 | 0.0040 | 0.1494 | 0.1374 | 399 | 0.0399 |
| | 1000 | 0.6883 | 3.0139 | 6.8297 | 0.0060 | 0.2311 | 0.2126 | 592 | 0.0621 |
| Rubber Tired Dozers Composite | | 0.2721 | 1.0420 | 2.2344 | 0.0025 | 0.0924 | 0.0850 | 239 | 0.0246 |
| Rubber Tired Loaders | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0049 | 0.0045 | 16.9 | 0.0018 |
| | 50 | 0.0993 | 0.3438 | 0.2888 | 0.0004 | 0.0242 | 0.0222 | 31.1 | 0.0090 |
| | 120 | 0.0835 | 0.4090 | 0.5226 | 0.0007 | 0.0431 | 0.0396 | 58.9 | 0.0075 |
| | 175 | 0.1094 | 0.6251 | 0.8077 | 0.0012 | 0.0445 | 0.0409 | 106 | 0.0099 |
| | 250 | 0.1118 | 0.3444 | 0.9890 | 0.0017 | 0.0337 | 0.0310 | 149 | 0.0101 |
| | 500 | 0.1678 | 0.5818 | 1.3980 | 0.0023 | 0.0499 | 0.0459 | 237 | 0.0151 |
| | 750 | 0.3459 | 1.1905 | 2.9534 | 0.0049 | 0.1040 | 0.0956 | 486 | 0.0312 |
| | 1000 | 0.4657 | 1.6412 | 5.2967 | 0.0060 | 0.1552 | 0.1428 | 594 | 0.0420 |
| Rubber Tired Loaders Composite | | 0.1050 | 0.4615 | 0.7838 | 0.0012 | 0.0416 | 0.0383 | 109 | 0.0095 |
| Scrapers | 120 | 0.1665 | 0.6826 | 0.9915 | 0.0011 | 0.0846 | 0.0778 | 93.9 | 0.0150 |
| | 175 | 0.1871 | 0.9030 | 1.3657 | 0.0017 | 0.0766 | 0.0704 | 148 | 0.0169 |
| | 250 | 0.2021 | 0.5906 | 1.7470 | 0.0024 | 0.0665 | 0.0612 | 209 | 0.0182 |
| | 500 | 0.2883 | 1.0688 | 2.4104 | 0.0032 | 0.0930 | 0.0855 | 321 | 0.0260 |
| | 750 | 0.5001 | 1.8419 | 4.2634 | 0.0056 | 0.1624 | 0.1494 | 555 | 0.0451 |
| Scrapers Composite | | 0.2513 | 0.9443 | 2.0647 | 0.0027 | 0.0854 | 0.0785 | 262 | 0.0227 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0931 | 0.3227 | 0.3148 | 0.0005 | 0.0243 | 0.0224 | 36.2 | 0.0084 |
| | 120 | 0.0970 | 0.5116 | 0.6762 | 0.0009 | 0.0525 | 0.0483 | 80.2 | 0.0088 |
| | 175 | 0.1290 | 0.8300 | 1.1249 | 0.0017 | 0.0559 | 0.0514 | 155 | 0.0116 |
| | 250 | 0.1416 | 0.5098 | 1.6229 | 0.0029 | 0.0474 | 0.0436 | 255 | 0.0128 |
| Signal Boards Composite | | 0.0171 | 0.0925 | 0.1250 | 0.0002 | 0.0066 | 0.0060 | 16.7 | 0.0015 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| Skid Steer Loaders | 25 | 0.0189 | 0.0601 | 0.1125 | 0.0002 | 0.0056 | 0.0052 | 13.8 | 0.0017 |
| | 50 | 0.0378 | 0.2138 | 0.2052 | 0.0003 | 0.0113 | 0.0104 | 25.5 | 0.0034 |
| | 120 | 0.0334 | 0.2710 | 0.2699 | 0.0005 | 0.0170 | 0.0156 | 42.8 | 0.0030 |
| Skid Steer Loaders Composite | | 0.0352 | 0.2220 | 0.2198 | 0.0004 | 0.0128 | 0.0118 | 30.3 | 0.0032 |
| Surfacing Equipment | 50 | 0.0408 | 0.1333 | 0.1263 | 0.0002 | 0.0101 | 0.0093 | 14.1 | 0.0037 |
| | 120 | 0.0840 | 0.4151 | 0.5756 | 0.0007 | 0.0439 | 0.0404 | 63.8 | 0.0076 |
| | 175 | 0.0787 | 0.4705 | 0.6706 | 0.0010 | 0.0335 | 0.0308 | 85.8 | 0.0071 |
| | 250 | 0.0891 | 0.3116 | 0.9338 | 0.0015 | 0.0309 | 0.0285 | 135 | 0.0080 |
| | 500 | 0.1342 | 0.5759 | 1.3809 | 0.0022 | 0.0468 | 0.0431 | 221 | 0.0121 |
| | 750 | 0.2139 | 0.9020 | 2.2264 | 0.0035 | 0.0745 | 0.0686 | 347 | 0.0193 |
| Surfacing Equipment Composite | | 0.1116 | 0.4705 | 1.0675 | 0.0017 | 0.0389 | 0.0357 | 166 | 0.0101 |
| Sweepers/Scrubbers | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0052 | 19.6 | 0.0021 |
| | 50 | 0.0782 | 0.3186 | 0.2828 | 0.0004 | 0.0211 | 0.0194 | 31.6 | 0.0071 |
| | 120 | 0.0880 | 0.5056 | 0.5893 | 0.0009 | 0.0466 | 0.0429 | 75.0 | 0.0079 |
| | 175 | 0.1193 | 0.7999 | 0.9051 | 0.0016 | 0.0488 | 0.0449 | 139 | 0.0108 |
| | 250 | 0.1029 | 0.3286 | 0.9094 | 0.0018 | 0.0289 | 0.0266 | 162 | 0.0093 |
| Sweepers/Scrubbers Composite | | 0.0913 | 0.5034 | 0.5746 | 0.0009 | 0.0387 | 0.0356 | 78.5 | 0.0082 |
| Tractors/Loaders/Backhoes | 25 | 0.0192 | 0.0653 | 0.1221 | 0.0002 | 0.0049 | 0.0045 | 15.9 | 0.0017 |
| | 50 | 0.0702 | 0.3020 | 0.2646 | 0.0004 | 0.0186 | 0.0171 | 30.3 | 0.0063 |
| | 120 | 0.0577 | 0.3480 | 0.3870 | 0.0006 | 0.0293 | 0.0270 | 51.7 | 0.0052 |
| | 175 | 0.0854 | 0.5853 | 0.6331 | 0.0011 | 0.0335 | 0.0308 | 101 | 0.0077 |
| | 250 | 0.1082 | 0.3566 | 0.9047 | 0.0019 | 0.0294 | 0.0270 | 172 | 0.0098 |
| | 500 | 0.2085 | 0.7089 | 1.6070 | 0.0039 | 0.0559 | 0.0514 | 345 | 0.0188 |
| | 750 | 0.3148 | 1.0631 | 2.4922 | 0.0058 | 0.0854 | 0.0786 | 517 | 0.0284 |
| Tractors/Loaders/Backhoes Composite | | 0.0666 | 0.3716 | 0.4501 | 0.0008 | 0.0298 | 0.0274 | 66.8 | 0.0060 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0087 | 32.9 | 0.0036 |
| | 50 | 0.1390 | 0.3900 | 0.3235 | 0.0004 | 0.0313 | 0.0288 | 32.9 | 0.0125 |
| | 120 | 0.1144 | 0.4600 | 0.7060 | 0.0008 | 0.0590 | 0.0542 | 64.9 | 0.0103 |
| | 175 | 0.1770 | 0.8534 | 1.3767 | 0.0016 | 0.0748 | 0.0688 | 144 | 0.0160 |
| | 250 | 0.2105 | 0.6510 | 1.9456 | 0.0025 | 0.0750 | 0.0690 | 223 | 0.0190 |
| | 500 | 0.2694 | 1.1349 | 2.4560 | 0.0031 | 0.0947 | 0.0871 | 311 | 0.0243 |
| | 750 | 0.5107 | 2.1334 | 4.7300 | 0.0059 | 0.1802 | 0.1658 | 587 | 0.0461 |
| Trenchers Composite | | 0.1274 | 0.4541 | 0.6043 | 0.0007 | 0.0485 | 0.0446 | 58.7 | 0.0115 |
| Welders | 15 | 0.0093 | 0.0400 | 0.0571 | 0.0001 | 0.0034 | 0.0032 | 6.2 | 0.0008 |
| | 25 | 0.0179 | 0.0532 | 0.0974 | 0.0001 | 0.0054 | 0.0050 | 11.3 | 0.0016 |
| | 50 | 0.0801 | 0.2564 | 0.2346 | 0.0003 | 0.0200 | 0.0184 | 26.0 | 0.0072 |
| | 120 | 0.0547 | 0.2606 | 0.3567 | 0.0005 | 0.0296 | 0.0273 | 39.5 | 0.0049 |
| | 175 | 0.0936 | 0.5424 | 0.7713 | 0.0011 | 0.0405 | 0.0373 | 98.2 | 0.0084 |
| | 250 | 0.0749 | 0.2483 | 0.8249 | 0.0013 | 0.0248 | 0.0228 | 119 | 0.0068 |
| | 500 | 0.0968 | 0.3491 | 1.0171 | 0.0016 | 0.0325 | 0.0299 | 168 | 0.0087 |
| Welders Composite | | 0.0534 | 0.1994 | 0.2301 | 0.0003 | 0.0187 | 0.0172 | 25.6 | 0.0048 |

## 2020 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0138 | 0.0459 | 0.0854 | 0.0001 | 0.0035 | 0.0032 | 11.0 | 0.0012 |
| | 50 | 0.0261 | 0.1436 | 0.1422 | 0.0003 | 0.0071 | 0.0065 | 19.6 | 0.0024 |
| | 120 | 0.0259 | 0.2292 | 0.2166 | 0.0004 | 0.0127 | 0.0117 | 38.1 | 0.0023 |
| | 500 | 0.0751 | 0.3804 | 0.6959 | 0.0021 | 0.0217 | 0.0199 | 213 | 0.0068 |
| | 750 | 0.1373 | 0.6877 | 1.2876 | 0.0039 | 0.0396 | 0.0365 | 385 | 0.0124 |
| Aerial Lifts Composite | | 0.0261 | 0.1696 | 0.1866 | 0.0004 | 0.0092 | 0.0084 | 34.7 | 0.0024 |
| Air Compressors | 15 | 0.0093 | 0.0451 | 0.0579 | 0.0001 | 0.0029 | 0.0027 | 7.2 | 0.0008 |
| | 25 | 0.0196 | 0.0630 | 0.1155 | 0.0002 | 0.0054 | 0.0050 | 14.4 | 0.0018 |
| | 50 | 0.0398 | 0.2030 | 0.1725 | 0.0003 | 0.0099 | 0.0091 | 22.3 | 0.0036 |
| | 120 | 0.0408 | 0.3058 | 0.2826 | 0.0006 | 0.0188 | 0.0173 | 47.0 | 0.0037 |
| | 175 | 0.0587 | 0.4989 | 0.4013 | 0.0010 | 0.0210 | 0.0193 | 88.5 | 0.0053 |
| | 250 | 0.0669 | 0.2592 | 0.5067 | 0.0015 | 0.0163 | 0.0150 | 131 | 0.0060 |
| | 500 | 0.1146 | 0.4395 | 0.7970 | 0.0023 | 0.0276 | 0.0254 | 232 | 0.0103 |
| | 750 | 0.1777 | 0.6792 | 1.2615 | 0.0036 | 0.0432 | 0.0398 | 358 | 0.0160 |
| | 1000 | 0.2641 | 0.9959 | 3.2946 | 0.0049 | 0.0804 | 0.0740 | 486 | 0.0238 |
| Air Compressors Composite | | 0.0483 | 0.3077 | 0.3255 | 0.0007 | 0.0185 | 0.0170 | 63.6 | 0.0044 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0196 | 0.2205 | 0.1756 | 0.0004 | 0.0020 | 0.0018 | 31.0 | 0.0018 |
| | 120 | 0.0280 | 0.4662 | 0.2329 | 0.0009 | 0.0040 | 0.0037 | 77.1 | 0.0025 |
| | 175 | 0.0402 | 0.7542 | 0.1862 | 0.0016 | 0.0051 | 0.0047 | 141 | 0.0036 |
| | 250 | 0.0474 | 0.3426 | 0.1617 | 0.0021 | 0.0044 | 0.0040 | 188 | 0.0043 |
| | 500 | 0.0784 | 0.5512 | 0.2622 | 0.0031 | 0.0072 | 0.0066 | 311 | 0.0071 |
| | 750 | 0.1549 | 1.0891 | 0.5202 | 0.0062 | 0.0143 | 0.0131 | 615 | 0.0140 |
| | 1000 | 0.2442 | 1.6437 | 3.9853 | 0.0093 | 0.0530 | 0.0488 | 928 | 0.0220 |
| Bore/Drill Rigs Composite | | 0.0480 | 0.5008 | 0.3439 | 0.0017 | 0.0062 | 0.0057 | 165 | 0.0043 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0223 | 0.0741 | 0.1372 | 0.0002 | 0.0058 | 0.0053 | 17.6 | 0.0020 |
| Cement and Mortar Mixers Co | | 0.0086 | 0.0415 | 0.0536 | 0.0001 | 0.0021 | 0.0020 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0424 | 0.2420 | 0.2231 | 0.0004 | 0.0113 | 0.0104 | 30.2 | 0.0038 |
| | 120 | 0.0524 | 0.4613 | 0.4128 | 0.0009 | 0.0249 | 0.0229 | 74.1 | 0.0047 |
| | 175 | 0.0865 | 0.8662 | 0.6554 | 0.0018 | 0.0323 | 0.0297 | 160 | 0.0078 |
| Concrete/Industrial Saws Com | | 0.0484 | 0.3783 | 0.3410 | 0.0007 | 0.0196 | 0.0180 | 58.5 | 0.0044 |
| Cranes | 50 | 0.0532 | 0.2423 | 0.1894 | 0.0003 | 0.0121 | 0.0111 | 23.2 | 0.0048 |
| | 120 | 0.0542 | 0.3446 | 0.3317 | 0.0006 | 0.0240 | 0.0221 | 50.1 | 0.0049 |
| | 175 | 0.0648 | 0.4754 | 0.4071 | 0.0009 | 0.0223 | 0.0206 | 80.3 | 0.0058 |
| | 250 | 0.0704 | 0.2440 | 0.4949 | 0.0013 | 0.0170 | 0.0157 | 112 | 0.0064 |
| | 500 | 0.1087 | 0.3839 | 0.7047 | 0.0018 | 0.0257 | 0.0236 | 180 | 0.0098 |
| | 750 | 0.1837 | 0.6455 | 1.2225 | 0.0030 | 0.0439 | 0.0404 | 303 | 0.0166 |
| | 9999 | 0.6702 | 2.1934 | 7.0436 | 0.0098 | 0.1797 | 0.1654 | 971 | 0.0605 |
| Cranes Composite | | 0.0898 | 0.3917 | 0.6610 | 0.0014 | 0.0256 | 0.0236 | 129 | 0.0081 |
| Crawler Tractors | 50 | 0.0699 | 0.2771 | 0.2107 | 0.0003 | 0.0150 | 0.0138 | 24.9 | 0.0063 |
| | 120 | 0.0831 | 0.4628 | 0.4896 | 0.0008 | 0.0371 | 0.0341 | 65.8 | 0.0075 |
| | 175 | 0.1123 | 0.7302 | 0.7150 | 0.0014 | 0.0398 | 0.0366 | 121 | 0.0101 |
| | 250 | 0.1188 | 0.3966 | 0.8681 | 0.0019 | 0.0315 | 0.0290 | 166 | 0.0107 |
| | 500 | 0.1759 | 0.6665 | 1.2170 | 0.0025 | 0.0455 | 0.0419 | 259 | 0.0159 |
| | 750 | 0.3168 | 1.1935 | 2.2429 | 0.0047 | 0.0828 | 0.0762 | 465 | 0.0286 |
| | 1000 | 0.4836 | 1.8458 | 5.2162 | 0.0066 | 0.1425 | 0.1311 | 658 | 0.0436 |
| Crawler Tractors Composite | | 0.1049 | 0.5260 | 0.6772 | 0.0013 | 0.0378 | 0.0348 | 114 | 0.0095 |
| Crushing/Proc. E | 50 | 0.0734 | 0.4036 | 0.3367 | 0.0006 | 0.0181 | 0.0166 | 44.0 | 0.0066 |
| | 120 | 0.0692 | 0.5446 | 0.4754 | 0.0010 | 0.0302 | 0.0278 | 83.1 | 0.0062 |
| | 175 | 0.1083 | 0.9519 | 0.7042 | 0.0019 | 0.0368 | 0.0338 | 167 | 0.0098 |
| | 250 | 0.1245 | 0.4844 | 0.8670 | 0.0028 | 0.0282 | 0.0259 | 245 | 0.0112 |
| | 500 | 0.1852 | 0.7092 | 1.1829 | 0.0037 | 0.0416 | 0.0383 | 374 | 0.0167 |
| | 750 | 0.2912 | 1.1167 | 1.9026 | 0.0059 | 0.0655 | 0.0603 | 589 | 0.0263 |
| | 9999 | 0.7584 | 2.6528 | 8.5119 | 0.0131 | 0.2049 | 0.1885 | 1,308 | 0.0684 |
| Crushing/Proc. Equipment Co | | 0.0934 | 0.6247 | 0.5983 | 0.0015 | 0.0310 | 0.0285 | 132 | 0.0084 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0384 | 0.2446 | 0.1862 | 0.0003 | 0.0080 | 0.0074 | 25.0 | 0.0035 |
| | 120 | 0.0583 | 0.4979 | 0.3717 | 0.0009 | 0.0206 | 0.0189 | 73.6 | 0.0053 |
| | 175 | 0.0703 | 0.6637 | 0.3868 | 0.0013 | 0.0195 | 0.0179 | 112 | 0.0063 |
| | 250 | 0.0828 | 0.3276 | 0.4493 | 0.0018 | 0.0154 | 0.0141 | 159 | 0.0075 |
| | 500 | 0.1198 | 0.4591 | 0.6028 | 0.0023 | 0.0219 | 0.0202 | 234 | 0.0108 |
| | 750 | 0.1987 | 0.7606 | 1.0153 | 0.0039 | 0.0365 | 0.0336 | 387 | 0.0179 |
| Excavators Composite | | 0.0733 | 0.5124 | 0.4042 | 0.0013 | 0.0184 | 0.0169 | 120 | 0.0066 |
| Forklifts | 50 | 0.0191 | 0.1400 | 0.1084 | 0.0002 | 0.0039 | 0.0036 | 14.7 | 0.0017 |
| | 120 | 0.0225 | 0.2102 | 0.1443 | 0.0004 | 0.0074 | 0.0068 | 31.2 | 0.0020 |
| | 175 | 0.0336 | 0.3315 | 0.1772 | 0.0006 | 0.0087 | 0.0080 | 56.1 | 0.0030 |
| | 250 | 0.0385 | 0.1554 | 0.1887 | 0.0009 | 0.0062 | 0.0057 | 77.1 | 0.0035 |
| | 500 | 0.0548 | 0.2126 | 0.2528 | 0.0011 | 0.0088 | 0.0081 | 111 | 0.0049 |
| Forklifts Composite | | 0.0320 | 0.2160 | 0.1691 | 0.0006 | 0.0070 | 0.0065 | 54.4 | 0.0029 |
| Generator Sets | 15 | 0.0116 | 0.0638 | 0.0814 | 0.0002 | 0.0038 | 0.0035 | 10.2 | 0.0011 |
| | 25 | 0.0224 | 0.0769 | 0.1410 | 0.0002 | 0.0064 | 0.0059 | 17.6 | 0.0020 |
| | 50 | 0.0379 | 0.2161 | 0.2199 | 0.0004 | 0.0106 | 0.0098 | 30.6 | 0.0034 |
| | 120 | 0.0506 | 0.4641 | 0.4378 | 0.0009 | 0.0250 | 0.0230 | 77.9 | 0.0046 |
| | 175 | 0.0676 | 0.7323 | 0.5990 | 0.0016 | 0.0266 | 0.0245 | 142 | 0.0061 |
| | 250 | 0.0747 | 0.3844 | 0.7614 | 0.0024 | 0.0218 | 0.0200 | 213 | 0.0067 |
| | 500 | 0.1125 | 0.5968 | 1.0874 | 0.0033 | 0.0333 | 0.0307 | 337 | 0.0102 |
| | 750 | 0.1842 | 0.9634 | 1.7962 | 0.0055 | 0.0544 | 0.0500 | 544 | 0.0166 |
| | 9999 | 0.4502 | 2.0059 | 6.6947 | 0.0105 | 0.1476 | 0.1358 | 1,049 | 0.0406 |
| Generator Sets Composite | | 0.0395 | 0.2732 | 0.3232 | 0.0007 | 0.0150 | 0.0138 | 61.0 | 0.0036 |
| Graders | 50 | 0.0563 | 0.2762 | 0.2156 | 0.0004 | 0.0124 | 0.0114 | 27.5 | 0.0051 |
| | 120 | 0.0738 | 0.5090 | 0.4568 | 0.0009 | 0.0311 | 0.0286 | 75.0 | 0.0067 |
| | 175 | 0.0918 | 0.7282 | 0.5622 | 0.0014 | 0.0303 | 0.0279 | 124 | 0.0083 |
| | 250 | 0.0999 | 0.3683 | 0.6701 | 0.0019 | 0.0230 | 0.0211 | 172 | 0.0090 |
| | 500 | 0.1284 | 0.4966 | 0.7982 | 0.0023 | 0.0288 | 0.0265 | 229 | 0.0116 |
| | 750 | 0.2731 | 1.0508 | 1.7425 | 0.0049 | 0.0621 | 0.0571 | 486 | 0.0246 |
| Graders Composite | | 0.0919 | 0.5765 | 0.5823 | 0.0015 | 0.0280 | 0.0258 | 133 | 0.0083 |
| Off-Highway Trac | 120 | 0.1455 | 0.6789 | 0.8421 | 0.0011 | 0.0674 | 0.0621 | 93.7 | 0.0131 |
| | 175 | 0.1455 | 0.8025 | 0.9712 | 0.0015 | 0.0547 | 0.0503 | 130 | 0.0131 |
| | 250 | 0.1147 | 0.3614 | 0.8843 | 0.0015 | 0.0348 | 0.0321 | 130 | 0.0103 |
| | 750 | 0.4683 | 1.8825 | 3.5643 | 0.0057 | 0.1391 | 0.1280 | 568 | 0.0423 |
| | 1000 | 0.7129 | 2.9445 | 7.4279 | 0.0082 | 0.2214 | 0.2037 | 814 | 0.0643 |
| Off-Highway Tractors Compos | | 0.1470 | 0.6517 | 1.0657 | 0.0017 | 0.0497 | 0.0457 | 151 | 0.0133 |
| Off-Highway Truc | 175 | 0.0837 | 0.7538 | 0.4564 | 0.0014 | 0.0234 | 0.0215 | 125 | 0.0076 |
| | 250 | 0.0927 | 0.3514 | 0.5042 | 0.0019 | 0.0173 | 0.0159 | 167 | 0.0084 |
| | 500 | 0.1488 | 0.5446 | 0.7481 | 0.0027 | 0.0273 | 0.0251 | 272 | 0.0134 |
| | 750 | 0.2416 | 0.8831 | 1.2347 | 0.0044 | 0.0446 | 0.0411 | 442 | 0.0218 |
| | 1000 | 0.3613 | 1.2913 | 3.8920 | 0.0063 | 0.0903 | 0.0831 | 625 | 0.0326 |
| Off-Highway Trucks Composit | | 0.1443 | 0.5514 | 0.8306 | 0.0027 | 0.0280 | 0.0258 | 260 | 0.0130 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0328 | 0.2267 | 0.1956 | 0.0004 | 0.0078 | 0.0072 | 28.0 | 0.0030 |
| | 120 | 0.0501 | 0.5080 | 0.3835 | 0.0009 | 0.0199 | 0.0183 | 80.9 | 0.0045 |
| | 175 | 0.0524 | 0.5859 | 0.3414 | 0.0012 | 0.0164 | 0.0151 | 107 | 0.0047 |
| | 500 | 0.1012 | 0.4676 | 0.6065 | 0.0025 | 0.0212 | 0.0195 | 254 | 0.0091 |
| Other Construction Equipment | | 0.0563 | 0.3508 | 0.3519 | 0.0013 | 0.0139 | 0.0128 | 122 | 0.0051 |
| Other General Ind | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0431 | 0.2211 | 0.1744 | 0.0003 | 0.0101 | 0.0093 | 21.7 | 0.0039 |
| | 120 | 0.0602 | 0.4232 | 0.3810 | 0.0007 | 0.0256 | 0.0236 | 62.0 | 0.0054 |
| | 175 | 0.0721 | 0.5668 | 0.4439 | 0.0011 | 0.0237 | 0.0218 | 95.9 | 0.0065 |
| | 250 | 0.0791 | 0.2804 | 0.5318 | 0.0015 | 0.0173 | 0.0159 | 136 | 0.0071 |
| | 500 | 0.1506 | 0.5217 | 0.9276 | 0.0026 | 0.0326 | 0.0300 | 265 | 0.0136 |
| | 750 | 0.2490 | 0.8599 | 1.5657 | 0.0044 | 0.0543 | 0.0500 | 437 | 0.0225 |
| | 1000 | 0.3467 | 1.1855 | 3.8628 | 0.0056 | 0.0969 | 0.0892 | 560 | 0.0313 |
| Other General Industrial Equip | | 0.0983 | 0.4517 | 0.6661 | 0.0016 | 0.0262 | 0.0241 | 152 | 0.0089 |
| Other Material Ha | 50 | 0.0595 | 0.3049 | 0.2425 | 0.0004 | 0.0141 | 0.0130 | 30.3 | 0.0054 |
| | 120 | 0.0583 | 0.4117 | 0.3720 | 0.0007 | 0.0250 | 0.0230 | 60.7 | 0.0053 |
| | 175 | 0.0907 | 0.7176 | 0.5642 | 0.0014 | 0.0301 | 0.0277 | 122 | 0.0082 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0836 | 0.2984 | 0.5684 | 0.0016 | 0.0185 | 0.0170 | 145 | 0.0075 |
| | 500 | 0.1074 | 0.3752 | 0.6692 | 0.0019 | 0.0235 | 0.0216 | 192 | 0.0097 |
| | 9999 | 0.4910 | 1.5647 | 5.1082 | 0.0073 | 0.1280 | 0.1177 | 741 | 0.0443 |
| Other Material Handling Equip | | 0.0924 | 0.4429 | 0.6500 | 0.0015 | 0.0252 | 0.0232 | 141 | 0.0083 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1427 | 0.0002 | 0.0055 | 0.0051 | 18.7 | 0.0020 |
| | 50 | 0.0834 | 0.3055 | 0.2398 | 0.0004 | 0.0184 | 0.0169 | 28.0 | 0.0075 |
| | 120 | 0.0910 | 0.4805 | 0.5471 | 0.0008 | 0.0428 | 0.0394 | 69.2 | 0.0082 |
| | 175 | 0.1217 | 0.7599 | 0.8187 | 0.0014 | 0.0459 | 0.0422 | 128 | 0.0110 |
| | 250 | 0.1411 | 0.4713 | 1.1106 | 0.0022 | 0.0407 | 0.0375 | 194 | 0.0127 |
| | 500 | 0.1595 | 0.6305 | 1.1959 | 0.0023 | 0.0450 | 0.0414 | 233 | 0.0144 |
| Pavers Composite | | 0.0989 | 0.4920 | 0.5450 | 0.0009 | 0.0355 | 0.0326 | 77.9 | 0.0089 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0702 | 0.2577 | 0.2043 | 0.0003 | 0.0157 | 0.0144 | 23.9 | 0.0063 |
| | 120 | 0.0708 | 0.3762 | 0.4280 | 0.0006 | 0.0337 | 0.0310 | 54.5 | 0.0064 |
| | 175 | 0.0944 | 0.5945 | 0.6403 | 0.0011 | 0.0360 | 0.0331 | 101 | 0.0085 |
| | 250 | 0.0864 | 0.2894 | 0.6928 | 0.0014 | 0.0249 | 0.0229 | 122 | 0.0078 |
| Paving Equipment Composite | | 0.0757 | 0.4084 | 0.4807 | 0.0008 | 0.0315 | 0.0290 | 68.9 | 0.0068 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0056 | 0.0305 | 0.0390 | 0.0001 | 0.0018 | 0.0017 | 4.9 | 0.0005 |
| | 25 | 0.0091 | 0.0312 | 0.0572 | 0.0001 | 0.0026 | 0.0024 | 7.1 | 0.0008 |
| | 50 | 0.0128 | 0.0856 | 0.0986 | 0.0002 | 0.0041 | 0.0038 | 14.3 | 0.0012 |
| | 120 | 0.0128 | 0.1367 | 0.1293 | 0.0003 | 0.0065 | 0.0060 | 24.1 | 0.0012 |
| Pressure Washers Composite | | 0.0085 | 0.0549 | 0.0650 | 0.0001 | 0.0030 | 0.0027 | 9.4 | 0.0008 |
| Pumps | 15 | 0.0096 | 0.0464 | 0.0595 | 0.0001 | 0.0030 | 0.0028 | 7.4 | 0.0009 |
| | 25 | 0.0265 | 0.0850 | 0.1558 | 0.0002 | 0.0073 | 0.0067 | 19.5 | 0.0024 |
| | 50 | 0.0465 | 0.2546 | 0.2497 | 0.0004 | 0.0126 | 0.0116 | 34.3 | 0.0042 |
| | 120 | 0.0537 | 0.4713 | 0.4442 | 0.0009 | 0.0263 | 0.0242 | 77.9 | 0.0048 |
| | 175 | 0.0712 | 0.7336 | 0.6007 | 0.0016 | 0.0277 | 0.0255 | 140 | 0.0064 |
| | 250 | 0.0760 | 0.3700 | 0.7338 | 0.0023 | 0.0215 | 0.0198 | 201 | 0.0069 |
| | 500 | 0.1241 | 0.6189 | 1.1297 | 0.0034 | 0.0355 | 0.0327 | 345 | 0.0112 |
| | 750 | 0.2075 | 1.0232 | 1.9114 | 0.0057 | 0.0594 | 0.0547 | 571 | 0.0187 |
| | 9999 | 0.6127 | 2.6255 | 8.7489 | 0.0136 | 0.1961 | 0.1804 | 1,355 | 0.0553 |
| Pumps Composite | | 0.0376 | 0.2674 | 0.2854 | 0.0006 | 0.0147 | 0.0135 | 49.6 | 0.0034 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0543 | 0.2436 | 0.2039 | 0.0003 | 0.0128 | 0.0117 | 26.0 | 0.0049 |
| | 120 | 0.0576 | 0.3873 | 0.3799 | 0.0007 | 0.0270 | 0.0249 | 59.0 | 0.0052 |
| | 175 | 0.0774 | 0.6114 | 0.5331 | 0.0012 | 0.0286 | 0.0263 | 108 | 0.0070 |
| | 250 | 0.0842 | 0.3201 | 0.6581 | 0.0017 | 0.0223 | 0.0205 | 153 | 0.0076 |
| | 500 | 0.1151 | 0.4607 | 0.8354 | 0.0022 | 0.0299 | 0.0275 | 219 | 0.0104 |
| Rollers Composite | | 0.0584 | 0.3837 | 0.3793 | 0.0008 | 0.0232 | 0.0214 | 67.0 | 0.0053 |
| Rough Terrain Fo | 50 | 0.0520 | 0.3171 | 0.2556 | 0.0004 | 0.0122 | 0.0113 | 33.9 | 0.0047 |
| | 120 | 0.0495 | 0.4142 | 0.3326 | 0.0007 | 0.0197 | 0.0181 | 62.4 | 0.0045 |
| | 175 | 0.0788 | 0.7229 | 0.4710 | 0.0014 | 0.0245 | 0.0226 | 125 | 0.0071 |
| | 250 | 0.0881 | 0.3442 | 0.5378 | 0.0019 | 0.0182 | 0.0168 | 171 | 0.0079 |
| | 500 | 0.1296 | 0.4936 | 0.7287 | 0.0025 | 0.0265 | 0.0244 | 257 | 0.0117 |
| Rough Terrain Forklifts Compo | | 0.0533 | 0.4464 | 0.3494 | 0.0008 | 0.0201 | 0.0185 | 70.3 | 0.0048 |
| Rubber Tired Doz | 175 | 0.1509 | 0.8124 | 0.9962 | 0.0015 | 0.0561 | 0.0516 | 129 | 0.0136 |
| | 250 | 0.1701 | 0.5279 | 1.2898 | 0.0021 | 0.0516 | 0.0474 | 183 | 0.0153 |
| | 500 | 0.2291 | 0.9276 | 1.6868 | 0.0026 | 0.0673 | 0.0619 | 265 | 0.0207 |
| | 750 | 0.3461 | 1.3934 | 2.5948 | 0.0040 | 0.1024 | 0.0942 | 399 | 0.0312 |
| | 1000 | 0.5438 | 2.2500 | 5.5311 | 0.0060 | 0.1672 | 0.1539 | 592 | 0.0491 |
| Rubber Tired Dozers Compos | | 0.2118 | 0.8006 | 1.5773 | 0.0025 | 0.0630 | 0.0580 | 239 | 0.0191 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0615 | 0.3080 | 0.2424 | 0.0004 | 0.0137 | 0.0126 | 31.1 | 0.0055 |
| | 120 | 0.0563 | 0.3977 | 0.3529 | 0.0007 | 0.0237 | 0.0218 | 58.9 | 0.0051 |
| | 175 | 0.0767 | 0.6215 | 0.4713 | 0.0012 | 0.0253 | 0.0233 | 106 | 0.0069 |
| | 250 | 0.0848 | 0.3159 | 0.5655 | 0.0017 | 0.0194 | 0.0179 | 149 | 0.0077 |
| | 500 | 0.1302 | 0.5016 | 0.8032 | 0.0023 | 0.0291 | 0.0268 | 237 | 0.0118 |
| | 750 | 0.2680 | 1.0271 | 1.6958 | 0.0049 | 0.0606 | 0.0558 | 486 | 0.0242 |
| | 1000 | 0.3484 | 1.3166 | 4.0040 | 0.0060 | 0.0983 | 0.0904 | 594 | 0.0314 |
| Rubber Tired Loaders Compos | | 0.0753 | 0.4406 | 0.4747 | 0.0012 | 0.0235 | 0.0216 | 109 | 0.0068 |
| Scrapers | 120 | 0.1218 | 0.6612 | 0.7170 | 0.0011 | 0.0551 | 0.0507 | 93.9 | 0.0110 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1400 | 0.8921 | 0.9020 | 0.0017 | 0.0505 | 0.0464 | 148 | 0.0126 |
| | 250 | 0.1522 | 0.5044 | 1.1344 | 0.0024 | 0.0412 | 0.0379 | 209 | 0.0137 |
| | 500 | 0.2211 | 0.8455 | 1.5615 | 0.0032 | 0.0584 | 0.0537 | 321 | 0.0200 |
| | 750 | 0.3839 | 1.4588 | 2.7734 | 0.0056 | 0.1024 | 0.0942 | 555 | 0.0346 |
| Scrapers Composite | | 0.1914 | 0.7938 | 1.3434 | 0.0027 | 0.0541 | 0.0497 | 262 | 0.0173 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0502 | 0.2833 | 0.2631 | 0.0005 | 0.0131 | 0.0121 | 36.2 | 0.0045 |
| | 120 | 0.0558 | 0.4946 | 0.4424 | 0.0009 | 0.0264 | 0.0243 | 80.2 | 0.0050 |
| | 175 | 0.0811 | 0.8276 | 0.6279 | 0.0017 | 0.0302 | 0.0277 | 155 | 0.0073 |
| | 250 | 0.1022 | 0.4765 | 0.8737 | 0.0029 | 0.0266 | 0.0245 | 255 | 0.0092 |
| Signal Boards Composite | | 0.0129 | 0.0912 | 0.0912 | 0.0002 | 0.0042 | 0.0038 | 16.7 | 0.0012 |
| Skid Steer Loade | 25 | 0.0171 | 0.0575 | 0.1070 | 0.0002 | 0.0044 | 0.0040 | 13.8 | 0.0015 |
| | 50 | 0.0230 | 0.2006 | 0.1655 | 0.0003 | 0.0043 | 0.0040 | 25.5 | 0.0021 |
| | 120 | 0.0218 | 0.2673 | 0.1647 | 0.0005 | 0.0064 | 0.0059 | 42.8 | 0.0020 |
| Skid Steer Loaders Composite | | 0.0222 | 0.2125 | 0.1614 | 0.0004 | 0.0050 | 0.0046 | 30.3 | 0.0020 |
| Surfacing Equipm | 50 | 0.0265 | 0.1191 | 0.1069 | 0.0002 | 0.0063 | 0.0058 | 14.1 | 0.0024 |
| | 120 | 0.0570 | 0.4028 | 0.4035 | 0.0007 | 0.0271 | 0.0250 | 63.8 | 0.0051 |
| | 175 | 0.0550 | 0.4663 | 0.4168 | 0.0010 | 0.0210 | 0.0193 | 85.8 | 0.0050 |
| | 250 | 0.0652 | 0.2754 | 0.5719 | 0.0015 | 0.0188 | 0.0173 | 135 | 0.0059 |
| | 500 | 0.1008 | 0.4728 | 0.8400 | 0.0022 | 0.0288 | 0.0265 | 221 | 0.0091 |
| | 750 | 0.1599 | 0.7413 | 1.3593 | 0.0035 | 0.0459 | 0.0423 | 347 | 0.0144 |
| Surfacing Equipment Compos | | 0.0823 | 0.3953 | 0.6593 | 0.0017 | 0.0239 | 0.0220 | 166 | 0.0074 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0430 | 0.2898 | 0.2365 | 0.0004 | 0.0098 | 0.0090 | 31.6 | 0.0039 |
| | 120 | 0.0555 | 0.4959 | 0.3694 | 0.0009 | 0.0210 | 0.0193 | 75.0 | 0.0050 |
| | 175 | 0.0845 | 0.8043 | 0.4869 | 0.0016 | 0.0253 | 0.0233 | 139 | 0.0076 |
| | 250 | 0.0803 | 0.3198 | 0.4530 | 0.0018 | 0.0152 | 0.0140 | 162 | 0.0072 |
| Sweepers/Scrubbers Compos | | 0.0584 | 0.4916 | 0.3563 | 0.0009 | 0.0183 | 0.0169 | 78.5 | 0.0053 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0046 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0407 | 0.2760 | 0.2179 | 0.0004 | 0.0087 | 0.0080 | 30.3 | 0.0037 |
| | 120 | 0.0366 | 0.3402 | 0.2466 | 0.0006 | 0.0129 | 0.0119 | 51.7 | 0.0033 |
| | 175 | 0.0571 | 0.5841 | 0.3220 | 0.0011 | 0.0159 | 0.0146 | 101 | 0.0052 |
| | 250 | 0.0813 | 0.3445 | 0.4427 | 0.0019 | 0.0151 | 0.0139 | 172 | 0.0073 |
| | 500 | 0.1606 | 0.6642 | 0.8132 | 0.0039 | 0.0294 | 0.0270 | 345 | 0.0145 |
| | 750 | 0.2409 | 0.9959 | 1.2387 | 0.0058 | 0.0443 | 0.0408 | 517 | 0.0217 |
| Tractors/Loaders/Backhoes C | | 0.0436 | 0.3616 | 0.2744 | 0.0008 | 0.0134 | 0.0124 | 66.8 | 0.0039 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0990 | 0.3495 | 0.2804 | 0.0004 | 0.0218 | 0.0201 | 32.9 | 0.0089 |
| | 120 | 0.0849 | 0.4443 | 0.5223 | 0.0008 | 0.0408 | 0.0375 | 64.9 | 0.0077 |
| | 175 | 0.1346 | 0.8393 | 0.9412 | 0.0016 | 0.0521 | 0.0479 | 144 | 0.0121 |
| | 250 | 0.1600 | 0.5472 | 1.3120 | 0.0025 | 0.0487 | 0.0448 | 223 | 0.0144 |
| | 500 | 0.2092 | 0.8710 | 1.6487 | 0.0031 | 0.0623 | 0.0573 | 311 | 0.0189 |
| | 750 | 0.3964 | 1.6395 | 3.1894 | 0.0059 | 0.1191 | 0.1095 | 587 | 0.0358 |
| Trenchers Composite | | 0.0933 | 0.4270 | 0.4575 | 0.0007 | 0.0336 | 0.0309 | 58.7 | 0.0084 |
| Welders | 15 | 0.0080 | 0.0388 | 0.0498 | 0.0001 | 0.0025 | 0.0023 | 6.2 | 0.0007 |
| | 25 | 0.0153 | 0.0492 | 0.0903 | 0.0001 | 0.0042 | 0.0039 | 11.3 | 0.0014 |
| | 50 | 0.0435 | 0.2219 | 0.1968 | 0.0003 | 0.0110 | 0.0102 | 26.0 | 0.0039 |
| | 120 | 0.0321 | 0.2508 | 0.2344 | 0.0005 | 0.0153 | 0.0140 | 39.5 | 0.0029 |
| | 175 | 0.0600 | 0.5396 | 0.4393 | 0.0011 | 0.0223 | 0.0205 | 98.2 | 0.0054 |
| | 250 | 0.0551 | 0.2294 | 0.4536 | 0.0013 | 0.0142 | 0.0130 | 119 | 0.0050 |
| | 500 | 0.0748 | 0.3117 | 0.5690 | 0.0016 | 0.0192 | 0.0176 | 168 | 0.0067 |
| Welders Composite | | 0.0310 | 0.1816 | 0.1735 | 0.0003 | 0.0102 | 0.0094 | 25.6 | 0.0028 |

**San Diego 2025 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,343,732.35 | ########### | 8,492,736.38 | 0.02 | 0.71 | 0.09 | 223.96 | 0.05 | 0.04 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 6,282.20 | 213,159.29 | 39,008.92 | 0.01 | 0.09 | 0.31 | 246.18 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 198,419.75 | 7,123,689.46 | 1,204,641.90 | 0.02 | 1.09 | 0.12 | 276.49 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 240.83 | 8,707.20 | 1,432.14 | 0.02 | 0.13 | 0.37 | 242.28 | 0.06 | 0.05 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 479,791.14 | ########### | 3,017,273.36 | 0.01 | 0.73 | 0.08 | 343.84 | 0.05 | 0.04 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 211.77 | 7,665.63 | 1,309.49 | 0.02 | 0.11 | 0.40 | 268.51 | 0.06 | 0.05 | 0.00 | | |
| Average | | | | | | | 0.019 | 0.478 | 0.227 | 266.878 | 0.052 | 0.042 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,476 | 582,978 | - | 0.22 | 1.01 | 2.06 | 1541.82 | 0.07 | 0.10 | 0.02 | | |

Source: EMFAC 2011

## 2025 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0132 | 0.0451 | 0.0838 | 0.0001 | 0.0032 | 0.0030 | 11.0 | 0.0012 |
| | 50 | 0.0168 | 0.1351 | 0.1218 | 0.0003 | 0.0035 | 0.0032 | 19.6 | 0.0015 |
| | 120 | 0.0176 | 0.2265 | 0.1496 | 0.0004 | 0.0063 | 0.0058 | 38.1 | 0.0016 |
| | 500 | 0.0580 | 0.3710 | 0.3660 | 0.0021 | 0.0109 | 0.0100 | 213 | 0.0052 |
| | 750 | 0.1054 | 0.6706 | 0.6753 | 0.0039 | 0.0199 | 0.0183 | 385 | 0.0095 |
| Aerial Lifts Composite | | 0.0184 | 0.1646 | 0.1366 | 0.0004 | 0.0048 | 0.0044 | 34.7 | 0.0017 |
| Air Compressors | 15 | 0.0087 | 0.0444 | 0.0545 | 0.0001 | 0.0023 | 0.0022 | 7.2 | 0.0008 |
| | 25 | 0.0181 | 0.0605 | 0.1121 | 0.0002 | 0.0045 | 0.0042 | 14.4 | 0.0016 |
| | 50 | 0.0263 | 0.1911 | 0.1476 | 0.0003 | 0.0047 | 0.0043 | 22.3 | 0.0024 |
| | 120 | 0.0289 | 0.3023 | 0.1928 | 0.0006 | 0.0088 | 0.0081 | 47.0 | 0.0026 |
| | 175 | 0.0424 | 0.4998 | 0.2187 | 0.0010 | 0.0104 | 0.0095 | 88.5 | 0.0038 |
| | 250 | 0.0514 | 0.2531 | 0.2553 | 0.0015 | 0.0078 | 0.0072 | 131 | 0.0046 |
| | 500 | 0.0894 | 0.4292 | 0.4150 | 0.0023 | 0.0134 | 0.0123 | 232 | 0.0081 |
| | 750 | 0.1385 | 0.6633 | 0.6545 | 0.0036 | 0.0210 | 0.0193 | 358 | 0.0125 |
| | 1000 | 0.1999 | 0.9265 | 2.5439 | 0.0049 | 0.0483 | 0.0444 | 486 | 0.0180 |
| Air Compressors Composite | | 0.0349 | 0.3027 | 0.2104 | 0.0007 | 0.0088 | 0.0081 | 63.6 | 0.0031 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0190 | 0.2200 | 0.1662 | 0.0004 | 0.0009 | 0.0008 | 31.0 | 0.0017 |
| | 120 | 0.0252 | 0.4660 | 0.1955 | 0.0009 | 0.0020 | 0.0018 | 77.1 | 0.0023 |
| | 175 | 0.0324 | 0.7542 | 0.0787 | 0.0016 | 0.0030 | 0.0027 | 141 | 0.0029 |
| | 250 | 0.0427 | 0.3426 | 0.0981 | 0.0021 | 0.0035 | 0.0032 | 188 | 0.0039 |
| | 500 | 0.0706 | 0.5512 | 0.1622 | 0.0031 | 0.0058 | 0.0054 | 311 | 0.0064 |
| | 750 | 0.1396 | 1.0891 | 0.3204 | 0.0062 | 0.0115 | 0.0106 | 615 | 0.0126 |
| | 1000 | 0.2115 | 1.6437 | 3.8912 | 0.0093 | 0.0364 | 0.0335 | 928 | 0.0191 |
| Bore/Drill Rigs Composite | | 0.0428 | 0.5007 | 0.2864 | 0.0017 | 0.0042 | 0.0038 | 165 | 0.0039 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0213 | 0.0724 | 0.1346 | 0.0002 | 0.0052 | 0.0048 | 17.6 | 0.0019 |
| Cement and Mortar Mixers Co | | 0.0085 | 0.0414 | 0.0534 | 0.0001 | 0.0021 | 0.0019 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0279 | 0.2284 | 0.1910 | 0.0004 | 0.0053 | 0.0049 | 30.2 | 0.0025 |
| | 120 | 0.0370 | 0.4561 | 0.2840 | 0.0009 | 0.0117 | 0.0108 | 74.1 | 0.0033 |
| | 175 | 0.0623 | 0.8663 | 0.3523 | 0.0018 | 0.0160 | 0.0147 | 160 | 0.0056 |
| Concrete/Industrial Saws Com | | 0.0337 | 0.3706 | 0.2471 | 0.0007 | 0.0093 | 0.0086 | 58.5 | 0.0030 |
| Cranes | 50 | 0.0350 | 0.2256 | 0.1644 | 0.0003 | 0.0062 | 0.0057 | 23.2 | 0.0032 |
| | 120 | 0.0376 | 0.3384 | 0.2298 | 0.0006 | 0.0120 | 0.0111 | 50.1 | 0.0034 |
| | 175 | 0.0462 | 0.4744 | 0.2300 | 0.0009 | 0.0120 | 0.0110 | 80.3 | 0.0042 |
| | 250 | 0.0544 | 0.2316 | 0.2705 | 0.0013 | 0.0094 | 0.0087 | 112 | 0.0049 |
| | 500 | 0.0858 | 0.3535 | 0.3977 | 0.0018 | 0.0146 | 0.0134 | 180 | 0.0077 |
| | 750 | 0.1446 | 0.5947 | 0.6821 | 0.0030 | 0.0248 | 0.0228 | 303 | 0.0130 |
| | 9999 | 0.5219 | 1.9715 | 5.5760 | 0.0098 | 0.1146 | 0.1055 | 971 | 0.0471 |
| Cranes Composite | | 0.0681 | 0.3738 | 0.4223 | 0.0014 | 0.0143 | 0.0132 | 129 | 0.0061 |
| Crawler Tractors | 50 | 0.0487 | 0.2566 | 0.1842 | 0.0003 | 0.0090 | 0.0083 | 24.9 | 0.0044 |
| | 120 | 0.0609 | 0.4537 | 0.3562 | 0.0008 | 0.0221 | 0.0203 | 65.8 | 0.0055 |
| | 175 | 0.0823 | 0.7265 | 0.4447 | 0.0014 | 0.0241 | 0.0222 | 121 | 0.0074 |
| | 250 | 0.0924 | 0.3662 | 0.5348 | 0.0019 | 0.0192 | 0.0177 | 166 | 0.0083 |
| | 500 | 0.1392 | 0.5877 | 0.7527 | 0.0025 | 0.0280 | 0.0258 | 259 | 0.0126 |
| | 750 | 0.2506 | 1.0528 | 1.3878 | 0.0047 | 0.0510 | 0.0469 | 465 | 0.0226 |
| | 1000 | 0.3749 | 1.5618 | 4.2168 | 0.0066 | 0.0958 | 0.0881 | 658 | 0.0338 |
| Crawler Tractors Composite | | 0.0789 | 0.5065 | 0.4492 | 0.0013 | 0.0227 | 0.0209 | 114 | 0.0071 |
| Crushing/Proc. E | 50 | 0.0508 | 0.3859 | 0.2899 | 0.0006 | 0.0083 | 0.0077 | 44.0 | 0.0046 |
| | 120 | 0.0506 | 0.5406 | 0.3289 | 0.0010 | 0.0140 | 0.0129 | 83.1 | 0.0046 |
| | 175 | 0.0795 | 0.9556 | 0.3830 | 0.0019 | 0.0177 | 0.0163 | 167 | 0.0072 |
| | 250 | 0.0967 | 0.4768 | 0.4357 | 0.0028 | 0.0134 | 0.0123 | 245 | 0.0087 |
| | 500 | 0.1459 | 0.6977 | 0.6163 | 0.0037 | 0.0200 | 0.0184 | 374 | 0.0132 |
| | 750 | 0.2307 | 1.1003 | 0.9907 | 0.0059 | 0.0316 | 0.0291 | 589 | 0.0208 |
| | 9999 | 0.6019 | 2.5014 | 6.6977 | 0.0131 | 0.1238 | 0.1139 | 1,308 | 0.0543 |
| Crushing/Proc. Equipment Co | | 0.0693 | 0.6187 | 0.3763 | 0.0015 | 0.0146 | 0.0134 | 132 | 0.0062 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0297 | 0.2365 | 0.1616 | 0.0003 | 0.0035 | 0.0032 | 25.0 | 0.0027 |
| | 120 | 0.0448 | 0.4942 | 0.2638 | 0.0009 | 0.0092 | 0.0085 | 73.6 | 0.0040 |
| | 175 | 0.0518 | 0.6636 | 0.1982 | 0.0013 | 0.0091 | 0.0084 | 112 | 0.0047 |
| | 250 | 0.0647 | 0.3210 | 0.2222 | 0.0018 | 0.0074 | 0.0068 | 159 | 0.0058 |
| | 500 | 0.0946 | 0.4495 | 0.3091 | 0.0023 | 0.0107 | 0.0098 | 234 | 0.0085 |
| | 750 | 0.1569 | 0.7451 | 0.5194 | 0.0039 | 0.0178 | 0.0164 | 387 | 0.0142 |
| Excavators Composite | | 0.0559 | 0.5086 | 0.2269 | 0.0013 | 0.0086 | 0.0079 | 120 | 0.0050 |
| Forklifts | 50 | 0.0150 | 0.1361 | 0.0904 | 0.0002 | 0.0013 | 0.0012 | 14.7 | 0.0014 |
| | 120 | 0.0168 | 0.2086 | 0.0997 | 0.0004 | 0.0023 | 0.0021 | 31.2 | 0.0015 |
| | 175 | 0.0228 | 0.3310 | 0.0732 | 0.0006 | 0.0029 | 0.0026 | 56.1 | 0.0021 |
| | 250 | 0.0289 | 0.1551 | 0.0746 | 0.0009 | 0.0027 | 0.0024 | 77.1 | 0.0026 |
| | 500 | 0.0416 | 0.2123 | 0.1038 | 0.0011 | 0.0038 | 0.0035 | 111 | 0.0038 |
| Forklifts Composite | | 0.0236 | 0.2148 | 0.0860 | 0.0006 | 0.0025 | 0.0023 | 54.4 | 0.0021 |
| Generator Sets | 15 | 0.0109 | 0.0627 | 0.0768 | 0.0002 | 0.0032 | 0.0030 | 10.2 | 0.0010 |
| | 25 | 0.0216 | 0.0738 | 0.1368 | 0.0002 | 0.0055 | 0.0050 | 17.6 | 0.0019 |
| | 50 | 0.0242 | 0.2034 | 0.1881 | 0.0004 | 0.0051 | 0.0047 | 30.6 | 0.0022 |
| | 120 | 0.0340 | 0.4585 | 0.3022 | 0.0009 | 0.0122 | 0.0112 | 77.9 | 0.0031 |
| | 175 | 0.0469 | 0.7328 | 0.3291 | 0.0016 | 0.0136 | 0.0125 | 142 | 0.0042 |
| | 250 | 0.0558 | 0.3746 | 0.3885 | 0.0024 | 0.0108 | 0.0099 | 213 | 0.0050 |
| | 500 | 0.0862 | 0.5820 | 0.5697 | 0.0033 | 0.0167 | 0.0153 | 337 | 0.0078 |
| | 750 | 0.1401 | 0.9395 | 0.9382 | 0.0055 | 0.0272 | 0.0250 | 544 | 0.0126 |
| | 9999 | 0.3235 | 1.8648 | 5.2188 | 0.0105 | 0.0888 | 0.0817 | 1,049 | 0.0292 |
| Generator Sets Composite | | 0.0288 | 0.2667 | 0.2329 | 0.0007 | 0.0081 | 0.0074 | 61.0 | 0.0026 |
| Graders | 50 | 0.0382 | 0.2599 | 0.1877 | 0.0004 | 0.0063 | 0.0058 | 27.5 | 0.0034 |
| | 120 | 0.0521 | 0.5009 | 0.3219 | 0.0009 | 0.0153 | 0.0141 | 75.0 | 0.0047 |
| | 175 | 0.0652 | 0.7261 | 0.3117 | 0.0014 | 0.0157 | 0.0144 | 124 | 0.0059 |
| | 250 | 0.0781 | 0.3549 | 0.3652 | 0.0019 | 0.0129 | 0.0119 | 172 | 0.0071 |
| | 500 | 0.1023 | 0.4610 | 0.4468 | 0.0023 | 0.0165 | 0.0152 | 229 | 0.0092 |
| | 750 | 0.2167 | 0.9755 | 0.9628 | 0.0049 | 0.0353 | 0.0324 | 486 | 0.0196 |
| Graders Composite | | 0.0676 | 0.5696 | 0.3314 | 0.0015 | 0.0147 | 0.0135 | 133 | 0.0061 |
| Off-Highway Trac | 120 | 0.1108 | 0.6619 | 0.6362 | 0.0011 | 0.0455 | 0.0419 | 93.7 | 0.0100 |
| | 175 | 0.1110 | 0.7932 | 0.6639 | 0.0015 | 0.0370 | 0.0341 | 130 | 0.0100 |
| | 250 | 0.0890 | 0.3179 | 0.5983 | 0.0015 | 0.0227 | 0.0208 | 130 | 0.0080 |
| | 750 | 0.3692 | 1.5358 | 2.4157 | 0.0057 | 0.0918 | 0.0844 | 568 | 0.0333 |
| | 1000 | 0.5623 | 2.3619 | 6.0896 | 0.0082 | 0.1577 | 0.1451 | 814 | 0.0507 |
| Off-Highway Tractors Compos | | 0.1134 | 0.6101 | 0.7291 | 0.0017 | 0.0331 | 0.0305 | 151 | 0.0102 |
| Off-Highway Truc | 175 | 0.0622 | 0.7536 | 0.2376 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0056 |
| | 250 | 0.0730 | 0.3435 | 0.2521 | 0.0019 | 0.0085 | 0.0078 | 167 | 0.0066 |
| | 500 | 0.1183 | 0.5319 | 0.3878 | 0.0027 | 0.0135 | 0.0124 | 272 | 0.0107 |
| | 750 | 0.1921 | 0.8627 | 0.6384 | 0.0044 | 0.0221 | 0.0203 | 442 | 0.0173 |
| | 1000 | 0.2823 | 1.2403 | 3.1782 | 0.0063 | 0.0546 | 0.0502 | 625 | 0.0255 |
| Off-Highway Trucks Composit | | 0.1140 | 0.5385 | 0.4769 | 0.0027 | 0.0142 | 0.0131 | 260 | 0.0103 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0244 | 0.2188 | 0.1693 | 0.0004 | 0.0034 | 0.0031 | 28.0 | 0.0022 |
| | 120 | 0.0379 | 0.5045 | 0.2730 | 0.0009 | 0.0087 | 0.0080 | 80.9 | 0.0034 |
| | 175 | 0.0384 | 0.5858 | 0.1729 | 0.0012 | 0.0075 | 0.0069 | 107 | 0.0035 |
| | 500 | 0.0792 | 0.4606 | 0.3034 | 0.0025 | 0.0099 | 0.0091 | 254 | 0.0071 |
| Other Construction Equipment | | 0.0442 | 0.3474 | 0.2021 | 0.0013 | 0.0069 | 0.0063 | 123 | 0.0040 |
| Other General In | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0298 | 0.2099 | 0.1491 | 0.0003 | 0.0047 | 0.0043 | 21.7 | 0.0027 |
| | 120 | 0.0436 | 0.4189 | 0.2603 | 0.0007 | 0.0120 | 0.0111 | 62.0 | 0.0039 |
| | 175 | 0.0519 | 0.5684 | 0.2412 | 0.0011 | 0.0115 | 0.0106 | 95.9 | 0.0047 |
| | 250 | 0.0608 | 0.2743 | 0.2679 | 0.0015 | 0.0083 | 0.0076 | 136 | 0.0055 |
| | 500 | 0.1174 | 0.5103 | 0.4826 | 0.0026 | 0.0157 | 0.0145 | 265 | 0.0106 |
| | 750 | 0.1939 | 0.8411 | 0.8117 | 0.0044 | 0.0262 | 0.0241 | 437 | 0.0175 |
| | 1000 | 0.2627 | 1.1060 | 2.9924 | 0.0056 | 0.0579 | 0.0533 | 560 | 0.0237 |
| Other General Industrial Equip | | 0.0747 | 0.4438 | 0.3947 | 0.0016 | 0.0130 | 0.0120 | 152 | 0.0067 |
| Other Material Ha | 50 | 0.0410 | 0.2893 | 0.2073 | 0.0004 | 0.0065 | 0.0060 | 30.3 | 0.0037 |
| | 120 | 0.0421 | 0.4076 | 0.2541 | 0.0007 | 0.0117 | 0.0108 | 60.7 | 0.0038 |
| | 175 | 0.0653 | 0.7197 | 0.3067 | 0.0014 | 0.0146 | 0.0134 | 122 | 0.0059 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0642 | 0.2920 | 0.2863 | 0.0016 | 0.0088 | 0.0081 | 145 | 0.0058 |
| | 500 | 0.0837 | 0.3670 | 0.3482 | 0.0019 | 0.0113 | 0.0104 | 192 | 0.0075 |
| | 9999 | 0.3781 | 1.4596 | 3.9555 | 0.0073 | 0.0764 | 0.0703 | 741 | 0.0341 |
| Other Material Handling Equip | | 0.0696 | 0.4355 | 0.3844 | 0.0015 | 0.0124 | 0.0114 | 141 | 0.0063 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1422 | 0.0002 | 0.0053 | 0.0049 | 18.7 | 0.0020 |
| | 50 | 0.0574 | 0.2803 | 0.2102 | 0.0004 | 0.0114 | 0.0105 | 28.0 | 0.0052 |
| | 120 | 0.0662 | 0.4696 | 0.4003 | 0.0008 | 0.0263 | 0.0242 | 69.2 | 0.0060 |
| | 175 | 0.0899 | 0.7543 | 0.5238 | 0.0014 | 0.0286 | 0.0263 | 128 | 0.0081 |
| | 250 | 0.1097 | 0.4287 | 0.7020 | 0.0022 | 0.0254 | 0.0234 | 194 | 0.0099 |
| | 500 | 0.1263 | 0.5374 | 0.7572 | 0.0023 | 0.0284 | 0.0261 | 233 | 0.0114 |
| Pavers Composite | | 0.0717 | 0.4745 | 0.3858 | 0.0009 | 0.0220 | 0.0202 | 77.9 | 0.0065 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0469 | 0.2355 | 0.1789 | 0.0003 | 0.0095 | 0.0088 | 23.9 | 0.0042 |
| | 120 | 0.0503 | 0.3671 | 0.3092 | 0.0006 | 0.0200 | 0.0184 | 54.5 | 0.0045 |
| | 175 | 0.0687 | 0.5900 | 0.4021 | 0.0011 | 0.0219 | 0.0201 | 101 | 0.0062 |
| | 250 | 0.0672 | 0.2648 | 0.4289 | 0.0014 | 0.0154 | 0.0141 | 122 | 0.0061 |
| Paving Equipment Composite | | 0.0548 | 0.3993 | 0.3281 | 0.0008 | 0.0190 | 0.0175 | 68.9 | 0.0049 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0052 | 0.0301 | 0.0368 | 0.0001 | 0.0015 | 0.0014 | 4.9 | 0.0005 |
| | 25 | 0.0087 | 0.0299 | 0.0555 | 0.0001 | 0.0022 | 0.0020 | 7.1 | 0.0008 |
| | 50 | 0.0079 | 0.0810 | 0.0843 | 0.0002 | 0.0019 | 0.0018 | 14.3 | 0.0007 |
| | 120 | 0.0082 | 0.1351 | 0.0897 | 0.0003 | 0.0031 | 0.0029 | 24.1 | 0.0007 |
| Pressure Washers Composite | | 0.0066 | 0.0531 | 0.0561 | 0.0001 | 0.0019 | 0.0017 | 9.4 | 0.0006 |
| Pumps | 15 | 0.0089 | 0.0456 | 0.0560 | 0.0001 | 0.0024 | 0.0022 | 7.4 | 0.0008 |
| | 25 | 0.0244 | 0.0816 | 0.1512 | 0.0002 | 0.0061 | 0.0056 | 19.5 | 0.0022 |
| | 50 | 0.0299 | 0.2394 | 0.2138 | 0.0004 | 0.0061 | 0.0056 | 34.3 | 0.0027 |
| | 120 | 0.0365 | 0.4656 | 0.3062 | 0.0009 | 0.0129 | 0.0119 | 77.9 | 0.0033 |
| | 175 | 0.0499 | 0.7342 | 0.3301 | 0.0016 | 0.0142 | 0.0130 | 140 | 0.0045 |
| | 250 | 0.0572 | 0.3604 | 0.3745 | 0.0023 | 0.0107 | 0.0098 | 201 | 0.0052 |
| | 500 | 0.0959 | 0.6034 | 0.5922 | 0.0034 | 0.0178 | 0.0163 | 345 | 0.0087 |
| | 750 | 0.1593 | 0.9975 | 0.9991 | 0.0057 | 0.0297 | 0.0274 | 571 | 0.0144 |
| | 9999 | 0.4488 | 2.4388 | 6.8114 | 0.0136 | 0.1186 | 0.1091 | 1,355 | 0.0405 |
| Pumps Composite | | 0.0270 | 0.2617 | 0.2079 | 0.0006 | 0.0078 | 0.0072 | 49.6 | 0.0024 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0345 | 0.2258 | 0.1776 | 0.0003 | 0.0068 | 0.0062 | 26.0 | 0.0031 |
| | 120 | 0.0392 | 0.3801 | 0.2647 | 0.0007 | 0.0137 | 0.0126 | 59.0 | 0.0035 |
| | 175 | 0.0553 | 0.6096 | 0.3030 | 0.0012 | 0.0156 | 0.0143 | 108 | 0.0050 |
| | 250 | 0.0656 | 0.3037 | 0.3629 | 0.0017 | 0.0127 | 0.0116 | 153 | 0.0059 |
| | 500 | 0.0920 | 0.4189 | 0.4752 | 0.0022 | 0.0174 | 0.0160 | 219 | 0.0083 |
| Rollers Composite | | 0.0410 | 0.3763 | 0.2501 | 0.0008 | 0.0122 | 0.0113 | 67.0 | 0.0037 |
| Rough Terrain Fo | 50 | 0.0381 | 0.3041 | 0.2193 | 0.0004 | 0.0054 | 0.0049 | 33.9 | 0.0034 |
| | 120 | 0.0369 | 0.4106 | 0.2316 | 0.0007 | 0.0087 | 0.0080 | 62.4 | 0.0033 |
| | 175 | 0.0569 | 0.7229 | 0.2450 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0051 |
| | 250 | 0.0671 | 0.3372 | 0.2625 | 0.0019 | 0.0084 | 0.0077 | 171 | 0.0061 |
| | 500 | 0.0999 | 0.4838 | 0.3682 | 0.0025 | 0.0123 | 0.0113 | 257 | 0.0090 |
| Rough Terrain Forklifts Compo | | 0.0396 | 0.4430 | 0.2336 | 0.0008 | 0.0090 | 0.0083 | 70.3 | 0.0036 |
| Rubber Tired Doz | 175 | 0.1163 | 0.8019 | 0.6895 | 0.0015 | 0.0386 | 0.0355 | 129 | 0.0105 |
| | 250 | 0.1329 | 0.4624 | 0.8841 | 0.0021 | 0.0340 | 0.0312 | 183 | 0.0120 |
| | 500 | 0.1817 | 0.7490 | 1.1543 | 0.0026 | 0.0448 | 0.0412 | 265 | 0.0164 |
| | 750 | 0.2747 | 1.1262 | 1.7818 | 0.0040 | 0.0684 | 0.0629 | 399 | 0.0248 |
| | 1000 | 0.4321 | 1.7954 | 4.5523 | 0.0060 | 0.1202 | 0.1106 | 592 | 0.0390 |
| Rubber Tired Dozers Composi | | 0.1672 | 0.6620 | 1.0824 | 0.0025 | 0.0419 | 0.0385 | 239 | 0.0151 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0418 | 0.2904 | 0.2109 | 0.0004 | 0.0069 | 0.0063 | 31.1 | 0.0038 |
| | 120 | 0.0397 | 0.3916 | 0.2476 | 0.0007 | 0.0115 | 0.0105 | 58.9 | 0.0036 |
| | 175 | 0.0546 | 0.6199 | 0.2592 | 0.0012 | 0.0130 | 0.0119 | 106 | 0.0049 |
| | 250 | 0.0661 | 0.3041 | 0.3040 | 0.0017 | 0.0107 | 0.0099 | 149 | 0.0060 |
| | 500 | 0.1034 | 0.4654 | 0.4455 | 0.0023 | 0.0164 | 0.0151 | 237 | 0.0093 |
| | 750 | 0.2119 | 0.9532 | 0.9273 | 0.0049 | 0.0338 | 0.0311 | 486 | 0.0191 |
| | 1000 | 0.2701 | 1.1927 | 3.2272 | 0.0060 | 0.0615 | 0.0566 | 594 | 0.0244 |
| Rubber Tired Loaders Compos | | 0.0559 | 0.4311 | 0.2835 | 0.0012 | 0.0121 | 0.0111 | 109 | 0.0050 |
| Scrapers | 120 | 0.0887 | 0.6472 | 0.5218 | 0.0011 | 0.0330 | 0.0303 | 93.9 | 0.0080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1025 | 0.8864 | 0.5654 | 0.0017 | 0.0307 | 0.0282 | 148 | 0.0092 |
| | 250 | 0.1187 | 0.4642 | 0.7040 | 0.0024 | 0.0254 | 0.0234 | 209 | 0.0107 |
| | 500 | 0.1755 | 0.7332 | 0.9727 | 0.0032 | 0.0364 | 0.0335 | 321 | 0.0158 |
| | 750 | 0.3043 | 1.2657 | 1.7266 | 0.0056 | 0.0638 | 0.0587 | 555 | 0.0275 |
| Scrapers Composite | | 0.1495 | 0.7187 | 0.8387 | 0.0027 | 0.0335 | 0.0308 | 262 | 0.0135 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0332 | 0.2686 | 0.2268 | 0.0005 | 0.0063 | 0.0058 | 36.2 | 0.0030 |
| | 120 | 0.0394 | 0.4898 | 0.3076 | 0.0009 | 0.0127 | 0.0116 | 80.2 | 0.0036 |
| | 175 | 0.0587 | 0.8292 | 0.3433 | 0.0017 | 0.0152 | 0.0139 | 155 | 0.0053 |
| | 250 | 0.0794 | 0.4676 | 0.4435 | 0.0029 | 0.0132 | 0.0121 | 255 | 0.0072 |
| Signal Boards Composite | | 0.0111 | 0.0909 | 0.0718 | 0.0002 | 0.0029 | 0.0026 | 16.7 | 0.0010 |
| Skid Steer Loade | 25 | 0.0167 | 0.0568 | 0.1055 | 0.0002 | 0.0040 | 0.0037 | 13.8 | 0.0015 |
| | 50 | 0.0194 | 0.1977 | 0.1446 | 0.0003 | 0.0015 | 0.0014 | 25.5 | 0.0017 |
| | 120 | 0.0175 | 0.2665 | 0.1240 | 0.0005 | 0.0022 | 0.0020 | 42.8 | 0.0016 |
| Skid Steer Loaders Composite | | 0.0186 | 0.2104 | 0.1354 | 0.0004 | 0.0019 | 0.0018 | 30.3 | 0.0017 |
| Surfacing Equipm | 50 | 0.0171 | 0.1105 | 0.0934 | 0.0002 | 0.0035 | 0.0033 | 14.1 | 0.0015 |
| | 120 | 0.0385 | 0.3950 | 0.2869 | 0.0007 | 0.0146 | 0.0134 | 63.8 | 0.0035 |
| | 175 | 0.0386 | 0.4642 | 0.2429 | 0.0010 | 0.0119 | 0.0109 | 85.8 | 0.0035 |
| | 250 | 0.0504 | 0.2604 | 0.3275 | 0.0015 | 0.0111 | 0.0103 | 135 | 0.0045 |
| | 500 | 0.0800 | 0.4236 | 0.4893 | 0.0022 | 0.0174 | 0.0160 | 221 | 0.0072 |
| | 750 | 0.1260 | 0.6643 | 0.7833 | 0.0035 | 0.0275 | 0.0253 | 347 | 0.0114 |
| Surfacing Equipment Compos | | 0.0638 | 0.3590 | 0.3924 | 0.0017 | 0.0142 | 0.0131 | 166 | 0.0058 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0308 | 0.2762 | 0.1942 | 0.0004 | 0.0033 | 0.0031 | 31.6 | 0.0028 |
| | 120 | 0.0395 | 0.4895 | 0.2530 | 0.0009 | 0.0068 | 0.0062 | 75.0 | 0.0036 |
| | 175 | 0.0565 | 0.8005 | 0.2201 | 0.0016 | 0.0084 | 0.0077 | 139 | 0.0051 |
| | 250 | 0.0587 | 0.3179 | 0.1898 | 0.0018 | 0.0062 | 0.0057 | 162 | 0.0053 |
| Sweepers/Scrubbers Compos | | 0.0410 | 0.4840 | 0.2255 | 0.0009 | 0.0061 | 0.0056 | 78.5 | 0.0037 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0045 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0316 | 0.2678 | 0.1895 | 0.0004 | 0.0037 | 0.0034 | 30.3 | 0.0029 |
| | 120 | 0.0281 | 0.3379 | 0.1761 | 0.0006 | 0.0055 | 0.0051 | 51.7 | 0.0025 |
| | 175 | 0.0420 | 0.5839 | 0.1613 | 0.0011 | 0.0072 | 0.0066 | 101 | 0.0038 |
| | 250 | 0.0633 | 0.3389 | 0.2157 | 0.0019 | 0.0073 | 0.0067 | 172 | 0.0057 |
| | 500 | 0.1263 | 0.6506 | 0.4127 | 0.0039 | 0.0144 | 0.0132 | 345 | 0.0114 |
| | 750 | 0.1896 | 0.9760 | 0.6256 | 0.0058 | 0.0216 | 0.0199 | 517 | 0.0171 |
| Tractors/Loaders/Backhoes C | | 0.0336 | 0.3586 | 0.1857 | 0.0008 | 0.0059 | 0.0054 | 66.8 | 0.0030 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0687 | 0.3197 | 0.2467 | 0.0004 | 0.0140 | 0.0129 | 32.9 | 0.0062 |
| | 120 | 0.0625 | 0.4341 | 0.3863 | 0.0008 | 0.0259 | 0.0239 | 64.9 | 0.0056 |
| | 175 | 0.1009 | 0.8327 | 0.6152 | 0.0016 | 0.0338 | 0.0311 | 144 | 0.0091 |
| | 250 | 0.1247 | 0.4925 | 0.8480 | 0.0025 | 0.0309 | 0.0285 | 223 | 0.0112 |
| | 500 | 0.1661 | 0.7370 | 1.0663 | 0.0031 | 0.0400 | 0.0368 | 311 | 0.0150 |
| | 750 | 0.3147 | 1.3882 | 2.0666 | 0.0059 | 0.0766 | 0.0705 | 587 | 0.0284 |
| Trenchers Composite | | 0.0674 | 0.4085 | 0.3481 | 0.0007 | 0.0215 | 0.0198 | 58.7 | 0.0061 |
| Welders | 15 | 0.0075 | 0.0381 | 0.0468 | 0.0001 | 0.0020 | 0.0018 | 6.2 | 0.0007 |
| | 25 | 0.0141 | 0.0473 | 0.0876 | 0.0001 | 0.0035 | 0.0033 | 11.3 | 0.0013 |
| | 50 | 0.0280 | 0.2077 | 0.1684 | 0.0003 | 0.0053 | 0.0048 | 26.0 | 0.0025 |
| | 120 | 0.0223 | 0.2476 | 0.1601 | 0.0005 | 0.0073 | 0.0067 | 39.5 | 0.0020 |
| | 175 | 0.0430 | 0.5400 | 0.2396 | 0.0011 | 0.0111 | 0.0103 | 98.2 | 0.0039 |
| | 250 | 0.0423 | 0.2236 | 0.2294 | 0.0013 | 0.0069 | 0.0064 | 119 | 0.0038 |
| | 500 | 0.0585 | 0.3040 | 0.2969 | 0.0016 | 0.0095 | 0.0087 | 168 | 0.0053 |
| Welders Composite | | 0.0214 | 0.1745 | 0.1373 | 0.0003 | 0.0052 | 0.0048 | 25.6 | 0.0019 |

# Attachment I2 Alternative EN-1B Emissions

EN1B - LSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15,326.46 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 |

Annual Emissions (tons/year)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 2.19 | 15.89 | 12.00 | | 0.80 | 0.74 | 1,898 |
| Construction Off-Road Equipment | 0.37 | 3.45 | 1.46 | 0.00 | 0.45 | 0.26 | 433 |
| On-Road Motor Vehicles | 0.00 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 9 |
| *Total On-Shore Emissions* | 0.37 | 3.47 | 1.49 | 0.00 | 0.45 | 0.27 | 2,340 |
| Amortized Construction | | | | | | | 468 |

EN1B - HSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15,326.46 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 |

Annual Emissions (tons/year)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 2.51 | 18.21 | 13.75 | | 0.92 | 0.85 | 2,176 |
| Construction Off-Road Equipment | 0.40 | 3.79 | 1.60 | 0.01 | 0.50 | 0.29 | 475 |
| On-Road Motor Vehicles | 0.00 | 0.02 | 0.03 | 0.00 | 0.00 | 0.00 | 10 |
| *Total On-Shore Emissions* | 0.40 | 3.80 | 1.63 | 0.01 | 0.50 | 0.29 | 2,661 |
| Amortized Construction | | | | | | | 532 |

SB2B - LSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15,326.46 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 |

Annual Emissions (tons/year)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 4.59 | 33.32 | 25.16 | | 1.69 | 1.55 | 3,982 |
| Construction Off-Road Equipment | 1.19 | 11.20 | 4.74 | 0.02 | 1.47 | 0.86 | 1,404 |
| On-Road Motor Vehicles | 0.00 | 0.04 | 0.09 | 0.00 | 0.01 | 0.00 | 28 |
| *Total On-Shore Emissions* | 1.19 | 11.24 | 4.83 | 0.02 | 1.47 | 0.86 | 5,414 |
| Amortized Construction | | | | | | | 541 |

BS-2B - HSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15326.46 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 |

Annual Emissions (tons/year)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 5.17 | 37.59 | 28.38 | | 1.90 | 1.75 | 4,491 |
| Construction Off-Road Equipment | 1.30 | 12.26 | 5.19 | 0.02 | 1.61 | 0.94 | 1,537 |
| On-Road Motor Vehicles | 0.01 | 0.04 | 0.10 | 0.00 | 0.01 | 0.00 | 31 |
| *Total On-Shore Emissions* | 1.31 | 12.30 | 5.29 | 0.02 | 1.61 | 0.94 | 6,058 |
| Amortized Construction | | | | | | | 606 |

EN1B - LSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 6.22 | 44.98 | 25.61 | 0.08 | 8.15 | 2.60 | 7,219.52 |
| On-Road Motor Vehicles | 0.10 | 2.03 | 0.61 | 0.01 | 0.11 | 0.06 | 797.79 |
| *Total On-Shore Emissions* | 6.32 | 47.01 | 26.22 | 0.09 | 8.26 | 2.66 | 8,017.32 |

E1BN - HSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 6.22 | 44.98 | 25.61 | 0.08 | 8.15 | 2.60 | 7219.52 |
| On-Road Motor Vehicles | 0.10 | 2.03 | 0.61 | 0.01 | 0.11 | 0.06 | 797.79 |
| *Total On-Shore Emissions* | 6.32 | 47.01 | 26.22 | 0.09 | 8.26 | 2.66 | 8,017.32 |

SB1B - LSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 4.90 | 30.72 | 22.16 | 0.08 | 7.49 | 1.99 | 7,219.38 |
| On-Road Motor Vehicles | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |
| *Total On-Shore Emissions* | 4.99 | 31.65 | 22.93 | 0.09 | 7.56 | 2.06 | 7,996.95 |

SB1B - HSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 4.90 | 30.72 | 22.16 | 0.08 | 7.49 | 1.99 | 7,219.38 |
| On-Road Motor Vehicles | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |
| *Total On-Shore Emissions* | 4.99 | 31.65 | 22.93 | 0.09 | 7.56 | 2.06 | 7,996.95 |

## Alternative EN-1B - Construction - Low Sea Level Rise

**Emission Factor**

| Source Description | Number | Usage Factor | Unit | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

**Emissions Summary**

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | |
| Pump | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8.285 | 0.37 | lbs/dav |
| Loader | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1.303 | 0.11 | lbs/dav |
| Dozer | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5.738 | 0.59 | lbs/dav |
| | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | | | 15,326.46 | 1.07 | lbs/day |
| | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | |
| Bulldozing | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/dav |
| **Peak Daily Emissions Summary, Uncontrolled =** | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | 6.28 | 0.88 | 15,326.46 | 1.07 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | **11.84** | **111.42** | **47.17** | **0.15** | | | **10.45** | **4.71** | **15,326.46** | **1.07** | **lbs/day** |

| Source Description | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | |
| Pump | | 0.13 | 1.50 | 0.52 | 0.00 | 0.04 | 0.04 | - | - | 234 | 0.0103 | tons |
| Loader | | 0.04 | 0.29 | 0.17 | 0.00 | 0.02 | 0.01 | - | - | 37 | 0.0032 | tons |
| Dozer | | 0.20 | 1.66 | 0.78 | 0.00 | 0.07 | 0.06 | - | - | 162 | 0.0166 | tons |
| | | 0.37 | 3.45 | 1.46 | 0.00 | 0.13 | 0.12 | | | 432.36 | 0.03 | tons |
| | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | |
| Bulldozing | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | 0.37 | 3.45 | 1.46 | 0.00 | 0.13 | 0.12 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | **0.37** | **3.45** | **1.46** | **0.00** | **0.45** | **0.26** | **0.32** | **0.15** | **432** | **0.030** | tons |
| | | | | | | | | | | **Total GHG Emissions** | **433** | tons |

| Project Length | Work Days |
|---|---|
| | 62 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 410,000 | 41 | 62 | 860,000 | 86 | 201 | ######## | 127 | 263 |
| HSL | 470,000 | 47 | 68 | 970,000 | 97 | 220 | ######## | 144 | 288 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warm |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Ph

# Alternative EN-1B - Construction - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| Construction Days Per Year | 41.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 2.19 | 15.89 | 12.00 | 0.80 | 0.74 | 1,898 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-1B - Construction - Low Sea Level Rise

**On-Road Construction Emissions**

| | | | | | | Total Daily Emissions (lbs) | | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 62 | 24,800 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 | 0.00 | 0.012 | 0.03 | 0.00 | 0.00 | 0.00 | 9 | 8 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 28 | 40 | 560 | 64 | 25,120 | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.00 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 9.90 | 9.01 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-1B - Operations - Low Sea Level Rise

**Emission Factor**

| Source Description | Number | Usage Factor | Unit | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.08 | 0.47 | 0.44 | 0.001 | 0.02 | 0.02 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.21 | 1.58 | 0.80 | 0.002 | 0.06 | 0.06 | - | - | 239.08 | 0.02 | lbs/hr |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

**Emissions Summary**

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | |
| Pump | 0.23 | 1.43 | 1.11 | 0.00 | 0.07 | 0.07 | - | - | 178 | 0.02 | lbs/day |
| Loader | 0.90 | 5.70 | 5.29 | 0.01 | 0.28 | 0.26 | - | - | 1,303 | 0.08 | lbs/day |
| Dozer | 5.08 | 37.85 | 19.21 | 0.06 | 1.51 | 1.39 | - | - | 5,738 | 0.46 | lbs/day |
| | 6.22 | 44.98 | 25.61 | 0.08 | 1.87 | 1.72 | | | 7,219.52 | 0.56 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | |
| Bulldozing | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | 6.22 | 44.98 | 25.61 | 0.08 | 1.87 | 1.72 | 6.28 | 0.88 | 7,219.52 | 0.56 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | **6.22** | **44.98** | **25.61** | **0.08** | | | **8.15** | **2.60** | **7,219.52** | **0.56** | **lbs/day** |

| Source Description | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | |
| Pump | | 0.01 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | - | - | 4 | 0.0004 | tons |
| Loader | | 0.02 | 0.13 | 0.12 | 0.00 | 0.01 | 0.01 | - | - | 28 | 0.0017 | tons |
| Dozer | | 0.12 | 0.89 | 0.45 | 0.00 | 0.04 | 0.03 | - | - | 123 | 0.0098 | tons |
| | | 0.15 | 1.06 | 0.60 | 0.00 | 0.04 | 0.04 | | | 154.39 | 0.01 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | |
| Bulldozing | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | 0.15 | 1.06 | 0.60 | 0.00 | 0.04 | 0.04 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | **0.15** | **1.06** | **0.60** | **0.00** | | | **0.19** | **0.06** | **154** | **0.012** | tons |
| | | | | | | | | | | **Total GHG Emissions** | **155** | tons |

| Project Length | Workdays |
|---|---|
| | 47 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 260,000 | 26 | 47 | 350,000 | 35 | 56 | 610,000 | 61 | 103 |
| HSL | 330,000 | 33 | 54 | 500,000 | 50 | 71 | 830,000 | 83 | 125 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

## Alternative EE1B - Operations - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |

Operating Days Per Year 26.0

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.36 | 2.65 | 7.61 | 0.06 | 0.06 | 1,323 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

# Alternative EN-1B - Operations - Low Sea Level Rise

## On-Road Construction Emissions

| | | | | | | Total Daily Emissions (lbs) | | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 47 | 18,800 | 0.02 | 0.55 | 0.25 | 0.00 | 0.05 | 0.02 | 251 | 0.00 | 0.013 | 0.01 | 0.00 | 0.00 | 0.00 | 6 | 5 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 1.48 | 0.36 | 0.01 | 0.06 | 0.04 | 547 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 28 | 40 | 560 | 49 | 19,120 | 0.10 | 2.03 | 0.61 | 0.01 | 0.11 | 0.06 | 797.79 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 6.45 | 5.87 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

# Alternative EN-1B - Construction - High Sea Level Rise

**Emission Factor**

| Source Description | Number | Usage Factor | Unit | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

**Emissions Summary**

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8.285 | 0.37 | lbs/day |
| Loader | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1.303 | 0.11 | lbs/day |
| Dozer | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5.738 | 0.59 | lbs/day |
| | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | | | 15,326.46 | 1.07 | lbs/day |
| Bulldozing | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | 6.28 | 0.88 | 15,326.46 | 1.07 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | **11.84** | **111.42** | **47.17** | **0.15** | | | **10.45** | **4.71** | **15,326.46** | **1.07** | **lbs/day** |

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump | 0.14 | 1.65 | 0.57 | 0.00 | 0.05 | 0.05 | - | - | 256 | 0.0113 | tons |
| Loader | 0.04 | 0.32 | 0.19 | 0.00 | 0.02 | 0.02 | - | - | 40 | 0.0035 | tons |
| Dozer | 0.22 | 1.82 | 0.85 | 0.00 | 0.08 | 0.07 | - | - | 178 | 0.0182 | tons |
| | 0.40 | 3.79 | 1.60 | 0.01 | 0.14 | 0.13 | | | 474.20 | 0.03 | tons |
| Bulldozing | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | 0.40 | 3.79 | 1.60 | 0.01 | 0.14 | 0.13 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | **0.40** | **3.79** | **1.60** | **0.01** | **0.50** | **0.29** | **0.36** | **0.16** | **474** | **0.033** | tons |
| | | | | | | | | | **Total GHG Emissions** | **475** | tons |

| Project Length | Work Days |
|---|---|
| | 68 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 410,000 | 41 | 62 | 860,000 | 86 | 201 | ######## | 127 | 263 |
| HSL | 470,000 | 47 | 68 | 970,000 | 97 | 220 | ######## | 144 | 288 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warm |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Ph

# Alternative EN-1B - Construction - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 47.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 2.51 | 18.21 | 13.75 | 0.92 | 0.85 | 2,176 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-1B - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | | | | | | Total Daily Emissions (lbs) | | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 68 | 27,200 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 | 0.00 | 0.013 | 0.03 | 0.00 | 0.00 | 0.00 | 10 | 9 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 28 | 40 | 560 | 70 | 27,520 | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.00 | 0.02 | 0.03 | 0.00 | 0.00 | 0.00 | 10.80 | 9.83 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-1B - Operations - High Sea Level Rise

**Emission Factor**

| Source Description | Number | Usage Factor | Unit | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.08 | 0.47 | 0.44 | 0.001 | 0.02 | 0.02 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.21 | 1.58 | 0.80 | 0.002 | 0.06 | 0.06 | - | - | 239.08 | 0.02 | lbs/hr |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

**Emissions Summary**

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | |
| Pump | 0.23 | 1.43 | 1.11 | 0.00 | 0.07 | 0.07 | - | - | 178 | 0.02 | lbs/day |
| Loader | 0.90 | 5.70 | 5.29 | 0.01 | 0.28 | 0.26 | - | - | 1,303 | 0.08 | lbs/day |
| Dozer | 5.08 | 37.85 | 19.21 | 0.06 | 1.51 | 1.39 | - | - | 5,738 | 0.46 | lbs/day |
| | 6.22 | 44.98 | 25.61 | 0.08 | 1.87 | 1.72 | | | 7,219.52 | 0.56 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | |
| Bulldozing | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | 6.22 | 44.98 | 25.61 | 0.08 | 1.87 | 1.72 | 6.28 | 0.88 | 7,219.52 | 0.56 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | **6.22** | **44.98** | **25.61** | **0.08** | | | **8.15** | **2.60** | **7,219.52** | **0.56** | **lbs/day** |

| Source Description | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | |
| Pump | | 0.01 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 | - | - | 4 | 0.0005 | tons |
| Loader | | 0.02 | 0.15 | 0.14 | 0.00 | 0.01 | 0.01 | - | - | 32 | 0.0020 | tons |
| Dozer | | 0.14 | 1.02 | 0.52 | 0.00 | 0.04 | 0.04 | - | - | 141 | 0.0113 | tons |
| | | 0.17 | 1.21 | 0.69 | 0.00 | 0.05 | 0.05 | | | 177.38 | 0.01 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | |
| Bulldozing | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | 0.17 | 1.21 | 0.69 | 0.00 | 0.05 | 0.05 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | **0.17** | **1.21** | **0.69** | **0.00** | | | **0.22** | **0.07** | **177** | **0.014** | tons |
| | | | | | | | | | | **Total GHG Emissions** | **178** | tons |

| Project Length | Workdays |
|---|---|
| | 54 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 260,000 | 26 | 47 | 350,000 | 35 | 56 | 610,000 | 61 | 103 |
| HSL | 330,000 | 33 | 54 | 500,000 | 50 | 71 | 830,000 | 83 | 125 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

# Alternative EN-1B - Operations - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| Operating Days Per Year | 33.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.46 | 3.37 | 9.66 | 0.08 | 0.07 | 1,679 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-1B - Operations - High Sea Level Rise

**On-Road Construction Emissions**

| | | | | | | Total Daily Emissions (lbs) | | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Total Trips** | **Distance** | **Average Daily Mileage** | **Project Length (days)** | **Total Mileage** | **ROG** | **$NO_x$** | **CO** | **SOx** | **PM10** | **PM25** | **CO2** | **ROG** | **$NO_x$** | **CO** | **SOx** | **PM10** | **PM25** | **$CO_2$** | **Total GHG Emissions (Metric Tons)** |
| Worker Trips | 20 | 20 | 400 | 54 | 21,600 | 0.02 | 0.55 | 0.25 | 0.00 | 0.05 | 0.02 | 251 | 0.00 | 0.015 | 0.01 | 0.00 | 0.00 | 0.00 | 7 | 6 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 1.48 | 0.36 | 0.01 | 0.06 | 0.04 | 547 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 28 | 40 | 560 | 56 | 21,920 | 0.10 | 2.03 | 0.61 | 0.01 | 0.11 | 0.06 | 797.79 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 7.33 | 6.67 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

**San Diego 2015 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,169,183 | 42,600,783.75 | 7,361,743.79 | 0.045 | 1.290 | 0.136 | 302.103 | 0.047 | 0.019 | 0.004 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,466 | 179,216.55 | 31,712.66 | 0.038 | 0.215 | 0.576 | 315.879 | 0.072 | 0.043 | 0.004 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 172,849 | 6,187,162.79 | 1,061,257.19 | 0.075 | 2.505 | 0.269 | 357.183 | 0.048 | 0.021 | 0.004 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 210 | 6,179.81 | 1,102.01 | 0.066 | 0.312 | 0.691 | 314.863 | 0.099 | 0.068 | 0.004 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 423,444 | 16,224,268.59 | 2,675,454.93 | 0.037 | 1.498 | 0.192 | 432.459 | 0.047 | 0.019 | 0.005 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 187 | 5,978.69 | 1,021.81 | 0.046 | 0.252 | 0.690 | 323.109 | 0.080 | 0.050 | 0.004 | | |
| Average | | | | | | | 0.051 | 1.012 | 0.426 | 340.933 | 0.066 | 0.037 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 2,454 | 392,614.49 | 0 | 0.296 | 1.343 | 8.984 | 1699.527 | 0.231 | 0.158 | 0.017 | | |

Source: EMFAC 2011

**San Diego 2020 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,261,438 | 46,436,329 | 7,971,039 | 0.03 | 0.10 | 0.83 | 244.16 | 0.05 | 0.02 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,897 | 203,726 | 36,279 | 0.02 | 0.39 | 0.13 | 265.72 | 0.06 | 0.03 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 186,176 | 6,674,684 | 1,134,440 | 0.04 | 0.17 | 1.56 | 297.84 | 0.05 | 0.02 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 226 | 8,187 | 1,308 | 0.03 | 0.45 | 0.17 | 259.42 | 0.07 | 0.04 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 450,141 | 17,355,693 | 2,832,803 | 0.02 | 0.11 | 0.93 | 364.76 | 0.05 | 0.02 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 199 | 7,528 | 1,228 | 0.02 | 0.47 | 0.14 | 280.32 | 0.06 | 0.03 | 0.00 | | |
| Average | | | | | | | 0.026 | 0.283 | 0.626 | 285.370 | 0.055 | 0.027 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,262 | 531,839 | - | 0.22 | 1.02 | 4.20 | 1553.04 | 0.18 | 0.11 | 0.02 | | |

Source: EMFAC 2011

## 2015 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0155 | 0.0486 | 0.0902 | 0.0001 | 0.0046 | 0.0042 | 11.0 | 0.0014 |
| | 50 | 0.0480 | 0.1641 | 0.1699 | 0.0003 | 0.0129 | 0.0119 | 19.6 | 0.0043 |
| | 120 | 0.0460 | 0.2377 | 0.3272 | 0.0004 | 0.0246 | 0.0226 | 38.1 | 0.0042 |
| | 500 | 0.1026 | 0.4261 | 1.2422 | 0.0021 | 0.0368 | 0.0339 | 213 | 0.0093 |
| | 750 | 0.1912 | 0.7702 | 2.3263 | 0.0039 | 0.0680 | 0.0626 | 385 | 0.0173 |
| Aerial Lifts Composite | | 0.0439 | 0.1837 | 0.2670 | 0.0004 | 0.0167 | 0.0154 | 34.7 | 0.0040 |
| Air Compressors | 15 | 0.0108 | 0.0466 | 0.0664 | 0.0001 | 0.0040 | 0.0037 | 7.2 | 0.0010 |
| | 25 | 0.0229 | 0.0681 | 0.1247 | 0.0002 | 0.0069 | 0.0064 | 14.4 | 0.0021 |
| | 50 | 0.0747 | 0.2360 | 0.2056 | 0.0003 | 0.0183 | 0.0168 | 22.3 | 0.0067 |
| | 120 | 0.0691 | 0.3182 | 0.4334 | 0.0006 | 0.0375 | 0.0345 | 47.0 | 0.0062 |
| | 175 | 0.0903 | 0.5019 | 0.7101 | 0.0010 | 0.0388 | 0.0357 | 88.5 | 0.0082 |
| | 250 | 0.0892 | 0.2803 | 0.9294 | 0.0015 | 0.0286 | 0.0263 | 131 | 0.0080 |
| | 500 | 0.1463 | 0.4915 | 1.4297 | 0.0023 | 0.0470 | 0.0432 | 232 | 0.0132 |
| | 750 | 0.2285 | 0.7595 | 2.2932 | 0.0036 | 0.0743 | 0.0683 | 358 | 0.0206 |
| | 1000 | 0.3551 | 1.1843 | 4.4558 | 0.0049 | 0.1239 | 0.1140 | 486 | 0.0320 |
| Air Compressors Composite | | 0.0773 | 0.3257 | 0.5175 | 0.0007 | 0.0357 | 0.0329 | 63.6 | 0.0070 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1220 | 0.0002 | 0.0047 | 0.0043 | 16.0 | 0.0017 |
| | 50 | 0.0234 | 0.2235 | 0.2240 | 0.0004 | 0.0075 | 0.0069 | 31.0 | 0.0021 |
| | 120 | 0.0376 | 0.4676 | 0.3736 | 0.0009 | 0.0160 | 0.0148 | 77.1 | 0.0034 |
| | 175 | 0.0618 | 0.7540 | 0.5364 | 0.0016 | 0.0198 | 0.0182 | 141 | 0.0056 |
| | 250 | 0.0681 | 0.3425 | 0.4900 | 0.0021 | 0.0144 | 0.0132 | 188 | 0.0061 |
| | 500 | 0.1118 | 0.5511 | 0.7692 | 0.0031 | 0.0236 | 0.0217 | 311 | 0.0101 |
| | 750 | 0.2212 | 1.0888 | 1.5301 | 0.0062 | 0.0466 | 0.0429 | 615 | 0.0200 |
| | 1000 | 0.3562 | 1.6528 | 4.9704 | 0.0093 | 0.1194 | 0.1098 | 928 | 0.0321 |
| Bore/Drill Rigs Composite | | 0.0673 | 0.5022 | 0.6138 | 0.0017 | 0.0200 | 0.0184 | 165 | 0.0061 |
| Cement and Mortar Mixers | 15 | 0.0074 | 0.0386 | 0.0464 | 0.0001 | 0.0019 | 0.0018 | 6.3 | 0.0007 |
| | 25 | 0.0251 | 0.0782 | 0.1456 | 0.0002 | 0.0074 | 0.0068 | 17.6 | 0.0023 |
| Cement and Mortar Mixers Composite | | 0.0088 | 0.0419 | 0.0545 | 0.0001 | 0.0024 | 0.0022 | 7.2 | 0.0008 |
| Concrete/Industrial Saws | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0782 | 0.2745 | 0.2652 | 0.0004 | 0.0206 | 0.0189 | 30.2 | 0.0071 |
| | 120 | 0.0892 | 0.4759 | 0.6249 | 0.0009 | 0.0486 | 0.0448 | 74.1 | 0.0080 |
| | 175 | 0.1340 | 0.8674 | 1.1593 | 0.0018 | 0.0585 | 0.0538 | 160 | 0.0121 |
| Concrete/Industrial Saws Composite | | 0.0835 | 0.3982 | 0.4921 | 0.0007 | 0.0374 | 0.0345 | 58.5 | 0.0075 |
| Cranes | 50 | 0.0853 | 0.2729 | 0.2235 | 0.0003 | 0.0202 | 0.0186 | 23.2 | 0.0077 |
| | 120 | 0.0800 | 0.3559 | 0.4822 | 0.0006 | 0.0415 | 0.0382 | 50.1 | 0.0072 |
| | 175 | 0.0919 | 0.4794 | 0.6684 | 0.0009 | 0.0378 | 0.0348 | 80.3 | 0.0083 |
| | 250 | 0.0925 | 0.2713 | 0.8284 | 0.0013 | 0.0286 | 0.0263 | 112 | 0.0083 |
| | 500 | 0.1393 | 0.4663 | 1.1812 | 0.0018 | 0.0426 | 0.0392 | 180 | 0.0126 |
| | 750 | 0.2358 | 0.7835 | 2.0490 | 0.0030 | 0.0729 | 0.0671 | 303 | 0.0213 |
| | 9999 | 0.8682 | 2.8913 | 9.2743 | 0.0098 | 0.2775 | 0.2553 | 971 | 0.0783 |
| Cranes Composite | | 0.1204 | 0.4395 | 1.0200 | 0.0014 | 0.0426 | 0.0392 | 129 | 0.0109 |
| Crawler Tractors | 50 | 0.1017 | 0.3087 | 0.2464 | 0.0003 | 0.0232 | 0.0214 | 24.9 | 0.0092 |
| | 120 | 0.1143 | 0.4774 | 0.6815 | 0.0008 | 0.0579 | 0.0533 | 65.8 | 0.0103 |
| | 175 | 0.1509 | 0.7384 | 1.0951 | 0.0014 | 0.0614 | 0.0565 | 121 | 0.0136 |
| | 250 | 0.1582 | 0.4614 | 1.3531 | 0.0019 | 0.0514 | 0.0473 | 166 | 0.0143 |
| | 500 | 0.2300 | 0.8352 | 1.8987 | 0.0025 | 0.0732 | 0.0673 | 259 | 0.0207 |
| | 750 | 0.4140 | 1.4936 | 3.4863 | 0.0047 | 0.1327 | 0.1221 | 465 | 0.0374 |
| | 1000 | 0.6278 | 2.3640 | 6.6574 | 0.0066 | 0.2075 | 0.1909 | 658 | 0.0566 |
| Crawler Tractors Composite | | 0.1415 | 0.5650 | 1.0059 | 0.0013 | 0.0594 | 0.0546 | 114 | 0.0128 |
| Crushing/Proc. Equipment | 50 | 0.1392 | 0.4644 | 0.4024 | 0.0006 | 0.0346 | 0.0318 | 44.0 | 0.0126 |
| | 120 | 0.1167 | 0.5646 | 0.7374 | 0.0010 | 0.0629 | 0.0579 | 83.1 | 0.0105 |
| | 175 | 0.1654 | 0.9559 | 1.2783 | 0.0019 | 0.0700 | 0.0644 | 167 | 0.0149 |
| | 250 | 0.1646 | 0.5171 | 1.6355 | 0.0028 | 0.0506 | 0.0466 | 245 | 0.0149 |
| | 500 | 0.2358 | 0.7790 | 2.1722 | 0.0037 | 0.0722 | 0.0664 | 374 | 0.0213 |
| | 750 | 0.3723 | 1.2184 | 3.5561 | 0.0059 | 0.1154 | 0.1062 | 589 | 0.0336 |
| | 9999 | 0.9726 | 3.0901 | 11.5626 | 0.0131 | 0.3225 | 0.2967 | 1,308 | 0.0878 |
| Crushing/Proc. Equipment Composite | | 0.1465 | 0.6549 | 0.9893 | 0.0015 | 0.0607 | 0.0558 | 132 | 0.0132 |
| Dumpers/Tenders | 25 | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Dumpers/Tenders Composite | | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0650 | 0.2683 | 0.2256 | 0.0003 | 0.0167 | 0.0154 | 25.0 | 0.0059 |
| | 120 | 0.0912 | 0.5102 | 0.5787 | 0.0009 | 0.0455 | 0.0418 | 73.6 | 0.0082 |
| | 175 | 0.1052 | 0.6653 | 0.7408 | 0.0013 | 0.0405 | 0.0372 | 112 | 0.0095 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1117 | 0.3431 | 0.8935 | 0.0018 | 0.0297 | 0.0273 | 159 | 0.0101 |
| | 500 | 0.1577 | 0.4964 | 1.1619 | 0.0023 | 0.0413 | 0.0380 | 234 | 0.0142 |
| | 750 | 0.2630 | 0.8225 | 1.9926 | 0.0039 | 0.0698 | 0.0642 | 387 | 0.0237 |
| Excavators Composite | | 0.1064 | 0.5248 | 0.7416 | 0.0013 | 0.0379 | 0.0349 | 120 | 0.0096 |
| Forklifts | 50 | 0.0324 | 0.1522 | 0.1324 | 0.0002 | 0.0092 | 0.0084 | 14.7 | 0.0029 |
| | 120 | 0.0345 | 0.2143 | 0.2326 | 0.0004 | 0.0174 | 0.0160 | 31.2 | 0.0031 |
| | 175 | 0.0486 | 0.3316 | 0.3442 | 0.0006 | 0.0189 | 0.0174 | 56.1 | 0.0044 |
| | 250 | 0.0518 | 0.1582 | 0.4040 | 0.0009 | 0.0133 | 0.0122 | 77.1 | 0.0047 |
| | 500 | 0.0724 | 0.2164 | 0.5170 | 0.0011 | 0.0185 | 0.0171 | 111 | 0.0065 |
| Forklifts Composite | | 0.0459 | 0.2200 | 0.3163 | 0.0006 | 0.0156 | 0.0143 | 54.4 | 0.0041 |
| Generator Sets | 15 | 0.0135 | 0.0658 | 0.0929 | 0.0002 | 0.0051 | 0.0047 | 10.2 | 0.0012 |
| | 25 | 0.0247 | 0.0831 | 0.1522 | 0.0002 | 0.0080 | 0.0074 | 17.6 | 0.0022 |
| | 50 | 0.0706 | 0.2465 | 0.2628 | 0.0004 | 0.0193 | 0.0178 | 30.6 | 0.0064 |
| | 120 | 0.0910 | 0.4811 | 0.6607 | 0.0009 | 0.0484 | 0.0445 | 77.9 | 0.0082 |
| | 175 | 0.1120 | 0.7350 | 1.0463 | 0.0016 | 0.0485 | 0.0446 | 142 | 0.0101 |
| | 250 | 0.1090 | 0.4148 | 1.3776 | 0.0024 | 0.0381 | 0.0351 | 213 | 0.0098 |
| Generator Sets - 500 hp | 500 | 0.1556 | 0.6639 | 1.9429 | 0.0033 | 0.0567 | 0.0522 | 337 | 0.0140 |
| | 750 | 0.2599 | 1.0718 | 3.2483 | 0.0055 | 0.0934 | 0.0860 | 544 | 0.0234 |
| | 9999 | 0.6582 | 2.3655 | 8.9789 | 0.0105 | 0.2325 | 0.2139 | 1,049 | 0.0594 |
| Generator Sets Composite | | 0.0640 | 0.2913 | 0.4717 | 0.0007 | 0.0268 | 0.0246 | 61.0 | 0.0058 |
| Graders | 50 | 0.0897 | 0.3082 | 0.2569 | 0.0004 | 0.0217 | 0.0200 | 27.5 | 0.0081 |
| | 120 | 0.1081 | 0.5230 | 0.6726 | 0.0009 | 0.0555 | 0.0511 | 75.0 | 0.0098 |
| | 175 | 0.1299 | 0.7319 | 0.9534 | 0.0014 | 0.0526 | 0.0484 | 124 | 0.0117 |
| | 250 | 0.1326 | 0.4046 | 1.1596 | 0.0019 | 0.0400 | 0.0368 | 172 | 0.0120 |
| | 500 | 0.1666 | 0.5739 | 1.3760 | 0.0023 | 0.0496 | 0.0456 | 229 | 0.0150 |
| | 750 | 0.3549 | 1.2133 | 3.0011 | 0.0049 | 0.1066 | 0.0981 | 486 | 0.0320 |
| Graders Composite | | 0.1277 | 0.5931 | 0.9795 | 0.0015 | 0.0489 | 0.0450 | 133 | 0.0115 |
| Off-Highway Tractors | 120 | 0.1905 | 0.7051 | 1.1159 | 0.0011 | 0.0952 | 0.0876 | 93.7 | 0.0172 |
| | 175 | 0.1870 | 0.8216 | 1.3703 | 0.0015 | 0.0771 | 0.0709 | 130 | 0.0169 |
| | 250 | 0.1489 | 0.4320 | 1.2644 | 0.0015 | 0.0520 | 0.0478 | 130 | 0.0134 |
| | 750 | 0.5975 | 2.5165 | 5.0885 | 0.0057 | 0.2047 | 0.1884 | 568 | 0.0539 |
| | 1000 | 0.9006 | 3.9378 | 9.2072 | 0.0082 | 0.3063 | 0.2818 | 814 | 0.0813 |
| Off-Highway Tractors Composite | | 0.1893 | 0.7244 | 1.5085 | 0.0017 | 0.0717 | 0.0660 | 151 | 0.0171 |
| Off-Highway Trucks | 175 | 0.1259 | 0.7559 | 0.8596 | 0.0014 | 0.0477 | 0.0438 | 125 | 0.0114 |
| | 250 | 0.1252 | 0.3702 | 0.9818 | 0.0019 | 0.0328 | 0.0301 | 167 | 0.0113 |
| | 500 | 0.1960 | 0.5949 | 1.4165 | 0.0027 | 0.0505 | 0.0465 | 272 | 0.0177 |
| | 750 | 0.3198 | 0.9645 | 2.3779 | 0.0044 | 0.0835 | 0.0768 | 442 | 0.0289 |
| | 1000 | 0.4873 | 1.4801 | 5.2216 | 0.0063 | 0.1505 | 0.1385 | 625 | 0.0440 |
| Off-Highway Trucks Composite | | 0.1924 | 0.5974 | 1.4932 | 0.0027 | 0.0516 | 0.0475 | 260 | 0.0174 |
| Other Construction Equipment | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0039 | 0.0036 | 13.2 | 0.0014 |
| | 50 | 0.0597 | 0.2506 | 0.2369 | 0.0004 | 0.0162 | 0.0149 | 28.0 | 0.0054 |
| | 120 | 0.0827 | 0.5202 | 0.6012 | 0.0009 | 0.0441 | 0.0406 | 80.9 | 0.0075 |
| | 175 | 0.0796 | 0.5864 | 0.6636 | 0.0012 | 0.0331 | 0.0305 | 107 | 0.0072 |
| | 500 | 0.1310 | 0.4963 | 1.1867 | 0.0025 | 0.0394 | 0.0362 | 254 | 0.0118 |
| Other Construction Equipment Composite | | 0.0768 | 0.3645 | 0.6392 | 0.0013 | 0.0264 | 0.0243 | 123 | 0.0069 |
| Other General Industrial Equipmen | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0786 | 0.2532 | 0.2077 | 0.0003 | 0.0191 | 0.0175 | 21.7 | 0.0071 |
| | 120 | 0.0987 | 0.4387 | 0.5864 | 0.0007 | 0.0521 | 0.0480 | 62.0 | 0.0089 |
| | 175 | 0.1083 | 0.5684 | 0.7866 | 0.0011 | 0.0448 | 0.0412 | 95.9 | 0.0098 |
| | 250 | 0.1050 | 0.3015 | 0.9812 | 0.0015 | 0.0312 | 0.0287 | 136 | 0.0095 |
| | 500 | 0.1931 | 0.5811 | 1.6702 | 0.0026 | 0.0569 | 0.0524 | 265 | 0.0174 |
| | 750 | 0.3208 | 0.9578 | 2.8569 | 0.0044 | 0.0959 | 0.0883 | 437 | 0.0289 |
| | 1000 | 0.4546 | 1.4023 | 5.2482 | 0.0056 | 0.1513 | 0.1392 | 560 | 0.0410 |
| Other General Industrial Equipmen Composite | | 0.1355 | 0.4843 | 1.1215 | 0.0016 | 0.0475 | 0.0437 | 152 | 0.0122 |
| Other Material Handling Equipmen | 50 | 0.1090 | 0.3501 | 0.2887 | 0.0004 | 0.0265 | 0.0244 | 30.3 | 0.0098 |
| | 120 | 0.0959 | 0.4271 | 0.5727 | 0.0007 | 0.0509 | 0.0468 | 60.7 | 0.0087 |
| | 175 | 0.1365 | 0.7201 | 0.9997 | 0.0014 | 0.0567 | 0.0522 | 122 | 0.0123 |
| | 250 | 0.1109 | 0.3211 | 1.0483 | 0.0016 | 0.0332 | 0.0306 | 145 | 0.0100 |
| | 500 | 0.1376 | 0.4182 | 1.2042 | 0.0019 | 0.0409 | 0.0377 | 192 | 0.0124 |
| | 9999 | 0.6190 | 1.8527 | 6.9410 | 0.0073 | 0.1995 | 0.1835 | 741 | 0.0558 |
| Other Material Handling Equipment Composite | | 0.1289 | 0.4698 | 1.0967 | 0.0015 | 0.0460 | 0.0423 | 141 | 0.0116 |
| Pavers | 25 | 0.0234 | 0.0780 | 0.1458 | 0.0002 | 0.0066 | 0.0060 | 18.7 | 0.0021 |
| | 50 | 0.1198 | 0.3421 | 0.2775 | 0.0004 | 0.0271 | 0.0249 | 28.0 | 0.0108 |
| | 120 | 0.1235 | 0.4969 | 0.7477 | 0.0008 | 0.0636 | 0.0585 | 69.2 | 0.0111 |
| | 175 | 0.1608 | 0.7707 | 1.2155 | 0.0014 | 0.0673 | 0.0619 | 128 | 0.0145 |

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1858 | 0.5585 | 1.6747 | 0.0022 | 0.0640 | 0.0589 | 194 | 0.0168 |
| | 500 | 0.2059 | 0.8113 | 1.8097 | 0.0023 | 0.0697 | 0.0641 | 233 | 0.0186 |
| Pavers Composite | | 0.1347 | 0.5203 | 0.7607 | 0.0009 | 0.0526 | 0.0484 | 77.9 | 0.0122 |
| Paving Equipment | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0037 | 0.0034 | 12.6 | 0.0014 |
| | 50 | 0.1023 | 0.2901 | 0.2367 | 0.0003 | 0.0231 | 0.0213 | 23.9 | 0.0092 |
| | 120 | 0.0969 | 0.3891 | 0.5874 | 0.0006 | 0.0503 | 0.0462 | 54.5 | 0.0087 |
| | 175 | 0.1254 | 0.6025 | 0.9549 | 0.0011 | 0.0528 | 0.0486 | 101 | 0.0113 |
| | 250 | 0.1140 | 0.3441 | 1.0498 | 0.0014 | 0.0394 | 0.0362 | 122 | 0.0103 |
| Paving Equipment Composite | | 0.1023 | 0.4234 | 0.6842 | 0.0008 | 0.0469 | 0.0431 | 68.9 | 0.0092 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washers | 15 | 0.0065 | 0.0315 | 0.0445 | 0.0001 | 0.0024 | 0.0022 | 4.9 | 0.0006 |
| | 25 | 0.0100 | 0.0337 | 0.0617 | 0.0001 | 0.0033 | 0.0030 | 7.1 | 0.0009 |
| | 50 | 0.0251 | 0.0970 | 0.1183 | 0.0002 | 0.0077 | 0.0070 | 14.3 | 0.0023 |
| | 120 | 0.0245 | 0.1416 | 0.1947 | 0.0003 | 0.0128 | 0.0118 | 24.1 | 0.0022 |
| Pressure Washers Composite | | 0.0133 | 0.0590 | 0.0799 | 0.0001 | 0.0049 | 0.0045 | 9.4 | 0.0012 |
| | 15 | 0.0111 | 0.0479 | 0.0683 | 0.0001 | 0.0041 | 0.0038 | 7.4 | 0.0010 |
| | 25 | 0.0309 | 0.0919 | 0.1682 | 0.0002 | 0.0094 | 0.0086 | 19.5 | 0.0028 |
| | 50 | 0.0855 | 0.2910 | 0.2982 | 0.0004 | 0.0228 | 0.0210 | 34.3 | 0.0077 |
| | 120 | 0.0949 | 0.4887 | 0.6710 | 0.0009 | 0.0508 | 0.0467 | 77.9 | 0.0086 |
| | 175 | 0.1158 | 0.7365 | 1.0489 | 0.0016 | 0.0502 | 0.0462 | 140 | 0.0104 |
| | 250 | 0.1088 | 0.3998 | 1.3270 | 0.0023 | 0.0376 | 0.0346 | 201 | 0.0098 |
| Pumps | 500 | 0.1686 | 0.6929 | 2.0163 | 0.0034 | 0.0603 | 0.0555 | 345 | 0.0152 |
| | 750 | 0.2872 | 1.1454 | 3.4529 | 0.0057 | 0.1018 | 0.0937 | 571 | 0.0259 |
| | 9999 | 0.8773 | 3.1134 | 11.7387 | 0.0136 | 0.3072 | 0.2826 | 1,355 | 0.0792 |
| Pumps Composite | | 0.0621 | 0.2825 | 0.4121 | 0.0006 | 0.0267 | 0.0245 | 49.6 | 0.0056 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1018 | 0.0002 | 0.0039 | 0.0036 | 13.3 | 0.0015 |
| | 50 | 0.0871 | 0.2754 | 0.2405 | 0.0003 | 0.0209 | 0.0192 | 26.0 | 0.0079 |
| | 120 | 0.0857 | 0.4000 | 0.5498 | 0.0007 | 0.0454 | 0.0418 | 59.0 | 0.0077 |
| | 175 | 0.1104 | 0.6166 | 0.8731 | 0.0012 | 0.0470 | 0.0433 | 108 | 0.0100 |
| | 250 | 0.1107 | 0.3575 | 1.0948 | 0.0017 | 0.0368 | 0.0339 | 153 | 0.0100 |
| | 500 | 0.1468 | 0.5595 | 1.3956 | 0.0022 | 0.0487 | 0.0448 | 219 | 0.0132 |
| Rollers Composite | | 0.0851 | 0.3979 | 0.5706 | 0.0008 | 0.0386 | 0.0355 | 67.1 | 0.0077 |
| Rough Terrain Forklifts | 50 | 0.0942 | 0.3551 | 0.3066 | 0.0004 | 0.0243 | 0.0224 | 33.9 | 0.0085 |
| | 120 | 0.0801 | 0.4260 | 0.5164 | 0.0007 | 0.0420 | 0.0387 | 62.4 | 0.0072 |
| | 175 | 0.1171 | 0.7240 | 0.8746 | 0.0014 | 0.0477 | 0.0439 | 125 | 0.0106 |
| | 250 | 0.1168 | 0.3650 | 1.0385 | 0.0019 | 0.0338 | 0.0311 | 171 | 0.0105 |
| | 500 | 0.1668 | 0.5337 | 1.3642 | 0.0025 | 0.0477 | 0.0439 | 257 | 0.0150 |
| Rough Terrain Forklifts Composite | | 0.0850 | 0.4577 | 0.5588 | 0.0008 | 0.0423 | 0.0389 | 70.3 | 0.0077 |
| Rubber Tired Dozers | 175 | 0.1942 | 0.8333 | 1.3944 | 0.0015 | 0.0790 | 0.0727 | 129 | 0.0175 |
| | 250 | 0.2209 | 0.6304 | 1.8273 | 0.0021 | 0.0762 | 0.0701 | 183 | 0.0199 |
| | 500 | 0.2932 | 1.2456 | 2.3951 | 0.0026 | 0.0985 | 0.0906 | 265 | 0.0265 |
| | 750 | 0.4423 | 1.8685 | 3.6712 | 0.0040 | 0.1494 | 0.1374 | 399 | 0.0399 |
| | 1000 | 0.6883 | 3.0139 | 6.8297 | 0.0060 | 0.2311 | 0.2126 | 592 | 0.0621 |
| Rubber Tired Dozers Composite | | 0.2721 | 1.0420 | 2.2344 | 0.0025 | 0.0924 | 0.0850 | 239 | 0.0246 |
| Rubber Tired Loaders | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0049 | 0.0045 | 16.9 | 0.0018 |
| | 50 | 0.0993 | 0.3438 | 0.2888 | 0.0004 | 0.0242 | 0.0222 | 31.1 | 0.0090 |
| | 120 | 0.0835 | 0.4090 | 0.5226 | 0.0007 | 0.0431 | 0.0396 | 58.9 | 0.0075 |
| | 175 | 0.1094 | 0.6251 | 0.8077 | 0.0012 | 0.0445 | 0.0409 | 106 | 0.0099 |
| | 250 | 0.1118 | 0.3444 | 0.9890 | 0.0017 | 0.0337 | 0.0310 | 149 | 0.0101 |
| | 500 | 0.1678 | 0.5818 | 1.3980 | 0.0023 | 0.0499 | 0.0459 | 237 | 0.0151 |
| | 750 | 0.3459 | 1.1905 | 2.9534 | 0.0049 | 0.1040 | 0.0956 | 486 | 0.0312 |
| | 1000 | 0.4657 | 1.6412 | 5.2967 | 0.0060 | 0.1552 | 0.1428 | 594 | 0.0420 |
| Rubber Tired Loaders Composite | | 0.1050 | 0.4615 | 0.7838 | 0.0012 | 0.0416 | 0.0383 | 109 | 0.0095 |
| Scrapers | 120 | 0.1665 | 0.6826 | 0.9915 | 0.0011 | 0.0846 | 0.0778 | 93.9 | 0.0150 |
| | 175 | 0.1871 | 0.9030 | 1.3657 | 0.0017 | 0.0766 | 0.0704 | 148 | 0.0169 |
| | 250 | 0.2021 | 0.5906 | 1.7470 | 0.0024 | 0.0665 | 0.0612 | 209 | 0.0182 |
| | 500 | 0.2883 | 1.0688 | 2.4104 | 0.0032 | 0.0930 | 0.0855 | 321 | 0.0260 |
| | 750 | 0.5001 | 1.8419 | 4.2634 | 0.0056 | 0.1624 | 0.1494 | 555 | 0.0451 |
| Scrapers Composite | | 0.2513 | 0.9443 | 2.0647 | 0.0027 | 0.0854 | 0.0785 | 262 | 0.0227 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0931 | 0.3227 | 0.3148 | 0.0005 | 0.0243 | 0.0224 | 36.2 | 0.0084 |
| | 120 | 0.0970 | 0.5116 | 0.6762 | 0.0009 | 0.0525 | 0.0483 | 80.2 | 0.0088 |
| | 175 | 0.1290 | 0.8300 | 1.1249 | 0.0017 | 0.0559 | 0.0514 | 155 | 0.0116 |
| | 250 | 0.1416 | 0.5098 | 1.6229 | 0.0029 | 0.0474 | 0.0436 | 255 | 0.0128 |
| Signal Boards Composite | | 0.0171 | 0.0925 | 0.1250 | 0.0002 | 0.0066 | 0.0060 | 16.7 | 0.0015 |

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Skid Steer Loaders | 25 | 0.0189 | 0.0601 | 0.1125 | 0.0002 | 0.0056 | 0.0052 | 13.8 | 0.0017 |
| | 50 | 0.0378 | 0.2138 | 0.2052 | 0.0003 | 0.0113 | 0.0104 | 25.5 | 0.0034 |
| | 120 | 0.0334 | 0.2710 | 0.2699 | 0.0005 | 0.0170 | 0.0156 | 42.8 | 0.0030 |
| Skid Steer Loaders Composite | | 0.0352 | 0.2220 | 0.2198 | 0.0004 | 0.0128 | 0.0118 | 30.3 | 0.0032 |
| Surfacing Equipment | 50 | 0.0408 | 0.1333 | 0.1263 | 0.0002 | 0.0101 | 0.0093 | 14.1 | 0.0037 |
| | 120 | 0.0840 | 0.4151 | 0.5756 | 0.0007 | 0.0439 | 0.0404 | 63.8 | 0.0076 |
| | 175 | 0.0787 | 0.4705 | 0.6706 | 0.0010 | 0.0335 | 0.0308 | 85.8 | 0.0071 |
| | 250 | 0.0891 | 0.3116 | 0.9338 | 0.0015 | 0.0309 | 0.0285 | 135 | 0.0080 |
| | 500 | 0.1342 | 0.5759 | 1.3809 | 0.0022 | 0.0468 | 0.0431 | 221 | 0.0121 |
| | 750 | 0.2139 | 0.9020 | 2.2264 | 0.0035 | 0.0745 | 0.0686 | 347 | 0.0193 |
| Surfacing Equipment Composite | | 0.1116 | 0.4705 | 1.0675 | 0.0017 | 0.0389 | 0.0357 | 166 | 0.0101 |
| Sweepers/Scrubbers | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0052 | 19.6 | 0.0021 |
| | 50 | 0.0782 | 0.3186 | 0.2828 | 0.0004 | 0.0211 | 0.0194 | 31.6 | 0.0071 |
| | 120 | 0.0880 | 0.5056 | 0.5893 | 0.0009 | 0.0466 | 0.0429 | 75.0 | 0.0079 |
| | 175 | 0.1193 | 0.7999 | 0.9051 | 0.0016 | 0.0488 | 0.0449 | 139 | 0.0108 |
| | 250 | 0.1029 | 0.3286 | 0.9094 | 0.0018 | 0.0289 | 0.0266 | 162 | 0.0093 |
| Sweepers/Scrubbers Composite | | 0.0913 | 0.5034 | 0.5746 | 0.0009 | 0.0387 | 0.0356 | 78.5 | 0.0082 |
| Tractors/Loaders/Backhoes | 25 | 0.0192 | 0.0653 | 0.1221 | 0.0002 | 0.0049 | 0.0045 | 15.9 | 0.0017 |
| | 50 | 0.0702 | 0.3020 | 0.2646 | 0.0004 | 0.0186 | 0.0171 | 30.3 | 0.0063 |
| | 120 | 0.0577 | 0.3480 | 0.3870 | 0.0006 | 0.0293 | 0.0270 | 51.7 | 0.0052 |
| | 175 | 0.0854 | 0.5853 | 0.6331 | 0.0011 | 0.0335 | 0.0308 | 101 | 0.0077 |
| | 250 | 0.1082 | 0.3566 | 0.9047 | 0.0019 | 0.0294 | 0.0270 | 172 | 0.0098 |
| | 500 | 0.2085 | 0.7089 | 1.6070 | 0.0039 | 0.0559 | 0.0514 | 345 | 0.0188 |
| | 750 | 0.3148 | 1.0631 | 2.4922 | 0.0058 | 0.0854 | 0.0786 | 517 | 0.0284 |
| Tractors/Loaders/Backhoes Composite | | 0.0666 | 0.3716 | 0.4501 | 0.0008 | 0.0298 | 0.0274 | 66.8 | 0.0060 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0087 | 32.9 | 0.0036 |
| | 50 | 0.1390 | 0.3900 | 0.3235 | 0.0004 | 0.0313 | 0.0288 | 32.9 | 0.0125 |
| | 120 | 0.1144 | 0.4600 | 0.7060 | 0.0008 | 0.0590 | 0.0542 | 64.9 | 0.0103 |
| | 175 | 0.1770 | 0.8534 | 1.3767 | 0.0016 | 0.0748 | 0.0688 | 144 | 0.0160 |
| | 250 | 0.2105 | 0.6510 | 1.9456 | 0.0025 | 0.0750 | 0.0690 | 223 | 0.0190 |
| | 500 | 0.2694 | 1.1349 | 2.4560 | 0.0031 | 0.0947 | 0.0871 | 311 | 0.0243 |
| | 750 | 0.5107 | 2.1334 | 4.7300 | 0.0059 | 0.1802 | 0.1658 | 587 | 0.0461 |
| Trenchers Composite | | 0.1274 | 0.4541 | 0.6043 | 0.0007 | 0.0485 | 0.0446 | 58.7 | 0.0115 |
| Welders | 15 | 0.0093 | 0.0400 | 0.0571 | 0.0001 | 0.0034 | 0.0032 | 6.2 | 0.0008 |
| | 25 | 0.0179 | 0.0532 | 0.0974 | 0.0001 | 0.0054 | 0.0050 | 11.3 | 0.0016 |
| | 50 | 0.0801 | 0.2564 | 0.2346 | 0.0003 | 0.0200 | 0.0184 | 26.0 | 0.0072 |
| | 120 | 0.0547 | 0.2606 | 0.3567 | 0.0005 | 0.0296 | 0.0273 | 39.5 | 0.0049 |
| | 175 | 0.0936 | 0.5424 | 0.7713 | 0.0011 | 0.0405 | 0.0373 | 98.2 | 0.0084 |
| | 250 | 0.0749 | 0.2483 | 0.8249 | 0.0013 | 0.0248 | 0.0228 | 119 | 0.0068 |
| | 500 | 0.0968 | 0.3491 | 1.0171 | 0.0016 | 0.0325 | 0.0299 | 168 | 0.0087 |
| Welders Composite | | 0.0534 | 0.1994 | 0.2301 | 0.0003 | 0.0187 | 0.0172 | 25.6 | 0.0048 |

**2020 Fleet Average Emission Factors (Diesel)**

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0138 | 0.0459 | 0.0854 | 0.0001 | 0.0035 | 0.0032 | 11.0 | 0.0012 |
| | 50 | 0.0261 | 0.1436 | 0.1422 | 0.0003 | 0.0071 | 0.0065 | 19.6 | 0.0024 |
| | 120 | 0.0259 | 0.2292 | 0.2166 | 0.0004 | 0.0127 | 0.0117 | 38.1 | 0.0023 |
| | 500 | 0.0751 | 0.3804 | 0.6959 | 0.0021 | 0.0217 | 0.0199 | 213 | 0.0068 |
| | 750 | 0.1373 | 0.6877 | 1.2876 | 0.0039 | 0.0396 | 0.0365 | 385 | 0.0124 |
| Aerial Lifts Composite | | 0.0261 | 0.1696 | 0.1866 | 0.0004 | 0.0092 | 0.0084 | 34.7 | 0.0024 |
| Air Compressors | 15 | 0.0093 | 0.0451 | 0.0579 | 0.0001 | 0.0029 | 0.0027 | 7.2 | 0.0008 |
| | 25 | 0.0196 | 0.0630 | 0.1155 | 0.0002 | 0.0054 | 0.0050 | 14.4 | 0.0018 |
| | 50 | 0.0398 | 0.2030 | 0.1725 | 0.0003 | 0.0099 | 0.0091 | 22.3 | 0.0036 |
| | 120 | 0.0408 | 0.3058 | 0.2826 | 0.0006 | 0.0188 | 0.0173 | 47.0 | 0.0037 |
| | 175 | 0.0587 | 0.4989 | 0.4013 | 0.0010 | 0.0210 | 0.0193 | 88.5 | 0.0053 |
| | 250 | 0.0669 | 0.2592 | 0.5067 | 0.0015 | 0.0163 | 0.0150 | 131 | 0.0060 |
| | 500 | 0.1146 | 0.4395 | 0.7970 | 0.0023 | 0.0276 | 0.0254 | 232 | 0.0103 |
| | 750 | 0.1777 | 0.6792 | 1.2615 | 0.0036 | 0.0432 | 0.0398 | 358 | 0.0160 |
| | 1000 | 0.2641 | 0.9959 | 3.2946 | 0.0049 | 0.0804 | 0.0740 | 486 | 0.0238 |
| Air Compressors Composite | | 0.0483 | 0.3077 | 0.3255 | 0.0007 | 0.0185 | 0.0170 | 63.6 | 0.0044 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0196 | 0.2205 | 0.1756 | 0.0004 | 0.0020 | 0.0018 | 31.0 | 0.0018 |
| | 120 | 0.0280 | 0.4662 | 0.2329 | 0.0009 | 0.0040 | 0.0037 | 77.1 | 0.0025 |
| | 175 | 0.0402 | 0.7542 | 0.1862 | 0.0016 | 0.0051 | 0.0047 | 141 | 0.0036 |
| | 250 | 0.0474 | 0.3426 | 0.1617 | 0.0021 | 0.0044 | 0.0040 | 188 | 0.0043 |
| | 500 | 0.0784 | 0.5512 | 0.2622 | 0.0031 | 0.0072 | 0.0066 | 311 | 0.0071 |
| | 750 | 0.1549 | 1.0891 | 0.5202 | 0.0062 | 0.0143 | 0.0131 | 615 | 0.0140 |
| | 1000 | 0.2442 | 1.6437 | 3.9853 | 0.0093 | 0.0530 | 0.0488 | 928 | 0.0220 |
| Bore/Drill Rigs Composite | | 0.0480 | 0.5008 | 0.3439 | 0.0017 | 0.0062 | 0.0057 | 165 | 0.0043 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0223 | 0.0741 | 0.1372 | 0.0002 | 0.0058 | 0.0053 | 17.6 | 0.0020 |
| Cement and Mortar Mixers Co | | 0.0086 | 0.0415 | 0.0536 | 0.0001 | 0.0021 | 0.0020 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0424 | 0.2420 | 0.2231 | 0.0004 | 0.0113 | 0.0104 | 30.2 | 0.0038 |
| | 120 | 0.0524 | 0.4613 | 0.4128 | 0.0009 | 0.0249 | 0.0229 | 74.1 | 0.0047 |
| | 175 | 0.0865 | 0.8662 | 0.6554 | 0.0018 | 0.0323 | 0.0297 | 160 | 0.0078 |
| Concrete/Industrial Saws Com | | 0.0484 | 0.3783 | 0.3410 | 0.0007 | 0.0196 | 0.0180 | 58.5 | 0.0044 |
| Cranes | 50 | 0.0532 | 0.2423 | 0.1894 | 0.0003 | 0.0121 | 0.0111 | 23.2 | 0.0048 |
| | 120 | 0.0542 | 0.3446 | 0.3317 | 0.0006 | 0.0240 | 0.0221 | 50.1 | 0.0049 |
| | 175 | 0.0648 | 0.4754 | 0.4071 | 0.0009 | 0.0223 | 0.0206 | 80.3 | 0.0058 |
| | 250 | 0.0704 | 0.2440 | 0.4949 | 0.0013 | 0.0170 | 0.0157 | 112 | 0.0064 |
| | 500 | 0.1087 | 0.3839 | 0.7047 | 0.0018 | 0.0257 | 0.0236 | 180 | 0.0098 |
| | 750 | 0.1837 | 0.6455 | 1.2225 | 0.0030 | 0.0439 | 0.0404 | 303 | 0.0166 |
| | 9999 | 0.6702 | 2.1934 | 7.0436 | 0.0098 | 0.1797 | 0.1654 | 971 | 0.0605 |
| Cranes Composite | | 0.0898 | 0.3917 | 0.6610 | 0.0014 | 0.0256 | 0.0236 | 129 | 0.0081 |
| Crawler Tractors | 50 | 0.0699 | 0.2771 | 0.2107 | 0.0003 | 0.0150 | 0.0138 | 24.9 | 0.0063 |
| | 120 | 0.0831 | 0.4628 | 0.4896 | 0.0008 | 0.0371 | 0.0341 | 65.8 | 0.0075 |
| | 175 | 0.1123 | 0.7302 | 0.7150 | 0.0014 | 0.0398 | 0.0366 | 121 | 0.0101 |
| | 250 | 0.1188 | 0.3966 | 0.8681 | 0.0019 | 0.0315 | 0.0290 | 166 | 0.0107 |
| | 500 | 0.1759 | 0.6665 | 1.2170 | 0.0025 | 0.0455 | 0.0419 | 259 | 0.0159 |
| | 750 | 0.3168 | 1.1935 | 2.2429 | 0.0047 | 0.0828 | 0.0762 | 465 | 0.0286 |
| | 1000 | 0.4836 | 1.8458 | 5.2162 | 0.0066 | 0.1425 | 0.1311 | 658 | 0.0436 |
| Crawler Tractors Composite | | 0.1049 | 0.5260 | 0.6772 | 0.0013 | 0.0378 | 0.0348 | 114 | 0.0095 |
| Crushing/Proc. E | 50 | 0.0734 | 0.4036 | 0.3367 | 0.0006 | 0.0181 | 0.0166 | 44.0 | 0.0066 |
| | 120 | 0.0692 | 0.5446 | 0.4754 | 0.0010 | 0.0302 | 0.0278 | 83.1 | 0.0062 |
| | 175 | 0.1083 | 0.9519 | 0.7042 | 0.0019 | 0.0368 | 0.0338 | 167 | 0.0098 |
| | 250 | 0.1245 | 0.4844 | 0.8670 | 0.0028 | 0.0282 | 0.0259 | 245 | 0.0112 |
| | 500 | 0.1852 | 0.7092 | 1.1829 | 0.0037 | 0.0416 | 0.0383 | 374 | 0.0167 |
| | 750 | 0.2912 | 1.1167 | 1.9026 | 0.0059 | 0.0655 | 0.0603 | 589 | 0.0263 |
| | 9999 | 0.7584 | 2.6528 | 8.5119 | 0.0131 | 0.2049 | 0.1885 | 1,308 | 0.0684 |
| Crushing/Proc. Equipment Co | | 0.0934 | 0.6247 | 0.5983 | 0.0015 | 0.0310 | 0.0285 | 132 | 0.0084 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0384 | 0.2446 | 0.1862 | 0.0003 | 0.0080 | 0.0074 | 25.0 | 0.0035 |
| | 120 | 0.0583 | 0.4979 | 0.3717 | 0.0009 | 0.0206 | 0.0189 | 73.6 | 0.0053 |
| | 175 | 0.0703 | 0.6637 | 0.3868 | 0.0013 | 0.0195 | 0.0179 | 112 | 0.0063 |
| | 250 | 0.0828 | 0.3276 | 0.4493 | 0.0018 | 0.0154 | 0.0141 | 159 | 0.0075 |
| | 500 | 0.1198 | 0.4591 | 0.6028 | 0.0023 | 0.0219 | 0.0202 | 234 | 0.0108 |
| | 750 | 0.1987 | 0.7606 | 1.0153 | 0.0039 | 0.0365 | 0.0336 | 387 | 0.0179 |
| Excavators Composite | | 0.0733 | 0.5124 | 0.4042 | 0.0013 | 0.0184 | 0.0169 | 120 | 0.0066 |
| Forklifts | 50 | 0.0191 | 0.1400 | 0.1084 | 0.0002 | 0.0039 | 0.0036 | 14.7 | 0.0017 |
| | 120 | 0.0225 | 0.2102 | 0.1443 | 0.0004 | 0.0074 | 0.0068 | 31.2 | 0.0020 |
| | 175 | 0.0336 | 0.3315 | 0.1772 | 0.0006 | 0.0087 | 0.0080 | 56.1 | 0.0030 |
| | 250 | 0.0385 | 0.1554 | 0.1887 | 0.0009 | 0.0062 | 0.0057 | 77.1 | 0.0035 |
| | 500 | 0.0548 | 0.2126 | 0.2528 | 0.0011 | 0.0088 | 0.0081 | 111 | 0.0049 |
| Forklifts Composite | | 0.0320 | 0.2160 | 0.1691 | 0.0006 | 0.0070 | 0.0065 | 54.4 | 0.0029 |
| Generator Sets | 15 | 0.0116 | 0.0638 | 0.0814 | 0.0002 | 0.0038 | 0.0035 | 10.2 | 0.0011 |
| | 25 | 0.0224 | 0.0769 | 0.1410 | 0.0002 | 0.0064 | 0.0059 | 17.6 | 0.0020 |
| | 50 | 0.0379 | 0.2161 | 0.2199 | 0.0004 | 0.0106 | 0.0098 | 30.6 | 0.0034 |
| | 120 | 0.0506 | 0.4641 | 0.4378 | 0.0009 | 0.0250 | 0.0230 | 77.9 | 0.0046 |
| | 175 | 0.0676 | 0.7323 | 0.5990 | 0.0016 | 0.0266 | 0.0245 | 142 | 0.0061 |
| | 250 | 0.0747 | 0.3844 | 0.7614 | 0.0024 | 0.0218 | 0.0200 | 213 | 0.0067 |
| | 500 | 0.1125 | 0.5968 | 1.0874 | 0.0033 | 0.0333 | 0.0307 | 337 | 0.0102 |
| | 750 | 0.1842 | 0.9634 | 1.7962 | 0.0055 | 0.0544 | 0.0500 | 544 | 0.0166 |
| | 9999 | 0.4502 | 2.0059 | 6.6947 | 0.0105 | 0.1476 | 0.1358 | 1,049 | 0.0406 |
| Generator Sets Composite | | 0.0395 | 0.2732 | 0.3232 | 0.0007 | 0.0150 | 0.0138 | 61.0 | 0.0036 |
| Graders | 50 | 0.0563 | 0.2762 | 0.2156 | 0.0004 | 0.0124 | 0.0114 | 27.5 | 0.0051 |
| | 120 | 0.0738 | 0.5090 | 0.4568 | 0.0009 | 0.0311 | 0.0286 | 75.0 | 0.0067 |
| | 175 | 0.0918 | 0.7282 | 0.5622 | 0.0014 | 0.0303 | 0.0279 | 124 | 0.0083 |
| | 250 | 0.0999 | 0.3683 | 0.6701 | 0.0019 | 0.0230 | 0.0211 | 172 | 0.0090 |
| | 500 | 0.1284 | 0.4966 | 0.7982 | 0.0023 | 0.0288 | 0.0265 | 229 | 0.0116 |
| | 750 | 0.2731 | 1.0508 | 1.7425 | 0.0049 | 0.0621 | 0.0571 | 486 | 0.0246 |
| Graders Composite | | 0.0919 | 0.5765 | 0.5823 | 0.0015 | 0.0280 | 0.0258 | 133 | 0.0083 |
| Off-Highway Trac | 120 | 0.1455 | 0.6789 | 0.8421 | 0.0011 | 0.0674 | 0.0621 | 93.7 | 0.0131 |
| | 175 | 0.1455 | 0.8025 | 0.9712 | 0.0015 | 0.0547 | 0.0503 | 130 | 0.0131 |
| | 250 | 0.1147 | 0.3614 | 0.8843 | 0.0015 | 0.0348 | 0.0321 | 130 | 0.0103 |
| | 750 | 0.4683 | 1.8825 | 3.5643 | 0.0057 | 0.1391 | 0.1280 | 568 | 0.0423 |
| | 1000 | 0.7129 | 2.9445 | 7.4279 | 0.0082 | 0.2214 | 0.2037 | 814 | 0.0643 |
| Off-Highway Tractors Compos | | 0.1470 | 0.6517 | 1.0657 | 0.0017 | 0.0497 | 0.0457 | 151 | 0.0133 |
| Off-Highway Truc | 175 | 0.0837 | 0.7538 | 0.4564 | 0.0014 | 0.0234 | 0.0215 | 125 | 0.0076 |
| | 250 | 0.0927 | 0.3514 | 0.5042 | 0.0019 | 0.0173 | 0.0159 | 167 | 0.0084 |
| | 500 | 0.1488 | 0.5446 | 0.7481 | 0.0027 | 0.0273 | 0.0251 | 272 | 0.0134 |
| | 750 | 0.2416 | 0.8831 | 1.2347 | 0.0044 | 0.0446 | 0.0411 | 442 | 0.0218 |
| | 1000 | 0.3613 | 1.2913 | 3.8920 | 0.0063 | 0.0903 | 0.0831 | 625 | 0.0326 |
| Off-Highway Trucks Composit | | 0.1443 | 0.5514 | 0.8306 | 0.0027 | 0.0280 | 0.0258 | 260 | 0.0130 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0328 | 0.2267 | 0.1956 | 0.0004 | 0.0078 | 0.0072 | 28.0 | 0.0030 |
| | 120 | 0.0501 | 0.5080 | 0.3835 | 0.0009 | 0.0199 | 0.0183 | 80.9 | 0.0045 |
| | 175 | 0.0524 | 0.5859 | 0.3414 | 0.0012 | 0.0164 | 0.0151 | 107 | 0.0047 |
| | 500 | 0.1012 | 0.4676 | 0.6065 | 0.0025 | 0.0212 | 0.0195 | 254 | 0.0091 |
| Other Construction Equipment | | 0.0563 | 0.3508 | 0.3519 | 0.0013 | 0.0139 | 0.0128 | 122 | 0.0051 |
| Other General In | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0431 | 0.2211 | 0.1744 | 0.0003 | 0.0101 | 0.0093 | 21.7 | 0.0039 |
| | 120 | 0.0602 | 0.4232 | 0.3810 | 0.0007 | 0.0256 | 0.0236 | 62.0 | 0.0054 |
| | 175 | 0.0721 | 0.5668 | 0.4439 | 0.0011 | 0.0237 | 0.0218 | 95.9 | 0.0065 |
| | 250 | 0.0791 | 0.2804 | 0.5318 | 0.0015 | 0.0173 | 0.0159 | 136 | 0.0071 |
| | 500 | 0.1506 | 0.5217 | 0.9276 | 0.0026 | 0.0326 | 0.0300 | 265 | 0.0136 |
| | 750 | 0.2490 | 0.8599 | 1.5657 | 0.0044 | 0.0543 | 0.0500 | 437 | 0.0225 |
| | 1000 | 0.3467 | 1.1855 | 3.8628 | 0.0056 | 0.0969 | 0.0892 | 560 | 0.0313 |
| Other General Industrial Equip | | 0.0983 | 0.4517 | 0.6661 | 0.0016 | 0.0262 | 0.0241 | 152 | 0.0089 |
| Other Material Ha | 50 | 0.0595 | 0.3049 | 0.2425 | 0.0004 | 0.0141 | 0.0130 | 30.3 | 0.0054 |
| | 120 | 0.0583 | 0.4117 | 0.3720 | 0.0007 | 0.0250 | 0.0230 | 60.7 | 0.0053 |
| | 175 | 0.0907 | 0.7176 | 0.5642 | 0.0014 | 0.0301 | 0.0277 | 122 | 0.0082 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0836 | 0.2984 | 0.5684 | 0.0016 | 0.0185 | 0.0170 | 145 | 0.0075 |
| | 500 | 0.1074 | 0.3752 | 0.6692 | 0.0019 | 0.0235 | 0.0216 | 192 | 0.0097 |
| | 9999 | 0.4910 | 1.5647 | 5.1082 | 0.0073 | 0.1280 | 0.1177 | 741 | 0.0443 |
| Other Material Handling Equip | | 0.0924 | 0.4429 | 0.6500 | 0.0015 | 0.0252 | 0.0232 | 141 | 0.0083 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1427 | 0.0002 | 0.0055 | 0.0051 | 18.7 | 0.0020 |
| | 50 | 0.0834 | 0.3055 | 0.2398 | 0.0004 | 0.0184 | 0.0169 | 28.0 | 0.0075 |
| | 120 | 0.0910 | 0.4805 | 0.5471 | 0.0008 | 0.0428 | 0.0394 | 69.2 | 0.0082 |
| | 175 | 0.1217 | 0.7599 | 0.8187 | 0.0014 | 0.0459 | 0.0422 | 128 | 0.0110 |
| | 250 | 0.1411 | 0.4713 | 1.1106 | 0.0022 | 0.0407 | 0.0375 | 194 | 0.0127 |
| | 500 | 0.1595 | 0.6305 | 1.1959 | 0.0023 | 0.0450 | 0.0414 | 233 | 0.0144 |
| Pavers Composite | | 0.0989 | 0.4920 | 0.5450 | 0.0009 | 0.0355 | 0.0326 | 77.9 | 0.0089 |
| Paving Equipmer | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0702 | 0.2577 | 0.2043 | 0.0003 | 0.0157 | 0.0144 | 23.9 | 0.0063 |
| | 120 | 0.0708 | 0.3762 | 0.4280 | 0.0006 | 0.0337 | 0.0310 | 54.5 | 0.0064 |
| | 175 | 0.0944 | 0.5945 | 0.6403 | 0.0011 | 0.0360 | 0.0331 | 101 | 0.0085 |
| | 250 | 0.0864 | 0.2894 | 0.6928 | 0.0014 | 0.0249 | 0.0229 | 122 | 0.0078 |
| Paving Equipment Composite | | 0.0757 | 0.4084 | 0.4807 | 0.0008 | 0.0315 | 0.0290 | 68.9 | 0.0068 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0056 | 0.0305 | 0.0390 | 0.0001 | 0.0018 | 0.0017 | 4.9 | 0.0005 |
| | 25 | 0.0091 | 0.0312 | 0.0572 | 0.0001 | 0.0026 | 0.0024 | 7.1 | 0.0008 |
| | 50 | 0.0128 | 0.0856 | 0.0986 | 0.0002 | 0.0041 | 0.0038 | 14.3 | 0.0012 |
| | 120 | 0.0128 | 0.1367 | 0.1293 | 0.0003 | 0.0065 | 0.0060 | 24.1 | 0.0012 |
| Pressure Washers Composite | | 0.0085 | 0.0549 | 0.0650 | 0.0001 | 0.0030 | 0.0027 | 9.4 | 0.0008 |
| Pumps | 15 | 0.0096 | 0.0464 | 0.0595 | 0.0001 | 0.0030 | 0.0028 | 7.4 | 0.0009 |
| | 25 | 0.0265 | 0.0850 | 0.1558 | 0.0002 | 0.0073 | 0.0067 | 19.5 | 0.0024 |
| | 50 | 0.0465 | 0.2546 | 0.2497 | 0.0004 | 0.0126 | 0.0116 | 34.3 | 0.0042 |
| | 120 | 0.0537 | 0.4713 | 0.4442 | 0.0009 | 0.0263 | 0.0242 | 77.9 | 0.0048 |
| | 175 | 0.0712 | 0.7336 | 0.6007 | 0.0016 | 0.0277 | 0.0255 | 140 | 0.0064 |
| | 250 | 0.0760 | 0.3700 | 0.7338 | 0.0023 | 0.0215 | 0.0198 | 201 | 0.0069 |
| | 500 | 0.1241 | 0.6189 | 1.1297 | 0.0034 | 0.0355 | 0.0327 | 345 | 0.0112 |
| | 750 | 0.2075 | 1.0232 | 1.9114 | 0.0057 | 0.0594 | 0.0547 | 571 | 0.0187 |
| | 9999 | 0.6127 | 2.6255 | 8.7489 | 0.0136 | 0.1961 | 0.1804 | 1,355 | 0.0553 |
| Pumps Composite | | 0.0376 | 0.2674 | 0.2854 | 0.0006 | 0.0147 | 0.0135 | 49.6 | 0.0034 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0543 | 0.2436 | 0.2039 | 0.0003 | 0.0128 | 0.0117 | 26.0 | 0.0049 |
| | 120 | 0.0576 | 0.3873 | 0.3799 | 0.0007 | 0.0270 | 0.0249 | 59.0 | 0.0052 |
| | 175 | 0.0774 | 0.6114 | 0.5331 | 0.0012 | 0.0286 | 0.0263 | 108 | 0.0070 |
| | 250 | 0.0842 | 0.3201 | 0.6581 | 0.0017 | 0.0223 | 0.0205 | 153 | 0.0076 |
| | 500 | 0.1151 | 0.4607 | 0.8354 | 0.0022 | 0.0299 | 0.0275 | 219 | 0.0104 |
| Rollers Composite | | 0.0584 | 0.3837 | 0.3793 | 0.0008 | 0.0232 | 0.0214 | 67.0 | 0.0053 |
| Rough Terrain Fo | 50 | 0.0520 | 0.3171 | 0.2556 | 0.0004 | 0.0122 | 0.0113 | 33.9 | 0.0047 |
| | 120 | 0.0495 | 0.4142 | 0.3326 | 0.0007 | 0.0197 | 0.0181 | 62.4 | 0.0045 |
| | 175 | 0.0788 | 0.7229 | 0.4710 | 0.0014 | 0.0245 | 0.0226 | 125 | 0.0071 |
| | 250 | 0.0881 | 0.3442 | 0.5378 | 0.0019 | 0.0182 | 0.0168 | 171 | 0.0079 |
| | 500 | 0.1296 | 0.4936 | 0.7287 | 0.0025 | 0.0265 | 0.0244 | 257 | 0.0117 |
| Rough Terrain Forklifts Compo | | 0.0533 | 0.4464 | 0.3494 | 0.0008 | 0.0201 | 0.0185 | 70.3 | 0.0048 |
| Rubber Tired Doz | 175 | 0.1509 | 0.8124 | 0.9962 | 0.0015 | 0.0561 | 0.0516 | 129 | 0.0136 |
| | 250 | 0.1701 | 0.5279 | 1.2898 | 0.0021 | 0.0516 | 0.0474 | 183 | 0.0153 |
| | 500 | 0.2291 | 0.9276 | 1.6868 | 0.0026 | 0.0673 | 0.0619 | 265 | 0.0207 |
| | 750 | 0.3461 | 1.3934 | 2.5948 | 0.0040 | 0.1024 | 0.0942 | 399 | 0.0312 |
| | 1000 | 0.5438 | 2.2500 | 5.5311 | 0.0060 | 0.1672 | 0.1539 | 592 | 0.0491 |
| Rubber Tired Dozers Compos | | 0.2118 | 0.8006 | 1.5773 | 0.0025 | 0.0630 | 0.0580 | 239 | 0.0191 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0615 | 0.3080 | 0.2424 | 0.0004 | 0.0137 | 0.0126 | 31.1 | 0.0055 |
| | 120 | 0.0563 | 0.3977 | 0.3529 | 0.0007 | 0.0237 | 0.0218 | 58.9 | 0.0051 |
| | 175 | 0.0767 | 0.6215 | 0.4713 | 0.0012 | 0.0253 | 0.0233 | 106 | 0.0069 |
| | 250 | 0.0848 | 0.3159 | 0.5655 | 0.0017 | 0.0194 | 0.0179 | 149 | 0.0077 |
| | 500 | 0.1302 | 0.5016 | 0.8032 | 0.0023 | 0.0291 | 0.0268 | 237 | 0.0118 |
| | 750 | 0.2680 | 1.0271 | 1.6958 | 0.0049 | 0.0606 | 0.0558 | 486 | 0.0242 |
| | 1000 | 0.3484 | 1.3166 | 4.0040 | 0.0060 | 0.0983 | 0.0904 | 594 | 0.0314 |
| Rubber Tired Loaders Compos | | 0.0753 | 0.4406 | 0.4747 | 0.0012 | 0.0235 | 0.0216 | 109 | 0.0068 |
| Scrapers | 120 | 0.1218 | 0.6612 | 0.7170 | 0.0011 | 0.0551 | 0.0507 | 93.9 | 0.0110 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1400 | 0.8921 | 0.9020 | 0.0017 | 0.0505 | 0.0464 | 148 | 0.0126 |
| | 250 | 0.1522 | 0.5044 | 1.1344 | 0.0024 | 0.0412 | 0.0379 | 209 | 0.0137 |
| | 500 | 0.2211 | 0.8455 | 1.5615 | 0.0032 | 0.0584 | 0.0537 | 321 | 0.0200 |
| | 750 | 0.3839 | 1.4588 | 2.7734 | 0.0056 | 0.1024 | 0.0942 | 555 | 0.0346 |
| Scrapers Composite | | 0.1914 | 0.7938 | 1.3434 | 0.0027 | 0.0541 | 0.0497 | 262 | 0.0173 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0502 | 0.2833 | 0.2631 | 0.0005 | 0.0131 | 0.0121 | 36.2 | 0.0045 |
| | 120 | 0.0558 | 0.4946 | 0.4424 | 0.0009 | 0.0264 | 0.0243 | 80.2 | 0.0050 |
| | 175 | 0.0811 | 0.8276 | 0.6279 | 0.0017 | 0.0302 | 0.0277 | 155 | 0.0073 |
| | 250 | 0.1022 | 0.4765 | 0.8737 | 0.0029 | 0.0266 | 0.0245 | 255 | 0.0092 |
| Signal Boards Composite | | 0.0129 | 0.0912 | 0.0912 | 0.0002 | 0.0042 | 0.0038 | 16.7 | 0.0012 |
| Skid Steer Loade | 25 | 0.0171 | 0.0575 | 0.1070 | 0.0002 | 0.0044 | 0.0040 | 13.8 | 0.0015 |
| | 50 | 0.0230 | 0.2006 | 0.1655 | 0.0003 | 0.0043 | 0.0040 | 25.5 | 0.0021 |
| | 120 | 0.0218 | 0.2673 | 0.1647 | 0.0005 | 0.0064 | 0.0059 | 42.8 | 0.0020 |
| Skid Steer Loaders Composite | | 0.0222 | 0.2125 | 0.1614 | 0.0004 | 0.0050 | 0.0046 | 30.3 | 0.0020 |
| Surfacing Equipm | 50 | 0.0265 | 0.1191 | 0.1069 | 0.0002 | 0.0063 | 0.0058 | 14.1 | 0.0024 |
| | 120 | 0.0570 | 0.4028 | 0.4035 | 0.0007 | 0.0271 | 0.0250 | 63.8 | 0.0051 |
| | 175 | 0.0550 | 0.4663 | 0.4168 | 0.0010 | 0.0210 | 0.0193 | 85.8 | 0.0050 |
| | 250 | 0.0652 | 0.2754 | 0.5719 | 0.0015 | 0.0188 | 0.0173 | 135 | 0.0059 |
| | 500 | 0.1008 | 0.4728 | 0.8400 | 0.0022 | 0.0288 | 0.0265 | 221 | 0.0091 |
| | 750 | 0.1599 | 0.7413 | 1.3593 | 0.0035 | 0.0459 | 0.0423 | 347 | 0.0144 |
| Surfacing Equipment Compos | | 0.0823 | 0.3953 | 0.6593 | 0.0017 | 0.0239 | 0.0220 | 166 | 0.0074 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0430 | 0.2898 | 0.2365 | 0.0004 | 0.0098 | 0.0090 | 31.6 | 0.0039 |
| | 120 | 0.0555 | 0.4959 | 0.3694 | 0.0009 | 0.0210 | 0.0193 | 75.0 | 0.0050 |
| | 175 | 0.0845 | 0.8043 | 0.4869 | 0.0016 | 0.0253 | 0.0233 | 139 | 0.0076 |
| | 250 | 0.0803 | 0.3198 | 0.4530 | 0.0018 | 0.0152 | 0.0140 | 162 | 0.0072 |
| Sweepers/Scrubbers Compos | | 0.0584 | 0.4916 | 0.3563 | 0.0009 | 0.0183 | 0.0169 | 78.5 | 0.0053 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0046 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0407 | 0.2760 | 0.2179 | 0.0004 | 0.0087 | 0.0080 | 30.3 | 0.0037 |
| | 120 | 0.0366 | 0.3402 | 0.2466 | 0.0006 | 0.0129 | 0.0119 | 51.7 | 0.0033 |
| | 175 | 0.0571 | 0.5841 | 0.3220 | 0.0011 | 0.0159 | 0.0146 | 101 | 0.0052 |
| | 250 | 0.0813 | 0.3445 | 0.4427 | 0.0019 | 0.0151 | 0.0139 | 172 | 0.0073 |
| | 500 | 0.1606 | 0.6642 | 0.8132 | 0.0039 | 0.0294 | 0.0270 | 345 | 0.0145 |
| | 750 | 0.2409 | 0.9959 | 1.2387 | 0.0058 | 0.0443 | 0.0408 | 517 | 0.0217 |
| Tractors/Loaders/Backhoes C | | 0.0436 | 0.3616 | 0.2744 | 0.0008 | 0.0134 | 0.0124 | 66.8 | 0.0039 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0990 | 0.3495 | 0.2804 | 0.0004 | 0.0218 | 0.0201 | 32.9 | 0.0089 |
| | 120 | 0.0849 | 0.4443 | 0.5223 | 0.0008 | 0.0408 | 0.0375 | 64.9 | 0.0077 |
| | 175 | 0.1346 | 0.8393 | 0.9412 | 0.0016 | 0.0521 | 0.0479 | 144 | 0.0121 |
| | 250 | 0.1600 | 0.5472 | 1.3120 | 0.0025 | 0.0487 | 0.0448 | 223 | 0.0144 |
| | 500 | 0.2092 | 0.8710 | 1.6487 | 0.0031 | 0.0623 | 0.0573 | 311 | 0.0189 |
| | 750 | 0.3964 | 1.6395 | 3.1894 | 0.0059 | 0.1191 | 0.1095 | 587 | 0.0358 |
| Trenchers Composite | | 0.0933 | 0.4270 | 0.4575 | 0.0007 | 0.0336 | 0.0309 | 58.7 | 0.0084 |
| Welders | 15 | 0.0080 | 0.0388 | 0.0498 | 0.0001 | 0.0025 | 0.0023 | 6.2 | 0.0007 |
| | 25 | 0.0153 | 0.0492 | 0.0903 | 0.0001 | 0.0042 | 0.0039 | 11.3 | 0.0014 |
| | 50 | 0.0435 | 0.2219 | 0.1968 | 0.0003 | 0.0110 | 0.0102 | 26.0 | 0.0039 |
| | 120 | 0.0321 | 0.2508 | 0.2344 | 0.0005 | 0.0153 | 0.0140 | 39.5 | 0.0029 |
| | 175 | 0.0600 | 0.5396 | 0.4393 | 0.0011 | 0.0223 | 0.0205 | 98.2 | 0.0054 |
| | 250 | 0.0551 | 0.2294 | 0.4536 | 0.0013 | 0.0142 | 0.0130 | 119 | 0.0050 |
| | 500 | 0.0748 | 0.3117 | 0.5690 | 0.0016 | 0.0192 | 0.0176 | 168 | 0.0067 |
| Welders Composite | | 0.0310 | 0.1816 | 0.1735 | 0.0003 | 0.0102 | 0.0094 | 25.6 | 0.0028 |

**San Diego 2025 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,343,732.35 | ########### | 8,492,736.38 | 0.02 | 0.71 | 0.09 | 223.96 | 0.05 | 0.04 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 6,282.20 | 213,159.29 | 39,008.92 | 0.01 | 0.09 | 0.31 | 246.18 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 198,419.75 | 7,123,689.46 | 1,204,641.90 | 0.02 | 1.09 | 0.12 | 276.49 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 240.83 | 8,707.20 | 1,432.14 | 0.02 | 0.13 | 0.37 | 242.28 | 0.06 | 0.05 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 479,791.14 | ########### | 3,017,273.36 | 0.01 | 0.73 | 0.08 | 343.84 | 0.05 | 0.04 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 211.77 | 7,665.63 | 1,309.49 | 0.02 | 0.11 | 0.40 | 268.51 | 0.06 | 0.05 | 0.00 | | |
| Average | | | | | | | 0.019 | 0.478 | 0.227 | 266.878 | 0.052 | 0.042 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,476 | 582,978 | - | 0.22 | 1.01 | 2.06 | 1541.82 | 0.07 | 0.10 | 0.02 | | |

Source: EMFAC 2011

## 2025 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0132 | 0.0451 | 0.0838 | 0.0001 | 0.0032 | 0.0030 | 11.0 | 0.0012 |
| | 50 | 0.0168 | 0.1351 | 0.1218 | 0.0003 | 0.0035 | 0.0032 | 19.6 | 0.0015 |
| | 120 | 0.0176 | 0.2265 | 0.1496 | 0.0004 | 0.0063 | 0.0058 | 38.1 | 0.0016 |
| | 500 | 0.0580 | 0.3710 | 0.3660 | 0.0021 | 0.0109 | 0.0100 | 213 | 0.0052 |
| | 750 | 0.1054 | 0.6706 | 0.6753 | 0.0039 | 0.0199 | 0.0183 | 385 | 0.0095 |
| Aerial Lifts Composite | | 0.0184 | 0.1646 | 0.1366 | 0.0004 | 0.0048 | 0.0044 | 34.7 | 0.0017 |
| Air Compressors | 15 | 0.0087 | 0.0444 | 0.0545 | 0.0001 | 0.0023 | 0.0022 | 7.2 | 0.0008 |
| | 25 | 0.0181 | 0.0605 | 0.1121 | 0.0002 | 0.0045 | 0.0042 | 14.4 | 0.0016 |
| | 50 | 0.0263 | 0.1911 | 0.1476 | 0.0003 | 0.0047 | 0.0043 | 22.3 | 0.0024 |
| | 120 | 0.0289 | 0.3023 | 0.1928 | 0.0006 | 0.0088 | 0.0081 | 47.0 | 0.0026 |
| | 175 | 0.0424 | 0.4998 | 0.2187 | 0.0010 | 0.0104 | 0.0095 | 88.5 | 0.0038 |
| | 250 | 0.0514 | 0.2531 | 0.2553 | 0.0015 | 0.0078 | 0.0072 | 131 | 0.0046 |
| | 500 | 0.0894 | 0.4292 | 0.4150 | 0.0023 | 0.0134 | 0.0123 | 232 | 0.0081 |
| | 750 | 0.1385 | 0.6633 | 0.6545 | 0.0036 | 0.0210 | 0.0193 | 358 | 0.0125 |
| | 1000 | 0.1999 | 0.9265 | 2.5439 | 0.0049 | 0.0483 | 0.0444 | 486 | 0.0180 |
| Air Compressors Composite | | 0.0349 | 0.3027 | 0.2104 | 0.0007 | 0.0088 | 0.0081 | 63.6 | 0.0031 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0190 | 0.2200 | 0.1662 | 0.0004 | 0.0009 | 0.0008 | 31.0 | 0.0017 |
| | 120 | 0.0252 | 0.4660 | 0.1955 | 0.0009 | 0.0020 | 0.0018 | 77.1 | 0.0023 |
| | 175 | 0.0324 | 0.7542 | 0.0787 | 0.0016 | 0.0030 | 0.0027 | 141 | 0.0029 |
| | 250 | 0.0427 | 0.3426 | 0.0981 | 0.0021 | 0.0035 | 0.0032 | 188 | 0.0039 |
| | 500 | 0.0706 | 0.5512 | 0.1622 | 0.0031 | 0.0058 | 0.0054 | 311 | 0.0064 |
| | 750 | 0.1396 | 1.0891 | 0.3204 | 0.0062 | 0.0115 | 0.0106 | 615 | 0.0126 |
| | 1000 | 0.2115 | 1.6437 | 3.8912 | 0.0093 | 0.0364 | 0.0335 | 928 | 0.0191 |
| Bore/Drill Rigs Composite | | 0.0428 | 0.5007 | 0.2864 | 0.0017 | 0.0042 | 0.0038 | 165 | 0.0039 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0213 | 0.0724 | 0.1346 | 0.0002 | 0.0052 | 0.0048 | 17.6 | 0.0019 |
| Cement and Mortar Mixers Co | | 0.0085 | 0.0414 | 0.0534 | 0.0001 | 0.0021 | 0.0019 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0279 | 0.2284 | 0.1910 | 0.0004 | 0.0053 | 0.0049 | 30.2 | 0.0025 |
| | 120 | 0.0370 | 0.4561 | 0.2840 | 0.0009 | 0.0117 | 0.0108 | 74.1 | 0.0033 |
| | 175 | 0.0623 | 0.8663 | 0.3523 | 0.0018 | 0.0160 | 0.0147 | 160 | 0.0056 |
| Concrete/Industrial Saws Com | | 0.0337 | 0.3706 | 0.2471 | 0.0007 | 0.0093 | 0.0086 | 58.5 | 0.0030 |
| Cranes | 50 | 0.0350 | 0.2256 | 0.1644 | 0.0003 | 0.0062 | 0.0057 | 23.2 | 0.0032 |
| | 120 | 0.0376 | 0.3384 | 0.2298 | 0.0006 | 0.0120 | 0.0111 | 50.1 | 0.0034 |
| | 175 | 0.0462 | 0.4744 | 0.2300 | 0.0009 | 0.0120 | 0.0110 | 80.3 | 0.0042 |
| | 250 | 0.0544 | 0.2316 | 0.2705 | 0.0013 | 0.0094 | 0.0087 | 112 | 0.0049 |
| | 500 | 0.0858 | 0.3535 | 0.3977 | 0.0018 | 0.0146 | 0.0134 | 180 | 0.0077 |
| | 750 | 0.1446 | 0.5947 | 0.6821 | 0.0030 | 0.0248 | 0.0228 | 303 | 0.0130 |
| | 9999 | 0.5219 | 1.9715 | 5.5760 | 0.0098 | 0.1146 | 0.1055 | 971 | 0.0471 |
| Cranes Composite | | 0.0681 | 0.3738 | 0.4223 | 0.0014 | 0.0143 | 0.0132 | 129 | 0.0061 |
| Crawler Tractors | 50 | 0.0487 | 0.2566 | 0.1842 | 0.0003 | 0.0090 | 0.0083 | 24.9 | 0.0044 |
| | 120 | 0.0609 | 0.4537 | 0.3562 | 0.0008 | 0.0221 | 0.0203 | 65.8 | 0.0055 |
| | 175 | 0.0823 | 0.7265 | 0.4447 | 0.0014 | 0.0241 | 0.0222 | 121 | 0.0074 |
| | 250 | 0.0924 | 0.3662 | 0.5348 | 0.0019 | 0.0192 | 0.0177 | 166 | 0.0083 |
| | 500 | 0.1392 | 0.5877 | 0.7527 | 0.0025 | 0.0280 | 0.0258 | 259 | 0.0126 |
| | 750 | 0.2506 | 1.0528 | 1.3878 | 0.0047 | 0.0510 | 0.0469 | 465 | 0.0226 |
| | 1000 | 0.3749 | 1.5618 | 4.2168 | 0.0066 | 0.0958 | 0.0881 | 658 | 0.0338 |
| Crawler Tractors Composite | | 0.0789 | 0.5065 | 0.4492 | 0.0013 | 0.0227 | 0.0209 | 114 | 0.0071 |
| Crushing/Proc. E | 50 | 0.0508 | 0.3859 | 0.2899 | 0.0006 | 0.0083 | 0.0077 | 44.0 | 0.0046 |
| | 120 | 0.0506 | 0.5406 | 0.3289 | 0.0010 | 0.0140 | 0.0129 | 83.1 | 0.0046 |
| | 175 | 0.0795 | 0.9556 | 0.3830 | 0.0019 | 0.0177 | 0.0163 | 167 | 0.0072 |
| | 250 | 0.0967 | 0.4768 | 0.4357 | 0.0028 | 0.0134 | 0.0123 | 245 | 0.0087 |
| | 500 | 0.1459 | 0.6977 | 0.6163 | 0.0037 | 0.0200 | 0.0184 | 374 | 0.0132 |
| | 750 | 0.2307 | 1.1003 | 0.9907 | 0.0059 | 0.0316 | 0.0291 | 589 | 0.0208 |
| | 9999 | 0.6019 | 2.5014 | 6.6977 | 0.0131 | 0.1238 | 0.1139 | 1,308 | 0.0543 |
| Crushing/Proc. Equipment Co | | 0.0693 | 0.6187 | 0.3763 | 0.0015 | 0.0146 | 0.0134 | 132 | 0.0062 |
| Dumpers/Tender | 25 | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0297 | 0.2365 | 0.1616 | 0.0003 | 0.0035 | 0.0032 | 25.0 | 0.0027 |
| | 120 | 0.0448 | 0.4942 | 0.2638 | 0.0009 | 0.0092 | 0.0085 | 73.6 | 0.0040 |
| | 175 | 0.0518 | 0.6636 | 0.1982 | 0.0013 | 0.0091 | 0.0084 | 112 | 0.0047 |
| | 250 | 0.0647 | 0.3210 | 0.2222 | 0.0018 | 0.0074 | 0.0068 | 159 | 0.0058 |
| | 500 | 0.0946 | 0.4495 | 0.3091 | 0.0023 | 0.0107 | 0.0098 | 234 | 0.0085 |
| | 750 | 0.1569 | 0.7451 | 0.5194 | 0.0039 | 0.0178 | 0.0164 | 387 | 0.0142 |
| Excavators Composite | | 0.0559 | 0.5086 | 0.2269 | 0.0013 | 0.0086 | 0.0079 | 120 | 0.0050 |
| Forklifts | 50 | 0.0150 | 0.1361 | 0.0904 | 0.0002 | 0.0013 | 0.0012 | 14.7 | 0.0014 |
| | 120 | 0.0168 | 0.2086 | 0.0997 | 0.0004 | 0.0023 | 0.0021 | 31.2 | 0.0015 |
| | 175 | 0.0228 | 0.3310 | 0.0732 | 0.0006 | 0.0029 | 0.0026 | 56.1 | 0.0021 |
| | 250 | 0.0289 | 0.1551 | 0.0746 | 0.0009 | 0.0027 | 0.0024 | 77.1 | 0.0026 |
| | 500 | 0.0416 | 0.2123 | 0.1038 | 0.0011 | 0.0038 | 0.0035 | 111 | 0.0038 |
| Forklifts Composite | | 0.0236 | 0.2148 | 0.0860 | 0.0006 | 0.0025 | 0.0023 | 54.4 | 0.0021 |
| Generator Sets | 15 | 0.0109 | 0.0627 | 0.0768 | 0.0002 | 0.0032 | 0.0030 | 10.2 | 0.0010 |
| | 25 | 0.0216 | 0.0738 | 0.1368 | 0.0002 | 0.0055 | 0.0050 | 17.6 | 0.0019 |
| | 50 | 0.0242 | 0.2034 | 0.1881 | 0.0004 | 0.0051 | 0.0047 | 30.6 | 0.0022 |
| | 120 | 0.0340 | 0.4585 | 0.3022 | 0.0009 | 0.0122 | 0.0112 | 77.9 | 0.0031 |
| | 175 | 0.0469 | 0.7328 | 0.3291 | 0.0016 | 0.0136 | 0.0125 | 142 | 0.0042 |
| | 250 | 0.0558 | 0.3746 | 0.3885 | 0.0024 | 0.0108 | 0.0099 | 213 | 0.0050 |
| | 500 | 0.0862 | 0.5820 | 0.5697 | 0.0033 | 0.0167 | 0.0153 | 337 | 0.0078 |
| | 750 | 0.1401 | 0.9395 | 0.9382 | 0.0055 | 0.0272 | 0.0250 | 544 | 0.0126 |
| | 9999 | 0.3235 | 1.8648 | 5.2188 | 0.0105 | 0.0888 | 0.0817 | 1,049 | 0.0292 |
| Generator Sets Composite | | 0.0288 | 0.2667 | 0.2329 | 0.0007 | 0.0081 | 0.0074 | 61.0 | 0.0026 |
| Graders | 50 | 0.0382 | 0.2599 | 0.1877 | 0.0004 | 0.0063 | 0.0058 | 27.5 | 0.0034 |
| | 120 | 0.0521 | 0.5009 | 0.3219 | 0.0009 | 0.0153 | 0.0141 | 75.0 | 0.0047 |
| | 175 | 0.0652 | 0.7261 | 0.3117 | 0.0014 | 0.0157 | 0.0144 | 124 | 0.0059 |
| | 250 | 0.0781 | 0.3549 | 0.3652 | 0.0019 | 0.0129 | 0.0119 | 172 | 0.0071 |
| | 500 | 0.1023 | 0.4610 | 0.4468 | 0.0023 | 0.0165 | 0.0152 | 229 | 0.0092 |
| | 750 | 0.2167 | 0.9755 | 0.9628 | 0.0049 | 0.0353 | 0.0324 | 486 | 0.0196 |
| Graders Composite | | 0.0676 | 0.5696 | 0.3314 | 0.0015 | 0.0147 | 0.0135 | 133 | 0.0061 |
| Off-Highway Trac | 120 | 0.1108 | 0.6619 | 0.6362 | 0.0011 | 0.0455 | 0.0419 | 93.7 | 0.0100 |
| | 175 | 0.1110 | 0.7932 | 0.6639 | 0.0015 | 0.0370 | 0.0341 | 130 | 0.0100 |
| | 250 | 0.0890 | 0.3179 | 0.5983 | 0.0015 | 0.0227 | 0.0208 | 130 | 0.0080 |
| | 750 | 0.3692 | 1.5358 | 2.4157 | 0.0057 | 0.0918 | 0.0844 | 568 | 0.0333 |
| | 1000 | 0.5623 | 2.3619 | 6.0896 | 0.0082 | 0.1577 | 0.1451 | 814 | 0.0507 |
| Off-Highway Tractors Compos | | 0.1134 | 0.6101 | 0.7291 | 0.0017 | 0.0331 | 0.0305 | 151 | 0.0102 |
| Off-Highway Truc | 175 | 0.0622 | 0.7536 | 0.2376 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0056 |
| | 250 | 0.0730 | 0.3435 | 0.2521 | 0.0019 | 0.0085 | 0.0078 | 167 | 0.0066 |
| | 500 | 0.1183 | 0.5319 | 0.3878 | 0.0027 | 0.0135 | 0.0124 | 272 | 0.0107 |
| | 750 | 0.1921 | 0.8627 | 0.6384 | 0.0044 | 0.0221 | 0.0203 | 442 | 0.0173 |
| | 1000 | 0.2823 | 1.2403 | 3.1782 | 0.0063 | 0.0546 | 0.0502 | 625 | 0.0255 |
| Off-Highway Trucks Composit | | 0.1140 | 0.5385 | 0.4769 | 0.0027 | 0.0142 | 0.0131 | 260 | 0.0103 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0244 | 0.2188 | 0.1693 | 0.0004 | 0.0034 | 0.0031 | 28.0 | 0.0022 |
| | 120 | 0.0379 | 0.5045 | 0.2730 | 0.0009 | 0.0087 | 0.0080 | 80.9 | 0.0034 |
| | 175 | 0.0384 | 0.5858 | 0.1729 | 0.0012 | 0.0075 | 0.0069 | 107 | 0.0035 |
| | 500 | 0.0792 | 0.4606 | 0.3034 | 0.0025 | 0.0099 | 0.0091 | 254 | 0.0071 |
| Other Construction Equipment | | 0.0442 | 0.3474 | 0.2021 | 0.0013 | 0.0069 | 0.0063 | 123 | 0.0040 |
| Other General Ind | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0298 | 0.2099 | 0.1491 | 0.0003 | 0.0047 | 0.0043 | 21.7 | 0.0027 |
| | 120 | 0.0436 | 0.4189 | 0.2603 | 0.0007 | 0.0120 | 0.0111 | 62.0 | 0.0039 |
| | 175 | 0.0519 | 0.5684 | 0.2412 | 0.0011 | 0.0115 | 0.0106 | 95.9 | 0.0047 |
| | 250 | 0.0608 | 0.2743 | 0.2679 | 0.0015 | 0.0083 | 0.0076 | 136 | 0.0055 |
| | 500 | 0.1174 | 0.5103 | 0.4826 | 0.0026 | 0.0157 | 0.0145 | 265 | 0.0106 |
| | 750 | 0.1939 | 0.8411 | 0.8117 | 0.0044 | 0.0262 | 0.0241 | 437 | 0.0175 |
| | 1000 | 0.2627 | 1.1060 | 2.9924 | 0.0056 | 0.0579 | 0.0533 | 560 | 0.0237 |
| Other General Industrial Equip | | 0.0747 | 0.4438 | 0.3947 | 0.0016 | 0.0130 | 0.0120 | 152 | 0.0067 |
| Other Material Ha | 50 | 0.0410 | 0.2893 | 0.2073 | 0.0004 | 0.0065 | 0.0060 | 30.3 | 0.0037 |
| | 120 | 0.0421 | 0.4076 | 0.2541 | 0.0007 | 0.0117 | 0.0108 | 60.7 | 0.0038 |
| | 175 | 0.0653 | 0.7197 | 0.3067 | 0.0014 | 0.0146 | 0.0134 | 122 | 0.0059 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0642 | 0.2920 | 0.2863 | 0.0016 | 0.0088 | 0.0081 | 145 | 0.0058 |
| | 500 | 0.0837 | 0.3670 | 0.3482 | 0.0019 | 0.0113 | 0.0104 | 192 | 0.0075 |
| | 9999 | 0.3781 | 1.4596 | 3.9555 | 0.0073 | 0.0764 | 0.0703 | 741 | 0.0341 |
| Other Material Handling Equip | | 0.0696 | 0.4355 | 0.3844 | 0.0015 | 0.0124 | 0.0114 | 141 | 0.0063 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1422 | 0.0002 | 0.0053 | 0.0049 | 18.7 | 0.0020 |
| | 50 | 0.0574 | 0.2803 | 0.2102 | 0.0004 | 0.0114 | 0.0105 | 28.0 | 0.0052 |
| | 120 | 0.0662 | 0.4696 | 0.4003 | 0.0008 | 0.0263 | 0.0242 | 69.2 | 0.0060 |
| | 175 | 0.0899 | 0.7543 | 0.5238 | 0.0014 | 0.0286 | 0.0263 | 128 | 0.0081 |
| | 250 | 0.1097 | 0.4287 | 0.7020 | 0.0022 | 0.0254 | 0.0234 | 194 | 0.0099 |
| | 500 | 0.1263 | 0.5374 | 0.7572 | 0.0023 | 0.0284 | 0.0261 | 233 | 0.0114 |
| Pavers Composite | | 0.0717 | 0.4745 | 0.3858 | 0.0009 | 0.0220 | 0.0202 | 77.9 | 0.0065 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0469 | 0.2355 | 0.1789 | 0.0003 | 0.0095 | 0.0088 | 23.9 | 0.0042 |
| | 120 | 0.0503 | 0.3671 | 0.3092 | 0.0006 | 0.0200 | 0.0184 | 54.5 | 0.0045 |
| | 175 | 0.0687 | 0.5900 | 0.4021 | 0.0011 | 0.0219 | 0.0201 | 101 | 0.0062 |
| | 250 | 0.0672 | 0.2648 | 0.4289 | 0.0014 | 0.0154 | 0.0141 | 122 | 0.0061 |
| Paving Equipment Composite | | 0.0548 | 0.3993 | 0.3281 | 0.0008 | 0.0190 | 0.0175 | 68.9 | 0.0049 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0052 | 0.0301 | 0.0368 | 0.0001 | 0.0015 | 0.0014 | 4.9 | 0.0005 |
| | 25 | 0.0087 | 0.0299 | 0.0555 | 0.0001 | 0.0022 | 0.0020 | 7.1 | 0.0008 |
| | 50 | 0.0079 | 0.0810 | 0.0843 | 0.0002 | 0.0019 | 0.0018 | 14.3 | 0.0007 |
| | 120 | 0.0082 | 0.1351 | 0.0897 | 0.0003 | 0.0031 | 0.0029 | 24.1 | 0.0007 |
| Pressure Washers Composite | | 0.0066 | 0.0531 | 0.0561 | 0.0001 | 0.0019 | 0.0017 | 9.4 | 0.0006 |
| Pumps | 15 | 0.0089 | 0.0456 | 0.0560 | 0.0001 | 0.0024 | 0.0022 | 7.4 | 0.0008 |
| | 25 | 0.0244 | 0.0816 | 0.1512 | 0.0002 | 0.0061 | 0.0056 | 19.5 | 0.0022 |
| | 50 | 0.0299 | 0.2394 | 0.2138 | 0.0004 | 0.0061 | 0.0056 | 34.3 | 0.0027 |
| | 120 | 0.0365 | 0.4656 | 0.3062 | 0.0009 | 0.0129 | 0.0119 | 77.9 | 0.0033 |
| | 175 | 0.0499 | 0.7342 | 0.3301 | 0.0016 | 0.0142 | 0.0130 | 140 | 0.0045 |
| | 250 | 0.0572 | 0.3604 | 0.3745 | 0.0023 | 0.0107 | 0.0098 | 201 | 0.0052 |
| | 500 | 0.0959 | 0.6034 | 0.5922 | 0.0034 | 0.0178 | 0.0163 | 345 | 0.0087 |
| | 750 | 0.1593 | 0.9975 | 0.9991 | 0.0057 | 0.0297 | 0.0274 | 571 | 0.0144 |
| | 9999 | 0.4488 | 2.4388 | 6.8114 | 0.0136 | 0.1186 | 0.1091 | 1,355 | 0.0405 |
| Pumps Composite | | 0.0270 | 0.2617 | 0.2079 | 0.0006 | 0.0078 | 0.0072 | 49.6 | 0.0024 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0345 | 0.2258 | 0.1776 | 0.0003 | 0.0068 | 0.0062 | 26.0 | 0.0031 |
| | 120 | 0.0392 | 0.3801 | 0.2647 | 0.0007 | 0.0137 | 0.0126 | 59.0 | 0.0035 |
| | 175 | 0.0553 | 0.6096 | 0.3030 | 0.0012 | 0.0156 | 0.0143 | 108 | 0.0050 |
| | 250 | 0.0656 | 0.3037 | 0.3629 | 0.0017 | 0.0127 | 0.0116 | 153 | 0.0059 |
| | 500 | 0.0920 | 0.4189 | 0.4752 | 0.0022 | 0.0174 | 0.0160 | 219 | 0.0083 |
| Rollers Composite | | 0.0410 | 0.3763 | 0.2501 | 0.0008 | 0.0122 | 0.0113 | 67.0 | 0.0037 |
| Rough Terrain Fo | 50 | 0.0381 | 0.3041 | 0.2193 | 0.0004 | 0.0054 | 0.0049 | 33.9 | 0.0034 |
| | 120 | 0.0369 | 0.4106 | 0.2316 | 0.0007 | 0.0087 | 0.0080 | 62.4 | 0.0033 |
| | 175 | 0.0569 | 0.7229 | 0.2450 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0051 |
| | 250 | 0.0671 | 0.3372 | 0.2625 | 0.0019 | 0.0084 | 0.0077 | 171 | 0.0061 |
| | 500 | 0.0999 | 0.4838 | 0.3682 | 0.0025 | 0.0123 | 0.0113 | 257 | 0.0090 |
| Rough Terrain Forklifts Compo | | 0.0396 | 0.4430 | 0.2336 | 0.0008 | 0.0090 | 0.0083 | 70.3 | 0.0036 |
| Rubber Tired Doz | 175 | 0.1163 | 0.8019 | 0.6895 | 0.0015 | 0.0386 | 0.0355 | 129 | 0.0105 |
| | 250 | 0.1329 | 0.4624 | 0.8841 | 0.0021 | 0.0340 | 0.0312 | 183 | 0.0120 |
| | 500 | 0.1817 | 0.7490 | 1.1543 | 0.0026 | 0.0448 | 0.0412 | 265 | 0.0164 |
| | 750 | 0.2747 | 1.1262 | 1.7818 | 0.0040 | 0.0684 | 0.0629 | 399 | 0.0248 |
| | 1000 | 0.4321 | 1.7954 | 4.5523 | 0.0060 | 0.1202 | 0.1106 | 592 | 0.0390 |
| Rubber Tired Dozers Compos | | 0.1672 | 0.6620 | 1.0824 | 0.0025 | 0.0419 | 0.0385 | 239 | 0.0151 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0418 | 0.2904 | 0.2109 | 0.0004 | 0.0069 | 0.0063 | 31.1 | 0.0038 |
| | 120 | 0.0397 | 0.3916 | 0.2476 | 0.0007 | 0.0115 | 0.0105 | 58.9 | 0.0036 |
| | 175 | 0.0546 | 0.6199 | 0.2592 | 0.0012 | 0.0130 | 0.0119 | 106 | 0.0049 |
| | 250 | 0.0661 | 0.3041 | 0.3040 | 0.0017 | 0.0107 | 0.0099 | 149 | 0.0060 |
| | 500 | 0.1034 | 0.4654 | 0.4455 | 0.0023 | 0.0164 | 0.0151 | 237 | 0.0093 |
| | 750 | 0.2119 | 0.9532 | 0.9273 | 0.0049 | 0.0338 | 0.0311 | 486 | 0.0191 |
| | 1000 | 0.2701 | 1.1927 | 3.2272 | 0.0060 | 0.0615 | 0.0566 | 594 | 0.0244 |
| Rubber Tired Loaders Compos | | 0.0559 | 0.4311 | 0.2835 | 0.0012 | 0.0121 | 0.0111 | 109 | 0.0050 |
| Scrapers | 120 | 0.0887 | 0.6472 | 0.5218 | 0.0011 | 0.0330 | 0.0303 | 93.9 | 0.0080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1025 | 0.8864 | 0.5654 | 0.0017 | 0.0307 | 0.0282 | 148 | 0.0092 |
| | 250 | 0.1187 | 0.4642 | 0.7040 | 0.0024 | 0.0254 | 0.0234 | 209 | 0.0107 |
| | 500 | 0.1755 | 0.7332 | 0.9727 | 0.0032 | 0.0364 | 0.0335 | 321 | 0.0158 |
| | 750 | 0.3043 | 1.2657 | 1.7266 | 0.0056 | 0.0638 | 0.0587 | 555 | 0.0275 |
| Scrapers Composite | | 0.1495 | 0.7187 | 0.8387 | 0.0027 | 0.0335 | 0.0308 | 262 | 0.0135 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0332 | 0.2686 | 0.2268 | 0.0005 | 0.0063 | 0.0058 | 36.2 | 0.0030 |
| | 120 | 0.0394 | 0.4898 | 0.3076 | 0.0009 | 0.0127 | 0.0116 | 80.2 | 0.0036 |
| | 175 | 0.0587 | 0.8292 | 0.3433 | 0.0017 | 0.0152 | 0.0139 | 155 | 0.0053 |
| | 250 | 0.0794 | 0.4676 | 0.4435 | 0.0029 | 0.0132 | 0.0121 | 255 | 0.0072 |
| Signal Boards Composite | | 0.0111 | 0.0909 | 0.0718 | 0.0002 | 0.0029 | 0.0026 | 16.7 | 0.0010 |
| Skid Steer Loade | 25 | 0.0167 | 0.0568 | 0.1055 | 0.0002 | 0.0040 | 0.0037 | 13.8 | 0.0015 |
| | 50 | 0.0194 | 0.1977 | 0.1446 | 0.0003 | 0.0015 | 0.0014 | 25.5 | 0.0017 |
| | 120 | 0.0175 | 0.2665 | 0.1240 | 0.0005 | 0.0022 | 0.0020 | 42.8 | 0.0016 |
| Skid Steer Loaders Composite | | 0.0186 | 0.2104 | 0.1354 | 0.0004 | 0.0019 | 0.0018 | 30.3 | 0.0017 |
| Surfacing Equipm | 50 | 0.0171 | 0.1105 | 0.0934 | 0.0002 | 0.0035 | 0.0033 | 14.1 | 0.0015 |
| | 120 | 0.0385 | 0.3950 | 0.2869 | 0.0007 | 0.0146 | 0.0134 | 63.8 | 0.0035 |
| | 175 | 0.0386 | 0.4642 | 0.2429 | 0.0010 | 0.0119 | 0.0109 | 85.8 | 0.0035 |
| | 250 | 0.0504 | 0.2604 | 0.3275 | 0.0015 | 0.0111 | 0.0103 | 135 | 0.0045 |
| | 500 | 0.0800 | 0.4236 | 0.4893 | 0.0022 | 0.0174 | 0.0160 | 221 | 0.0072 |
| | 750 | 0.1260 | 0.6643 | 0.7833 | 0.0035 | 0.0275 | 0.0253 | 347 | 0.0114 |
| Surfacing Equipment Compos | | 0.0638 | 0.3590 | 0.3924 | 0.0017 | 0.0142 | 0.0131 | 166 | 0.0058 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0308 | 0.2762 | 0.1942 | 0.0004 | 0.0033 | 0.0031 | 31.6 | 0.0028 |
| | 120 | 0.0395 | 0.4895 | 0.2530 | 0.0009 | 0.0068 | 0.0062 | 75.0 | 0.0036 |
| | 175 | 0.0565 | 0.8005 | 0.2201 | 0.0016 | 0.0084 | 0.0077 | 139 | 0.0051 |
| | 250 | 0.0587 | 0.3179 | 0.1898 | 0.0018 | 0.0062 | 0.0057 | 162 | 0.0053 |
| Sweepers/Scrubbers Compos | | 0.0410 | 0.4840 | 0.2255 | 0.0009 | 0.0061 | 0.0056 | 78.5 | 0.0037 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0045 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0316 | 0.2678 | 0.1895 | 0.0004 | 0.0037 | 0.0034 | 30.3 | 0.0029 |
| | 120 | 0.0281 | 0.3379 | 0.1761 | 0.0006 | 0.0055 | 0.0051 | 51.7 | 0.0025 |
| | 175 | 0.0420 | 0.5839 | 0.1613 | 0.0011 | 0.0072 | 0.0066 | 101 | 0.0038 |
| | 250 | 0.0633 | 0.3389 | 0.2157 | 0.0019 | 0.0073 | 0.0067 | 172 | 0.0057 |
| | 500 | 0.1263 | 0.6506 | 0.4127 | 0.0039 | 0.0144 | 0.0132 | 345 | 0.0114 |
| | 750 | 0.1896 | 0.9760 | 0.6256 | 0.0058 | 0.0216 | 0.0199 | 517 | 0.0171 |
| Tractors/Loaders/Backhoes C | | 0.0336 | 0.3586 | 0.1857 | 0.0008 | 0.0059 | 0.0054 | 66.8 | 0.0030 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0687 | 0.3197 | 0.2467 | 0.0004 | 0.0140 | 0.0129 | 32.9 | 0.0062 |
| | 120 | 0.0625 | 0.4341 | 0.3863 | 0.0008 | 0.0259 | 0.0239 | 64.9 | 0.0056 |
| | 175 | 0.1009 | 0.8327 | 0.6152 | 0.0016 | 0.0338 | 0.0311 | 144 | 0.0091 |
| | 250 | 0.1247 | 0.4925 | 0.8480 | 0.0025 | 0.0309 | 0.0285 | 223 | 0.0112 |
| | 500 | 0.1661 | 0.7370 | 1.0663 | 0.0031 | 0.0400 | 0.0368 | 311 | 0.0150 |
| | 750 | 0.3147 | 1.3882 | 2.0666 | 0.0059 | 0.0766 | 0.0705 | 587 | 0.0284 |
| Trenchers Composite | | 0.0674 | 0.4085 | 0.3481 | 0.0007 | 0.0215 | 0.0198 | 58.7 | 0.0061 |
| Welders | 15 | 0.0075 | 0.0381 | 0.0468 | 0.0001 | 0.0020 | 0.0018 | 6.2 | 0.0007 |
| | 25 | 0.0141 | 0.0473 | 0.0876 | 0.0001 | 0.0035 | 0.0033 | 11.3 | 0.0013 |
| | 50 | 0.0280 | 0.2077 | 0.1684 | 0.0003 | 0.0053 | 0.0048 | 26.0 | 0.0025 |
| | 120 | 0.0223 | 0.2476 | 0.1601 | 0.0005 | 0.0073 | 0.0067 | 39.5 | 0.0020 |
| | 175 | 0.0430 | 0.5400 | 0.2396 | 0.0011 | 0.0111 | 0.0103 | 98.2 | 0.0039 |
| | 250 | 0.0423 | 0.2236 | 0.2294 | 0.0013 | 0.0069 | 0.0064 | 119 | 0.0038 |
| | 500 | 0.0585 | 0.3040 | 0.2969 | 0.0016 | 0.0095 | 0.0087 | 168 | 0.0053 |
| Welders Composite | | 0.0214 | 0.1745 | 0.1373 | 0.0003 | 0.0052 | 0.0048 | 25.6 | 0.0019 |

## Fugitive Dust Emission Calculation Methodology

### Fugitive Dust Source Emissions - Material Handling

**Truck Loading/Unloading (Removed debris/concrete materials)**

*Emission Factor [lb/ton] = k(0.0032) x (mean wind speed [mi/hr] / 5)* $^{1.3}$ / (moisture [%] / 2) $^{1.4}$

*Reference: AP-42, Equation (1), Section 13.2.4, November 2006*

| | | | |
|---|---|---|---|
| *k = Aerodynamic Particle Size Multiplier,* $PM_{10}$ | 0.35 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *k = Aerodynamic Particle Size Multiplier,* $PM_{2.5}$ | 0.053 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *Mean Wind Speed* | 15 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *Moisture* | 4.8 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *PM10 Emission Factor* | 0.0014 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |
| *PM2.5 Emission Factor* | 0.0002 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |

**Demolition (Sq. Ft)**

| | | | |
|---|---|---|---|
| PM10, uncontrolled | 0.00042 | lbs/cubic ft[1] | http://www.urbemis.com/software/URBEMIS9%20Users%20Manual%20Appendices.pdf |
| PM2.5, uncontrolled | 0.00009 | lbs/cubic ft[2] | PM2.5 fraction of PM10 = 0.208; SCAQMD Appendix A - Updated CEIDARS List with PM2.5 Fractions (www.aqmd.gov/ceqa/handbook/PM2_5/PM2_5.html |

**Bulldozing**

*Emission Factor [lb/hr] = [1.0 x (silt content [%])* $^{1.5}$ / (moisture) $^{1.4}$]*Scaling Factor

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Silt Content* | 6.9 | | AP-42 Chapter 11, Table 11.9-3 for overburden |
| *Moisture* | 16.8 | | AP-42 Chapter 11, Table 11.9-3 for overburden, upper end or range |
| *$PM_{10}$ Scaling Factor* | 0.75 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *$PM_{2.5}$ Scaling Factor* | 0.105 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *PM10 Emission Factor* | 0.26 | lb/hr | |
| *PM2.5 Emission Factor* | 0.04 | lb/hr | |

**Grading and Scraping**[d]

*Emission Factor [lb/VMT] = [0.051 (S)^2.0*Scaling Factor*

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Mean Vehicle Speed (S)*[a] *- Miles Per Hour (MPH)* | 2 | | Assumption based on project footprint |
| *$PM_{10}$ Scaling Factor* | 0.6 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *$PM_{2.5}$ Scaling Factor* | 0.031 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *PM10 Emission Factor (Uncontrolled)* | 0.12 | lb/VMT | |
| *PM2.5 Emission Factor (Uncontrolled)* | 0.00632 | lb/VMT | |

**Stock Pile Wind Erosion**

Emission Factor [lb/day-acre] = 0.85 x (silt content [%] / 1.5) x (365 / 235) x (percentage of time unobstructed wind exceeds 12 mph / 15)
Reference: SCAQMD CEQA Air Quality Handbook (1993), Table 9-9-E

| Parameter | Value | Basis |
|---|---|---|
| Silt Content | 7.5 | SCAQMD CEQA Handbook, (1993) Table A9-9-E-1 for overburden |
| Pct. time wind > 12 mph | 17.84 | Used 17.84% from AERMET Surface File used for dispersion modeling |

| | |
|---|---|
| PM10 Emission Factor (Uncontrolled) | 7.9 lb/day-acre |
| Reduction from Watering Twice/Day | 50% |
| Controlled PM10 Emission Factor | 3.9 lb/day-acre |
| Controlled PM2.5 Emission Factor[a] | 0.8 lb/day-acre |

[a] PM2.5 emission factor [lb/hr] = PM10 emission factor [lb/hr] x PM2.5 fraction of PM10

PM2.5 Fraction of PM10 in Construction Dust = 0.208 from Appendix A, Final–Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds, SCAQMD, October 2006

Emissions [pounds per day] = Controlled emission factor [pounds per acre-day] x Stock pile surface area [acres]

# Attachment I3 Alternative EN-2A Emissions

EN-2A - Low Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 4.48 | 32.55 | 24.58 | | 1.65 | 1.52 | 3,889 |
| Construction Off-Road Equipment | 13.43 | 122.22 | 56.60 | 0.17 | 11.05 | 5.27 | 16,883.99 | 0.66 | 6.10 | 2.69 | 0.01 | 0.81 | 0.49 | 766 |
| On-Road Motor Vehicles | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 | 0.01 | 0.30 | 0.09 | 0.00 | 0.01 | 0.01 | 62 |
| *Total On-Shore Emissions* | 13.97 | 137.61 | 59.73 | 0.20 | 11.49 | 5.56 | 20,025.62 | 0.67 | 6.39 | 2.78 | 0.01 | 0.82 | 0.50 | 4,717 |
| Amortized Construction | | | | | | | | | | | | | | 472 |

EN-2A - High Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 5.12 | 37.20 | 28.09 | | 1.88 | 1.73 | 4,445 |
| Construction Off-Road Equipment | 13.43 | 122.22 | 56.60 | 0.17 | 11.05 | 5.27 | 16,883.99 | 0.73 | 6.77 | 2.98 | 0.01 | 0.90 | 0.54 | 850 |
| On-Road Motor Vehicles | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 | 0.01 | 0.30 | 0.09 | 0.00 | 0.01 | 0.01 | 63 |
| *Total On-Shore Emissions* | 13.97 | 137.61 | 59.73 | 0.20 | 11.49 | 5.56 | 20,025.62 | 0.74 | 7.06 | 3.07 | 0.01 | 0.91 | 0.55 | 5,358 |
| Amortized Construction | | | | | | | | | | | | | | 536 |

EN-2A - Low Sea Level

| | Daily Emissions (pounds/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **ROG** | **NOX** | **CO** | **SOX** | **PM10** | **PM2.5** | **CO2** |
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 5.68 | 33.91 | 31.52 | 0.09 | 7.64 | 2.12 | 8,776.91 |
| On-Road Motor Vehicles | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |
| *Total On-Shore Emissions* | 6.06 | 37.56 | 33.62 | 0.12 | 7.81 | 2.33 | 11,589.68 |

EN-2A - High Sea Level

| | Daily Emissions (pounds/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **ROG** | **NOX** | **CO** | **SOX** | **PM10** | **PM2.5** | **CO2** |
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 5.68 | 33.91 | 31.52 | 0.09 | 7.64 | 2.12 | 8,776.91 |
| On-Road Motor Vehicles | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |
| *Total On-Shore Emissions* | 6.06 | 37.56 | 33.62 | 0.12 | 7.81 | 2.33 | 11,589.68 |

## Alternative EN-2A - Construction - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.13 | 0.86 | 0.76 | 0.001 | 0.05 | 0.04 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.08 | 0.06 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-2A - Construction - Low Sea Level

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Emissions Summary | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| Concrete Trucks | 2 | 6 | 1.51 | 10.32 | 9.07 | 0.02 | 0.57 | 0.53 | - | - | 1,501 | 0.14 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.08 | 0.48 | 0.35 | 0.00 | 0.03 | 0.03 | - | - | 56 | 0.01 | lbs/day |
| | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | | | 16,883.99 | 1.21 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | 6.28 | 0.88 | 16,883.99 | 1.21 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **13.43** | **122.22** | **56.60** | **0.17** | | | **11.05** | **5.27** | **16,883.99** | **1.21** | **lbs/day** |

| Project Length | Work Days |
|---|---|
| | 105 |
| Notch Fill | 46 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 840,000 | 84 | 105 | 860,000 | 86 | 107 | ######## | 170 | 212 |
| HSL | 960,000 | 96 | 117 | 970,000 | 97 | 118 | ######## | 193 | 235 |

## Alternative EN-2A - Construction - Low Sea Level

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.21 | 2.54 | 0.87 | 0.00 | 0.08 | 0.07 | - | - | 396 | 0.0174 | tons |
| Loader | 1 | 12 | | 0.07 | 0.49 | 0.29 | 0.00 | 0.03 | 0.02 | - | - | 62 | 0.0054 | tons |
| Dozer | 2 | 12 | | 0.34 | 2.82 | 1.31 | 0.00 | 0.12 | 0.11 | - | - | 274 | 0.0282 | tons |
| Concrete Trucks | 2 | 6 | | 0.03 | 0.24 | 0.21 | 0.00 | 0.01 | 0.01 | - | - | 31 | 0.0028 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0002 | tons |
| | | | | 0.66 | 6.10 | 2.69 | 0.01 | 0.23 | 0.21 | | | 764.82 | 0.05 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.66 | 6.10 | 2.69 | 0.01 | 0.23 | 0.21 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.66** | **6.10** | **2.69** | **0.01** | **0.81** | **0.49** | **0.58** | **0.28** | **765** | **0.051** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **766** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative EN-2A - Construction - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 84.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 4.48 | 32.55 | 24.58 | 1.65 | 1.52 | 3,889 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-2A - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 105 | 42,000 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.39 | 11.86 | 1.77 | 0.02 | 0.30 | 0.21 | 2,243 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 58 | 60 | 1,160 | 153 | 69,920 | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-2A - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 105 | 42,000 | 0.00 | 0.020 | 0.05 | 0.00 | 0.00 | 0.00 | 16 | 14 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.273 | 0.04 | 0.00 | 0.01 | 0.00 | 52 | 47 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 58 | 60 | 1,160 | 153 | 69,920 | 0.01 | 0.30 | 0.09 | 0.00 | 0.01 | 0.01 | 67.95 | 61.83 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative EN-2A - Operations - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.06 | 0.24 | 0.75 | 0.001 | 0.01 | 0.01 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-2A - Operations - Low

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 2 | 12 | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| Concrete Trucks | 2 | 6 | 0.75 | 2.85 | 9.04 | 0.02 | 0.13 | 0.12 | - | - | 1,501 | 0.07 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.04 | 0.34 | 0.32 | 0.00 | 0.01 | 0.01 | - | - | 56 | 0.00 | lbs/day |
| | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | | | 8,776.91 | 0.51 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | 6.28 | 0.88 | 8,776.91 | 0.51 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **5.68** | **33.91** | **31.52** | **0.09** | | | **7.64** | **2.12** | **8,776.91** | **0.51** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 93 |
| Notch Fill | 46 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 720,000 | 72 | 93 | 350,000 | 35 | 56 | 1,070,000 | 107 | 149 |
| HSL | 880,000 | 88 | 109 | 500,000 | 50 | 71 | 1,380,000 | 138 | 180 |

## Alternative EN-2A - Operations - Low S

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.06 | 0.05 | 0.00 | 0.00 | 0.00 | - | - | 8 | 0.0008 | tons |
| Loader | 1 | 12 | | 0.03 | 0.16 | 0.24 | 0.00 | 0.01 | 0.01 | - | - | 55 | 0.0026 | tons |
| Dozer | 2 | 12 | | 0.19 | 1.21 | 0.74 | 0.00 | 0.05 | 0.04 | - | - | 243 | 0.0153 | tons |
| Concrete Trucks | 2 | 6 | | 0.02 | 0.07 | 0.21 | 0.00 | 0.00 | 0.00 | - | - | 31 | 0.0014 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0001 | tons |
| | | | | 0.25 | 1.50 | 1.25 | 0.00 | 0.06 | 0.05 | | | 338.09 | 0.02 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.25 | 1.50 | 1.25 | 0.00 | 0.06 | 0.05 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.25** | **1.50** | **1.25** | **0.00** | | | **0.36** | **0.10** | **338** | **0.020** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **339** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

# Alternative EN-2A - Operations - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Operating Days Per Year | 72.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 1.00 | 7.34 | 21.07 | 0.17 | 0.16 | 3,663 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-2A - Operations - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 93 | 37,200 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.29 | 2.72 | 1.33 | 0.02 | 0.10 | 0.14 | 2,035 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 |
| Total | 58 | 60 | 1,160 | 141 | 65,120 | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-2A - Operations - Low Sea Level Rise

**On-Road Construction Emissions**

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 93 | 37,200 | 0.00 | 0.009 | 0.02 | 0.00 | 0.00 | 0.00 | 11 | 10 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.063 | 0.03 | 0.00 | 0.00 | 0.00 | 47 | 43 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 58 | 60 | 1,160 | 141 | 65,120 | 0.01 | 0.07 | 0.05 | 0.00 | 0.00 | 0.00 | 58.27 | 53.03 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

## Alternative EN-2A - Construction - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.13 | 0.86 | 0.76 | 0.001 | 0.05 | 0.04 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.08 | 0.06 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-2A - Construction - High Sea Leve

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| Concrete Trucks | 2 | 6 | 1.51 | 10.32 | 9.07 | 0.02 | 0.57 | 0.53 | - | - | 1,501 | 0.14 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.08 | 0.48 | 0.35 | 0.00 | 0.03 | 0.03 | - | - | 56 | 0.01 | lbs/day |
| | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | | | 16,883.99 | 1.21 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | 6.28 | 0.88 | 16,883.99 | 1.21 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **13.43** | **122.22** | **56.60** | **0.17** | | | **11.05** | **5.27** | **16,883.99** | **1.21** | **lbs/day** |

| **Project Length** | **Work Days** |
|---|---|
| | 117 |
| Notch Fill | 46 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 840,000 | 84 | 105 | 860,000 | 86 | 107 | ######## | 170 | 212 |
| HSL | 960,000 | 96 | 117 | 970,000 | 97 | 118 | ######## | 193 | 235 |

## Alternative EN-2A - Construction - High Sea Leve

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.24 | 2.83 | 0.97 | 0.00 | 0.08 | 0.08 | - | - | 441 | 0.0194 | tons |
| Loader | 1 | 12 | | 0.07 | 0.55 | 0.32 | 0.00 | 0.03 | 0.03 | - | - | 69 | 0.0061 | tons |
| Dozer | 2 | 12 | | 0.38 | 3.14 | 1.46 | 0.00 | 0.13 | 0.12 | - | - | 305 | 0.0314 | tons |
| Concrete Trucks | 2 | 6 | | 0.03 | 0.24 | 0.21 | 0.00 | 0.01 | 0.01 | - | - | 31 | 0.0028 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0002 | tons |
| | | | | 0.73 | 6.77 | 2.98 | 0.01 | 0.26 | 0.24 | | | 848.50 | 0.06 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.73 | 6.77 | 2.98 | 0.01 | 0.26 | 0.24 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.73** | **6.77** | **2.98** | **0.01** | **0.90** | **0.54** | **0.65** | **0.31** | **849** | **0.057** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **850** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative EN-2A - Construction - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 96.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 5.12 | 37.20 | 28.09 | 1.88 | 1.73 | 4,445 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-2A - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 117 | 46,800 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.39 | 11.86 | 1.77 | 0.02 | 0.30 | 0.21 | 2,243 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 58 | 60 | 1,160 | 165 | 74,720 | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-2A - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 117 | 46,800 | 0.00 | 0.022 | 0.05 | 0.00 | 0.00 | 0.00 | 18 | 16 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.273 | 0.04 | 0.00 | 0.01 | 0.00 | 52 | 47 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 58 | 60 | 1,160 | 165 | 74,720 | 0.01 | 0.30 | 0.09 | 0.00 | 0.01 | 0.01 | 69.75 | 63.47 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative EN-2A - Operations -High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.06 | 0.24 | 0.75 | 0.001 | 0.01 | 0.01 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-2A - Operations -High S

| Source Description | Number | Usage Factor | Emissions Summary ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 2 | 12 | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| Concrete Trucks | 2 | 6 | 0.75 | 2.85 | 9.04 | 0.02 | 0.13 | 0.12 | - | - | 1,501 | 0.07 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.04 | 0.34 | 0.32 | 0.00 | 0.01 | 0.01 | - | - | 56 | 0.00 | lbs/day |
| | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | | | 8,776.91 | 0.51 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | 6.28 | 0.88 | 8,776.91 | 0.51 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **5.68** | **33.91** | **31.52** | **0.09** | | | **7.64** | **2.12** | **8,776.91** | **0.51** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 109 |
| Notch Fill | 46 |

| | Encinitas Volume | Dredging Days | Construction Days | Solana Beach Volume | Dredging Days | Construction Days | Total Volume | Dredging Days | Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 720,000 | 72 | 93 | 350,000 | 35 | 56 | ######## | 107 | 149 |
| HSL | 880,000 | 88 | 109 | 500,000 | 50 | 71 | ######## | 138 | 180 |

## Alternative EN-2A - Operations -High S

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.07 | 0.06 | 0.00 | 0.00 | 0.00 | - | - | 9 | 0.0010 | tons |
| Loader | 1 | 12 | | 0.04 | 0.19 | 0.28 | 0.00 | 0.01 | 0.01 | - | - | 65 | 0.0030 | tons |
| Dozer | 2 | 12 | | 0.22 | 1.42 | 0.87 | 0.00 | 0.05 | 0.05 | - | - | 285 | 0.0180 | tons |
| Concrete Trucks | 2 | 6 | | 0.02 | 0.07 | 0.21 | 0.00 | 0.00 | 0.00 | - | - | 31 | 0.0014 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0001 | tons |
| | | | | 0.28 | 1.75 | 1.42 | 0.00 | 0.07 | 0.06 | | | 390.64 | 0.02 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.28 | 1.75 | 1.42 | 0.00 | 0.07 | 0.06 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.28** | **1.75** | **1.42** | **0.00** | | | **0.42** | **0.12** | **391** | **0.023** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **391** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

## Alternative EN-2A - Operations - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Operating Days Per Year | 88.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 1.22 | 8.97 | 25.75 | 0.21 | 0.19 | 4,477 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-2A - Operations - High Sea Level Rise

### On-Road Construction Emissions

| | | | | | | Total Daily Emissions (lbs) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
| Worker Trips | 20 | 20 | 400 | 109 | 43,600 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.29 | 2.72 | 1.33 | 0.02 | 0.10 | 0.14 | 2,035 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 |
| Total | 58 | 60 | 1,160 | 157 | 71,520 | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-2A - Operations - High Sea Level Rise

**On-Road Construction Emissions**

| | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 109 | 43,600 | 0.00 | 0.011 | 0.02 | 0.00 | 0.00 | 0.00 | 13 | 12 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.063 | 0.03 | 0.00 | 0.00 | 0.00 | 47 | 43 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 58 | 60 | 1,160 | 157 | 71,520 | 0.01 | 0.07 | 0.05 | 0.00 | 0.00 | 0.01 | 60.15 | 54.74 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

**San Diego 2015 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,169,183 | 42,600,783.75 | 7,361,743.79 | 0.045 | 1.290 | 0.136 | 302.103 | 0.047 | 0.019 | 0.004 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,466 | 179,216.55 | 31,712.66 | 0.038 | 0.215 | 0.576 | 315.879 | 0.072 | 0.043 | 0.004 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 172,849 | 6,187,162.79 | 1,061,257.19 | 0.075 | 2.505 | 0.269 | 357.183 | 0.048 | 0.021 | 0.004 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 210 | 6,179.81 | 1,102.01 | 0.066 | 0.312 | 0.691 | 314.863 | 0.099 | 0.068 | 0.004 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 423,444 | 16,224,268.59 | 2,675,454.93 | 0.037 | 1.498 | 0.192 | 432.459 | 0.047 | 0.019 | 0.005 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 187 | 5,978.69 | 1,021.81 | 0.046 | 0.252 | 0.690 | 323.109 | 0.080 | 0.050 | 0.004 | | |
| Average | | | | | | | 0.051 | 1.012 | 0.426 | 340.933 | 0.066 | 0.037 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 2,454 | 392,614.49 | 0 | 0.296 | 1.343 | 8.984 | 1699.527 | 0.231 | 0.158 | 0.017 | | |

Source: EMFAC 2011

**San Diego 2020 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,261,438 | 46,436,329 | 7,971,039 | 0.03 | 0.10 | 0.83 | 244.16 | 0.05 | 0.02 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,897 | 203,726 | 36,279 | 0.02 | 0.39 | 0.13 | 265.72 | 0.06 | 0.03 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 186,176 | 6,674,684 | 1,134,440 | 0.04 | 0.17 | 1.56 | 297.84 | 0.05 | 0.02 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 226 | 8,187 | 1,308 | 0.03 | 0.45 | 0.17 | 259.42 | 0.07 | 0.04 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 450,141 | 17,355,693 | 2,832,803 | 0.02 | 0.11 | 0.93 | 364.76 | 0.05 | 0.02 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 199 | 7,528 | 1,228 | 0.02 | 0.47 | 0.14 | 280.32 | 0.06 | 0.03 | 0.00 | | |
| Average | | | | | | | 0.026 | 0.283 | 0.626 | 285.370 | 0.055 | 0.027 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,262 | 531,839 | - | 0.22 | 1.02 | 4.20 | 1553.04 | 0.18 | 0.11 | 0.02 | | |

Source: EMFAC 2011

**San Diego 2025 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,343,732.35 | ########### | 8,492,736.38 | 0.02 | 0.71 | 0.09 | 223.96 | 0.05 | 0.04 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 6,282.20 | 213,159.29 | 39,008.92 | 0.01 | 0.09 | 0.31 | 246.18 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 198,419.75 | 7,123,689.46 | 1,204,641.90 | 0.02 | 1.09 | 0.12 | 276.49 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 240.83 | 8,707.20 | 1,432.14 | 0.02 | 0.13 | 0.37 | 242.28 | 0.06 | 0.05 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 479,791.14 | ########### | 3,017,273.36 | 0.01 | 0.73 | 0.08 | 343.84 | 0.05 | 0.04 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 211.77 | 7,665.63 | 1,309.49 | 0.02 | 0.11 | 0.40 | 268.51 | 0.06 | 0.05 | 0.00 | | |
| Average | | | | | | | 0.019 | 0.478 | 0.227 | 266.878 | 0.052 | 0.042 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,476 | 582,978 | - | 0.22 | 1.01 | 2.06 | 1541.82 | 0.07 | 0.10 | 0.02 | | |

Source: EMFAC 2011

## 2015 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0155 | 0.0486 | 0.0902 | 0.0001 | 0.0046 | 0.0042 | 11.0 | 0.0014 |
| | 50 | 0.0480 | 0.1641 | 0.1699 | 0.0003 | 0.0129 | 0.0119 | 19.6 | 0.0043 |
| | 120 | 0.0460 | 0.2377 | 0.3272 | 0.0004 | 0.0246 | 0.0226 | 38.1 | 0.0042 |
| | 500 | 0.1026 | 0.4261 | 1.2422 | 0.0021 | 0.0368 | 0.0339 | 213 | 0.0093 |
| | 750 | 0.1912 | 0.7702 | 2.3263 | 0.0039 | 0.0680 | 0.0626 | 385 | 0.0173 |
| Aerial Lifts Composite | | 0.0439 | 0.1837 | 0.2670 | 0.0004 | 0.0167 | 0.0154 | 34.7 | 0.0040 |
| Air Compressors | 15 | 0.0108 | 0.0466 | 0.0664 | 0.0001 | 0.0040 | 0.0037 | 7.2 | 0.0010 |
| | 25 | 0.0229 | 0.0681 | 0.1247 | 0.0002 | 0.0069 | 0.0064 | 14.4 | 0.0021 |
| | 50 | 0.0747 | 0.2360 | 0.2056 | 0.0003 | 0.0183 | 0.0168 | 22.3 | 0.0067 |
| | 120 | 0.0691 | 0.3182 | 0.4334 | 0.0006 | 0.0375 | 0.0345 | 47.0 | 0.0062 |
| | 175 | 0.0903 | 0.5019 | 0.7101 | 0.0010 | 0.0388 | 0.0357 | 88.5 | 0.0082 |
| | 250 | 0.0892 | 0.2803 | 0.9294 | 0.0015 | 0.0286 | 0.0263 | 131 | 0.0080 |
| | 500 | 0.1463 | 0.4915 | 1.4297 | 0.0023 | 0.0470 | 0.0432 | 232 | 0.0132 |
| | 750 | 0.2285 | 0.7595 | 2.2932 | 0.0036 | 0.0743 | 0.0683 | 358 | 0.0206 |
| | 1000 | 0.3551 | 1.1843 | 4.4558 | 0.0049 | 0.1239 | 0.1140 | 486 | 0.0320 |
| Air Compressors Composite | | 0.0773 | 0.3257 | 0.5175 | 0.0007 | 0.0357 | 0.0329 | 63.6 | 0.0070 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1220 | 0.0002 | 0.0047 | 0.0043 | 16.0 | 0.0017 |
| | 50 | 0.0234 | 0.2235 | 0.2240 | 0.0004 | 0.0075 | 0.0069 | 31.0 | 0.0021 |
| | 120 | 0.0376 | 0.4676 | 0.3736 | 0.0009 | 0.0160 | 0.0148 | 77.1 | 0.0034 |
| | 175 | 0.0618 | 0.7540 | 0.5364 | 0.0016 | 0.0198 | 0.0182 | 141 | 0.0056 |
| | 250 | 0.0681 | 0.3425 | 0.4900 | 0.0021 | 0.0144 | 0.0132 | 188 | 0.0061 |
| | 500 | 0.1118 | 0.5511 | 0.7692 | 0.0031 | 0.0236 | 0.0217 | 311 | 0.0101 |
| | 750 | 0.2212 | 1.0888 | 1.5301 | 0.0062 | 0.0466 | 0.0429 | 615 | 0.0200 |
| | 1000 | 0.3562 | 1.6528 | 4.9704 | 0.0093 | 0.1194 | 0.1098 | 928 | 0.0321 |
| Bore/Drill Rigs Composite | | 0.0673 | 0.5022 | 0.6138 | 0.0017 | 0.0200 | 0.0184 | 165 | 0.0061 |
| Cement and Mortar Mixers | 15 | 0.0074 | 0.0386 | 0.0464 | 0.0001 | 0.0019 | 0.0018 | 6.3 | 0.0007 |
| | 25 | 0.0251 | 0.0782 | 0.1456 | 0.0002 | 0.0074 | 0.0068 | 17.6 | 0.0023 |
| Cement and Mortar Mixers Composite | | 0.0088 | 0.0419 | 0.0545 | 0.0001 | 0.0024 | 0.0022 | 7.2 | 0.0008 |
| Concrete/Industrial Saws | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0782 | 0.2745 | 0.2652 | 0.0004 | 0.0206 | 0.0189 | 30.2 | 0.0071 |
| | 120 | 0.0892 | 0.4759 | 0.6249 | 0.0009 | 0.0486 | 0.0448 | 74.1 | 0.0080 |
| | 175 | 0.1340 | 0.8674 | 1.1593 | 0.0018 | 0.0585 | 0.0538 | 160 | 0.0121 |
| Concrete/Industrial Saws Composite | | 0.0835 | 0.3982 | 0.4921 | 0.0007 | 0.0374 | 0.0345 | 58.5 | 0.0075 |
| Cranes | 50 | 0.0853 | 0.2729 | 0.2235 | 0.0003 | 0.0202 | 0.0186 | 23.2 | 0.0077 |
| | 120 | 0.0800 | 0.3559 | 0.4822 | 0.0006 | 0.0415 | 0.0382 | 50.1 | 0.0072 |
| | 175 | 0.0919 | 0.4794 | 0.6684 | 0.0009 | 0.0378 | 0.0348 | 80.3 | 0.0083 |
| | 250 | 0.0925 | 0.2713 | 0.8284 | 0.0013 | 0.0286 | 0.0263 | 112 | 0.0083 |
| | 500 | 0.1393 | 0.4663 | 1.1812 | 0.0018 | 0.0426 | 0.0392 | 180 | 0.0126 |
| | 750 | 0.2358 | 0.7835 | 2.0490 | 0.0030 | 0.0729 | 0.0671 | 303 | 0.0213 |
| | 9999 | 0.8682 | 2.8913 | 9.2743 | 0.0098 | 0.2775 | 0.2553 | 971 | 0.0783 |
| Cranes Composite | | 0.1204 | 0.4395 | 1.0200 | 0.0014 | 0.0426 | 0.0392 | 129 | 0.0109 |
| Crawler Tractors | 50 | 0.1017 | 0.3087 | 0.2464 | 0.0003 | 0.0232 | 0.0214 | 24.9 | 0.0092 |
| | 120 | 0.1143 | 0.4774 | 0.6815 | 0.0008 | 0.0579 | 0.0533 | 65.8 | 0.0103 |
| | 175 | 0.1509 | 0.7384 | 1.0951 | 0.0014 | 0.0614 | 0.0565 | 121 | 0.0136 |
| | 250 | 0.1582 | 0.4614 | 1.3531 | 0.0019 | 0.0514 | 0.0473 | 166 | 0.0143 |
| | 500 | 0.2300 | 0.8352 | 1.8987 | 0.0025 | 0.0732 | 0.0673 | 259 | 0.0207 |
| | 750 | 0.4140 | 1.4936 | 3.4863 | 0.0047 | 0.1327 | 0.1221 | 465 | 0.0374 |
| | 1000 | 0.6278 | 2.3640 | 6.6574 | 0.0066 | 0.2075 | 0.1909 | 658 | 0.0566 |
| Crawler Tractors Composite | | 0.1415 | 0.5650 | 1.0059 | 0.0013 | 0.0594 | 0.0546 | 114 | 0.0128 |
| Crushing/Proc. Equipment | 50 | 0.1392 | 0.4644 | 0.4024 | 0.0006 | 0.0346 | 0.0318 | 44.0 | 0.0126 |
| | 120 | 0.1167 | 0.5646 | 0.7374 | 0.0010 | 0.0629 | 0.0579 | 83.1 | 0.0105 |
| | 175 | 0.1654 | 0.9559 | 1.2783 | 0.0019 | 0.0700 | 0.0644 | 167 | 0.0149 |
| | 250 | 0.1646 | 0.5171 | 1.6355 | 0.0028 | 0.0506 | 0.0466 | 245 | 0.0149 |
| | 500 | 0.2358 | 0.7790 | 2.1722 | 0.0037 | 0.0722 | 0.0664 | 374 | 0.0213 |
| | 750 | 0.3723 | 1.2184 | 3.5561 | 0.0059 | 0.1154 | 0.1062 | 589 | 0.0336 |
| | 9999 | 0.9726 | 3.0901 | 11.5626 | 0.0131 | 0.3225 | 0.2967 | 1,308 | 0.0878 |
| Crushing/Proc. Equipment Composite | | 0.1465 | 0.6549 | 0.9893 | 0.0015 | 0.0607 | 0.0558 | 132 | 0.0132 |
| Dumpers/Tenders | 25 | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Dumpers/Tenders Composite | | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0650 | 0.2683 | 0.2256 | 0.0003 | 0.0167 | 0.0154 | 25.0 | 0.0059 |
| | 120 | 0.0912 | 0.5102 | 0.5787 | 0.0009 | 0.0455 | 0.0418 | 73.6 | 0.0082 |
| | 175 | 0.1052 | 0.6653 | 0.7408 | 0.0013 | 0.0405 | 0.0372 | 112 | 0.0095 |

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| | 250 | 0.1117 | 0.3431 | 0.8935 | 0.0018 | 0.0297 | 0.0273 | 159 | 0.0101 |
| | 500 | 0.1577 | 0.4964 | 1.1619 | 0.0023 | 0.0413 | 0.0380 | 234 | 0.0142 |
| | 750 | 0.2630 | 0.8225 | 1.9926 | 0.0039 | 0.0698 | 0.0642 | 387 | 0.0237 |
| Excavators Composite | | 0.1064 | 0.5248 | 0.7416 | 0.0013 | 0.0379 | 0.0349 | 120 | 0.0096 |
| Forklifts | 50 | 0.0324 | 0.1522 | 0.1324 | 0.0002 | 0.0092 | 0.0084 | 14.7 | 0.0029 |
| | 120 | 0.0345 | 0.2143 | 0.2326 | 0.0004 | 0.0174 | 0.0160 | 31.2 | 0.0031 |
| | 175 | 0.0486 | 0.3316 | 0.3442 | 0.0006 | 0.0189 | 0.0174 | 56.1 | 0.0044 |
| | 250 | 0.0518 | 0.1582 | 0.4040 | 0.0009 | 0.0133 | 0.0122 | 77.1 | 0.0047 |
| | 500 | 0.0724 | 0.2164 | 0.5170 | 0.0011 | 0.0185 | 0.0171 | 111 | 0.0065 |
| Forklifts Composite | | 0.0459 | 0.2200 | 0.3163 | 0.0006 | 0.0156 | 0.0143 | 54.4 | 0.0041 |
| Generator Sets | 15 | 0.0135 | 0.0658 | 0.0929 | 0.0002 | 0.0051 | 0.0047 | 10.2 | 0.0012 |
| | 25 | 0.0247 | 0.0831 | 0.1522 | 0.0002 | 0.0080 | 0.0074 | 17.6 | 0.0022 |
| | 50 | 0.0706 | 0.2465 | 0.2628 | 0.0004 | 0.0193 | 0.0178 | 30.6 | 0.0064 |
| | 120 | 0.0910 | 0.4811 | 0.6607 | 0.0009 | 0.0484 | 0.0445 | 77.9 | 0.0082 |
| | 175 | 0.1120 | 0.7350 | 1.0463 | 0.0016 | 0.0485 | 0.0446 | 142 | 0.0101 |
| | 250 | 0.1090 | 0.4148 | 1.3776 | 0.0024 | 0.0381 | 0.0351 | 213 | 0.0098 |
| Generator Sets - 500 hp | 500 | 0.1556 | 0.6639 | 1.9429 | 0.0033 | 0.0567 | 0.0522 | 337 | 0.0140 |
| | 750 | 0.2599 | 1.0718 | 3.2483 | 0.0055 | 0.0934 | 0.0860 | 544 | 0.0234 |
| | 9999 | 0.6582 | 2.3655 | 8.9789 | 0.0105 | 0.2325 | 0.2139 | 1,049 | 0.0594 |
| Generator Sets Composite | | 0.0640 | 0.2913 | 0.4717 | 0.0007 | 0.0268 | 0.0246 | 61.0 | 0.0058 |
| Graders | 50 | 0.0897 | 0.3082 | 0.2569 | 0.0004 | 0.0217 | 0.0200 | 27.5 | 0.0081 |
| | 120 | 0.1081 | 0.5230 | 0.6726 | 0.0009 | 0.0555 | 0.0511 | 75.0 | 0.0098 |
| | 175 | 0.1299 | 0.7319 | 0.9534 | 0.0014 | 0.0526 | 0.0484 | 124 | 0.0117 |
| | 250 | 0.1326 | 0.4046 | 1.1596 | 0.0019 | 0.0400 | 0.0368 | 172 | 0.0120 |
| | 500 | 0.1666 | 0.5739 | 1.3760 | 0.0023 | 0.0496 | 0.0456 | 229 | 0.0150 |
| | 750 | 0.3549 | 1.2133 | 3.0011 | 0.0049 | 0.1066 | 0.0981 | 486 | 0.0320 |
| Graders Composite | | 0.1277 | 0.5931 | 0.9795 | 0.0015 | 0.0489 | 0.0450 | 133 | 0.0115 |
| Off-Highway Tractors | 120 | 0.1905 | 0.7051 | 1.1159 | 0.0011 | 0.0952 | 0.0876 | 93.7 | 0.0172 |
| | 175 | 0.1870 | 0.8216 | 1.3703 | 0.0015 | 0.0771 | 0.0709 | 130 | 0.0169 |
| | 250 | 0.1489 | 0.4320 | 1.2644 | 0.0015 | 0.0520 | 0.0478 | 130 | 0.0134 |
| | 750 | 0.5975 | 2.5165 | 5.0885 | 0.0057 | 0.2047 | 0.1884 | 568 | 0.0539 |
| | 1000 | 0.9006 | 3.9378 | 9.2072 | 0.0082 | 0.3063 | 0.2818 | 814 | 0.0813 |
| Off-Highway Tractors Composite | | 0.1893 | 0.7244 | 1.5085 | 0.0017 | 0.0717 | 0.0660 | 151 | 0.0171 |
| Off-Highway Trucks | 175 | 0.1259 | 0.7559 | 0.8596 | 0.0014 | 0.0477 | 0.0438 | 125 | 0.0114 |
| | 250 | 0.1252 | 0.3702 | 0.9818 | 0.0019 | 0.0328 | 0.0301 | 167 | 0.0113 |
| | 500 | 0.1960 | 0.5949 | 1.4165 | 0.0027 | 0.0505 | 0.0465 | 272 | 0.0177 |
| | 750 | 0.3198 | 0.9645 | 2.3779 | 0.0044 | 0.0835 | 0.0768 | 442 | 0.0289 |
| | 1000 | 0.4873 | 1.4801 | 5.2216 | 0.0063 | 0.1505 | 0.1385 | 625 | 0.0440 |
| Off-Highway Trucks Composite | | 0.1924 | 0.5974 | 1.4932 | 0.0027 | 0.0516 | 0.0475 | 260 | 0.0174 |
| Other Construction Equipment | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0039 | 0.0036 | 13.2 | 0.0014 |
| | 50 | 0.0597 | 0.2506 | 0.2369 | 0.0004 | 0.0162 | 0.0149 | 28.0 | 0.0054 |
| | 120 | 0.0827 | 0.5202 | 0.6012 | 0.0009 | 0.0441 | 0.0406 | 80.9 | 0.0075 |
| | 175 | 0.0796 | 0.5864 | 0.6636 | 0.0012 | 0.0331 | 0.0305 | 107 | 0.0072 |
| | 500 | 0.1310 | 0.4963 | 1.1867 | 0.0025 | 0.0394 | 0.0362 | 254 | 0.0118 |
| Other Construction Equipment Composite | | 0.0768 | 0.3645 | 0.6392 | 0.0013 | 0.0264 | 0.0243 | 123 | 0.0069 |
| Other General Industrial Equipmen | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0786 | 0.2532 | 0.2077 | 0.0003 | 0.0191 | 0.0175 | 21.7 | 0.0071 |
| | 120 | 0.0987 | 0.4387 | 0.5864 | 0.0007 | 0.0521 | 0.0480 | 62.0 | 0.0089 |
| | 175 | 0.1083 | 0.5684 | 0.7866 | 0.0011 | 0.0448 | 0.0412 | 95.9 | 0.0098 |
| | 250 | 0.1050 | 0.3015 | 0.9812 | 0.0015 | 0.0312 | 0.0287 | 136 | 0.0095 |
| | 500 | 0.1931 | 0.5811 | 1.6702 | 0.0026 | 0.0569 | 0.0524 | 265 | 0.0174 |
| | 750 | 0.3208 | 0.9578 | 2.8569 | 0.0044 | 0.0959 | 0.0883 | 437 | 0.0289 |
| | 1000 | 0.4546 | 1.4023 | 5.2482 | 0.0056 | 0.1513 | 0.1392 | 560 | 0.0410 |
| Other General Industrial Equipmen Composite | | 0.1355 | 0.4843 | 1.1215 | 0.0016 | 0.0475 | 0.0437 | 152 | 0.0122 |
| Other Material Handling Equipmen | 50 | 0.1090 | 0.3501 | 0.2887 | 0.0004 | 0.0265 | 0.0244 | 30.3 | 0.0098 |
| | 120 | 0.0959 | 0.4271 | 0.5727 | 0.0007 | 0.0509 | 0.0468 | 60.7 | 0.0087 |
| | 175 | 0.1365 | 0.7201 | 0.9997 | 0.0014 | 0.0567 | 0.0522 | 122 | 0.0123 |
| | 250 | 0.1109 | 0.3211 | 1.0483 | 0.0016 | 0.0332 | 0.0306 | 145 | 0.0100 |
| | 500 | 0.1376 | 0.4182 | 1.2042 | 0.0019 | 0.0409 | 0.0377 | 192 | 0.0124 |
| | 9999 | 0.6190 | 1.8527 | 6.9410 | 0.0073 | 0.1995 | 0.1835 | 741 | 0.0558 |
| Other Material Handling Equipment Composite | | 0.1289 | 0.4698 | 1.0967 | 0.0015 | 0.0460 | 0.0423 | 141 | 0.0116 |
| Pavers | 25 | 0.0234 | 0.0780 | 0.1458 | 0.0002 | 0.0066 | 0.0060 | 18.7 | 0.0021 |
| | 50 | 0.1198 | 0.3421 | 0.2775 | 0.0004 | 0.0271 | 0.0249 | 28.0 | 0.0108 |
| | 120 | 0.1235 | 0.4969 | 0.7477 | 0.0008 | 0.0636 | 0.0585 | 69.2 | 0.0111 |
| | 175 | 0.1608 | 0.7707 | 1.2155 | 0.0014 | 0.0673 | 0.0619 | 128 | 0.0145 |

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1858 | 0.5585 | 1.6747 | 0.0022 | 0.0640 | 0.0589 | 194 | 0.0168 |
| | 500 | 0.2059 | 0.8113 | 1.8097 | 0.0023 | 0.0697 | 0.0641 | 233 | 0.0186 |
| Pavers Composite | | 0.1347 | 0.5203 | 0.7607 | 0.0009 | 0.0526 | 0.0484 | 77.9 | 0.0122 |
| Paving Equipment | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0037 | 0.0034 | 12.6 | 0.0014 |
| | 50 | 0.1023 | 0.2901 | 0.2367 | 0.0003 | 0.0231 | 0.0213 | 23.9 | 0.0092 |
| | 120 | 0.0969 | 0.3891 | 0.5874 | 0.0006 | 0.0503 | 0.0462 | 54.5 | 0.0087 |
| | 175 | 0.1254 | 0.6025 | 0.9549 | 0.0011 | 0.0528 | 0.0486 | 101 | 0.0113 |
| | 250 | 0.1140 | 0.3441 | 1.0498 | 0.0014 | 0.0394 | 0.0362 | 122 | 0.0103 |
| Paving Equipment Composite | | 0.1023 | 0.4234 | 0.6842 | 0.0008 | 0.0469 | 0.0431 | 68.9 | 0.0092 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washers | 15 | 0.0065 | 0.0315 | 0.0445 | 0.0001 | 0.0024 | 0.0022 | 4.9 | 0.0006 |
| | 25 | 0.0100 | 0.0337 | 0.0617 | 0.0001 | 0.0033 | 0.0030 | 7.1 | 0.0009 |
| | 50 | 0.0251 | 0.0970 | 0.1183 | 0.0002 | 0.0077 | 0.0070 | 14.3 | 0.0023 |
| | 120 | 0.0245 | 0.1416 | 0.1947 | 0.0003 | 0.0128 | 0.0118 | 24.1 | 0.0022 |
| Pressure Washers Composite | | 0.0133 | 0.0590 | 0.0799 | 0.0001 | 0.0049 | 0.0045 | 9.4 | 0.0012 |
| | 15 | 0.0111 | 0.0479 | 0.0683 | 0.0001 | 0.0041 | 0.0038 | 7.4 | 0.0010 |
| | 25 | 0.0309 | 0.0919 | 0.1682 | 0.0002 | 0.0094 | 0.0086 | 19.5 | 0.0028 |
| | 50 | 0.0855 | 0.2910 | 0.2982 | 0.0004 | 0.0228 | 0.0210 | 34.3 | 0.0077 |
| | 120 | 0.0949 | 0.4887 | 0.6710 | 0.0009 | 0.0508 | 0.0467 | 77.9 | 0.0086 |
| | 175 | 0.1158 | 0.7365 | 1.0489 | 0.0016 | 0.0502 | 0.0462 | 140 | 0.0104 |
| | 250 | 0.1088 | 0.3998 | 1.3270 | 0.0023 | 0.0376 | 0.0346 | 201 | 0.0098 |
| Pumps | 500 | 0.1686 | 0.6929 | 2.0163 | 0.0034 | 0.0603 | 0.0555 | 345 | 0.0152 |
| | 750 | 0.2872 | 1.1454 | 3.4529 | 0.0057 | 0.1018 | 0.0937 | 571 | 0.0259 |
| | 9999 | 0.8773 | 3.1134 | 11.7387 | 0.0136 | 0.3072 | 0.2826 | 1,355 | 0.0792 |
| Pumps Composite | | 0.0621 | 0.2825 | 0.4121 | 0.0006 | 0.0267 | 0.0245 | 49.6 | 0.0056 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1018 | 0.0002 | 0.0039 | 0.0036 | 13.3 | 0.0015 |
| | 50 | 0.0871 | 0.2754 | 0.2405 | 0.0003 | 0.0209 | 0.0192 | 26.0 | 0.0079 |
| | 120 | 0.0857 | 0.4000 | 0.5498 | 0.0007 | 0.0454 | 0.0418 | 59.0 | 0.0077 |
| | 175 | 0.1104 | 0.6166 | 0.8731 | 0.0012 | 0.0470 | 0.0433 | 108 | 0.0100 |
| | 250 | 0.1107 | 0.3575 | 1.0948 | 0.0017 | 0.0368 | 0.0339 | 153 | 0.0100 |
| | 500 | 0.1468 | 0.5595 | 1.3956 | 0.0022 | 0.0487 | 0.0448 | 219 | 0.0132 |
| Rollers Composite | | 0.0851 | 0.3979 | 0.5706 | 0.0008 | 0.0386 | 0.0355 | 67.1 | 0.0077 |
| Rough Terrain Forklifts | 50 | 0.0942 | 0.3551 | 0.3066 | 0.0004 | 0.0243 | 0.0224 | 33.9 | 0.0085 |
| | 120 | 0.0801 | 0.4260 | 0.5164 | 0.0007 | 0.0420 | 0.0387 | 62.4 | 0.0072 |
| | 175 | 0.1171 | 0.7240 | 0.8746 | 0.0014 | 0.0477 | 0.0439 | 125 | 0.0106 |
| | 250 | 0.1168 | 0.3650 | 1.0385 | 0.0019 | 0.0338 | 0.0311 | 171 | 0.0105 |
| | 500 | 0.1668 | 0.5337 | 1.3642 | 0.0025 | 0.0477 | 0.0439 | 257 | 0.0150 |
| Rough Terrain Forklifts Composite | | 0.0850 | 0.4577 | 0.5588 | 0.0008 | 0.0423 | 0.0389 | 70.3 | 0.0077 |
| Rubber Tired Dozers | 175 | 0.1942 | 0.8333 | 1.3944 | 0.0015 | 0.0790 | 0.0727 | 129 | 0.0175 |
| | 250 | 0.2209 | 0.6304 | 1.8273 | 0.0021 | 0.0762 | 0.0701 | 183 | 0.0199 |
| | 500 | 0.2932 | 1.2456 | 2.3951 | 0.0026 | 0.0985 | 0.0906 | 265 | 0.0265 |
| | 750 | 0.4423 | 1.8685 | 3.6712 | 0.0040 | 0.1494 | 0.1374 | 399 | 0.0399 |
| | 1000 | 0.6883 | 3.0139 | 6.8297 | 0.0060 | 0.2311 | 0.2126 | 592 | 0.0621 |
| Rubber Tired Dozers Composite | | 0.2721 | 1.0420 | 2.2344 | 0.0025 | 0.0924 | 0.0850 | 239 | 0.0246 |
| Rubber Tired Loaders | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0049 | 0.0045 | 16.9 | 0.0018 |
| | 50 | 0.0993 | 0.3438 | 0.2888 | 0.0004 | 0.0242 | 0.0222 | 31.1 | 0.0090 |
| | 120 | 0.0835 | 0.4090 | 0.5226 | 0.0007 | 0.0431 | 0.0396 | 58.9 | 0.0075 |
| | 175 | 0.1094 | 0.6251 | 0.8077 | 0.0012 | 0.0445 | 0.0409 | 106 | 0.0099 |
| | 250 | 0.1118 | 0.3444 | 0.9890 | 0.0017 | 0.0337 | 0.0310 | 149 | 0.0101 |
| | 500 | 0.1678 | 0.5818 | 1.3980 | 0.0023 | 0.0499 | 0.0459 | 237 | 0.0151 |
| | 750 | 0.3459 | 1.1905 | 2.9534 | 0.0049 | 0.1040 | 0.0956 | 486 | 0.0312 |
| | 1000 | 0.4657 | 1.6412 | 5.2967 | 0.0060 | 0.1552 | 0.1428 | 594 | 0.0420 |
| Rubber Tired Loaders Composite | | 0.1050 | 0.4615 | 0.7838 | 0.0012 | 0.0416 | 0.0383 | 109 | 0.0095 |
| Scrapers | 120 | 0.1665 | 0.6826 | 0.9915 | 0.0011 | 0.0846 | 0.0778 | 93.9 | 0.0150 |
| | 175 | 0.1871 | 0.9030 | 1.3657 | 0.0017 | 0.0766 | 0.0704 | 148 | 0.0169 |
| | 250 | 0.2021 | 0.5906 | 1.7470 | 0.0024 | 0.0665 | 0.0612 | 209 | 0.0182 |
| | 500 | 0.2883 | 1.0688 | 2.4104 | 0.0032 | 0.0930 | 0.0855 | 321 | 0.0260 |
| | 750 | 0.5001 | 1.8419 | 4.2634 | 0.0056 | 0.1624 | 0.1494 | 555 | 0.0451 |
| Scrapers Composite | | 0.2513 | 0.9443 | 2.0647 | 0.0027 | 0.0854 | 0.0785 | 262 | 0.0227 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0931 | 0.3227 | 0.3148 | 0.0005 | 0.0243 | 0.0224 | 36.2 | 0.0084 |
| | 120 | 0.0970 | 0.5116 | 0.6762 | 0.0009 | 0.0525 | 0.0483 | 80.2 | 0.0088 |
| | 175 | 0.1290 | 0.8300 | 1.1249 | 0.0017 | 0.0559 | 0.0514 | 155 | 0.0116 |
| | 250 | 0.1416 | 0.5098 | 1.6229 | 0.0029 | 0.0474 | 0.0436 | 255 | 0.0128 |
| Signal Boards Composite | | 0.0171 | 0.0925 | 0.1250 | 0.0002 | 0.0066 | 0.0060 | 16.7 | 0.0015 |

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Skid Steer Loaders | 25 | 0.0189 | 0.0601 | 0.1125 | 0.0002 | 0.0056 | 0.0052 | 13.8 | 0.0017 |
| | 50 | 0.0378 | 0.2138 | 0.2052 | 0.0003 | 0.0113 | 0.0104 | 25.5 | 0.0034 |
| | 120 | 0.0334 | 0.2710 | 0.2699 | 0.0005 | 0.0170 | 0.0156 | 42.8 | 0.0030 |
| Skid Steer Loaders Composite | | 0.0352 | 0.2220 | 0.2198 | 0.0004 | 0.0128 | 0.0118 | 30.3 | 0.0032 |
| Surfacing Equipment | 50 | 0.0408 | 0.1333 | 0.1263 | 0.0002 | 0.0101 | 0.0093 | 14.1 | 0.0037 |
| | 120 | 0.0840 | 0.4151 | 0.5756 | 0.0007 | 0.0439 | 0.0404 | 63.8 | 0.0076 |
| | 175 | 0.0787 | 0.4705 | 0.6706 | 0.0010 | 0.0335 | 0.0308 | 85.8 | 0.0071 |
| | 250 | 0.0891 | 0.3116 | 0.9338 | 0.0015 | 0.0309 | 0.0285 | 135 | 0.0080 |
| | 500 | 0.1342 | 0.5759 | 1.3809 | 0.0022 | 0.0468 | 0.0431 | 221 | 0.0121 |
| | 750 | 0.2139 | 0.9020 | 2.2264 | 0.0035 | 0.0745 | 0.0686 | 347 | 0.0193 |
| Surfacing Equipment Composite | | 0.1116 | 0.4705 | 1.0675 | 0.0017 | 0.0389 | 0.0357 | 166 | 0.0101 |
| Sweepers/Scrubbers | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0052 | 19.6 | 0.0021 |
| | 50 | 0.0782 | 0.3186 | 0.2828 | 0.0004 | 0.0211 | 0.0194 | 31.6 | 0.0071 |
| | 120 | 0.0880 | 0.5056 | 0.5893 | 0.0009 | 0.0466 | 0.0429 | 75.0 | 0.0079 |
| | 175 | 0.1193 | 0.7999 | 0.9051 | 0.0016 | 0.0488 | 0.0449 | 139 | 0.0108 |
| | 250 | 0.1029 | 0.3286 | 0.9094 | 0.0018 | 0.0289 | 0.0266 | 162 | 0.0093 |
| Sweepers/Scrubbers Composite | | 0.0913 | 0.5034 | 0.5746 | 0.0009 | 0.0387 | 0.0356 | 78.5 | 0.0082 |
| Tractors/Loaders/Backhoes | 25 | 0.0192 | 0.0653 | 0.1221 | 0.0002 | 0.0049 | 0.0045 | 15.9 | 0.0017 |
| | 50 | 0.0702 | 0.3020 | 0.2646 | 0.0004 | 0.0186 | 0.0171 | 30.3 | 0.0063 |
| | 120 | 0.0577 | 0.3480 | 0.3870 | 0.0006 | 0.0293 | 0.0270 | 51.7 | 0.0052 |
| | 175 | 0.0854 | 0.5853 | 0.6331 | 0.0011 | 0.0335 | 0.0308 | 101 | 0.0077 |
| | 250 | 0.1082 | 0.3566 | 0.9047 | 0.0019 | 0.0294 | 0.0270 | 172 | 0.0098 |
| | 500 | 0.2085 | 0.7089 | 1.6070 | 0.0039 | 0.0559 | 0.0514 | 345 | 0.0188 |
| | 750 | 0.3148 | 1.0631 | 2.4922 | 0.0058 | 0.0854 | 0.0786 | 517 | 0.0284 |
| Tractors/Loaders/Backhoes Composite | | 0.0666 | 0.3716 | 0.4501 | 0.0008 | 0.0298 | 0.0274 | 66.8 | 0.0060 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0087 | 32.9 | 0.0036 |
| | 50 | 0.1390 | 0.3900 | 0.3235 | 0.0004 | 0.0313 | 0.0288 | 32.9 | 0.0125 |
| | 120 | 0.1144 | 0.4600 | 0.7060 | 0.0008 | 0.0590 | 0.0542 | 64.9 | 0.0103 |
| | 175 | 0.1770 | 0.8534 | 1.3767 | 0.0016 | 0.0748 | 0.0688 | 144 | 0.0160 |
| | 250 | 0.2105 | 0.6510 | 1.9456 | 0.0025 | 0.0750 | 0.0690 | 223 | 0.0190 |
| | 500 | 0.2694 | 1.1349 | 2.4560 | 0.0031 | 0.0947 | 0.0871 | 311 | 0.0243 |
| | 750 | 0.5107 | 2.1334 | 4.7300 | 0.0059 | 0.1802 | 0.1658 | 587 | 0.0461 |
| Trenchers Composite | | 0.1274 | 0.4541 | 0.6043 | 0.0007 | 0.0485 | 0.0446 | 58.7 | 0.0115 |
| Welders | 15 | 0.0093 | 0.0400 | 0.0571 | 0.0001 | 0.0034 | 0.0032 | 6.2 | 0.0008 |
| | 25 | 0.0179 | 0.0532 | 0.0974 | 0.0001 | 0.0054 | 0.0050 | 11.3 | 0.0016 |
| | 50 | 0.0801 | 0.2564 | 0.2346 | 0.0003 | 0.0200 | 0.0184 | 26.0 | 0.0072 |
| | 120 | 0.0547 | 0.2606 | 0.3567 | 0.0005 | 0.0296 | 0.0273 | 39.5 | 0.0049 |
| | 175 | 0.0936 | 0.5424 | 0.7713 | 0.0011 | 0.0405 | 0.0373 | 98.2 | 0.0084 |
| | 250 | 0.0749 | 0.2483 | 0.8249 | 0.0013 | 0.0248 | 0.0228 | 119 | 0.0068 |
| | 500 | 0.0968 | 0.3491 | 1.0171 | 0.0016 | 0.0325 | 0.0299 | 168 | 0.0087 |
| Welders Composite | | 0.0534 | 0.1994 | 0.2301 | 0.0003 | 0.0187 | 0.0172 | 25.6 | 0.0048 |

## 2020 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0138 | 0.0459 | 0.0854 | 0.0001 | 0.0035 | 0.0032 | 11.0 | 0.0012 |
| | 50 | 0.0261 | 0.1436 | 0.1422 | 0.0003 | 0.0071 | 0.0065 | 19.6 | 0.0024 |
| | 120 | 0.0259 | 0.2292 | 0.2166 | 0.0004 | 0.0127 | 0.0117 | 38.1 | 0.0023 |
| | 500 | 0.0751 | 0.3804 | 0.6959 | 0.0021 | 0.0217 | 0.0199 | 213 | 0.0068 |
| | 750 | 0.1373 | 0.6877 | 1.2876 | 0.0039 | 0.0396 | 0.0365 | 385 | 0.0124 |
| Aerial Lifts Composite | | 0.0261 | 0.1696 | 0.1866 | 0.0004 | 0.0092 | 0.0084 | 34.7 | 0.0024 |
| Air Compressors | 15 | 0.0093 | 0.0451 | 0.0579 | 0.0001 | 0.0029 | 0.0027 | 7.2 | 0.0008 |
| | 25 | 0.0196 | 0.0630 | 0.1155 | 0.0002 | 0.0054 | 0.0050 | 14.4 | 0.0018 |
| | 50 | 0.0398 | 0.2030 | 0.1725 | 0.0003 | 0.0099 | 0.0091 | 22.3 | 0.0036 |
| | 120 | 0.0408 | 0.3058 | 0.2826 | 0.0006 | 0.0188 | 0.0173 | 47.0 | 0.0037 |
| | 175 | 0.0587 | 0.4989 | 0.4013 | 0.0010 | 0.0210 | 0.0193 | 88.5 | 0.0053 |
| | 250 | 0.0669 | 0.2592 | 0.5067 | 0.0015 | 0.0163 | 0.0150 | 131 | 0.0060 |
| | 500 | 0.1146 | 0.4395 | 0.7970 | 0.0023 | 0.0276 | 0.0254 | 232 | 0.0103 |
| | 750 | 0.1777 | 0.6792 | 1.2615 | 0.0036 | 0.0432 | 0.0398 | 358 | 0.0160 |
| | 1000 | 0.2641 | 0.9959 | 3.2946 | 0.0049 | 0.0804 | 0.0740 | 486 | 0.0238 |
| Air Compressors Composite | | 0.0483 | 0.3077 | 0.3255 | 0.0007 | 0.0185 | 0.0170 | 63.6 | 0.0044 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0196 | 0.2205 | 0.1756 | 0.0004 | 0.0020 | 0.0018 | 31.0 | 0.0018 |
| | 120 | 0.0280 | 0.4662 | 0.2329 | 0.0009 | 0.0040 | 0.0037 | 77.1 | 0.0025 |
| | 175 | 0.0402 | 0.7542 | 0.1862 | 0.0016 | 0.0051 | 0.0047 | 141 | 0.0036 |
| | 250 | 0.0474 | 0.3426 | 0.1617 | 0.0021 | 0.0044 | 0.0040 | 188 | 0.0043 |
| | 500 | 0.0784 | 0.5512 | 0.2622 | 0.0031 | 0.0072 | 0.0066 | 311 | 0.0071 |
| | 750 | 0.1549 | 1.0891 | 0.5202 | 0.0062 | 0.0143 | 0.0131 | 615 | 0.0140 |
| | 1000 | 0.2442 | 1.6437 | 3.9853 | 0.0093 | 0.0530 | 0.0488 | 928 | 0.0220 |
| Bore/Drill Rigs Composite | | 0.0480 | 0.5008 | 0.3439 | 0.0017 | 0.0062 | 0.0057 | 165 | 0.0043 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0223 | 0.0741 | 0.1372 | 0.0002 | 0.0058 | 0.0053 | 17.6 | 0.0020 |
| Cement and Mortar Mixers Co | | 0.0086 | 0.0415 | 0.0536 | 0.0001 | 0.0021 | 0.0020 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0424 | 0.2420 | 0.2231 | 0.0004 | 0.0113 | 0.0104 | 30.2 | 0.0038 |
| | 120 | 0.0524 | 0.4613 | 0.4128 | 0.0009 | 0.0249 | 0.0229 | 74.1 | 0.0047 |
| | 175 | 0.0865 | 0.8662 | 0.6554 | 0.0018 | 0.0323 | 0.0297 | 160 | 0.0078 |
| Concrete/Industrial Saws Com | | 0.0484 | 0.3783 | 0.3410 | 0.0007 | 0.0196 | 0.0180 | 58.5 | 0.0044 |
| Cranes | 50 | 0.0532 | 0.2423 | 0.1894 | 0.0003 | 0.0121 | 0.0111 | 23.2 | 0.0048 |
| | 120 | 0.0542 | 0.3446 | 0.3317 | 0.0006 | 0.0240 | 0.0221 | 50.1 | 0.0049 |
| | 175 | 0.0648 | 0.4754 | 0.4071 | 0.0009 | 0.0223 | 0.0206 | 80.3 | 0.0058 |
| | 250 | 0.0704 | 0.2440 | 0.4949 | 0.0013 | 0.0170 | 0.0157 | 112 | 0.0064 |
| | 500 | 0.1087 | 0.3839 | 0.7047 | 0.0018 | 0.0257 | 0.0236 | 180 | 0.0098 |
| | 750 | 0.1837 | 0.6455 | 1.2225 | 0.0030 | 0.0439 | 0.0404 | 303 | 0.0166 |
| | 9999 | 0.6702 | 2.1934 | 7.0436 | 0.0098 | 0.1797 | 0.1654 | 971 | 0.0605 |
| Cranes Composite | | 0.0898 | 0.3917 | 0.6610 | 0.0014 | 0.0256 | 0.0236 | 129 | 0.0081 |
| Crawler Tractors | 50 | 0.0699 | 0.2771 | 0.2107 | 0.0003 | 0.0150 | 0.0138 | 24.9 | 0.0063 |
| | 120 | 0.0831 | 0.4628 | 0.4896 | 0.0008 | 0.0371 | 0.0341 | 65.8 | 0.0075 |
| | 175 | 0.1123 | 0.7302 | 0.7150 | 0.0014 | 0.0398 | 0.0366 | 121 | 0.0101 |
| | 250 | 0.1188 | 0.3966 | 0.8681 | 0.0019 | 0.0315 | 0.0290 | 166 | 0.0107 |
| | 500 | 0.1759 | 0.6665 | 1.2170 | 0.0025 | 0.0455 | 0.0419 | 259 | 0.0159 |
| | 750 | 0.3168 | 1.1935 | 2.2429 | 0.0047 | 0.0828 | 0.0762 | 465 | 0.0286 |
| | 1000 | 0.4836 | 1.8458 | 5.2162 | 0.0066 | 0.1425 | 0.1311 | 658 | 0.0436 |
| Crawler Tractors Composite | | 0.1049 | 0.5260 | 0.6772 | 0.0013 | 0.0378 | 0.0348 | 114 | 0.0095 |
| Crushing/Proc. E | 50 | 0.0734 | 0.4036 | 0.3367 | 0.0006 | 0.0181 | 0.0166 | 44.0 | 0.0066 |
| | 120 | 0.0692 | 0.5446 | 0.4754 | 0.0010 | 0.0302 | 0.0278 | 83.1 | 0.0062 |
| | 175 | 0.1083 | 0.9519 | 0.7042 | 0.0019 | 0.0368 | 0.0338 | 167 | 0.0098 |
| | 250 | 0.1245 | 0.4844 | 0.8670 | 0.0028 | 0.0282 | 0.0259 | 245 | 0.0112 |
| | 500 | 0.1852 | 0.7092 | 1.1829 | 0.0037 | 0.0416 | 0.0383 | 374 | 0.0167 |
| | 750 | 0.2912 | 1.1167 | 1.9026 | 0.0059 | 0.0655 | 0.0603 | 589 | 0.0263 |
| | 9999 | 0.7584 | 2.6528 | 8.5119 | 0.0131 | 0.2049 | 0.1885 | 1,308 | 0.0684 |
| Crushing/Proc. Equipment Co | | 0.0934 | 0.6247 | 0.5983 | 0.0015 | 0.0310 | 0.0285 | 132 | 0.0084 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0384 | 0.2446 | 0.1862 | 0.0003 | 0.0080 | 0.0074 | 25.0 | 0.0035 |
| | 120 | 0.0583 | 0.4979 | 0.3717 | 0.0009 | 0.0206 | 0.0189 | 73.6 | 0.0053 |
| | 175 | 0.0703 | 0.6637 | 0.3868 | 0.0013 | 0.0195 | 0.0179 | 112 | 0.0063 |
| | 250 | 0.0828 | 0.3276 | 0.4493 | 0.0018 | 0.0154 | 0.0141 | 159 | 0.0075 |
| | 500 | 0.1198 | 0.4591 | 0.6028 | 0.0023 | 0.0219 | 0.0202 | 234 | 0.0108 |
| | 750 | 0.1987 | 0.7606 | 1.0153 | 0.0039 | 0.0365 | 0.0336 | 387 | 0.0179 |
| Excavators Composite | | 0.0733 | 0.5124 | 0.4042 | 0.0013 | 0.0184 | 0.0169 | 120 | 0.0066 |
| Forklifts | 50 | 0.0191 | 0.1400 | 0.1084 | 0.0002 | 0.0039 | 0.0036 | 14.7 | 0.0017 |
| | 120 | 0.0225 | 0.2102 | 0.1443 | 0.0004 | 0.0074 | 0.0068 | 31.2 | 0.0020 |
| | 175 | 0.0336 | 0.3315 | 0.1772 | 0.0006 | 0.0087 | 0.0080 | 56.1 | 0.0030 |
| | 250 | 0.0385 | 0.1554 | 0.1887 | 0.0009 | 0.0062 | 0.0057 | 77.1 | 0.0035 |
| | 500 | 0.0548 | 0.2126 | 0.2528 | 0.0011 | 0.0088 | 0.0081 | 111 | 0.0049 |
| Forklifts Composite | | 0.0320 | 0.2160 | 0.1691 | 0.0006 | 0.0070 | 0.0065 | 54.4 | 0.0029 |
| Generator Sets | 15 | 0.0116 | 0.0638 | 0.0814 | 0.0002 | 0.0038 | 0.0035 | 10.2 | 0.0011 |
| | 25 | 0.0224 | 0.0769 | 0.1410 | 0.0002 | 0.0064 | 0.0059 | 17.6 | 0.0020 |
| | 50 | 0.0379 | 0.2161 | 0.2199 | 0.0004 | 0.0106 | 0.0098 | 30.6 | 0.0034 |
| | 120 | 0.0506 | 0.4641 | 0.4378 | 0.0009 | 0.0250 | 0.0230 | 77.9 | 0.0046 |
| | 175 | 0.0676 | 0.7323 | 0.5990 | 0.0016 | 0.0266 | 0.0245 | 142 | 0.0061 |
| | 250 | 0.0747 | 0.3844 | 0.7614 | 0.0024 | 0.0218 | 0.0200 | 213 | 0.0067 |
| | 500 | 0.1125 | 0.5968 | 1.0874 | 0.0033 | 0.0333 | 0.0307 | 337 | 0.0102 |
| | 750 | 0.1842 | 0.9634 | 1.7962 | 0.0055 | 0.0544 | 0.0500 | 544 | 0.0166 |
| | 9999 | 0.4502 | 2.0059 | 6.6947 | 0.0105 | 0.1476 | 0.1358 | 1,049 | 0.0406 |
| Generator Sets Composite | | 0.0395 | 0.2732 | 0.3232 | 0.0007 | 0.0150 | 0.0138 | 61.0 | 0.0036 |
| Graders | 50 | 0.0563 | 0.2762 | 0.2156 | 0.0004 | 0.0124 | 0.0114 | 27.5 | 0.0051 |
| | 120 | 0.0738 | 0.5090 | 0.4568 | 0.0009 | 0.0311 | 0.0286 | 75.0 | 0.0067 |
| | 175 | 0.0918 | 0.7282 | 0.5622 | 0.0014 | 0.0303 | 0.0279 | 124 | 0.0083 |
| | 250 | 0.0999 | 0.3683 | 0.6701 | 0.0019 | 0.0230 | 0.0211 | 172 | 0.0090 |
| | 500 | 0.1284 | 0.4966 | 0.7982 | 0.0023 | 0.0288 | 0.0265 | 229 | 0.0116 |
| | 750 | 0.2731 | 1.0508 | 1.7425 | 0.0049 | 0.0621 | 0.0571 | 486 | 0.0246 |
| Graders Composite | | 0.0919 | 0.5765 | 0.5823 | 0.0015 | 0.0280 | 0.0258 | 133 | 0.0083 |
| Off-Highway Trac | 120 | 0.1455 | 0.6789 | 0.8421 | 0.0011 | 0.0674 | 0.0621 | 93.7 | 0.0131 |
| | 175 | 0.1455 | 0.8025 | 0.9712 | 0.0015 | 0.0547 | 0.0503 | 130 | 0.0131 |
| | 250 | 0.1147 | 0.3614 | 0.8843 | 0.0015 | 0.0348 | 0.0321 | 130 | 0.0103 |
| | 750 | 0.4683 | 1.8825 | 3.5643 | 0.0057 | 0.1391 | 0.1280 | 568 | 0.0423 |
| | 1000 | 0.7129 | 2.9445 | 7.4279 | 0.0082 | 0.2214 | 0.2037 | 814 | 0.0643 |
| Off-Highway Tractors Compos | | 0.1470 | 0.6517 | 1.0657 | 0.0017 | 0.0497 | 0.0457 | 151 | 0.0133 |
| Off-Highway Truc | 175 | 0.0837 | 0.7538 | 0.4564 | 0.0014 | 0.0234 | 0.0215 | 125 | 0.0076 |
| | 250 | 0.0927 | 0.3514 | 0.5042 | 0.0019 | 0.0173 | 0.0159 | 167 | 0.0084 |
| | 500 | 0.1488 | 0.5446 | 0.7481 | 0.0027 | 0.0273 | 0.0251 | 272 | 0.0134 |
| | 750 | 0.2416 | 0.8831 | 1.2347 | 0.0044 | 0.0446 | 0.0411 | 442 | 0.0218 |
| | 1000 | 0.3613 | 1.2913 | 3.8920 | 0.0063 | 0.0903 | 0.0831 | 625 | 0.0326 |
| Off-Highway Trucks Composit | | 0.1443 | 0.5514 | 0.8306 | 0.0027 | 0.0280 | 0.0258 | 260 | 0.0130 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0328 | 0.2267 | 0.1956 | 0.0004 | 0.0078 | 0.0072 | 28.0 | 0.0030 |
| | 120 | 0.0501 | 0.5080 | 0.3835 | 0.0009 | 0.0199 | 0.0183 | 80.9 | 0.0045 |
| | 175 | 0.0524 | 0.5859 | 0.3414 | 0.0012 | 0.0164 | 0.0151 | 107 | 0.0047 |
| | 500 | 0.1012 | 0.4676 | 0.6065 | 0.0025 | 0.0212 | 0.0195 | 254 | 0.0091 |
| Other Construction Equipment | | 0.0563 | 0.3508 | 0.3519 | 0.0013 | 0.0139 | 0.0128 | 122 | 0.0051 |
| Other General In | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0431 | 0.2211 | 0.1744 | 0.0003 | 0.0101 | 0.0093 | 21.7 | 0.0039 |
| | 120 | 0.0602 | 0.4232 | 0.3810 | 0.0007 | 0.0256 | 0.0236 | 62.0 | 0.0054 |
| | 175 | 0.0721 | 0.5668 | 0.4439 | 0.0011 | 0.0237 | 0.0218 | 95.9 | 0.0065 |
| | 250 | 0.0791 | 0.2804 | 0.5318 | 0.0015 | 0.0173 | 0.0159 | 136 | 0.0071 |
| | 500 | 0.1506 | 0.5217 | 0.9276 | 0.0026 | 0.0326 | 0.0300 | 265 | 0.0136 |
| | 750 | 0.2490 | 0.8599 | 1.5657 | 0.0044 | 0.0543 | 0.0500 | 437 | 0.0225 |
| | 1000 | 0.3467 | 1.1855 | 3.8628 | 0.0056 | 0.0969 | 0.0892 | 560 | 0.0313 |
| Other General Industrial Equip | | 0.0983 | 0.4517 | 0.6661 | 0.0016 | 0.0262 | 0.0241 | 152 | 0.0089 |
| Other Material Ha | 50 | 0.0595 | 0.3049 | 0.2425 | 0.0004 | 0.0141 | 0.0130 | 30.3 | 0.0054 |
| | 120 | 0.0583 | 0.4117 | 0.3720 | 0.0007 | 0.0250 | 0.0230 | 60.7 | 0.0053 |
| | 175 | 0.0907 | 0.7176 | 0.5642 | 0.0014 | 0.0301 | 0.0277 | 122 | 0.0082 |

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|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0836 | 0.2984 | 0.5684 | 0.0016 | 0.0185 | 0.0170 | 145 | 0.0075 |
| | 500 | 0.1074 | 0.3752 | 0.6692 | 0.0019 | 0.0235 | 0.0216 | 192 | 0.0097 |
| | 9999 | 0.4910 | 1.5647 | 5.1082 | 0.0073 | 0.1280 | 0.1177 | 741 | 0.0443 |
| Other Material Handling Equip | | 0.0924 | 0.4429 | 0.6500 | 0.0015 | 0.0252 | 0.0232 | 141 | 0.0083 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1427 | 0.0002 | 0.0055 | 0.0051 | 18.7 | 0.0020 |
| | 50 | 0.0834 | 0.3055 | 0.2398 | 0.0004 | 0.0184 | 0.0169 | 28.0 | 0.0075 |
| | 120 | 0.0910 | 0.4805 | 0.5471 | 0.0008 | 0.0428 | 0.0394 | 69.2 | 0.0082 |
| | 175 | 0.1217 | 0.7599 | 0.8187 | 0.0014 | 0.0459 | 0.0422 | 128 | 0.0110 |
| | 250 | 0.1411 | 0.4713 | 1.1106 | 0.0022 | 0.0407 | 0.0375 | 194 | 0.0127 |
| | 500 | 0.1595 | 0.6305 | 1.1959 | 0.0023 | 0.0450 | 0.0414 | 233 | 0.0144 |
| Pavers Composite | | 0.0989 | 0.4920 | 0.5450 | 0.0009 | 0.0355 | 0.0326 | 77.9 | 0.0089 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0702 | 0.2577 | 0.2043 | 0.0003 | 0.0157 | 0.0144 | 23.9 | 0.0063 |
| | 120 | 0.0708 | 0.3762 | 0.4280 | 0.0006 | 0.0337 | 0.0310 | 54.5 | 0.0064 |
| | 175 | 0.0944 | 0.5945 | 0.6403 | 0.0011 | 0.0360 | 0.0331 | 101 | 0.0085 |
| | 250 | 0.0864 | 0.2894 | 0.6928 | 0.0014 | 0.0249 | 0.0229 | 122 | 0.0078 |
| Paving Equipment Composite | | 0.0757 | 0.4084 | 0.4807 | 0.0008 | 0.0315 | 0.0290 | 68.9 | 0.0068 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0056 | 0.0305 | 0.0390 | 0.0001 | 0.0018 | 0.0017 | 4.9 | 0.0005 |
| | 25 | 0.0091 | 0.0312 | 0.0572 | 0.0001 | 0.0026 | 0.0024 | 7.1 | 0.0008 |
| | 50 | 0.0128 | 0.0856 | 0.0986 | 0.0002 | 0.0041 | 0.0038 | 14.3 | 0.0012 |
| | 120 | 0.0128 | 0.1367 | 0.1293 | 0.0003 | 0.0065 | 0.0060 | 24.1 | 0.0012 |
| Pressure Washers Composite | | 0.0085 | 0.0549 | 0.0650 | 0.0001 | 0.0030 | 0.0027 | 9.4 | 0.0008 |
| Pumps | 15 | 0.0096 | 0.0464 | 0.0595 | 0.0001 | 0.0030 | 0.0028 | 7.4 | 0.0009 |
| | 25 | 0.0265 | 0.0850 | 0.1558 | 0.0002 | 0.0073 | 0.0067 | 19.5 | 0.0024 |
| | 50 | 0.0465 | 0.2546 | 0.2497 | 0.0004 | 0.0126 | 0.0116 | 34.3 | 0.0042 |
| | 120 | 0.0537 | 0.4713 | 0.4442 | 0.0009 | 0.0263 | 0.0242 | 77.9 | 0.0048 |
| | 175 | 0.0712 | 0.7336 | 0.6007 | 0.0016 | 0.0277 | 0.0255 | 140 | 0.0064 |
| | 250 | 0.0760 | 0.3700 | 0.7338 | 0.0023 | 0.0215 | 0.0198 | 201 | 0.0069 |
| | 500 | 0.1241 | 0.6189 | 1.1297 | 0.0034 | 0.0355 | 0.0327 | 345 | 0.0112 |
| | 750 | 0.2075 | 1.0232 | 1.9114 | 0.0057 | 0.0594 | 0.0547 | 571 | 0.0187 |
| | 9999 | 0.6127 | 2.6255 | 8.7489 | 0.0136 | 0.1961 | 0.1804 | 1,355 | 0.0553 |
| Pumps Composite | | 0.0376 | 0.2674 | 0.2854 | 0.0006 | 0.0147 | 0.0135 | 49.6 | 0.0034 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0543 | 0.2436 | 0.2039 | 0.0003 | 0.0128 | 0.0117 | 26.0 | 0.0049 |
| | 120 | 0.0576 | 0.3873 | 0.3799 | 0.0007 | 0.0270 | 0.0249 | 59.0 | 0.0052 |
| | 175 | 0.0774 | 0.6114 | 0.5331 | 0.0012 | 0.0286 | 0.0263 | 108 | 0.0070 |
| | 250 | 0.0842 | 0.3201 | 0.6581 | 0.0017 | 0.0223 | 0.0205 | 153 | 0.0076 |
| | 500 | 0.1151 | 0.4607 | 0.8354 | 0.0022 | 0.0299 | 0.0275 | 219 | 0.0104 |
| Rollers Composite | | 0.0584 | 0.3837 | 0.3793 | 0.0008 | 0.0232 | 0.0214 | 67.0 | 0.0053 |
| Rough Terrain Fo | 50 | 0.0520 | 0.3171 | 0.2556 | 0.0004 | 0.0122 | 0.0113 | 33.9 | 0.0047 |
| | 120 | 0.0495 | 0.4142 | 0.3326 | 0.0007 | 0.0197 | 0.0181 | 62.4 | 0.0045 |
| | 175 | 0.0788 | 0.7229 | 0.4710 | 0.0014 | 0.0245 | 0.0226 | 125 | 0.0071 |
| | 250 | 0.0881 | 0.3442 | 0.5378 | 0.0019 | 0.0182 | 0.0168 | 171 | 0.0079 |
| | 500 | 0.1296 | 0.4936 | 0.7287 | 0.0025 | 0.0265 | 0.0244 | 257 | 0.0117 |
| Rough Terrain Forklifts Compo | | 0.0533 | 0.4464 | 0.3494 | 0.0008 | 0.0201 | 0.0185 | 70.3 | 0.0048 |
| Rubber Tired Doz | 175 | 0.1509 | 0.8124 | 0.9962 | 0.0015 | 0.0561 | 0.0516 | 129 | 0.0136 |
| | 250 | 0.1701 | 0.5279 | 1.2898 | 0.0021 | 0.0516 | 0.0474 | 183 | 0.0153 |
| | 500 | 0.2291 | 0.9276 | 1.6868 | 0.0026 | 0.0673 | 0.0619 | 265 | 0.0207 |
| | 750 | 0.3461 | 1.3934 | 2.5948 | 0.0040 | 0.1024 | 0.0942 | 399 | 0.0312 |
| | 1000 | 0.5438 | 2.2500 | 5.5311 | 0.0060 | 0.1672 | 0.1539 | 592 | 0.0491 |
| Rubber Tired Dozers Compos | | 0.2118 | 0.8006 | 1.5773 | 0.0025 | 0.0630 | 0.0580 | 239 | 0.0191 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0615 | 0.3080 | 0.2424 | 0.0004 | 0.0137 | 0.0126 | 31.1 | 0.0055 |
| | 120 | 0.0563 | 0.3977 | 0.3529 | 0.0007 | 0.0237 | 0.0218 | 58.9 | 0.0051 |
| | 175 | 0.0767 | 0.6215 | 0.4713 | 0.0012 | 0.0253 | 0.0233 | 106 | 0.0069 |
| | 250 | 0.0848 | 0.3159 | 0.5655 | 0.0017 | 0.0194 | 0.0179 | 149 | 0.0077 |
| | 500 | 0.1302 | 0.5016 | 0.8032 | 0.0023 | 0.0291 | 0.0268 | 237 | 0.0118 |
| | 750 | 0.2680 | 1.0271 | 1.6958 | 0.0049 | 0.0606 | 0.0558 | 486 | 0.0242 |
| | 1000 | 0.3484 | 1.3166 | 4.0040 | 0.0060 | 0.0983 | 0.0904 | 594 | 0.0314 |
| Rubber Tired Loaders Compos | | 0.0753 | 0.4406 | 0.4747 | 0.0012 | 0.0235 | 0.0216 | 109 | 0.0068 |
| Scrapers | 120 | 0.1218 | 0.6612 | 0.7170 | 0.0011 | 0.0551 | 0.0507 | 93.9 | 0.0110 |

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|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1400 | 0.8921 | 0.9020 | 0.0017 | 0.0505 | 0.0464 | 148 | 0.0126 |
| | 250 | 0.1522 | 0.5044 | 1.1344 | 0.0024 | 0.0412 | 0.0379 | 209 | 0.0137 |
| | 500 | 0.2211 | 0.8455 | 1.5615 | 0.0032 | 0.0584 | 0.0537 | 321 | 0.0200 |
| | 750 | 0.3839 | 1.4588 | 2.7734 | 0.0056 | 0.1024 | 0.0942 | 555 | 0.0346 |
| Scrapers Composite | | 0.1914 | 0.7938 | 1.3434 | 0.0027 | 0.0541 | 0.0497 | 262 | 0.0173 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0502 | 0.2833 | 0.2631 | 0.0005 | 0.0131 | 0.0121 | 36.2 | 0.0045 |
| | 120 | 0.0558 | 0.4946 | 0.4424 | 0.0009 | 0.0264 | 0.0243 | 80.2 | 0.0050 |
| | 175 | 0.0811 | 0.8276 | 0.6279 | 0.0017 | 0.0302 | 0.0277 | 155 | 0.0073 |
| | 250 | 0.1022 | 0.4765 | 0.8737 | 0.0029 | 0.0266 | 0.0245 | 255 | 0.0092 |
| Signal Boards Composite | | 0.0129 | 0.0912 | 0.0912 | 0.0002 | 0.0042 | 0.0038 | 16.7 | 0.0012 |
| Skid Steer Loade | 25 | 0.0171 | 0.0575 | 0.1070 | 0.0002 | 0.0044 | 0.0040 | 13.8 | 0.0015 |
| | 50 | 0.0230 | 0.2006 | 0.1655 | 0.0003 | 0.0043 | 0.0040 | 25.5 | 0.0021 |
| | 120 | 0.0218 | 0.2673 | 0.1647 | 0.0005 | 0.0064 | 0.0059 | 42.8 | 0.0020 |
| Skid Steer Loaders Composite | | 0.0222 | 0.2125 | 0.1614 | 0.0004 | 0.0050 | 0.0046 | 30.3 | 0.0020 |
| Surfacing Equipm | 50 | 0.0265 | 0.1191 | 0.1069 | 0.0002 | 0.0063 | 0.0058 | 14.1 | 0.0024 |
| | 120 | 0.0570 | 0.4028 | 0.4035 | 0.0007 | 0.0271 | 0.0250 | 63.8 | 0.0051 |
| | 175 | 0.0550 | 0.4663 | 0.4168 | 0.0010 | 0.0210 | 0.0193 | 85.8 | 0.0050 |
| | 250 | 0.0652 | 0.2754 | 0.5719 | 0.0015 | 0.0188 | 0.0173 | 135 | 0.0059 |
| | 500 | 0.1008 | 0.4728 | 0.8400 | 0.0022 | 0.0288 | 0.0265 | 221 | 0.0091 |
| | 750 | 0.1599 | 0.7413 | 1.3593 | 0.0035 | 0.0459 | 0.0423 | 347 | 0.0144 |
| Surfacing Equipment Compos | | 0.0823 | 0.3953 | 0.6593 | 0.0017 | 0.0239 | 0.0220 | 166 | 0.0074 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0430 | 0.2898 | 0.2365 | 0.0004 | 0.0098 | 0.0090 | 31.6 | 0.0039 |
| | 120 | 0.0555 | 0.4959 | 0.3694 | 0.0009 | 0.0210 | 0.0193 | 75.0 | 0.0050 |
| | 175 | 0.0845 | 0.8043 | 0.4869 | 0.0016 | 0.0253 | 0.0233 | 139 | 0.0076 |
| | 250 | 0.0803 | 0.3198 | 0.4530 | 0.0018 | 0.0152 | 0.0140 | 162 | 0.0072 |
| Sweepers/Scrubbers Composi | | 0.0584 | 0.4916 | 0.3563 | 0.0009 | 0.0183 | 0.0169 | 78.5 | 0.0053 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0046 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0407 | 0.2760 | 0.2179 | 0.0004 | 0.0087 | 0.0080 | 30.3 | 0.0037 |
| | 120 | 0.0366 | 0.3402 | 0.2466 | 0.0006 | 0.0129 | 0.0119 | 51.7 | 0.0033 |
| | 175 | 0.0571 | 0.5841 | 0.3220 | 0.0011 | 0.0159 | 0.0146 | 101 | 0.0052 |
| | 250 | 0.0813 | 0.3445 | 0.4427 | 0.0019 | 0.0151 | 0.0139 | 172 | 0.0073 |
| | 500 | 0.1606 | 0.6642 | 0.8132 | 0.0039 | 0.0294 | 0.0270 | 345 | 0.0145 |
| | 750 | 0.2409 | 0.9959 | 1.2387 | 0.0058 | 0.0443 | 0.0408 | 517 | 0.0217 |
| Tractors/Loaders/Backhoes C | | 0.0436 | 0.3616 | 0.2744 | 0.0008 | 0.0134 | 0.0124 | 66.8 | 0.0039 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0990 | 0.3495 | 0.2804 | 0.0004 | 0.0218 | 0.0201 | 32.9 | 0.0089 |
| | 120 | 0.0849 | 0.4443 | 0.5223 | 0.0008 | 0.0408 | 0.0375 | 64.9 | 0.0077 |
| | 175 | 0.1346 | 0.8393 | 0.9412 | 0.0016 | 0.0521 | 0.0479 | 144 | 0.0121 |
| | 250 | 0.1600 | 0.5472 | 1.3120 | 0.0025 | 0.0487 | 0.0448 | 223 | 0.0144 |
| | 500 | 0.2092 | 0.8710 | 1.6487 | 0.0031 | 0.0623 | 0.0573 | 311 | 0.0189 |
| | 750 | 0.3964 | 1.6395 | 3.1894 | 0.0059 | 0.1191 | 0.1095 | 587 | 0.0358 |
| Trenchers Composite | | 0.0933 | 0.4270 | 0.4575 | 0.0007 | 0.0336 | 0.0309 | 58.7 | 0.0084 |
| Welders | 15 | 0.0080 | 0.0388 | 0.0498 | 0.0001 | 0.0025 | 0.0023 | 6.2 | 0.0007 |
| | 25 | 0.0153 | 0.0492 | 0.0903 | 0.0001 | 0.0042 | 0.0039 | 11.3 | 0.0014 |
| | 50 | 0.0435 | 0.2219 | 0.1968 | 0.0003 | 0.0110 | 0.0102 | 26.0 | 0.0039 |
| | 120 | 0.0321 | 0.2508 | 0.2344 | 0.0005 | 0.0153 | 0.0140 | 39.5 | 0.0029 |
| | 175 | 0.0600 | 0.5396 | 0.4393 | 0.0011 | 0.0223 | 0.0205 | 98.2 | 0.0054 |
| | 250 | 0.0551 | 0.2294 | 0.4536 | 0.0013 | 0.0142 | 0.0130 | 119 | 0.0050 |
| | 500 | 0.0748 | 0.3117 | 0.5690 | 0.0016 | 0.0192 | 0.0176 | 168 | 0.0067 |
| Welders Composite | | 0.0310 | 0.1816 | 0.1735 | 0.0003 | 0.0102 | 0.0094 | 25.6 | 0.0028 |

## 2025 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0132 | 0.0451 | 0.0838 | 0.0001 | 0.0032 | 0.0030 | 11.0 | 0.0012 |
| | 50 | 0.0168 | 0.1351 | 0.1218 | 0.0003 | 0.0035 | 0.0032 | 19.6 | 0.0015 |
| | 120 | 0.0176 | 0.2265 | 0.1496 | 0.0004 | 0.0063 | 0.0058 | 38.1 | 0.0016 |
| | 500 | 0.0580 | 0.3710 | 0.3660 | 0.0021 | 0.0109 | 0.0100 | 213 | 0.0052 |
| | 750 | 0.1054 | 0.6706 | 0.6753 | 0.0039 | 0.0199 | 0.0183 | 385 | 0.0095 |
| Aerial Lifts Composite | | 0.0184 | 0.1646 | 0.1366 | 0.0004 | 0.0048 | 0.0044 | 34.7 | 0.0017 |
| Air Compressors | 15 | 0.0087 | 0.0444 | 0.0545 | 0.0001 | 0.0023 | 0.0022 | 7.2 | 0.0008 |
| | 25 | 0.0181 | 0.0605 | 0.1121 | 0.0002 | 0.0045 | 0.0042 | 14.4 | 0.0016 |
| | 50 | 0.0263 | 0.1911 | 0.1476 | 0.0003 | 0.0047 | 0.0043 | 22.3 | 0.0024 |
| | 120 | 0.0289 | 0.3023 | 0.1928 | 0.0006 | 0.0088 | 0.0081 | 47.0 | 0.0026 |
| | 175 | 0.0424 | 0.4998 | 0.2187 | 0.0010 | 0.0104 | 0.0095 | 88.5 | 0.0038 |
| | 250 | 0.0514 | 0.2531 | 0.2553 | 0.0015 | 0.0078 | 0.0072 | 131 | 0.0046 |
| | 500 | 0.0894 | 0.4292 | 0.4150 | 0.0023 | 0.0134 | 0.0123 | 232 | 0.0081 |
| | 750 | 0.1385 | 0.6633 | 0.6545 | 0.0036 | 0.0210 | 0.0193 | 358 | 0.0125 |
| | 1000 | 0.1999 | 0.9265 | 2.5439 | 0.0049 | 0.0483 | 0.0444 | 486 | 0.0180 |
| Air Compressors Composite | | 0.0349 | 0.3027 | 0.2104 | 0.0007 | 0.0088 | 0.0081 | 63.6 | 0.0031 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0190 | 0.2200 | 0.1662 | 0.0004 | 0.0009 | 0.0008 | 31.0 | 0.0017 |
| | 120 | 0.0252 | 0.4660 | 0.1955 | 0.0009 | 0.0020 | 0.0018 | 77.1 | 0.0023 |
| | 175 | 0.0324 | 0.7542 | 0.0787 | 0.0016 | 0.0030 | 0.0027 | 141 | 0.0029 |
| | 250 | 0.0427 | 0.3426 | 0.0981 | 0.0021 | 0.0035 | 0.0032 | 188 | 0.0039 |
| | 500 | 0.0706 | 0.5512 | 0.1622 | 0.0031 | 0.0058 | 0.0054 | 311 | 0.0064 |
| | 750 | 0.1396 | 1.0891 | 0.3204 | 0.0062 | 0.0115 | 0.0106 | 615 | 0.0126 |
| | 1000 | 0.2115 | 1.6437 | 3.8912 | 0.0093 | 0.0364 | 0.0335 | 928 | 0.0191 |
| Bore/Drill Rigs Composite | | 0.0428 | 0.5007 | 0.2864 | 0.0017 | 0.0042 | 0.0038 | 165 | 0.0039 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0213 | 0.0724 | 0.1346 | 0.0002 | 0.0052 | 0.0048 | 17.6 | 0.0019 |
| Cement and Mortar Mixers Co | | 0.0085 | 0.0414 | 0.0534 | 0.0001 | 0.0021 | 0.0019 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0279 | 0.2284 | 0.1910 | 0.0004 | 0.0053 | 0.0049 | 30.2 | 0.0025 |
| | 120 | 0.0370 | 0.4561 | 0.2840 | 0.0009 | 0.0117 | 0.0108 | 74.1 | 0.0033 |
| | 175 | 0.0623 | 0.8663 | 0.3523 | 0.0018 | 0.0160 | 0.0147 | 160 | 0.0056 |
| Concrete/Industrial Saws Com | | 0.0337 | 0.3706 | 0.2471 | 0.0007 | 0.0093 | 0.0086 | 58.5 | 0.0030 |
| Cranes | 50 | 0.0350 | 0.2256 | 0.1644 | 0.0003 | 0.0062 | 0.0057 | 23.2 | 0.0032 |
| | 120 | 0.0376 | 0.3384 | 0.2298 | 0.0006 | 0.0120 | 0.0111 | 50.1 | 0.0034 |
| | 175 | 0.0462 | 0.4744 | 0.2300 | 0.0009 | 0.0120 | 0.0110 | 80.3 | 0.0042 |
| | 250 | 0.0544 | 0.2316 | 0.2705 | 0.0013 | 0.0094 | 0.0087 | 112 | 0.0049 |
| | 500 | 0.0858 | 0.3535 | 0.3977 | 0.0018 | 0.0146 | 0.0134 | 180 | 0.0077 |
| | 750 | 0.1446 | 0.5947 | 0.6821 | 0.0030 | 0.0248 | 0.0228 | 303 | 0.0130 |
| | 9999 | 0.5219 | 1.9715 | 5.5760 | 0.0098 | 0.1146 | 0.1055 | 971 | 0.0471 |
| Cranes Composite | | 0.0681 | 0.3738 | 0.4223 | 0.0014 | 0.0143 | 0.0132 | 129 | 0.0061 |
| Crawler Tractors | 50 | 0.0487 | 0.2566 | 0.1842 | 0.0003 | 0.0090 | 0.0083 | 24.9 | 0.0044 |
| | 120 | 0.0609 | 0.4537 | 0.3562 | 0.0008 | 0.0221 | 0.0203 | 65.8 | 0.0055 |
| | 175 | 0.0823 | 0.7265 | 0.4447 | 0.0014 | 0.0241 | 0.0222 | 121 | 0.0074 |
| | 250 | 0.0924 | 0.3662 | 0.5348 | 0.0019 | 0.0192 | 0.0177 | 166 | 0.0083 |
| | 500 | 0.1392 | 0.5877 | 0.7527 | 0.0025 | 0.0280 | 0.0258 | 259 | 0.0126 |
| | 750 | 0.2506 | 1.0528 | 1.3878 | 0.0047 | 0.0510 | 0.0469 | 465 | 0.0226 |
| | 1000 | 0.3749 | 1.5618 | 4.2168 | 0.0066 | 0.0958 | 0.0881 | 658 | 0.0338 |
| Crawler Tractors Composite | | 0.0789 | 0.5065 | 0.4492 | 0.0013 | 0.0227 | 0.0209 | 114 | 0.0071 |
| Crushing/Proc. E | 50 | 0.0508 | 0.3859 | 0.2899 | 0.0006 | 0.0083 | 0.0077 | 44.0 | 0.0046 |
| | 120 | 0.0506 | 0.5406 | 0.3289 | 0.0010 | 0.0140 | 0.0129 | 83.1 | 0.0046 |
| | 175 | 0.0795 | 0.9556 | 0.3830 | 0.0019 | 0.0177 | 0.0163 | 167 | 0.0072 |
| | 250 | 0.0967 | 0.4768 | 0.4357 | 0.0028 | 0.0134 | 0.0123 | 245 | 0.0087 |
| | 500 | 0.1459 | 0.6977 | 0.6163 | 0.0037 | 0.0200 | 0.0184 | 374 | 0.0132 |
| | 750 | 0.2307 | 1.1003 | 0.9907 | 0.0059 | 0.0316 | 0.0291 | 589 | 0.0208 |
| | 9999 | 0.6019 | 2.5014 | 6.6977 | 0.0131 | 0.1238 | 0.1139 | 1,308 | 0.0543 |
| Crushing/Proc. Equipment Co | | 0.0693 | 0.6187 | 0.3763 | 0.0015 | 0.0146 | 0.0134 | 132 | 0.0062 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0297 | 0.2365 | 0.1616 | 0.0003 | 0.0035 | 0.0032 | 25.0 | 0.0027 |
| | 120 | 0.0448 | 0.4942 | 0.2638 | 0.0009 | 0.0092 | 0.0085 | 73.6 | 0.0040 |
| | 175 | 0.0518 | 0.6636 | 0.1982 | 0.0013 | 0.0091 | 0.0084 | 112 | 0.0047 |
| | 250 | 0.0647 | 0.3210 | 0.2222 | 0.0018 | 0.0074 | 0.0068 | 159 | 0.0058 |
| | 500 | 0.0946 | 0.4495 | 0.3091 | 0.0023 | 0.0107 | 0.0098 | 234 | 0.0085 |
| | 750 | 0.1569 | 0.7451 | 0.5194 | 0.0039 | 0.0178 | 0.0164 | 387 | 0.0142 |
| Excavators Composite | | 0.0559 | 0.5086 | 0.2269 | 0.0013 | 0.0086 | 0.0079 | 120 | 0.0050 |
| Forklifts | 50 | 0.0150 | 0.1361 | 0.0904 | 0.0002 | 0.0013 | 0.0012 | 14.7 | 0.0014 |
| | 120 | 0.0168 | 0.2086 | 0.0997 | 0.0004 | 0.0023 | 0.0021 | 31.2 | 0.0015 |
| | 175 | 0.0228 | 0.3310 | 0.0732 | 0.0006 | 0.0029 | 0.0026 | 56.1 | 0.0021 |
| | 250 | 0.0289 | 0.1551 | 0.0746 | 0.0009 | 0.0027 | 0.0024 | 77.1 | 0.0026 |
| | 500 | 0.0416 | 0.2123 | 0.1038 | 0.0011 | 0.0038 | 0.0035 | 111 | 0.0038 |
| Forklifts Composite | | 0.0236 | 0.2148 | 0.0860 | 0.0006 | 0.0025 | 0.0023 | 54.4 | 0.0021 |
| Generator Sets | 15 | 0.0109 | 0.0627 | 0.0768 | 0.0002 | 0.0032 | 0.0030 | 10.2 | 0.0010 |
| | 25 | 0.0216 | 0.0738 | 0.1368 | 0.0002 | 0.0055 | 0.0050 | 17.6 | 0.0019 |
| | 50 | 0.0242 | 0.2034 | 0.1881 | 0.0004 | 0.0051 | 0.0047 | 30.6 | 0.0022 |
| | 120 | 0.0340 | 0.4585 | 0.3022 | 0.0009 | 0.0122 | 0.0112 | 77.9 | 0.0031 |
| | 175 | 0.0469 | 0.7328 | 0.3291 | 0.0016 | 0.0136 | 0.0125 | 142 | 0.0042 |
| | 250 | 0.0558 | 0.3746 | 0.3885 | 0.0024 | 0.0108 | 0.0099 | 213 | 0.0050 |
| | 500 | 0.0862 | 0.5820 | 0.5697 | 0.0033 | 0.0167 | 0.0153 | 337 | 0.0078 |
| | 750 | 0.1401 | 0.9395 | 0.9382 | 0.0055 | 0.0272 | 0.0250 | 544 | 0.0126 |
| | 9999 | 0.3235 | 1.8648 | 5.2188 | 0.0105 | 0.0888 | 0.0817 | 1,049 | 0.0292 |
| Generator Sets Composite | | 0.0288 | 0.2667 | 0.2329 | 0.0007 | 0.0081 | 0.0074 | 61.0 | 0.0026 |
| Graders | 50 | 0.0382 | 0.2599 | 0.1877 | 0.0004 | 0.0063 | 0.0058 | 27.5 | 0.0034 |
| | 120 | 0.0521 | 0.5009 | 0.3219 | 0.0009 | 0.0153 | 0.0141 | 75.0 | 0.0047 |
| | 175 | 0.0652 | 0.7261 | 0.3117 | 0.0014 | 0.0157 | 0.0144 | 124 | 0.0059 |
| | 250 | 0.0781 | 0.3549 | 0.3652 | 0.0019 | 0.0129 | 0.0119 | 172 | 0.0071 |
| | 500 | 0.1023 | 0.4610 | 0.4468 | 0.0023 | 0.0165 | 0.0152 | 229 | 0.0092 |
| | 750 | 0.2167 | 0.9755 | 0.9628 | 0.0049 | 0.0353 | 0.0324 | 486 | 0.0196 |
| Graders Composite | | 0.0676 | 0.5696 | 0.3314 | 0.0015 | 0.0147 | 0.0135 | 133 | 0.0061 |
| Off-Highway Trac | 120 | 0.1108 | 0.6619 | 0.6362 | 0.0011 | 0.0455 | 0.0419 | 93.7 | 0.0100 |
| | 175 | 0.1110 | 0.7932 | 0.6639 | 0.0015 | 0.0370 | 0.0341 | 130 | 0.0100 |
| | 250 | 0.0890 | 0.3179 | 0.5983 | 0.0015 | 0.0227 | 0.0208 | 130 | 0.0080 |
| | 750 | 0.3692 | 1.5358 | 2.4157 | 0.0057 | 0.0918 | 0.0844 | 568 | 0.0333 |
| | 1000 | 0.5623 | 2.3619 | 6.0896 | 0.0082 | 0.1577 | 0.1451 | 814 | 0.0507 |
| Off-Highway Tractors Compos | | 0.1134 | 0.6101 | 0.7291 | 0.0017 | 0.0331 | 0.0305 | 151 | 0.0102 |
| Off-Highway Truc | 175 | 0.0622 | 0.7536 | 0.2376 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0056 |
| | 250 | 0.0730 | 0.3435 | 0.2521 | 0.0019 | 0.0085 | 0.0078 | 167 | 0.0066 |
| | 500 | 0.1183 | 0.5319 | 0.3878 | 0.0027 | 0.0135 | 0.0124 | 272 | 0.0107 |
| | 750 | 0.1921 | 0.8627 | 0.6384 | 0.0044 | 0.0221 | 0.0203 | 442 | 0.0173 |
| | 1000 | 0.2823 | 1.2403 | 3.1782 | 0.0063 | 0.0546 | 0.0502 | 625 | 0.0255 |
| Off-Highway Trucks Composit | | 0.1140 | 0.5385 | 0.4769 | 0.0027 | 0.0142 | 0.0131 | 260 | 0.0103 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0244 | 0.2188 | 0.1693 | 0.0004 | 0.0034 | 0.0031 | 28.0 | 0.0022 |
| | 120 | 0.0379 | 0.5045 | 0.2730 | 0.0009 | 0.0087 | 0.0080 | 80.9 | 0.0034 |
| | 175 | 0.0384 | 0.5858 | 0.1729 | 0.0012 | 0.0075 | 0.0069 | 107 | 0.0035 |
| | 500 | 0.0792 | 0.4606 | 0.3034 | 0.0025 | 0.0099 | 0.0091 | 254 | 0.0071 |
| Other Construction Equipment | | 0.0442 | 0.3474 | 0.2021 | 0.0013 | 0.0069 | 0.0063 | 123 | 0.0040 |
| Other General Ind | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0298 | 0.2099 | 0.1491 | 0.0003 | 0.0047 | 0.0043 | 21.7 | 0.0027 |
| | 120 | 0.0436 | 0.4189 | 0.2603 | 0.0007 | 0.0120 | 0.0111 | 62.0 | 0.0039 |
| | 175 | 0.0519 | 0.5684 | 0.2412 | 0.0011 | 0.0115 | 0.0106 | 95.9 | 0.0047 |
| | 250 | 0.0608 | 0.2743 | 0.2679 | 0.0015 | 0.0083 | 0.0076 | 136 | 0.0055 |
| | 500 | 0.1174 | 0.5103 | 0.4826 | 0.0026 | 0.0157 | 0.0145 | 265 | 0.0106 |
| | 750 | 0.1939 | 0.8411 | 0.8117 | 0.0044 | 0.0262 | 0.0241 | 437 | 0.0175 |
| | 1000 | 0.2627 | 1.1060 | 2.9924 | 0.0056 | 0.0579 | 0.0533 | 560 | 0.0237 |
| Other General Industrial Equip | | 0.0747 | 0.4438 | 0.3947 | 0.0016 | 0.0130 | 0.0120 | 152 | 0.0067 |
| Other Material Ha | 50 | 0.0410 | 0.2893 | 0.2073 | 0.0004 | 0.0065 | 0.0060 | 30.3 | 0.0037 |
| | 120 | 0.0421 | 0.4076 | 0.2541 | 0.0007 | 0.0117 | 0.0108 | 60.7 | 0.0038 |
| | 175 | 0.0653 | 0.7197 | 0.3067 | 0.0014 | 0.0146 | 0.0134 | 122 | 0.0059 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0642 | 0.2920 | 0.2863 | 0.0016 | 0.0088 | 0.0081 | 145 | 0.0058 |
| | 500 | 0.0837 | 0.3670 | 0.3482 | 0.0019 | 0.0113 | 0.0104 | 192 | 0.0075 |
| | 9999 | 0.3781 | 1.4596 | 3.9555 | 0.0073 | 0.0764 | 0.0703 | 741 | 0.0341 |
| Other Material Handling Equip | | 0.0696 | 0.4355 | 0.3844 | 0.0015 | 0.0124 | 0.0114 | 141 | 0.0063 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1422 | 0.0002 | 0.0053 | 0.0049 | 18.7 | 0.0020 |
| | 50 | 0.0574 | 0.2803 | 0.2102 | 0.0004 | 0.0114 | 0.0105 | 28.0 | 0.0052 |
| | 120 | 0.0662 | 0.4696 | 0.4003 | 0.0008 | 0.0263 | 0.0242 | 69.2 | 0.0060 |
| | 175 | 0.0899 | 0.7543 | 0.5238 | 0.0014 | 0.0286 | 0.0263 | 128 | 0.0081 |
| | 250 | 0.1097 | 0.4287 | 0.7020 | 0.0022 | 0.0254 | 0.0234 | 194 | 0.0099 |
| | 500 | 0.1263 | 0.5374 | 0.7572 | 0.0023 | 0.0284 | 0.0261 | 233 | 0.0114 |
| Pavers Composite | | 0.0717 | 0.4745 | 0.3858 | 0.0009 | 0.0220 | 0.0202 | 77.9 | 0.0065 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0469 | 0.2355 | 0.1789 | 0.0003 | 0.0095 | 0.0088 | 23.9 | 0.0042 |
| | 120 | 0.0503 | 0.3671 | 0.3092 | 0.0006 | 0.0200 | 0.0184 | 54.5 | 0.0045 |
| | 175 | 0.0687 | 0.5900 | 0.4021 | 0.0011 | 0.0219 | 0.0201 | 101 | 0.0062 |
| | 250 | 0.0672 | 0.2648 | 0.4289 | 0.0014 | 0.0154 | 0.0141 | 122 | 0.0061 |
| Paving Equipment Composite | | 0.0548 | 0.3993 | 0.3281 | 0.0008 | 0.0190 | 0.0175 | 68.9 | 0.0049 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0052 | 0.0301 | 0.0368 | 0.0001 | 0.0015 | 0.0014 | 4.9 | 0.0005 |
| | 25 | 0.0087 | 0.0299 | 0.0555 | 0.0001 | 0.0022 | 0.0020 | 7.1 | 0.0008 |
| | 50 | 0.0079 | 0.0810 | 0.0843 | 0.0002 | 0.0019 | 0.0018 | 14.3 | 0.0007 |
| | 120 | 0.0082 | 0.1351 | 0.0897 | 0.0003 | 0.0031 | 0.0029 | 24.1 | 0.0007 |
| Pressure Washers Composite | | 0.0066 | 0.0531 | 0.0561 | 0.0001 | 0.0019 | 0.0017 | 9.4 | 0.0006 |
| Pumps | 15 | 0.0089 | 0.0456 | 0.0560 | 0.0001 | 0.0024 | 0.0022 | 7.4 | 0.0008 |
| | 25 | 0.0244 | 0.0816 | 0.1512 | 0.0002 | 0.0061 | 0.0056 | 19.5 | 0.0022 |
| | 50 | 0.0299 | 0.2394 | 0.2138 | 0.0004 | 0.0061 | 0.0056 | 34.3 | 0.0027 |
| | 120 | 0.0365 | 0.4656 | 0.3062 | 0.0009 | 0.0129 | 0.0119 | 77.9 | 0.0033 |
| | 175 | 0.0499 | 0.7342 | 0.3301 | 0.0016 | 0.0142 | 0.0130 | 140 | 0.0045 |
| | 250 | 0.0572 | 0.3604 | 0.3745 | 0.0023 | 0.0107 | 0.0098 | 201 | 0.0052 |
| | 500 | 0.0959 | 0.6034 | 0.5922 | 0.0034 | 0.0178 | 0.0163 | 345 | 0.0087 |
| | 750 | 0.1593 | 0.9975 | 0.9991 | 0.0057 | 0.0297 | 0.0274 | 571 | 0.0144 |
| | 9999 | 0.4488 | 2.4388 | 6.8114 | 0.0136 | 0.1186 | 0.1091 | 1,355 | 0.0405 |
| Pumps Composite | | 0.0270 | 0.2617 | 0.2079 | 0.0006 | 0.0078 | 0.0072 | 49.6 | 0.0024 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0345 | 0.2258 | 0.1776 | 0.0003 | 0.0068 | 0.0062 | 26.0 | 0.0031 |
| | 120 | 0.0392 | 0.3801 | 0.2647 | 0.0007 | 0.0137 | 0.0126 | 59.0 | 0.0035 |
| | 175 | 0.0553 | 0.6096 | 0.3030 | 0.0012 | 0.0156 | 0.0143 | 108 | 0.0050 |
| | 250 | 0.0656 | 0.3037 | 0.3629 | 0.0017 | 0.0127 | 0.0116 | 153 | 0.0059 |
| | 500 | 0.0920 | 0.4189 | 0.4752 | 0.0022 | 0.0174 | 0.0160 | 219 | 0.0083 |
| Rollers Composite | | 0.0410 | 0.3763 | 0.2501 | 0.0008 | 0.0122 | 0.0113 | 67.0 | 0.0037 |
| Rough Terrain Fo | 50 | 0.0381 | 0.3041 | 0.2193 | 0.0004 | 0.0054 | 0.0049 | 33.9 | 0.0034 |
| | 120 | 0.0369 | 0.4106 | 0.2316 | 0.0007 | 0.0087 | 0.0080 | 62.4 | 0.0033 |
| | 175 | 0.0569 | 0.7229 | 0.2450 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0051 |
| | 250 | 0.0671 | 0.3372 | 0.2625 | 0.0019 | 0.0084 | 0.0077 | 171 | 0.0061 |
| | 500 | 0.0999 | 0.4838 | 0.3682 | 0.0025 | 0.0123 | 0.0113 | 257 | 0.0090 |
| Rough Terrain Forklifts Compo | | 0.0396 | 0.4430 | 0.2336 | 0.0008 | 0.0090 | 0.0083 | 70.3 | 0.0036 |
| Rubber Tired Doz | 175 | 0.1163 | 0.8019 | 0.6895 | 0.0015 | 0.0386 | 0.0355 | 129 | 0.0105 |
| | 250 | 0.1329 | 0.4624 | 0.8841 | 0.0021 | 0.0340 | 0.0312 | 183 | 0.0120 |
| | 500 | 0.1817 | 0.7490 | 1.1543 | 0.0026 | 0.0448 | 0.0412 | 265 | 0.0164 |
| | 750 | 0.2747 | 1.1262 | 1.7818 | 0.0040 | 0.0684 | 0.0629 | 399 | 0.0248 |
| | 1000 | 0.4321 | 1.7954 | 4.5523 | 0.0060 | 0.1202 | 0.1106 | 592 | 0.0390 |
| Rubber Tired Dozers Compos | | 0.1672 | 0.6620 | 1.0824 | 0.0025 | 0.0419 | 0.0385 | 239 | 0.0151 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0418 | 0.2904 | 0.2109 | 0.0004 | 0.0069 | 0.0063 | 31.1 | 0.0038 |
| | 120 | 0.0397 | 0.3916 | 0.2476 | 0.0007 | 0.0115 | 0.0105 | 58.9 | 0.0036 |
| | 175 | 0.0546 | 0.6199 | 0.2592 | 0.0012 | 0.0130 | 0.0119 | 106 | 0.0049 |
| | 250 | 0.0661 | 0.3041 | 0.3040 | 0.0017 | 0.0107 | 0.0099 | 149 | 0.0060 |
| | 500 | 0.1034 | 0.4654 | 0.4455 | 0.0023 | 0.0164 | 0.0151 | 237 | 0.0093 |
| | 750 | 0.2119 | 0.9532 | 0.9273 | 0.0049 | 0.0338 | 0.0311 | 486 | 0.0191 |
| | 1000 | 0.2701 | 1.1927 | 3.2272 | 0.0060 | 0.0615 | 0.0566 | 594 | 0.0244 |
| Rubber Tired Loaders Compos | | 0.0559 | 0.4311 | 0.2835 | 0.0012 | 0.0121 | 0.0111 | 109 | 0.0050 |
| Scrapers | 120 | 0.0887 | 0.6472 | 0.5218 | 0.0011 | 0.0330 | 0.0303 | 93.9 | 0.0080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1025 | 0.8864 | 0.5654 | 0.0017 | 0.0307 | 0.0282 | 148 | 0.0092 |
| | 250 | 0.1187 | 0.4642 | 0.7040 | 0.0024 | 0.0254 | 0.0234 | 209 | 0.0107 |
| | 500 | 0.1755 | 0.7332 | 0.9727 | 0.0032 | 0.0364 | 0.0335 | 321 | 0.0158 |
| | 750 | 0.3043 | 1.2657 | 1.7266 | 0.0056 | 0.0638 | 0.0587 | 555 | 0.0275 |
| Scrapers Composite | | 0.1495 | 0.7187 | 0.8387 | 0.0027 | 0.0335 | 0.0308 | 262 | 0.0135 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0332 | 0.2686 | 0.2268 | 0.0005 | 0.0063 | 0.0058 | 36.2 | 0.0030 |
| | 120 | 0.0394 | 0.4898 | 0.3076 | 0.0009 | 0.0127 | 0.0116 | 80.2 | 0.0036 |
| | 175 | 0.0587 | 0.8292 | 0.3433 | 0.0017 | 0.0152 | 0.0139 | 155 | 0.0053 |
| | 250 | 0.0794 | 0.4676 | 0.4435 | 0.0029 | 0.0132 | 0.0121 | 255 | 0.0072 |
| Signal Boards Composite | | 0.0111 | 0.0909 | 0.0718 | 0.0002 | 0.0029 | 0.0026 | 16.7 | 0.0010 |
| Skid Steer Loade | 25 | 0.0167 | 0.0568 | 0.1055 | 0.0002 | 0.0040 | 0.0037 | 13.8 | 0.0015 |
| | 50 | 0.0194 | 0.1977 | 0.1446 | 0.0003 | 0.0015 | 0.0014 | 25.5 | 0.0017 |
| | 120 | 0.0175 | 0.2665 | 0.1240 | 0.0005 | 0.0022 | 0.0020 | 42.8 | 0.0016 |
| Skid Steer Loaders Composite | | 0.0186 | 0.2104 | 0.1354 | 0.0004 | 0.0019 | 0.0018 | 30.3 | 0.0017 |
| Surfacing Equipm | 50 | 0.0171 | 0.1105 | 0.0934 | 0.0002 | 0.0035 | 0.0033 | 14.1 | 0.0015 |
| | 120 | 0.0385 | 0.3950 | 0.2869 | 0.0007 | 0.0146 | 0.0134 | 63.8 | 0.0035 |
| | 175 | 0.0386 | 0.4642 | 0.2429 | 0.0010 | 0.0119 | 0.0109 | 85.8 | 0.0035 |
| | 250 | 0.0504 | 0.2604 | 0.3275 | 0.0015 | 0.0111 | 0.0103 | 135 | 0.0045 |
| | 500 | 0.0800 | 0.4236 | 0.4893 | 0.0022 | 0.0174 | 0.0160 | 221 | 0.0072 |
| | 750 | 0.1260 | 0.6643 | 0.7833 | 0.0035 | 0.0275 | 0.0253 | 347 | 0.0114 |
| Surfacing Equipment Compos | | 0.0638 | 0.3590 | 0.3924 | 0.0017 | 0.0142 | 0.0131 | 166 | 0.0058 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0308 | 0.2762 | 0.1942 | 0.0004 | 0.0033 | 0.0031 | 31.6 | 0.0028 |
| | 120 | 0.0395 | 0.4895 | 0.2530 | 0.0009 | 0.0068 | 0.0062 | 75.0 | 0.0036 |
| | 175 | 0.0565 | 0.8005 | 0.2201 | 0.0016 | 0.0084 | 0.0077 | 139 | 0.0051 |
| | 250 | 0.0587 | 0.3179 | 0.1898 | 0.0018 | 0.0062 | 0.0057 | 162 | 0.0053 |
| Sweepers/Scrubbers Composi | | 0.0410 | 0.4840 | 0.2255 | 0.0009 | 0.0061 | 0.0056 | 78.5 | 0.0037 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0045 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0316 | 0.2678 | 0.1895 | 0.0004 | 0.0037 | 0.0034 | 30.3 | 0.0029 |
| | 120 | 0.0281 | 0.3379 | 0.1761 | 0.0006 | 0.0055 | 0.0051 | 51.7 | 0.0025 |
| | 175 | 0.0420 | 0.5839 | 0.1613 | 0.0011 | 0.0072 | 0.0066 | 101 | 0.0038 |
| | 250 | 0.0633 | 0.3389 | 0.2157 | 0.0019 | 0.0073 | 0.0067 | 172 | 0.0057 |
| | 500 | 0.1263 | 0.6506 | 0.4127 | 0.0039 | 0.0144 | 0.0132 | 345 | 0.0114 |
| | 750 | 0.1896 | 0.9760 | 0.6256 | 0.0058 | 0.0216 | 0.0199 | 517 | 0.0171 |
| Tractors/Loaders/Backhoes C | | 0.0336 | 0.3586 | 0.1857 | 0.0008 | 0.0059 | 0.0054 | 66.8 | 0.0030 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0687 | 0.3197 | 0.2467 | 0.0004 | 0.0140 | 0.0129 | 32.9 | 0.0062 |
| | 120 | 0.0625 | 0.4341 | 0.3863 | 0.0008 | 0.0259 | 0.0239 | 64.9 | 0.0056 |
| | 175 | 0.1009 | 0.8327 | 0.6152 | 0.0016 | 0.0338 | 0.0311 | 144 | 0.0091 |
| | 250 | 0.1247 | 0.4925 | 0.8480 | 0.0025 | 0.0309 | 0.0285 | 223 | 0.0112 |
| | 500 | 0.1661 | 0.7370 | 1.0663 | 0.0031 | 0.0400 | 0.0368 | 311 | 0.0150 |
| | 750 | 0.3147 | 1.3882 | 2.0666 | 0.0059 | 0.0766 | 0.0705 | 587 | 0.0284 |
| Trenchers Composite | | 0.0674 | 0.4085 | 0.3481 | 0.0007 | 0.0215 | 0.0198 | 58.7 | 0.0061 |
| Welders | 15 | 0.0075 | 0.0381 | 0.0468 | 0.0001 | 0.0020 | 0.0018 | 6.2 | 0.0007 |
| | 25 | 0.0141 | 0.0473 | 0.0876 | 0.0001 | 0.0035 | 0.0033 | 11.3 | 0.0013 |
| | 50 | 0.0280 | 0.2077 | 0.1684 | 0.0003 | 0.0053 | 0.0048 | 26.0 | 0.0025 |
| | 120 | 0.0223 | 0.2476 | 0.1601 | 0.0005 | 0.0073 | 0.0067 | 39.5 | 0.0020 |
| | 175 | 0.0430 | 0.5400 | 0.2396 | 0.0011 | 0.0111 | 0.0103 | 98.2 | 0.0039 |
| | 250 | 0.0423 | 0.2236 | 0.2294 | 0.0013 | 0.0069 | 0.0064 | 119 | 0.0038 |
| | 500 | 0.0585 | 0.3040 | 0.2969 | 0.0016 | 0.0095 | 0.0087 | 168 | 0.0053 |
| Welders Composite | | 0.0214 | 0.1745 | 0.1373 | 0.0003 | 0.0052 | 0.0048 | 25.6 | 0.0019 |

## Fugitive Dust Emission Calculation Methodology

### Fugitive Dust Source Emissions - Material Handling

**Truck Loading/Unloading (Removed debris/concrete materials)**

*Emission Factor [lb/ton] = k(0.0032) x (mean wind speed [mi/hr] / 5)* $^{1.3}$ / (moisture [%] / 2) $^{1.4}$ — *Reference: AP-42, Equation (1), Section 13.2.4, November 2006*

| | | | |
|---|---|---|---|
| *k = Aerodynamic Particle Size Multiplier,* $PM_{10}$ | 0.35 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *k = Aerodynamic Particle Size Multiplier,* $PM_{2.5}$ | 0.053 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *Mean Wind Speed* | 15 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *Moisture* | 4.8 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *PM10 Emission Factor* | 0.0014 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |
| *PM2.5 Emission Factor* | 0.0002 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |

**Demolition (Sq. Ft)**

| | | | |
|---|---|---|---|
| PM10, uncontrolled | 0.00042 | lbs/cubic ft[1] | http://www.urbemis.com/software/URBEMIS9%20Users%20Manual%20Appendices.pdf |
| PM2.5, uncontrolled | 0.00009 | lbs/cubic ft[2] | PM2.5 fraction of PM10 = 0.208; SCAQMD Appendix A - Updated CEIDARS List with PM2.5 Fractions (www.aqmd.gov/ceqa/handbook/PM2_5/PM2_5.html |

**Bulldozing**

*Emission Factor [lb/hr] = [1.0 x (silt content [%])* $^{1.5}$ / (moisture) $^{1.4}$]*Scaling Factor

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Silt Content* | 6.9 | | AP-42 Chapter 11, Table 11.9-3 for overburden |
| *Moisture* | 16.8 | | AP-42 Chapter 11, Table 11.9-3 for overburden, upper end or range |
| $PM_{10}$ *Scaling Factor* | 0.75 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| $PM_{2.5}$ *Scaling Factor* | 0.105 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *PM10 Emission Factor* | 0.26 | lb/hr | |
| *PM2.5 Emission Factor* | 0.04 | lb/hr | |

**Grading and Scraping[d]**

*Emission Factor [lb/VMT] = [0.051 (S)^2.0*Scaling Factor*

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Mean Vehicle Speed (S)[a] - Miles Per Hour (MPH)* | 2 | | Assumption based on project footprint |
| $PM_{10}$ *Scaling Factor* | 0.6 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| $PM_{2.5}$ *Scaling Factor* | 0.031 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *PM10 Emission Factor (Uncontrolled)* | 0.12 | lb/VMT | |
| *PM2.5 Emission Factor (Uncontrolled)* | 0.00632 | lb/VMT | |

**Stock Pile Wind Erosion**

Emission Factor [lb/day-acre] = 0.85 x (silt content [%] / 1.5) x (365 / 235) x (percentage of time unobstructed wind exceeds 12 mph / 15)
Reference: SCAQMD CEQA Air Quality Handbook (1993), Table 9-9-E

| Parameter | Value | Basis |
|---|---|---|
| Silt Content | 7.5 | SCAQMD CEQA Handbook, (1993) Table A9-9-E-1 for overburden |
| Pct. time wind > 12 mph | 17.84 | Used 17.84% from AERMET Surface File used for dispersion modeling |

| | | |
|---|---|---|
| PM10 Emission Factor (Uncontrolled) | 7.9 | lb/day-acre |
| Reduction from Watering Twice/Day | 50% | |
| Controlled PM10 Emission Factor | 3.9 | lb/day-acre |
| Controlled PM2.5 Emission Factor[a] | 0.8 | lb/day-acre |

[a] PM2.5 emission factor [lb/hr] = PM10 emission factor [lb/hr] x PM2.5 fraction of PM10

PM2.5 Fraction of PM10 in Construction Dust = 0.208 from Appendix A, Final–Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds, SCAQMD, October 2006

Emissions [pounds per day] = Controlled emission factor [pounds per acre-day] x Stock pile surface area [acres]

# Attachment I4 Alternative EN-2B Emissions

EN-2B - Low Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 2.19 | 15.89 | 12.00 | | 0.80 | 0.74 | 1,898 |
| Construction Off-Road Equipment | 13.43 | 122.22 | 56.60 | 0.17 | 11.05 | 5.27 | 16,883.99 | 0.40 | 3.70 | 1.68 | 0.01 | 0.49 | 0.29 | 466 |
| On-Road Motor Vehicles | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 | 0.01 | 0.29 | 0.07 | 0.00 | 0.01 | 0.01 | 56 |
| *Total On-Shore Emissions* | 13.97 | 137.61 | 59.73 | 0.20 | 11.49 | 5.56 | 20,025.62 | 0.41 | 3.99 | 1.75 | 0.01 | 0.49 | 0.30 | 2,420 |
| Amortized Construction | | | | | | | | | | | | | | 484 |

EN-2B - High Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 2.51 | 18.21 | 13.75 | | 0.92 | 0.85 | 2,176 |
| Construction Off-Road Equipment | 13.43 | 122.22 | 56.60 | 0.17 | 11.05 | 5.27 | 16,883.99 | 0.44 | 4.04 | 1.82 | 0.01 | 0.53 | 0.32 | 508 |
| On-Road Motor Vehicles | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 | 0.01 | 0.29 | 0.07 | 0.00 | 0.01 | 0.01 | 57 |
| *Total On-Shore Emissions* | 13.97 | 137.61 | 59.73 | 0.20 | 11.49 | 5.56 | 20,025.62 | 0.45 | 4.33 | 1.89 | 0.01 | 0.54 | 0.33 | 2,740 |
| Amortized Construction | | | | | | | | | | | | | | 548 |

EN-2B - Low Sea Level

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 7.27 | 50.85 | 34.99 | 0.09 | 8.45 | 2.87 | 8,777.06 |
| On-Road Motor Vehicles | 0.39 | 7.57 | 1.95 | 0.03 | 0.34 | 0.20 | 2,847.80 |
| *Total On-Shore Emissions* | 7.67 | 58.41 | 36.94 | 0.12 | 8.79 | 3.08 | 11,624.86 |

EN-2B - High Sea Level

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 7.27 | 50.85 | 34.99 | 0.09 | 8.45 | 2.87 | 8,777.06 |
| On-Road Motor Vehicles | 0.39 | 7.57 | 1.95 | 0.03 | 0.34 | 0.20 | 2,847.80 |
| *Total On-Shore Emissions* | 7.67 | 58.41 | 36.94 | 0.12 | 8.79 | 3.08 | 11,624.86 |

## Alternative EN-2B - Construction - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.13 | 0.86 | 0.76 | 0.001 | 0.05 | 0.04 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.08 | 0.06 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-2B - Construction - Low Sea Level

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| Concrete Trucks | 2 | 6 | 1.51 | 10.32 | 9.07 | 0.02 | 0.57 | 0.53 | - | - | 1,501 | 0.14 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.08 | 0.48 | 0.35 | 0.00 | 0.03 | 0.03 | - | - | 56 | 0.01 | lbs/day |
| | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | | | 16,883.99 | 1.21 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | 6.28 | 0.88 | 16,883.99 | 1.21 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **13.43** | **122.22** | **56.60** | **0.17** | | | **11.05** | **5.27** | **16,883.99** | **1.21** | **lbs/day** |

Emissions Summary

| **Project Length** | **Work Days** |
|---|---|
| | 62 |
| Notch Fill | 46 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 410,000 | 41 | 62 | 550,000 | 55 | 76 | 960,000 | 96 | 138 |
| HSL | 470,000 | 47 | 68 | 660,000 | 66 | 87 | ######## | 113 | 155 |

## Alternative EN-2B - Construction - Low Sea Level

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.13 | 1.50 | 0.52 | 0.00 | 0.04 | 0.04 | - | - | 234 | 0.0103 | tons |
| Loader | 1 | 12 | | 0.04 | 0.29 | 0.17 | 0.00 | 0.02 | 0.01 | - | - | 37 | 0.0032 | tons |
| Dozer | 2 | 12 | | 0.20 | 1.66 | 0.78 | 0.00 | 0.07 | 0.06 | - | - | 162 | 0.0166 | tons |
| Concrete Trucks | 2 | 6 | | 0.03 | 0.24 | 0.21 | 0.00 | 0.01 | 0.01 | - | - | 31 | 0.0028 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0002 | tons |
| | | | | 0.40 | 3.70 | 1.68 | 0.01 | 0.14 | 0.13 | | | 464.96 | 0.03 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.40 | 3.70 | 1.68 | 0.01 | 0.14 | 0.13 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.40** | **3.70** | **1.68** | **0.01** | **0.49** | **0.29** | **0.34** | **0.16** | **465** | **0.030** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **466** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative EN-2B - Construction - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 41.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 2.19 | 15.89 | 12.00 | 0.80 | 0.74 | 1,898 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-2B - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 62 | 24,800 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.39 | 11.86 | 1.77 | 0.02 | 0.30 | 0.21 | 2,243 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 58 | 60 | 1,160 | 110 | 52,720 | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-2B - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 62 | 24,800 | 0.00 | 0.012 | 0.03 | 0.00 | 0.00 | 0.00 | 9 | 8 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.273 | 0.04 | 0.00 | 0.01 | 0.00 | 52 | 47 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 58 | 60 | 1,160 | 110 | 52,720 | 0.01 | 0.29 | 0.07 | 0.00 | 0.01 | 0.01 | 61.50 | 55.96 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative EN-2B - Operations - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.08 | 0.47 | 0.44 | 0.001 | 0.02 | 0.02 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.21 | 1.58 | 0.80 | 0.002 | 0.06 | 0.06 | - | - | 239.08 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.08 | 0.46 | 0.75 | 0.001 | 0.02 | 0.02 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-2B - Operations - Low S

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.23 | 1.43 | 1.11 | 0.00 | 0.07 | 0.07 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.90 | 5.70 | 5.29 | 0.01 | 0.28 | 0.26 | - | - | 1,303 | 0.08 | lbs/day |
| Dozer | 2 | 12 | 5.08 | 37.85 | 19.21 | 0.06 | 1.51 | 1.39 | - | - | 5,738 | 0.46 | lbs/day |
| Concrete Trucks | 2 | 6 | 1.00 | 5.48 | 9.05 | 0.02 | 0.28 | 0.26 | - | - | 1,501 | 0.09 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.05 | 0.39 | 0.33 | 0.00 | 0.02 | 0.02 | - | - | 56 | 0.00 | lbs/day |
| | | | 7.27 | 50.85 | 34.99 | 0.09 | 2.16 | 1.99 | | | 8,777.06 | 0.66 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 7.27 | 50.85 | 34.99 | 0.09 | 2.16 | 1.99 | 6.28 | 0.88 | 8,777.06 | 0.66 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **7.27** | **50.85** | **34.99** | **0.09** | | | **8.45** | **2.87** | **8,777.06** | **0.66** | **lbs/day** |

Emissions Summary

| Project Length | Workdays |
|---|---|
| | 47 |
| Notch Fill | 46 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 260,000 | 26 | 47 | 310,000 | 31 | 52 | 570,000 | 57 | 99 |
| HSL | 330,000 | 33 | 54 | 460,000 | 46 | 67 | 790,000 | 79 | 121 |

## Alternative EN-2B - Operations - Low

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | - | - | 4 | 0.0004 | tons |
| Loader | 1 | 12 | | 0.02 | 0.13 | 0.12 | 0.00 | 0.01 | 0.01 | - | - | 28 | 0.0017 | tons |
| Dozer | 2 | 12 | | 0.12 | 0.89 | 0.45 | 0.00 | 0.04 | 0.03 | - | - | 123 | 0.0098 | tons |
| Concrete Trucks | 2 | 6 | | 0.02 | 0.13 | 0.21 | 0.00 | 0.01 | 0.01 | - | - | 31 | 0.0019 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0001 | tons |
| | | | | 0.17 | 1.19 | 0.82 | 0.00 | 0.05 | 0.05 | | | 186.99 | 0.01 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.17 | 1.19 | 0.82 | 0.00 | 0.05 | 0.05 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.17** | **1.19** | **0.82** | **0.00** | | | **0.20** | **0.07** | **187** | **0.014** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **187** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

## Alternative EN-2B - Operations - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Operating Days Per Year | 26.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.36 | 2.65 | 7.61 | 0.06 | 0.06 | 1,323 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-2B - Operations - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 47 | 18,800 | 0.02 | 0.55 | 0.25 | 0.00 | 0.05 | 0.02 | 251 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.29 | 5.54 | 1.34 | 0.02 | 0.23 | 0.14 | 2,050 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 1.48 | 0.36 | 0.01 | 0.06 | 0.04 | 547 |
| Total | 58 | 60 | 1,160 | 95 | 46,720 | 0.39 | 7.57 | 1.95 | 0.03 | 0.34 | 0.20 | 2,847.80 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-2B - Operations - Low Sea Level Rise

**On-Road Construction Emissions**

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 47 | 18,800 | 0.00 | 0.013 | 0.01 | 0.00 | 0.00 | 0.00 | 6 | 5 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.127 | 0.03 | 0.00 | 0.01 | 0.00 | 47 | 43 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 58 | 60 | 1,160 | 95 | 46,720 | 0.01 | 0.14 | 0.04 | 0.00 | 0.01 | 0.00 | 53.60 | 48.77 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

## Alternative EN-2B - Construction - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.13 | 0.86 | 0.76 | 0.001 | 0.05 | 0.04 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.08 | 0.06 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-2B - Construction - High Sea Leve

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Emissions Summary | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| Concrete Trucks | 2 | 6 | 1.51 | 10.32 | 9.07 | 0.02 | 0.57 | 0.53 | - | - | 1,501 | 0.14 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.08 | 0.48 | 0.35 | 0.00 | 0.03 | 0.03 | - | - | 56 | 0.01 | lbs/day |
| | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | | | 16,883.99 | 1.21 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | 6.28 | 0.88 | 16,883.99 | 1.21 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **13.43** | **122.22** | **56.60** | **0.17** | | | **11.05** | **5.27** | **16,883.99** | **1.21** | **lbs/day** |

| Project Length | Work Days |
|---|---|
| | 68 |
| Notch Fill | 46 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 410,000 | 41 | 62 | 550,000 | 55 | 76 | 960,000 | 96 | 138 |
| HSL | 470,000 | 47 | 68 | 660,000 | 66 | 87 | ######## | 113 | 155 |

## Alternative EN-2B - Construction - High Sea Leve

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.14 | 1.65 | 0.57 | 0.00 | 0.05 | 0.05 | - | - | 256 | 0.0113 | tons |
| Loader | 1 | 12 | | 0.04 | 0.32 | 0.19 | 0.00 | 0.02 | 0.02 | - | - | 40 | 0.0035 | tons |
| Dozer | 2 | 12 | | 0.22 | 1.82 | 0.85 | 0.00 | 0.08 | 0.07 | - | - | 178 | 0.0182 | tons |
| Concrete Trucks | 2 | 6 | | 0.03 | 0.24 | 0.21 | 0.00 | 0.01 | 0.01 | - | - | 31 | 0.0028 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0002 | tons |
| | | | | 0.44 | 4.04 | 1.82 | 0.01 | 0.16 | 0.14 | | | 506.80 | 0.03 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.44 | 4.04 | 1.82 | 0.01 | 0.16 | 0.14 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.44** | **4.04** | **1.82** | **0.01** | **0.53** | **0.32** | **0.38** | **0.18** | **507** | **0.033** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **508** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative EN-2B - Construction - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| Construction Days Per Year | 47.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 2.51 | 18.21 | 13.75 | 0.92 | 0.85 | 2,176 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-2B - Construction - High Sea Level Rise

**On-Road Construction Emissions**

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 68 | 27,200 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.39 | 11.86 | 1.77 | 0.02 | 0.30 | 0.21 | 2,243 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 58 | 60 | 1,160 | 116 | 55,120 | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-2B - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 68 | 27,200 | 0.00 | 0.013 | 0.03 | 0.00 | 0.00 | 0.00 | 10 | 9 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.273 | 0.04 | 0.00 | 0.01 | 0.00 | 52 | 47 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 58 | 60 | 1,160 | 116 | 55,120 | 0.01 | 0.29 | 0.07 | 0.00 | 0.01 | 0.01 | 62.40 | 56.78 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

# Alternative EN-2B - Operations - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.08 | 0.47 | 0.44 | 0.001 | 0.02 | 0.02 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.21 | 1.58 | 0.80 | 0.002 | 0.06 | 0.06 | - | - | 239.08 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.08 | 0.46 | 0.75 | 0.001 | 0.02 | 0.02 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative EN-2B - Operations - High

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.23 | 1.43 | 1.11 | 0.00 | 0.07 | 0.07 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.90 | 5.70 | 5.29 | 0.01 | 0.28 | 0.26 | - | - | 1,303 | 0.08 | lbs/day |
| Dozer | 2 | 12 | 5.08 | 37.85 | 19.21 | 0.06 | 1.51 | 1.39 | - | - | 5,738 | 0.46 | lbs/day |
| Concrete Trucks | 2 | 6 | 1.00 | 5.48 | 9.05 | 0.02 | 0.28 | 0.26 | - | - | 1,501 | 0.09 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.05 | 0.39 | 0.33 | 0.00 | 0.02 | 0.02 | - | - | 56 | 0.00 | lbs/day |
| | | | 7.27 | 50.85 | 34.99 | 0.09 | 2.16 | 1.99 | | | 8,777.06 | 0.66 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 7.27 | 50.85 | 34.99 | 0.09 | 2.16 | 1.99 | 6.28 | 0.88 | 8,777.06 | 0.66 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **7.27** | **50.85** | **34.99** | **0.09** | | | **8.45** | **2.87** | **8,777.06** | **0.66** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 54 |
| Notch Fill | 46 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 260,000 | 26 | 47 | 310,000 | 31 | 52 | 570,000 | 57 | 99 |
| HSL | 330,000 | 33 | 54 | 460,000 | 46 | 67 | 790,000 | 79 | 121 |

# Alternative EN-2B - Operations - High

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 | - | - | 4 | 0.0005 | tons |
| Loader | 1 | 12 | | 0.02 | 0.15 | 0.14 | 0.00 | 0.01 | 0.01 | - | - | 32 | 0.0020 | tons |
| Dozer | 2 | 12 | | 0.14 | 1.02 | 0.52 | 0.00 | 0.04 | 0.04 | - | - | 141 | 0.0113 | tons |
| Concrete Trucks | 2 | 6 | | 0.02 | 0.13 | 0.21 | 0.00 | 0.01 | 0.01 | - | - | 31 | 0.0019 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0001 | tons |
| | | | | 0.19 | 1.35 | 0.91 | 0.00 | 0.06 | 0.05 | | | 209.98 | 0.02 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.19 | 1.35 | 0.91 | 0.00 | 0.06 | 0.05 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.19** | **1.35** | **0.91** | **0.00** | | | **0.23** | **0.08** | **210** | **0.016** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **210** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

# Alternative EN-2B - Operations - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |

Operating Days Per Year 33.0

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.46 | 3.37 | 9.66 | 0.08 | 0.07 | 1,679 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative EN-2B - Operations - High Sea Level Rise

**On-Road Construction Emissions**

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 54 | 21,600 | 0.02 | 0.55 | 0.25 | 0.00 | 0.05 | 0.02 | 251 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.29 | 5.54 | 1.34 | 0.02 | 0.23 | 0.14 | 2,050 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 1.48 | 0.36 | 0.01 | 0.06 | 0.04 | 547 |
| Total | 58 | 60 | 1,160 | 102 | 49,520 | 0.39 | 7.57 | 1.95 | 0.03 | 0.34 | 0.20 | 2,847.80 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative EN-2B - Operations - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 54 | 21,600 | 0.00 | 0.015 | 0.01 | 0.00 | 0.00 | 0.00 | 7 | 6 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.127 | 0.03 | 0.00 | 0.01 | 0.00 | 47 | 43 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 58 | 60 | 1,160 | 102 | 49,520 | 0.01 | 0.14 | 0.04 | 0.00 | 0.01 | 0.00 | 54.48 | 49.57 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

**San Diego 2015 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,169,183 | 42,600,783.75 | 7,361,743.79 | 0.045 | 1.290 | 0.136 | 302.103 | 0.047 | 0.019 | 0.004 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,466 | 179,216.55 | 31,712.66 | 0.038 | 0.215 | 0.576 | 315.879 | 0.072 | 0.043 | 0.004 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 172,849 | 6,187,162.79 | 1,061,257.19 | 0.075 | 2.505 | 0.269 | 357.183 | 0.048 | 0.021 | 0.004 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 210 | 6,179.81 | 1,102.01 | 0.066 | 0.312 | 0.691 | 314.863 | 0.099 | 0.068 | 0.004 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 423,444 | 16,224,268.59 | 2,675,454.93 | 0.037 | 1.498 | 0.192 | 432.459 | 0.047 | 0.019 | 0.005 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 187 | 5,978.69 | 1,021.81 | 0.046 | 0.252 | 0.690 | 323.109 | 0.080 | 0.050 | 0.004 | | |
| Average | | | | | | | 0.051 | 1.012 | 0.426 | 340.933 | 0.066 | 0.037 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 2,454 | 392,614.49 | 0 | 0.296 | 1.343 | 8.984 | 1699.527 | 0.231 | 0.158 | 0.017 | | |

Source: EMFAC 2011

**San Diego 2020 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED | POP | VMT | TRIPS | ROG_RUNEX | CO_RUNEX | NOX_RUNEX | CO2_RUNEX | PM10_Total | PM2_5_Total | SOX_RUNEX | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (Miles/hr) | (Vehicles) | (Miles/day) | (Trips/day) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) |
| LDA | GAS | AllMYr | AllSpeeds | 1,261,438 | 46,436,329 | 7,971,039 | 0.03 | 0.10 | 0.83 | 244.16 | 0.05 | 0.02 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,897 | 203,726 | 36,279 | 0.02 | 0.39 | 0.13 | 265.72 | 0.06 | 0.03 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 186,176 | 6,674,684 | 1,134,440 | 0.04 | 0.17 | 1.56 | 297.84 | 0.05 | 0.02 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 226 | 8,187 | 1,308 | 0.03 | 0.45 | 0.17 | 259.42 | 0.07 | 0.04 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 450,141 | 17,355,693 | 2,832,803 | 0.02 | 0.11 | 0.93 | 364.76 | 0.05 | 0.02 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 199 | 7,528 | 1,228 | 0.02 | 0.47 | 0.14 | 280.32 | 0.06 | 0.03 | 0.00 | | |
| Average | | | | | | | 0.026 | 0.283 | 0.626 | 285.370 | 0.055 | 0.027 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED | POP | VMT | TRIPS | ROG_RUNEX | CO_RUNEX | NOX_RUNEX | CO2_RUNEX | PM10_Total | PM2_5_Total | SOX_RUNEX | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (Miles/hr) | (Vehicles) | (Miles/day) | (Trips/day) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) |
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,262 | 531,839 | - | 0.22 | 1.02 | 4.20 | 1553.04 | 0.18 | 0.11 | 0.02 | | |

Source: EMFAC 2011

**San Diego 2025 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,343,732.35 | 49,534,906.21 | 8,492,736.38 | 0.02 | 0.71 | 0.09 | 223.96 | 0.05 | 0.04 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 6,282.20 | 213,159.29 | 39,008.92 | 0.01 | 0.09 | 0.31 | 246.18 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 198,419.75 | 7,123,689.46 | 1,204,641.90 | 0.02 | 1.09 | 0.12 | 276.49 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 240.83 | 8,707.20 | 1,432.14 | 0.02 | 0.13 | 0.37 | 242.28 | 0.06 | 0.05 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 479,791.14 | 18,608,664.04 | 3,017,273.36 | 0.01 | 0.73 | 0.08 | 343.84 | 0.05 | 0.04 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 211.77 | 7,665.63 | 1,309.49 | 0.02 | 0.11 | 0.40 | 268.51 | 0.06 | 0.05 | 0.00 | | |
| Average | | | | | | | 0.019 | 0.478 | 0.227 | 266.878 | 0.052 | 0.042 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,476 | 582,978 | - | 0.22 | 1.01 | 2.06 | 1541.82 | 0.07 | 0.10 | 0.02 | | |

Source: EMFAC 2011

## 2015 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0155 | 0.0486 | 0.0902 | 0.0001 | 0.0046 | 0.0042 | 11.0 | 0.0014 |
| | 50 | 0.0480 | 0.1641 | 0.1699 | 0.0003 | 0.0129 | 0.0119 | 19.6 | 0.0043 |
| | 120 | 0.0460 | 0.2377 | 0.3272 | 0.0004 | 0.0246 | 0.0226 | 38.1 | 0.0042 |
| | 500 | 0.1026 | 0.4261 | 1.2422 | 0.0021 | 0.0368 | 0.0339 | 213 | 0.0093 |
| | 750 | 0.1912 | 0.7702 | 2.3263 | 0.0039 | 0.0680 | 0.0626 | 385 | 0.0173 |
| Aerial Lifts Composite | | 0.0439 | 0.1837 | 0.2670 | 0.0004 | 0.0167 | 0.0154 | 34.7 | 0.0040 |
| Air Compressors | 15 | 0.0108 | 0.0466 | 0.0664 | 0.0001 | 0.0040 | 0.0037 | 7.2 | 0.0010 |
| | 25 | 0.0229 | 0.0681 | 0.1247 | 0.0002 | 0.0069 | 0.0064 | 14.4 | 0.0021 |
| | 50 | 0.0747 | 0.2360 | 0.2056 | 0.0003 | 0.0183 | 0.0168 | 22.3 | 0.0067 |
| | 120 | 0.0691 | 0.3182 | 0.4334 | 0.0006 | 0.0375 | 0.0345 | 47.0 | 0.0062 |
| | 175 | 0.0903 | 0.5019 | 0.7101 | 0.0010 | 0.0388 | 0.0357 | 88.5 | 0.0082 |
| | 250 | 0.0892 | 0.2803 | 0.9294 | 0.0015 | 0.0286 | 0.0263 | 131 | 0.0080 |
| | 500 | 0.1463 | 0.4915 | 1.4297 | 0.0023 | 0.0470 | 0.0432 | 232 | 0.0132 |
| | 750 | 0.2285 | 0.7595 | 2.2932 | 0.0036 | 0.0743 | 0.0683 | 358 | 0.0206 |
| | 1000 | 0.3551 | 1.1843 | 4.4558 | 0.0049 | 0.1239 | 0.1140 | 486 | 0.0320 |
| Air Compressors Composite | | 0.0773 | 0.3257 | 0.5175 | 0.0007 | 0.0357 | 0.0329 | 63.6 | 0.0070 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1220 | 0.0002 | 0.0047 | 0.0043 | 16.0 | 0.0017 |
| | 50 | 0.0234 | 0.2235 | 0.2240 | 0.0004 | 0.0075 | 0.0069 | 31.0 | 0.0021 |
| | 120 | 0.0376 | 0.4676 | 0.3736 | 0.0009 | 0.0160 | 0.0148 | 77.1 | 0.0034 |
| | 175 | 0.0618 | 0.7540 | 0.5364 | 0.0016 | 0.0198 | 0.0182 | 141 | 0.0056 |
| | 250 | 0.0681 | 0.3425 | 0.4900 | 0.0021 | 0.0144 | 0.0132 | 188 | 0.0061 |
| | 500 | 0.1118 | 0.5511 | 0.7692 | 0.0031 | 0.0236 | 0.0217 | 311 | 0.0101 |
| | 750 | 0.2212 | 1.0888 | 1.5301 | 0.0062 | 0.0466 | 0.0429 | 615 | 0.0200 |
| | 1000 | 0.3562 | 1.6528 | 4.9704 | 0.0093 | 0.1194 | 0.1098 | 928 | 0.0321 |
| Bore/Drill Rigs Composite | | 0.0673 | 0.5022 | 0.6138 | 0.0017 | 0.0200 | 0.0184 | 165 | 0.0061 |
| Cement and Mortar Mixers | 15 | 0.0074 | 0.0386 | 0.0464 | 0.0001 | 0.0019 | 0.0018 | 6.3 | 0.0007 |
| | 25 | 0.0251 | 0.0782 | 0.1456 | 0.0002 | 0.0074 | 0.0068 | 17.6 | 0.0023 |
| Cement and Mortar Mixers Composite | | 0.0088 | 0.0419 | 0.0545 | 0.0001 | 0.0024 | 0.0022 | 7.2 | 0.0008 |
| Concrete/Industrial Saws | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0782 | 0.2745 | 0.2652 | 0.0004 | 0.0206 | 0.0189 | 30.2 | 0.0071 |
| | 120 | 0.0892 | 0.4759 | 0.6249 | 0.0009 | 0.0486 | 0.0448 | 74.1 | 0.0080 |
| | 175 | 0.1340 | 0.8674 | 1.1593 | 0.0018 | 0.0585 | 0.0538 | 160 | 0.0121 |
| Concrete/Industrial Saws Composite | | 0.0835 | 0.3982 | 0.4921 | 0.0007 | 0.0374 | 0.0345 | 58.5 | 0.0075 |
| Cranes | 50 | 0.0853 | 0.2729 | 0.2235 | 0.0003 | 0.0202 | 0.0186 | 23.2 | 0.0077 |
| | 120 | 0.0800 | 0.3559 | 0.4822 | 0.0006 | 0.0415 | 0.0382 | 50.1 | 0.0072 |
| | 175 | 0.0919 | 0.4794 | 0.6684 | 0.0009 | 0.0378 | 0.0348 | 80.3 | 0.0083 |
| | 250 | 0.0925 | 0.2713 | 0.8284 | 0.0013 | 0.0286 | 0.0263 | 112 | 0.0083 |
| | 500 | 0.1393 | 0.4663 | 1.1812 | 0.0018 | 0.0426 | 0.0392 | 180 | 0.0126 |
| | 750 | 0.2358 | 0.7835 | 2.0490 | 0.0030 | 0.0729 | 0.0671 | 303 | 0.0213 |
| | 9999 | 0.8682 | 2.8913 | 9.2743 | 0.0098 | 0.2775 | 0.2553 | 971 | 0.0783 |
| Cranes Composite | | 0.1204 | 0.4395 | 1.0200 | 0.0014 | 0.0426 | 0.0392 | 129 | 0.0109 |
| Crawler Tractors | 50 | 0.1017 | 0.3087 | 0.2464 | 0.0003 | 0.0232 | 0.0214 | 24.9 | 0.0092 |
| | 120 | 0.1143 | 0.4774 | 0.6815 | 0.0008 | 0.0579 | 0.0533 | 65.8 | 0.0103 |
| | 175 | 0.1509 | 0.7384 | 1.0951 | 0.0014 | 0.0614 | 0.0565 | 121 | 0.0136 |
| | 250 | 0.1582 | 0.4614 | 1.3531 | 0.0019 | 0.0514 | 0.0473 | 166 | 0.0143 |
| | 500 | 0.2300 | 0.8352 | 1.8987 | 0.0025 | 0.0732 | 0.0673 | 259 | 0.0207 |
| | 750 | 0.4140 | 1.4936 | 3.4863 | 0.0047 | 0.1327 | 0.1221 | 465 | 0.0374 |
| | 1000 | 0.6278 | 2.3640 | 6.6574 | 0.0066 | 0.2075 | 0.1909 | 658 | 0.0566 |
| Crawler Tractors Composite | | 0.1415 | 0.5650 | 1.0059 | 0.0013 | 0.0594 | 0.0546 | 114 | 0.0128 |
| Crushing/Proc. Equipment | 50 | 0.1392 | 0.4644 | 0.4024 | 0.0006 | 0.0346 | 0.0318 | 44.0 | 0.0126 |
| | 120 | 0.1167 | 0.5646 | 0.7374 | 0.0010 | 0.0629 | 0.0579 | 83.1 | 0.0105 |
| | 175 | 0.1654 | 0.9559 | 1.2783 | 0.0019 | 0.0700 | 0.0644 | 167 | 0.0149 |
| | 250 | 0.1646 | 0.5171 | 1.6355 | 0.0028 | 0.0506 | 0.0466 | 245 | 0.0149 |
| | 500 | 0.2358 | 0.7790 | 2.1722 | 0.0037 | 0.0722 | 0.0664 | 374 | 0.0213 |
| | 750 | 0.3723 | 1.2184 | 3.5561 | 0.0059 | 0.1154 | 0.1062 | 589 | 0.0336 |
| | 9999 | 0.9726 | 3.0901 | 11.5626 | 0.0131 | 0.3225 | 0.2967 | 1,308 | 0.0878 |
| Crushing/Proc. Equipment Composite | | 0.1465 | 0.6549 | 0.9893 | 0.0015 | 0.0607 | 0.0558 | 132 | 0.0132 |
| Dumpers/Tenders | 25 | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Dumpers/Tenders Composite | | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0650 | 0.2683 | 0.2256 | 0.0003 | 0.0167 | 0.0154 | 25.0 | 0.0059 |
| | 120 | 0.0912 | 0.5102 | 0.5787 | 0.0009 | 0.0455 | 0.0418 | 73.6 | 0.0082 |
| | 175 | 0.1052 | 0.6653 | 0.7408 | 0.0013 | 0.0405 | 0.0372 | 112 | 0.0095 |

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| | 250 | 0.1117 | 0.3431 | 0.8935 | 0.0018 | 0.0297 | 0.0273 | 159 | 0.0101 |
| | 500 | 0.1577 | 0.4964 | 1.1619 | 0.0023 | 0.0413 | 0.0380 | 234 | 0.0142 |
| | 750 | 0.2630 | 0.8225 | 1.9926 | 0.0039 | 0.0698 | 0.0642 | 387 | 0.0237 |
| Excavators Composite | | 0.1064 | 0.5248 | 0.7416 | 0.0013 | 0.0379 | 0.0349 | 120 | 0.0096 |
| Forklifts | 50 | 0.0324 | 0.1522 | 0.1324 | 0.0002 | 0.0092 | 0.0084 | 14.7 | 0.0029 |
| | 120 | 0.0345 | 0.2143 | 0.2326 | 0.0004 | 0.0174 | 0.0160 | 31.2 | 0.0031 |
| | 175 | 0.0486 | 0.3316 | 0.3442 | 0.0006 | 0.0189 | 0.0174 | 56.1 | 0.0044 |
| | 250 | 0.0518 | 0.1582 | 0.4040 | 0.0009 | 0.0133 | 0.0122 | 77.1 | 0.0047 |
| | 500 | 0.0724 | 0.2164 | 0.5170 | 0.0011 | 0.0185 | 0.0171 | 111 | 0.0065 |
| Forklifts Composite | | 0.0459 | 0.2200 | 0.3163 | 0.0006 | 0.0156 | 0.0143 | 54.4 | 0.0041 |
| Generator Sets | 15 | 0.0135 | 0.0658 | 0.0929 | 0.0002 | 0.0051 | 0.0047 | 10.2 | 0.0012 |
| | 25 | 0.0247 | 0.0831 | 0.1522 | 0.0002 | 0.0080 | 0.0074 | 17.6 | 0.0022 |
| | 50 | 0.0706 | 0.2465 | 0.2628 | 0.0004 | 0.0193 | 0.0178 | 30.6 | 0.0064 |
| | 120 | 0.0910 | 0.4811 | 0.6607 | 0.0009 | 0.0484 | 0.0445 | 77.9 | 0.0082 |
| | 175 | 0.1120 | 0.7350 | 1.0463 | 0.0016 | 0.0485 | 0.0446 | 142 | 0.0101 |
| | 250 | 0.1090 | 0.4148 | 1.3776 | 0.0024 | 0.0381 | 0.0351 | 213 | 0.0098 |
| Generator Sets - 500 hp | 500 | 0.1556 | 0.6639 | 1.9429 | 0.0033 | 0.0567 | 0.0522 | 337 | 0.0140 |
| | 750 | 0.2599 | 1.0718 | 3.2483 | 0.0055 | 0.0934 | 0.0860 | 544 | 0.0234 |
| | 9999 | 0.6582 | 2.3655 | 8.9789 | 0.0105 | 0.2325 | 0.2139 | 1,049 | 0.0594 |
| Generator Sets Composite | | 0.0640 | 0.2913 | 0.4717 | 0.0007 | 0.0268 | 0.0246 | 61.0 | 0.0058 |
| Graders | 50 | 0.0897 | 0.3082 | 0.2569 | 0.0004 | 0.0217 | 0.0200 | 27.5 | 0.0081 |
| | 120 | 0.1081 | 0.5230 | 0.6726 | 0.0009 | 0.0555 | 0.0511 | 75.0 | 0.0098 |
| | 175 | 0.1299 | 0.7319 | 0.9534 | 0.0014 | 0.0526 | 0.0484 | 124 | 0.0117 |
| | 250 | 0.1326 | 0.4046 | 1.1596 | 0.0019 | 0.0400 | 0.0368 | 172 | 0.0120 |
| | 500 | 0.1666 | 0.5739 | 1.3760 | 0.0023 | 0.0496 | 0.0456 | 229 | 0.0150 |
| | 750 | 0.3549 | 1.2133 | 3.0011 | 0.0049 | 0.1066 | 0.0981 | 486 | 0.0320 |
| Graders Composite | | 0.1277 | 0.5931 | 0.9795 | 0.0015 | 0.0489 | 0.0450 | 133 | 0.0115 |
| Off-Highway Tractors | 120 | 0.1905 | 0.7051 | 1.1159 | 0.0011 | 0.0952 | 0.0876 | 93.7 | 0.0172 |
| | 175 | 0.1870 | 0.8216 | 1.3703 | 0.0015 | 0.0771 | 0.0709 | 130 | 0.0169 |
| | 250 | 0.1489 | 0.4320 | 1.2644 | 0.0015 | 0.0520 | 0.0478 | 130 | 0.0134 |
| | 750 | 0.5975 | 2.5165 | 5.0885 | 0.0057 | 0.2047 | 0.1884 | 568 | 0.0539 |
| | 1000 | 0.9006 | 3.9378 | 9.2072 | 0.0082 | 0.3063 | 0.2818 | 814 | 0.0813 |
| Off-Highway Tractors Composite | | 0.1893 | 0.7244 | 1.5085 | 0.0017 | 0.0717 | 0.0660 | 151 | 0.0171 |
| Off-Highway Trucks | 175 | 0.1259 | 0.7559 | 0.8596 | 0.0014 | 0.0477 | 0.0438 | 125 | 0.0114 |
| | 250 | 0.1252 | 0.3702 | 0.9818 | 0.0019 | 0.0328 | 0.0301 | 167 | 0.0113 |
| | 500 | 0.1960 | 0.5949 | 1.4165 | 0.0027 | 0.0505 | 0.0465 | 272 | 0.0177 |
| | 750 | 0.3198 | 0.9645 | 2.3779 | 0.0044 | 0.0835 | 0.0768 | 442 | 0.0289 |
| | 1000 | 0.4873 | 1.4801 | 5.2216 | 0.0063 | 0.1505 | 0.1385 | 625 | 0.0440 |
| Off-Highway Trucks Composite | | 0.1924 | 0.5974 | 1.4932 | 0.0027 | 0.0516 | 0.0475 | 260 | 0.0174 |
| Other Construction Equipment | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0039 | 0.0036 | 13.2 | 0.0014 |
| | 50 | 0.0597 | 0.2506 | 0.2369 | 0.0004 | 0.0162 | 0.0149 | 28.0 | 0.0054 |
| | 120 | 0.0827 | 0.5202 | 0.6012 | 0.0009 | 0.0441 | 0.0406 | 80.9 | 0.0075 |
| | 175 | 0.0796 | 0.5864 | 0.6636 | 0.0012 | 0.0331 | 0.0305 | 107 | 0.0072 |
| | 500 | 0.1310 | 0.4963 | 1.1867 | 0.0025 | 0.0394 | 0.0362 | 254 | 0.0118 |
| Other Construction Equipment Composite | | 0.0768 | 0.3645 | 0.6392 | 0.0013 | 0.0264 | 0.0243 | 123 | 0.0069 |
| Other General Industrial Equipmen | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0786 | 0.2532 | 0.2077 | 0.0003 | 0.0191 | 0.0175 | 21.7 | 0.0071 |
| | 120 | 0.0987 | 0.4387 | 0.5864 | 0.0007 | 0.0521 | 0.0480 | 62.0 | 0.0089 |
| | 175 | 0.1083 | 0.5684 | 0.7866 | 0.0011 | 0.0448 | 0.0412 | 95.9 | 0.0098 |
| | 250 | 0.1050 | 0.3015 | 0.9812 | 0.0015 | 0.0312 | 0.0287 | 136 | 0.0095 |
| | 500 | 0.1931 | 0.5811 | 1.6702 | 0.0026 | 0.0569 | 0.0524 | 265 | 0.0174 |
| | 750 | 0.3208 | 0.9578 | 2.8569 | 0.0044 | 0.0959 | 0.0883 | 437 | 0.0289 |
| | 1000 | 0.4546 | 1.4023 | 5.2482 | 0.0056 | 0.1513 | 0.1392 | 560 | 0.0410 |
| Other General Industrial Equipmen Composite | | 0.1355 | 0.4843 | 1.1215 | 0.0016 | 0.0475 | 0.0437 | 152 | 0.0122 |
| Other Material Handling Equipmen | 50 | 0.1090 | 0.3501 | 0.2887 | 0.0004 | 0.0265 | 0.0244 | 30.3 | 0.0098 |
| | 120 | 0.0959 | 0.4271 | 0.5727 | 0.0007 | 0.0509 | 0.0468 | 60.7 | 0.0087 |
| | 175 | 0.1365 | 0.7201 | 0.9997 | 0.0014 | 0.0567 | 0.0522 | 122 | 0.0123 |
| | 250 | 0.1109 | 0.3211 | 1.0483 | 0.0016 | 0.0332 | 0.0306 | 145 | 0.0100 |
| | 500 | 0.1376 | 0.4182 | 1.2042 | 0.0019 | 0.0409 | 0.0377 | 192 | 0.0124 |
| | 9999 | 0.6190 | 1.8527 | 6.9410 | 0.0073 | 0.1995 | 0.1835 | 741 | 0.0558 |
| Other Material Handling Equipment Composite | | 0.1289 | 0.4698 | 1.0967 | 0.0015 | 0.0460 | 0.0423 | 141 | 0.0116 |
| Pavers | 25 | 0.0234 | 0.0780 | 0.1458 | 0.0002 | 0.0066 | 0.0060 | 18.7 | 0.0021 |
| | 50 | 0.1198 | 0.3421 | 0.2775 | 0.0004 | 0.0271 | 0.0249 | 28.0 | 0.0108 |
| | 120 | 0.1235 | 0.4969 | 0.7477 | 0.0008 | 0.0636 | 0.0585 | 69.2 | 0.0111 |
| | 175 | 0.1608 | 0.7707 | 1.2155 | 0.0014 | 0.0673 | 0.0619 | 128 | 0.0145 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1858 | 0.5585 | 1.6747 | 0.0022 | 0.0640 | 0.0589 | 194 | 0.0168 |
| | 500 | 0.2059 | 0.8113 | 1.8097 | 0.0023 | 0.0697 | 0.0641 | 233 | 0.0186 |
| Pavers Composite | | 0.1347 | 0.5203 | 0.7607 | 0.0009 | 0.0526 | 0.0484 | 77.9 | 0.0122 |
| Paving Equipment | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0037 | 0.0034 | 12.6 | 0.0014 |
| | 50 | 0.1023 | 0.2901 | 0.2367 | 0.0003 | 0.0231 | 0.0213 | 23.9 | 0.0092 |
| | 120 | 0.0969 | 0.3891 | 0.5874 | 0.0006 | 0.0503 | 0.0462 | 54.5 | 0.0087 |
| | 175 | 0.1254 | 0.6025 | 0.9549 | 0.0011 | 0.0528 | 0.0486 | 101 | 0.0113 |
| | 250 | 0.1140 | 0.3441 | 1.0498 | 0.0014 | 0.0394 | 0.0362 | 122 | 0.0103 |
| Paving Equipment Composite | | 0.1023 | 0.4234 | 0.6842 | 0.0008 | 0.0469 | 0.0431 | 68.9 | 0.0092 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washers | 15 | 0.0065 | 0.0315 | 0.0445 | 0.0001 | 0.0024 | 0.0022 | 4.9 | 0.0006 |
| | 25 | 0.0100 | 0.0337 | 0.0617 | 0.0001 | 0.0033 | 0.0030 | 7.1 | 0.0009 |
| | 50 | 0.0251 | 0.0970 | 0.1183 | 0.0002 | 0.0077 | 0.0070 | 14.3 | 0.0023 |
| | 120 | 0.0245 | 0.1416 | 0.1947 | 0.0003 | 0.0128 | 0.0118 | 24.1 | 0.0022 |
| Pressure Washers Composite | | 0.0133 | 0.0590 | 0.0799 | 0.0001 | 0.0049 | 0.0045 | 9.4 | 0.0012 |
| | 15 | 0.0111 | 0.0479 | 0.0683 | 0.0001 | 0.0041 | 0.0038 | 7.4 | 0.0010 |
| | 25 | 0.0309 | 0.0919 | 0.1682 | 0.0002 | 0.0094 | 0.0086 | 19.5 | 0.0028 |
| | 50 | 0.0855 | 0.2910 | 0.2982 | 0.0004 | 0.0228 | 0.0210 | 34.3 | 0.0077 |
| | 120 | 0.0949 | 0.4887 | 0.6710 | 0.0009 | 0.0508 | 0.0467 | 77.9 | 0.0086 |
| | 175 | 0.1158 | 0.7365 | 1.0489 | 0.0016 | 0.0502 | 0.0462 | 140 | 0.0104 |
| | 250 | 0.1088 | 0.3998 | 1.3270 | 0.0023 | 0.0376 | 0.0346 | 201 | 0.0098 |
| Pumps | 500 | 0.1686 | 0.6929 | 2.0163 | 0.0034 | 0.0603 | 0.0555 | 345 | 0.0152 |
| | 750 | 0.2872 | 1.1454 | 3.4529 | 0.0057 | 0.1018 | 0.0937 | 571 | 0.0259 |
| | 9999 | 0.8773 | 3.1134 | 11.7387 | 0.0136 | 0.3072 | 0.2826 | 1,355 | 0.0792 |
| Pumps Composite | | 0.0621 | 0.2825 | 0.4121 | 0.0006 | 0.0267 | 0.0245 | 49.6 | 0.0056 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1018 | 0.0002 | 0.0039 | 0.0036 | 13.3 | 0.0015 |
| | 50 | 0.0871 | 0.2754 | 0.2405 | 0.0003 | 0.0209 | 0.0192 | 26.0 | 0.0079 |
| | 120 | 0.0857 | 0.4000 | 0.5498 | 0.0007 | 0.0454 | 0.0418 | 59.0 | 0.0077 |
| | 175 | 0.1104 | 0.6166 | 0.8731 | 0.0012 | 0.0470 | 0.0433 | 108 | 0.0100 |
| | 250 | 0.1107 | 0.3575 | 1.0948 | 0.0017 | 0.0368 | 0.0339 | 153 | 0.0100 |
| | 500 | 0.1468 | 0.5595 | 1.3956 | 0.0022 | 0.0487 | 0.0448 | 219 | 0.0132 |
| Rollers Composite | | 0.0851 | 0.3979 | 0.5706 | 0.0008 | 0.0386 | 0.0355 | 67.1 | 0.0077 |
| Rough Terrain Forklifts | 50 | 0.0942 | 0.3551 | 0.3066 | 0.0004 | 0.0243 | 0.0224 | 33.9 | 0.0085 |
| | 120 | 0.0801 | 0.4260 | 0.5164 | 0.0007 | 0.0420 | 0.0387 | 62.4 | 0.0072 |
| | 175 | 0.1171 | 0.7240 | 0.8746 | 0.0014 | 0.0477 | 0.0439 | 125 | 0.0106 |
| | 250 | 0.1168 | 0.3650 | 1.0385 | 0.0019 | 0.0338 | 0.0311 | 171 | 0.0105 |
| | 500 | 0.1668 | 0.5337 | 1.3642 | 0.0025 | 0.0477 | 0.0439 | 257 | 0.0150 |
| Rough Terrain Forklifts Composite | | 0.0850 | 0.4577 | 0.5588 | 0.0008 | 0.0423 | 0.0389 | 70.3 | 0.0077 |
| Rubber Tired Dozers | 175 | 0.1942 | 0.8333 | 1.3944 | 0.0015 | 0.0790 | 0.0727 | 129 | 0.0175 |
| | 250 | 0.2209 | 0.6304 | 1.8273 | 0.0021 | 0.0762 | 0.0701 | 183 | 0.0199 |
| | 500 | 0.2932 | 1.2456 | 2.3951 | 0.0026 | 0.0985 | 0.0906 | 265 | 0.0265 |
| | 750 | 0.4423 | 1.8685 | 3.6712 | 0.0040 | 0.1494 | 0.1374 | 399 | 0.0399 |
| | 1000 | 0.6883 | 3.0139 | 6.8297 | 0.0060 | 0.2311 | 0.2126 | 592 | 0.0621 |
| Rubber Tired Dozers Composite | | 0.2721 | 1.0420 | 2.2344 | 0.0025 | 0.0924 | 0.0850 | 239 | 0.0246 |
| Rubber Tired Loaders | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0049 | 0.0045 | 16.9 | 0.0018 |
| | 50 | 0.0993 | 0.3438 | 0.2888 | 0.0004 | 0.0242 | 0.0222 | 31.1 | 0.0090 |
| | 120 | 0.0835 | 0.4090 | 0.5226 | 0.0007 | 0.0431 | 0.0396 | 58.9 | 0.0075 |
| | 175 | 0.1094 | 0.6251 | 0.8077 | 0.0012 | 0.0445 | 0.0409 | 106 | 0.0099 |
| | 250 | 0.1118 | 0.3444 | 0.9890 | 0.0017 | 0.0337 | 0.0310 | 149 | 0.0101 |
| | 500 | 0.1678 | 0.5818 | 1.3980 | 0.0023 | 0.0499 | 0.0459 | 237 | 0.0151 |
| | 750 | 0.3459 | 1.1905 | 2.9534 | 0.0049 | 0.1040 | 0.0956 | 486 | 0.0312 |
| | 1000 | 0.4657 | 1.6412 | 5.2967 | 0.0060 | 0.1552 | 0.1428 | 594 | 0.0420 |
| Rubber Tired Loaders Composite | | 0.1050 | 0.4615 | 0.7838 | 0.0012 | 0.0416 | 0.0383 | 109 | 0.0095 |
| Scrapers | 120 | 0.1665 | 0.6826 | 0.9915 | 0.0011 | 0.0846 | 0.0778 | 93.9 | 0.0150 |
| | 175 | 0.1871 | 0.9030 | 1.3657 | 0.0017 | 0.0766 | 0.0704 | 148 | 0.0169 |
| | 250 | 0.2021 | 0.5906 | 1.7470 | 0.0024 | 0.0665 | 0.0612 | 209 | 0.0182 |
| | 500 | 0.2883 | 1.0688 | 2.4104 | 0.0032 | 0.0930 | 0.0855 | 321 | 0.0260 |
| | 750 | 0.5001 | 1.8419 | 4.2634 | 0.0056 | 0.1624 | 0.1494 | 555 | 0.0451 |
| Scrapers Composite | | 0.2513 | 0.9443 | 2.0647 | 0.0027 | 0.0854 | 0.0785 | 262 | 0.0227 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0931 | 0.3227 | 0.3148 | 0.0005 | 0.0243 | 0.0224 | 36.2 | 0.0084 |
| | 120 | 0.0970 | 0.5116 | 0.6762 | 0.0009 | 0.0525 | 0.0483 | 80.2 | 0.0088 |
| | 175 | 0.1290 | 0.8300 | 1.1249 | 0.0017 | 0.0559 | 0.0514 | 155 | 0.0116 |
| | 250 | 0.1416 | 0.5098 | 1.6229 | 0.0029 | 0.0474 | 0.0436 | 255 | 0.0128 |
| Signal Boards Composite | | 0.0171 | 0.0925 | 0.1250 | 0.0002 | 0.0066 | 0.0060 | 16.7 | 0.0015 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| Skid Steer Loaders | 25 | 0.0189 | 0.0601 | 0.1125 | 0.0002 | 0.0056 | 0.0052 | 13.8 | 0.0017 |
| | 50 | 0.0378 | 0.2138 | 0.2052 | 0.0003 | 0.0113 | 0.0104 | 25.5 | 0.0034 |
| | 120 | 0.0334 | 0.2710 | 0.2699 | 0.0005 | 0.0170 | 0.0156 | 42.8 | 0.0030 |
| Skid Steer Loaders Composite | | 0.0352 | 0.2220 | 0.2198 | 0.0004 | 0.0128 | 0.0118 | 30.3 | 0.0032 |
| Surfacing Equipment | 50 | 0.0408 | 0.1333 | 0.1263 | 0.0002 | 0.0101 | 0.0093 | 14.1 | 0.0037 |
| | 120 | 0.0840 | 0.4151 | 0.5756 | 0.0007 | 0.0439 | 0.0404 | 63.8 | 0.0076 |
| | 175 | 0.0787 | 0.4705 | 0.6706 | 0.0010 | 0.0335 | 0.0308 | 85.8 | 0.0071 |
| | 250 | 0.0891 | 0.3116 | 0.9338 | 0.0015 | 0.0309 | 0.0285 | 135 | 0.0080 |
| | 500 | 0.1342 | 0.5759 | 1.3809 | 0.0022 | 0.0468 | 0.0431 | 221 | 0.0121 |
| | 750 | 0.2139 | 0.9020 | 2.2264 | 0.0035 | 0.0745 | 0.0686 | 347 | 0.0193 |
| Surfacing Equipment Composite | | 0.1116 | 0.4705 | 1.0675 | 0.0017 | 0.0389 | 0.0357 | 166 | 0.0101 |
| Sweepers/Scrubbers | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0052 | 19.6 | 0.0021 |
| | 50 | 0.0782 | 0.3186 | 0.2828 | 0.0004 | 0.0211 | 0.0194 | 31.6 | 0.0071 |
| | 120 | 0.0880 | 0.5056 | 0.5893 | 0.0009 | 0.0466 | 0.0429 | 75.0 | 0.0079 |
| | 175 | 0.1193 | 0.7999 | 0.9051 | 0.0016 | 0.0488 | 0.0449 | 139 | 0.0108 |
| | 250 | 0.1029 | 0.3286 | 0.9094 | 0.0018 | 0.0289 | 0.0266 | 162 | 0.0093 |
| Sweepers/Scrubbers Composite | | 0.0913 | 0.5034 | 0.5746 | 0.0009 | 0.0387 | 0.0356 | 78.5 | 0.0082 |
| Tractors/Loaders/Backhoes | 25 | 0.0192 | 0.0653 | 0.1221 | 0.0002 | 0.0049 | 0.0045 | 15.9 | 0.0017 |
| | 50 | 0.0702 | 0.3020 | 0.2646 | 0.0004 | 0.0186 | 0.0171 | 30.3 | 0.0063 |
| | 120 | 0.0577 | 0.3480 | 0.3870 | 0.0006 | 0.0293 | 0.0270 | 51.7 | 0.0052 |
| | 175 | 0.0854 | 0.5853 | 0.6331 | 0.0011 | 0.0335 | 0.0308 | 101 | 0.0077 |
| | 250 | 0.1082 | 0.3566 | 0.9047 | 0.0019 | 0.0294 | 0.0270 | 172 | 0.0098 |
| | 500 | 0.2085 | 0.7089 | 1.6070 | 0.0039 | 0.0559 | 0.0514 | 345 | 0.0188 |
| | 750 | 0.3148 | 1.0631 | 2.4922 | 0.0058 | 0.0854 | 0.0786 | 517 | 0.0284 |
| Tractors/Loaders/Backhoes Composite | | 0.0666 | 0.3716 | 0.4501 | 0.0008 | 0.0298 | 0.0274 | 66.8 | 0.0060 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0087 | 32.9 | 0.0036 |
| | 50 | 0.1390 | 0.3900 | 0.3235 | 0.0004 | 0.0313 | 0.0288 | 32.9 | 0.0125 |
| | 120 | 0.1144 | 0.4600 | 0.7060 | 0.0008 | 0.0590 | 0.0542 | 64.9 | 0.0103 |
| | 175 | 0.1770 | 0.8534 | 1.3767 | 0.0016 | 0.0748 | 0.0688 | 144 | 0.0160 |
| | 250 | 0.2105 | 0.6510 | 1.9456 | 0.0025 | 0.0750 | 0.0690 | 223 | 0.0190 |
| | 500 | 0.2694 | 1.1349 | 2.4560 | 0.0031 | 0.0947 | 0.0871 | 311 | 0.0243 |
| | 750 | 0.5107 | 2.1334 | 4.7300 | 0.0059 | 0.1802 | 0.1658 | 587 | 0.0461 |
| Trenchers Composite | | 0.1274 | 0.4541 | 0.6043 | 0.0007 | 0.0485 | 0.0446 | 58.7 | 0.0115 |
| Welders | 15 | 0.0093 | 0.0400 | 0.0571 | 0.0001 | 0.0034 | 0.0032 | 6.2 | 0.0008 |
| | 25 | 0.0179 | 0.0532 | 0.0974 | 0.0001 | 0.0054 | 0.0050 | 11.3 | 0.0016 |
| | 50 | 0.0801 | 0.2564 | 0.2346 | 0.0003 | 0.0200 | 0.0184 | 26.0 | 0.0072 |
| | 120 | 0.0547 | 0.2606 | 0.3567 | 0.0005 | 0.0296 | 0.0273 | 39.5 | 0.0049 |
| | 175 | 0.0936 | 0.5424 | 0.7713 | 0.0011 | 0.0405 | 0.0373 | 98.2 | 0.0084 |
| | 250 | 0.0749 | 0.2483 | 0.8249 | 0.0013 | 0.0248 | 0.0228 | 119 | 0.0068 |
| | 500 | 0.0968 | 0.3491 | 1.0171 | 0.0016 | 0.0325 | 0.0299 | 168 | 0.0087 |
| Welders Composite | | 0.0534 | 0.1994 | 0.2301 | 0.0003 | 0.0187 | 0.0172 | 25.6 | 0.0048 |

**2020 Fleet Average Emission Factors (Diesel)**

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0138 | 0.0459 | 0.0854 | 0.0001 | 0.0035 | 0.0032 | 11.0 | 0.0012 |
| | 50 | 0.0261 | 0.1436 | 0.1422 | 0.0003 | 0.0071 | 0.0065 | 19.6 | 0.0024 |
| | 120 | 0.0259 | 0.2292 | 0.2166 | 0.0004 | 0.0127 | 0.0117 | 38.1 | 0.0023 |
| | 500 | 0.0751 | 0.3804 | 0.6959 | 0.0021 | 0.0217 | 0.0199 | 213 | 0.0068 |
| | 750 | 0.1373 | 0.6877 | 1.2876 | 0.0039 | 0.0396 | 0.0365 | 385 | 0.0124 |
| Aerial Lifts Composite | | 0.0261 | 0.1696 | 0.1866 | 0.0004 | 0.0092 | 0.0084 | 34.7 | 0.0024 |
| Air Compressors | 15 | 0.0093 | 0.0451 | 0.0579 | 0.0001 | 0.0029 | 0.0027 | 7.2 | 0.0008 |
| | 25 | 0.0196 | 0.0630 | 0.1155 | 0.0002 | 0.0054 | 0.0050 | 14.4 | 0.0018 |
| | 50 | 0.0398 | 0.2030 | 0.1725 | 0.0003 | 0.0099 | 0.0091 | 22.3 | 0.0036 |
| | 120 | 0.0408 | 0.3058 | 0.2826 | 0.0006 | 0.0188 | 0.0173 | 47.0 | 0.0037 |
| | 175 | 0.0587 | 0.4989 | 0.4013 | 0.0010 | 0.0210 | 0.0193 | 88.5 | 0.0053 |
| | 250 | 0.0669 | 0.2592 | 0.5067 | 0.0015 | 0.0163 | 0.0150 | 131 | 0.0060 |
| | 500 | 0.1146 | 0.4395 | 0.7970 | 0.0023 | 0.0276 | 0.0254 | 232 | 0.0103 |
| | 750 | 0.1777 | 0.6792 | 1.2615 | 0.0036 | 0.0432 | 0.0398 | 358 | 0.0160 |
| | 1000 | 0.2641 | 0.9959 | 3.2946 | 0.0049 | 0.0804 | 0.0740 | 486 | 0.0238 |
| Air Compressors Composite | | 0.0483 | 0.3077 | 0.3255 | 0.0007 | 0.0185 | 0.0170 | 63.6 | 0.0044 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0196 | 0.2205 | 0.1756 | 0.0004 | 0.0020 | 0.0018 | 31.0 | 0.0018 |
| | 120 | 0.0280 | 0.4662 | 0.2329 | 0.0009 | 0.0040 | 0.0037 | 77.1 | 0.0025 |
| | 175 | 0.0402 | 0.7542 | 0.1862 | 0.0016 | 0.0051 | 0.0047 | 141 | 0.0036 |
| | 250 | 0.0474 | 0.3426 | 0.1617 | 0.0021 | 0.0044 | 0.0040 | 188 | 0.0043 |
| | 500 | 0.0784 | 0.5512 | 0.2622 | 0.0031 | 0.0072 | 0.0066 | 311 | 0.0071 |
| | 750 | 0.1549 | 1.0891 | 0.5202 | 0.0062 | 0.0143 | 0.0131 | 615 | 0.0140 |
| | 1000 | 0.2442 | 1.6437 | 3.9853 | 0.0093 | 0.0530 | 0.0488 | 928 | 0.0220 |
| Bore/Drill Rigs Composite | | 0.0480 | 0.5008 | 0.3439 | 0.0017 | 0.0062 | 0.0057 | 165 | 0.0043 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0223 | 0.0741 | 0.1372 | 0.0002 | 0.0058 | 0.0053 | 17.6 | 0.0020 |
| Cement and Mortar Mixers Co | | 0.0086 | 0.0415 | 0.0536 | 0.0001 | 0.0021 | 0.0020 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0424 | 0.2420 | 0.2231 | 0.0004 | 0.0113 | 0.0104 | 30.2 | 0.0038 |
| | 120 | 0.0524 | 0.4613 | 0.4128 | 0.0009 | 0.0249 | 0.0229 | 74.1 | 0.0047 |
| | 175 | 0.0865 | 0.8662 | 0.6554 | 0.0018 | 0.0323 | 0.0297 | 160 | 0.0078 |
| Concrete/Industrial Saws Com | | 0.0484 | 0.3783 | 0.3410 | 0.0007 | 0.0196 | 0.0180 | 58.5 | 0.0044 |
| Cranes | 50 | 0.0532 | 0.2423 | 0.1894 | 0.0003 | 0.0121 | 0.0111 | 23.2 | 0.0048 |
| | 120 | 0.0542 | 0.3446 | 0.3317 | 0.0006 | 0.0240 | 0.0221 | 50.1 | 0.0049 |
| | 175 | 0.0648 | 0.4754 | 0.4071 | 0.0009 | 0.0223 | 0.0206 | 80.3 | 0.0058 |
| | 250 | 0.0704 | 0.2440 | 0.4949 | 0.0013 | 0.0170 | 0.0157 | 112 | 0.0064 |
| | 500 | 0.1087 | 0.3839 | 0.7047 | 0.0018 | 0.0257 | 0.0236 | 180 | 0.0098 |
| | 750 | 0.1837 | 0.6455 | 1.2225 | 0.0030 | 0.0439 | 0.0404 | 303 | 0.0166 |
| | 9999 | 0.6702 | 2.1934 | 7.0436 | 0.0098 | 0.1797 | 0.1654 | 971 | 0.0605 |
| Cranes Composite | | 0.0898 | 0.3917 | 0.6610 | 0.0014 | 0.0256 | 0.0236 | 129 | 0.0081 |
| Crawler Tractors | 50 | 0.0699 | 0.2771 | 0.2107 | 0.0003 | 0.0150 | 0.0138 | 24.9 | 0.0063 |
| | 120 | 0.0831 | 0.4628 | 0.4896 | 0.0008 | 0.0371 | 0.0341 | 65.8 | 0.0075 |
| | 175 | 0.1123 | 0.7302 | 0.7150 | 0.0014 | 0.0398 | 0.0366 | 121 | 0.0101 |
| | 250 | 0.1188 | 0.3966 | 0.8681 | 0.0019 | 0.0315 | 0.0290 | 166 | 0.0107 |
| | 500 | 0.1759 | 0.6665 | 1.2170 | 0.0025 | 0.0455 | 0.0419 | 259 | 0.0159 |
| | 750 | 0.3168 | 1.1935 | 2.2429 | 0.0047 | 0.0828 | 0.0762 | 465 | 0.0286 |
| | 1000 | 0.4836 | 1.8458 | 5.2162 | 0.0066 | 0.1425 | 0.1311 | 658 | 0.0436 |
| Crawler Tractors Composite | | 0.1049 | 0.5260 | 0.6772 | 0.0013 | 0.0378 | 0.0348 | 114 | 0.0095 |
| Crushing/Proc. E | 50 | 0.0734 | 0.4036 | 0.3367 | 0.0006 | 0.0181 | 0.0166 | 44.0 | 0.0066 |
| | 120 | 0.0692 | 0.5446 | 0.4754 | 0.0010 | 0.0302 | 0.0278 | 83.1 | 0.0062 |
| | 175 | 0.1083 | 0.9519 | 0.7042 | 0.0019 | 0.0368 | 0.0338 | 167 | 0.0098 |
| | 250 | 0.1245 | 0.4844 | 0.8670 | 0.0028 | 0.0282 | 0.0259 | 245 | 0.0112 |
| | 500 | 0.1852 | 0.7092 | 1.1829 | 0.0037 | 0.0416 | 0.0383 | 374 | 0.0167 |
| | 750 | 0.2912 | 1.1167 | 1.9026 | 0.0059 | 0.0655 | 0.0603 | 589 | 0.0263 |
| | 9999 | 0.7584 | 2.6528 | 8.5119 | 0.0131 | 0.2049 | 0.1885 | 1,308 | 0.0684 |
| Crushing/Proc. Equipment Co | | 0.0934 | 0.6247 | 0.5983 | 0.0015 | 0.0310 | 0.0285 | 132 | 0.0084 |
| Dumpers/Tender | 25 | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0384 | 0.2446 | 0.1862 | 0.0003 | 0.0080 | 0.0074 | 25.0 | 0.0035 |
| | 120 | 0.0583 | 0.4979 | 0.3717 | 0.0009 | 0.0206 | 0.0189 | 73.6 | 0.0053 |
| | 175 | 0.0703 | 0.6637 | 0.3868 | 0.0013 | 0.0195 | 0.0179 | 112 | 0.0063 |
| | 250 | 0.0828 | 0.3276 | 0.4493 | 0.0018 | 0.0154 | 0.0141 | 159 | 0.0075 |
| | 500 | 0.1198 | 0.4591 | 0.6028 | 0.0023 | 0.0219 | 0.0202 | 234 | 0.0108 |
| | 750 | 0.1987 | 0.7606 | 1.0153 | 0.0039 | 0.0365 | 0.0336 | 387 | 0.0179 |
| Excavators Composite | | 0.0733 | 0.5124 | 0.4042 | 0.0013 | 0.0184 | 0.0169 | 120 | 0.0066 |
| Forklifts | 50 | 0.0191 | 0.1400 | 0.1084 | 0.0002 | 0.0039 | 0.0036 | 14.7 | 0.0017 |
| | 120 | 0.0225 | 0.2102 | 0.1443 | 0.0004 | 0.0074 | 0.0068 | 31.2 | 0.0020 |
| | 175 | 0.0336 | 0.3315 | 0.1772 | 0.0006 | 0.0087 | 0.0080 | 56.1 | 0.0030 |
| | 250 | 0.0385 | 0.1554 | 0.1887 | 0.0009 | 0.0062 | 0.0057 | 77.1 | 0.0035 |
| | 500 | 0.0548 | 0.2126 | 0.2528 | 0.0011 | 0.0088 | 0.0081 | 111 | 0.0049 |
| Forklifts Composite | | 0.0320 | 0.2160 | 0.1691 | 0.0006 | 0.0070 | 0.0065 | 54.4 | 0.0029 |
| Generator Sets | 15 | 0.0116 | 0.0638 | 0.0814 | 0.0002 | 0.0038 | 0.0035 | 10.2 | 0.0011 |
| | 25 | 0.0224 | 0.0769 | 0.1410 | 0.0002 | 0.0064 | 0.0059 | 17.6 | 0.0020 |
| | 50 | 0.0379 | 0.2161 | 0.2199 | 0.0004 | 0.0106 | 0.0098 | 30.6 | 0.0034 |
| | 120 | 0.0506 | 0.4641 | 0.4378 | 0.0009 | 0.0250 | 0.0230 | 77.9 | 0.0046 |
| | 175 | 0.0676 | 0.7323 | 0.5990 | 0.0016 | 0.0266 | 0.0245 | 142 | 0.0061 |
| | 250 | 0.0747 | 0.3844 | 0.7614 | 0.0024 | 0.0218 | 0.0200 | 213 | 0.0067 |
| | 500 | 0.1125 | 0.5968 | 1.0874 | 0.0033 | 0.0333 | 0.0307 | 337 | 0.0102 |
| | 750 | 0.1842 | 0.9634 | 1.7962 | 0.0055 | 0.0544 | 0.0500 | 544 | 0.0166 |
| | 9999 | 0.4502 | 2.0059 | 6.6947 | 0.0105 | 0.1476 | 0.1358 | 1,049 | 0.0406 |
| Generator Sets Composite | | 0.0395 | 0.2732 | 0.3232 | 0.0007 | 0.0150 | 0.0138 | 61.0 | 0.0036 |
| Graders | 50 | 0.0563 | 0.2762 | 0.2156 | 0.0004 | 0.0124 | 0.0114 | 27.5 | 0.0051 |
| | 120 | 0.0738 | 0.5090 | 0.4568 | 0.0009 | 0.0311 | 0.0286 | 75.0 | 0.0067 |
| | 175 | 0.0918 | 0.7282 | 0.5622 | 0.0014 | 0.0303 | 0.0279 | 124 | 0.0083 |
| | 250 | 0.0999 | 0.3683 | 0.6701 | 0.0019 | 0.0230 | 0.0211 | 172 | 0.0090 |
| | 500 | 0.1284 | 0.4966 | 0.7982 | 0.0023 | 0.0288 | 0.0265 | 229 | 0.0116 |
| | 750 | 0.2731 | 1.0508 | 1.7425 | 0.0049 | 0.0621 | 0.0571 | 486 | 0.0246 |
| Graders Composite | | 0.0919 | 0.5765 | 0.5823 | 0.0015 | 0.0280 | 0.0258 | 133 | 0.0083 |
| Off-Highway Trac | 120 | 0.1455 | 0.6789 | 0.8421 | 0.0011 | 0.0674 | 0.0621 | 93.7 | 0.0131 |
| | 175 | 0.1455 | 0.8025 | 0.9712 | 0.0015 | 0.0547 | 0.0503 | 130 | 0.0131 |
| | 250 | 0.1147 | 0.3614 | 0.8843 | 0.0015 | 0.0348 | 0.0321 | 130 | 0.0103 |
| | 750 | 0.4683 | 1.8825 | 3.5643 | 0.0057 | 0.1391 | 0.1280 | 568 | 0.0423 |
| | 1000 | 0.7129 | 2.9445 | 7.4279 | 0.0082 | 0.2214 | 0.2037 | 814 | 0.0643 |
| Off-Highway Tractors Compos | | 0.1470 | 0.6517 | 1.0657 | 0.0017 | 0.0497 | 0.0457 | 151 | 0.0133 |
| Off-Highway Truc | 175 | 0.0837 | 0.7538 | 0.4564 | 0.0014 | 0.0234 | 0.0215 | 125 | 0.0076 |
| | 250 | 0.0927 | 0.3514 | 0.5042 | 0.0019 | 0.0173 | 0.0159 | 167 | 0.0084 |
| | 500 | 0.1488 | 0.5446 | 0.7481 | 0.0027 | 0.0273 | 0.0251 | 272 | 0.0134 |
| | 750 | 0.2416 | 0.8831 | 1.2347 | 0.0044 | 0.0446 | 0.0411 | 442 | 0.0218 |
| | 1000 | 0.3613 | 1.2913 | 3.8920 | 0.0063 | 0.0903 | 0.0831 | 625 | 0.0326 |
| Off-Highway Trucks Composit | | 0.1443 | 0.5514 | 0.8306 | 0.0027 | 0.0280 | 0.0258 | 260 | 0.0130 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0328 | 0.2267 | 0.1956 | 0.0004 | 0.0078 | 0.0072 | 28.0 | 0.0030 |
| | 120 | 0.0501 | 0.5080 | 0.3835 | 0.0009 | 0.0199 | 0.0183 | 80.9 | 0.0045 |
| | 175 | 0.0524 | 0.5859 | 0.3414 | 0.0012 | 0.0164 | 0.0151 | 107 | 0.0047 |
| | 500 | 0.1012 | 0.4676 | 0.6065 | 0.0025 | 0.0212 | 0.0195 | 254 | 0.0091 |
| Other Construction Equipment | | 0.0563 | 0.3508 | 0.3519 | 0.0013 | 0.0139 | 0.0128 | 122 | 0.0051 |
| Other General In | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0431 | 0.2211 | 0.1744 | 0.0003 | 0.0101 | 0.0093 | 21.7 | 0.0039 |
| | 120 | 0.0602 | 0.4232 | 0.3810 | 0.0007 | 0.0256 | 0.0236 | 62.0 | 0.0054 |
| | 175 | 0.0721 | 0.5668 | 0.4439 | 0.0011 | 0.0237 | 0.0218 | 95.9 | 0.0065 |
| | 250 | 0.0791 | 0.2804 | 0.5318 | 0.0015 | 0.0173 | 0.0159 | 136 | 0.0071 |
| | 500 | 0.1506 | 0.5217 | 0.9276 | 0.0026 | 0.0326 | 0.0300 | 265 | 0.0136 |
| | 750 | 0.2490 | 0.8599 | 1.5657 | 0.0044 | 0.0543 | 0.0500 | 437 | 0.0225 |
| | 1000 | 0.3467 | 1.1855 | 3.8628 | 0.0056 | 0.0969 | 0.0892 | 560 | 0.0313 |
| Other General Industrial Equip | | 0.0983 | 0.4517 | 0.6661 | 0.0016 | 0.0262 | 0.0241 | 152 | 0.0089 |
| Other Material Ha | 50 | 0.0595 | 0.3049 | 0.2425 | 0.0004 | 0.0141 | 0.0130 | 30.3 | 0.0054 |
| | 120 | 0.0583 | 0.4117 | 0.3720 | 0.0007 | 0.0250 | 0.0230 | 60.7 | 0.0053 |
| | 175 | 0.0907 | 0.7176 | 0.5642 | 0.0014 | 0.0301 | 0.0277 | 122 | 0.0082 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0836 | 0.2984 | 0.5684 | 0.0016 | 0.0185 | 0.0170 | 145 | 0.0075 |
| | 500 | 0.1074 | 0.3752 | 0.6692 | 0.0019 | 0.0235 | 0.0216 | 192 | 0.0097 |
| | 9999 | 0.4910 | 1.5647 | 5.1082 | 0.0073 | 0.1280 | 0.1177 | 741 | 0.0443 |
| Other Material Handling Equip | | 0.0924 | 0.4429 | 0.6500 | 0.0015 | 0.0252 | 0.0232 | 141 | 0.0083 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1427 | 0.0002 | 0.0055 | 0.0051 | 18.7 | 0.0020 |
| | 50 | 0.0834 | 0.3055 | 0.2398 | 0.0004 | 0.0184 | 0.0169 | 28.0 | 0.0075 |
| | 120 | 0.0910 | 0.4805 | 0.5471 | 0.0008 | 0.0428 | 0.0394 | 69.2 | 0.0082 |
| | 175 | 0.1217 | 0.7599 | 0.8187 | 0.0014 | 0.0459 | 0.0422 | 128 | 0.0110 |
| | 250 | 0.1411 | 0.4713 | 1.1106 | 0.0022 | 0.0407 | 0.0375 | 194 | 0.0127 |
| | 500 | 0.1595 | 0.6305 | 1.1959 | 0.0023 | 0.0450 | 0.0414 | 233 | 0.0144 |
| Pavers Composite | | 0.0989 | 0.4920 | 0.5450 | 0.0009 | 0.0355 | 0.0326 | 77.9 | 0.0089 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0702 | 0.2577 | 0.2043 | 0.0003 | 0.0157 | 0.0144 | 23.9 | 0.0063 |
| | 120 | 0.0708 | 0.3762 | 0.4280 | 0.0006 | 0.0337 | 0.0310 | 54.5 | 0.0064 |
| | 175 | 0.0944 | 0.5945 | 0.6403 | 0.0011 | 0.0360 | 0.0331 | 101 | 0.0085 |
| | 250 | 0.0864 | 0.2894 | 0.6928 | 0.0014 | 0.0249 | 0.0229 | 122 | 0.0078 |
| Paving Equipment Composite | | 0.0757 | 0.4084 | 0.4807 | 0.0008 | 0.0315 | 0.0290 | 68.9 | 0.0068 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0056 | 0.0305 | 0.0390 | 0.0001 | 0.0018 | 0.0017 | 4.9 | 0.0005 |
| | 25 | 0.0091 | 0.0312 | 0.0572 | 0.0001 | 0.0026 | 0.0024 | 7.1 | 0.0008 |
| | 50 | 0.0128 | 0.0856 | 0.0986 | 0.0002 | 0.0041 | 0.0038 | 14.3 | 0.0012 |
| | 120 | 0.0128 | 0.1367 | 0.1293 | 0.0003 | 0.0065 | 0.0060 | 24.1 | 0.0012 |
| Pressure Washers Composite | | 0.0085 | 0.0549 | 0.0650 | 0.0001 | 0.0030 | 0.0027 | 9.4 | 0.0008 |
| Pumps | 15 | 0.0096 | 0.0464 | 0.0595 | 0.0001 | 0.0030 | 0.0028 | 7.4 | 0.0009 |
| | 25 | 0.0265 | 0.0850 | 0.1558 | 0.0002 | 0.0073 | 0.0067 | 19.5 | 0.0024 |
| | 50 | 0.0465 | 0.2546 | 0.2497 | 0.0004 | 0.0126 | 0.0116 | 34.3 | 0.0042 |
| | 120 | 0.0537 | 0.4713 | 0.4442 | 0.0009 | 0.0263 | 0.0242 | 77.9 | 0.0048 |
| | 175 | 0.0712 | 0.7336 | 0.6007 | 0.0016 | 0.0277 | 0.0255 | 140 | 0.0064 |
| | 250 | 0.0760 | 0.3700 | 0.7338 | 0.0023 | 0.0215 | 0.0198 | 201 | 0.0069 |
| | 500 | 0.1241 | 0.6189 | 1.1297 | 0.0034 | 0.0355 | 0.0327 | 345 | 0.0112 |
| | 750 | 0.2075 | 1.0232 | 1.9114 | 0.0057 | 0.0594 | 0.0547 | 571 | 0.0187 |
| | 9999 | 0.6127 | 2.6255 | 8.7489 | 0.0136 | 0.1961 | 0.1804 | 1,355 | 0.0553 |
| Pumps Composite | | 0.0376 | 0.2674 | 0.2854 | 0.0006 | 0.0147 | 0.0135 | 49.6 | 0.0034 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0543 | 0.2436 | 0.2039 | 0.0003 | 0.0128 | 0.0117 | 26.0 | 0.0049 |
| | 120 | 0.0576 | 0.3873 | 0.3799 | 0.0007 | 0.0270 | 0.0249 | 59.0 | 0.0052 |
| | 175 | 0.0774 | 0.6114 | 0.5331 | 0.0012 | 0.0286 | 0.0263 | 108 | 0.0070 |
| | 250 | 0.0842 | 0.3201 | 0.6581 | 0.0017 | 0.0223 | 0.0205 | 153 | 0.0076 |
| | 500 | 0.1151 | 0.4607 | 0.8354 | 0.0022 | 0.0299 | 0.0275 | 219 | 0.0104 |
| Rollers Composite | | 0.0584 | 0.3837 | 0.3793 | 0.0008 | 0.0232 | 0.0214 | 67.0 | 0.0053 |
| Rough Terrain Fo | 50 | 0.0520 | 0.3171 | 0.2556 | 0.0004 | 0.0122 | 0.0113 | 33.9 | 0.0047 |
| | 120 | 0.0495 | 0.4142 | 0.3326 | 0.0007 | 0.0197 | 0.0181 | 62.4 | 0.0045 |
| | 175 | 0.0788 | 0.7229 | 0.4710 | 0.0014 | 0.0245 | 0.0226 | 125 | 0.0071 |
| | 250 | 0.0881 | 0.3442 | 0.5378 | 0.0019 | 0.0182 | 0.0168 | 171 | 0.0079 |
| | 500 | 0.1296 | 0.4936 | 0.7287 | 0.0025 | 0.0265 | 0.0244 | 257 | 0.0117 |
| Rough Terrain Forklifts Compo | | 0.0533 | 0.4464 | 0.3494 | 0.0008 | 0.0201 | 0.0185 | 70.3 | 0.0048 |
| Rubber Tired Doz | 175 | 0.1509 | 0.8124 | 0.9962 | 0.0015 | 0.0561 | 0.0516 | 129 | 0.0136 |
| | 250 | 0.1701 | 0.5279 | 1.2898 | 0.0021 | 0.0516 | 0.0474 | 183 | 0.0153 |
| | 500 | 0.2291 | 0.9276 | 1.6868 | 0.0026 | 0.0673 | 0.0619 | 265 | 0.0207 |
| | 750 | 0.3461 | 1.3934 | 2.5948 | 0.0040 | 0.1024 | 0.0942 | 399 | 0.0312 |
| | 1000 | 0.5438 | 2.2500 | 5.5311 | 0.0060 | 0.1672 | 0.1539 | 592 | 0.0491 |
| Rubber Tired Dozers Compos | | 0.2118 | 0.8006 | 1.5773 | 0.0025 | 0.0630 | 0.0580 | 239 | 0.0191 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0615 | 0.3080 | 0.2424 | 0.0004 | 0.0137 | 0.0126 | 31.1 | 0.0055 |
| | 120 | 0.0563 | 0.3977 | 0.3529 | 0.0007 | 0.0237 | 0.0218 | 58.9 | 0.0051 |
| | 175 | 0.0767 | 0.6215 | 0.4713 | 0.0012 | 0.0253 | 0.0233 | 106 | 0.0069 |
| | 250 | 0.0848 | 0.3159 | 0.5655 | 0.0017 | 0.0194 | 0.0179 | 149 | 0.0077 |
| | 500 | 0.1302 | 0.5016 | 0.8032 | 0.0023 | 0.0291 | 0.0268 | 237 | 0.0118 |
| | 750 | 0.2680 | 1.0271 | 1.6958 | 0.0049 | 0.0606 | 0.0558 | 486 | 0.0242 |
| | 1000 | 0.3484 | 1.3166 | 4.0040 | 0.0060 | 0.0983 | 0.0904 | 594 | 0.0314 |
| Rubber Tired Loaders Compos | | 0.0753 | 0.4406 | 0.4747 | 0.0012 | 0.0235 | 0.0216 | 109 | 0.0068 |
| Scrapers | 120 | 0.1218 | 0.6612 | 0.7170 | 0.0011 | 0.0551 | 0.0507 | 93.9 | 0.0110 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1400 | 0.8921 | 0.9020 | 0.0017 | 0.0505 | 0.0464 | 148 | 0.0126 |
| | 250 | 0.1522 | 0.5044 | 1.1344 | 0.0024 | 0.0412 | 0.0379 | 209 | 0.0137 |
| | 500 | 0.2211 | 0.8455 | 1.5615 | 0.0032 | 0.0584 | 0.0537 | 321 | 0.0200 |
| | 750 | 0.3839 | 1.4588 | 2.7734 | 0.0056 | 0.1024 | 0.0942 | 555 | 0.0346 |
| Scrapers Composite | | 0.1914 | 0.7938 | 1.3434 | 0.0027 | 0.0541 | 0.0497 | 262 | 0.0173 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0502 | 0.2833 | 0.2631 | 0.0005 | 0.0131 | 0.0121 | 36.2 | 0.0045 |
| | 120 | 0.0558 | 0.4946 | 0.4424 | 0.0009 | 0.0264 | 0.0243 | 80.2 | 0.0050 |
| | 175 | 0.0811 | 0.8276 | 0.6279 | 0.0017 | 0.0302 | 0.0277 | 155 | 0.0073 |
| | 250 | 0.1022 | 0.4765 | 0.8737 | 0.0029 | 0.0266 | 0.0245 | 255 | 0.0092 |
| Signal Boards Composite | | 0.0129 | 0.0912 | 0.0912 | 0.0002 | 0.0042 | 0.0038 | 16.7 | 0.0012 |
| Skid Steer Loade | 25 | 0.0171 | 0.0575 | 0.1070 | 0.0002 | 0.0044 | 0.0040 | 13.8 | 0.0015 |
| | 50 | 0.0230 | 0.2006 | 0.1655 | 0.0003 | 0.0043 | 0.0040 | 25.5 | 0.0021 |
| | 120 | 0.0218 | 0.2673 | 0.1647 | 0.0005 | 0.0064 | 0.0059 | 42.8 | 0.0020 |
| Skid Steer Loaders Composite | | 0.0222 | 0.2125 | 0.1614 | 0.0004 | 0.0050 | 0.0046 | 30.3 | 0.0020 |
| Surfacing Equipm | 50 | 0.0265 | 0.1191 | 0.1069 | 0.0002 | 0.0063 | 0.0058 | 14.1 | 0.0024 |
| | 120 | 0.0570 | 0.4028 | 0.4035 | 0.0007 | 0.0271 | 0.0250 | 63.8 | 0.0051 |
| | 175 | 0.0550 | 0.4663 | 0.4168 | 0.0010 | 0.0210 | 0.0193 | 85.8 | 0.0050 |
| | 250 | 0.0652 | 0.2754 | 0.5719 | 0.0015 | 0.0188 | 0.0173 | 135 | 0.0059 |
| | 500 | 0.1008 | 0.4728 | 0.8400 | 0.0022 | 0.0288 | 0.0265 | 221 | 0.0091 |
| | 750 | 0.1599 | 0.7413 | 1.3593 | 0.0035 | 0.0459 | 0.0423 | 347 | 0.0144 |
| Surfacing Equipment Compos | | 0.0823 | 0.3953 | 0.6593 | 0.0017 | 0.0239 | 0.0220 | 166 | 0.0074 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0430 | 0.2898 | 0.2365 | 0.0004 | 0.0098 | 0.0090 | 31.6 | 0.0039 |
| | 120 | 0.0555 | 0.4959 | 0.3694 | 0.0009 | 0.0210 | 0.0193 | 75.0 | 0.0050 |
| | 175 | 0.0845 | 0.8043 | 0.4869 | 0.0016 | 0.0253 | 0.0233 | 139 | 0.0076 |
| | 250 | 0.0803 | 0.3198 | 0.4530 | 0.0018 | 0.0152 | 0.0140 | 162 | 0.0072 |
| Sweepers/Scrubbers Composi | | 0.0584 | 0.4916 | 0.3563 | 0.0009 | 0.0183 | 0.0169 | 78.5 | 0.0053 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0046 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0407 | 0.2760 | 0.2179 | 0.0004 | 0.0087 | 0.0080 | 30.3 | 0.0037 |
| | 120 | 0.0366 | 0.3402 | 0.2466 | 0.0006 | 0.0129 | 0.0119 | 51.7 | 0.0033 |
| | 175 | 0.0571 | 0.5841 | 0.3220 | 0.0011 | 0.0159 | 0.0146 | 101 | 0.0052 |
| | 250 | 0.0813 | 0.3445 | 0.4427 | 0.0019 | 0.0151 | 0.0139 | 172 | 0.0073 |
| | 500 | 0.1606 | 0.6642 | 0.8132 | 0.0039 | 0.0294 | 0.0270 | 345 | 0.0145 |
| | 750 | 0.2409 | 0.9959 | 1.2387 | 0.0058 | 0.0443 | 0.0408 | 517 | 0.0217 |
| Tractors/Loaders/Backhoes C | | 0.0436 | 0.3616 | 0.2744 | 0.0008 | 0.0134 | 0.0124 | 66.8 | 0.0039 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0990 | 0.3495 | 0.2804 | 0.0004 | 0.0218 | 0.0201 | 32.9 | 0.0089 |
| | 120 | 0.0849 | 0.4443 | 0.5223 | 0.0008 | 0.0408 | 0.0375 | 64.9 | 0.0077 |
| | 175 | 0.1346 | 0.8393 | 0.9412 | 0.0016 | 0.0521 | 0.0479 | 144 | 0.0121 |
| | 250 | 0.1600 | 0.5472 | 1.3120 | 0.0025 | 0.0487 | 0.0448 | 223 | 0.0144 |
| | 500 | 0.2092 | 0.8710 | 1.6487 | 0.0031 | 0.0623 | 0.0573 | 311 | 0.0189 |
| | 750 | 0.3964 | 1.6395 | 3.1894 | 0.0059 | 0.1191 | 0.1095 | 587 | 0.0358 |
| Trenchers Composite | | 0.0933 | 0.4270 | 0.4575 | 0.0007 | 0.0336 | 0.0309 | 58.7 | 0.0084 |
| Welders | 15 | 0.0080 | 0.0388 | 0.0498 | 0.0001 | 0.0025 | 0.0023 | 6.2 | 0.0007 |
| | 25 | 0.0153 | 0.0492 | 0.0903 | 0.0001 | 0.0042 | 0.0039 | 11.3 | 0.0014 |
| | 50 | 0.0435 | 0.2219 | 0.1968 | 0.0003 | 0.0110 | 0.0102 | 26.0 | 0.0039 |
| | 120 | 0.0321 | 0.2508 | 0.2344 | 0.0005 | 0.0153 | 0.0140 | 39.5 | 0.0029 |
| | 175 | 0.0600 | 0.5396 | 0.4393 | 0.0011 | 0.0223 | 0.0205 | 98.2 | 0.0054 |
| | 250 | 0.0551 | 0.2294 | 0.4536 | 0.0013 | 0.0142 | 0.0130 | 119 | 0.0050 |
| | 500 | 0.0748 | 0.3117 | 0.5690 | 0.0016 | 0.0192 | 0.0176 | 168 | 0.0067 |
| Welders Composite | | 0.0310 | 0.1816 | 0.1735 | 0.0003 | 0.0102 | 0.0094 | 25.6 | 0.0028 |

## 2025 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0132 | 0.0451 | 0.0838 | 0.0001 | 0.0032 | 0.0030 | 11.0 | 0.0012 |
| | 50 | 0.0168 | 0.1351 | 0.1218 | 0.0003 | 0.0035 | 0.0032 | 19.6 | 0.0015 |
| | 120 | 0.0176 | 0.2265 | 0.1496 | 0.0004 | 0.0063 | 0.0058 | 38.1 | 0.0016 |
| | 500 | 0.0580 | 0.3710 | 0.3660 | 0.0021 | 0.0109 | 0.0100 | 213 | 0.0052 |
| | 750 | 0.1054 | 0.6706 | 0.6753 | 0.0039 | 0.0199 | 0.0183 | 385 | 0.0095 |
| Aerial Lifts Composite | | 0.0184 | 0.1646 | 0.1366 | 0.0004 | 0.0048 | 0.0044 | 34.7 | 0.0017 |
| Air Compressors | 15 | 0.0087 | 0.0444 | 0.0545 | 0.0001 | 0.0023 | 0.0022 | 7.2 | 0.0008 |
| | 25 | 0.0181 | 0.0605 | 0.1121 | 0.0002 | 0.0045 | 0.0042 | 14.4 | 0.0016 |
| | 50 | 0.0263 | 0.1911 | 0.1476 | 0.0003 | 0.0047 | 0.0043 | 22.3 | 0.0024 |
| | 120 | 0.0289 | 0.3023 | 0.1928 | 0.0006 | 0.0088 | 0.0081 | 47.0 | 0.0026 |
| | 175 | 0.0424 | 0.4998 | 0.2187 | 0.0010 | 0.0104 | 0.0095 | 88.5 | 0.0038 |
| | 250 | 0.0514 | 0.2531 | 0.2553 | 0.0015 | 0.0078 | 0.0072 | 131 | 0.0046 |
| | 500 | 0.0894 | 0.4292 | 0.4150 | 0.0023 | 0.0134 | 0.0123 | 232 | 0.0081 |
| | 750 | 0.1385 | 0.6633 | 0.6545 | 0.0036 | 0.0210 | 0.0193 | 358 | 0.0125 |
| | 1000 | 0.1999 | 0.9265 | 2.5439 | 0.0049 | 0.0483 | 0.0444 | 486 | 0.0180 |
| Air Compressors Composite | | 0.0349 | 0.3027 | 0.2104 | 0.0007 | 0.0088 | 0.0081 | 63.6 | 0.0031 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0190 | 0.2200 | 0.1662 | 0.0004 | 0.0009 | 0.0008 | 31.0 | 0.0017 |
| | 120 | 0.0252 | 0.4660 | 0.1955 | 0.0009 | 0.0020 | 0.0018 | 77.1 | 0.0023 |
| | 175 | 0.0324 | 0.7542 | 0.0787 | 0.0016 | 0.0030 | 0.0027 | 141 | 0.0029 |
| | 250 | 0.0427 | 0.3426 | 0.0981 | 0.0021 | 0.0035 | 0.0032 | 188 | 0.0039 |
| | 500 | 0.0706 | 0.5512 | 0.1622 | 0.0031 | 0.0058 | 0.0054 | 311 | 0.0064 |
| | 750 | 0.1396 | 1.0891 | 0.3204 | 0.0062 | 0.0115 | 0.0106 | 615 | 0.0126 |
| | 1000 | 0.2115 | 1.6437 | 3.8912 | 0.0093 | 0.0364 | 0.0335 | 928 | 0.0191 |
| Bore/Drill Rigs Composite | | 0.0428 | 0.5007 | 0.2864 | 0.0017 | 0.0042 | 0.0038 | 165 | 0.0039 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0213 | 0.0724 | 0.1346 | 0.0002 | 0.0052 | 0.0048 | 17.6 | 0.0019 |
| Cement and Mortar Mixers Co | | 0.0085 | 0.0414 | 0.0534 | 0.0001 | 0.0021 | 0.0019 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0279 | 0.2284 | 0.1910 | 0.0004 | 0.0053 | 0.0049 | 30.2 | 0.0025 |
| | 120 | 0.0370 | 0.4561 | 0.2840 | 0.0009 | 0.0117 | 0.0108 | 74.1 | 0.0033 |
| | 175 | 0.0623 | 0.8663 | 0.3523 | 0.0018 | 0.0160 | 0.0147 | 160 | 0.0056 |
| Concrete/Industrial Saws Com | | 0.0337 | 0.3706 | 0.2471 | 0.0007 | 0.0093 | 0.0086 | 58.5 | 0.0030 |
| Cranes | 50 | 0.0350 | 0.2256 | 0.1644 | 0.0003 | 0.0062 | 0.0057 | 23.2 | 0.0032 |
| | 120 | 0.0376 | 0.3384 | 0.2298 | 0.0006 | 0.0120 | 0.0111 | 50.1 | 0.0034 |
| | 175 | 0.0462 | 0.4744 | 0.2300 | 0.0009 | 0.0120 | 0.0110 | 80.3 | 0.0042 |
| | 250 | 0.0544 | 0.2316 | 0.2705 | 0.0013 | 0.0094 | 0.0087 | 112 | 0.0049 |
| | 500 | 0.0858 | 0.3535 | 0.3977 | 0.0018 | 0.0146 | 0.0134 | 180 | 0.0077 |
| | 750 | 0.1446 | 0.5947 | 0.6821 | 0.0030 | 0.0248 | 0.0228 | 303 | 0.0130 |
| | 9999 | 0.5219 | 1.9715 | 5.5760 | 0.0098 | 0.1146 | 0.1055 | 971 | 0.0471 |
| Cranes Composite | | 0.0681 | 0.3738 | 0.4223 | 0.0014 | 0.0143 | 0.0132 | 129 | 0.0061 |
| Crawler Tractors | 50 | 0.0487 | 0.2566 | 0.1842 | 0.0003 | 0.0090 | 0.0083 | 24.9 | 0.0044 |
| | 120 | 0.0609 | 0.4537 | 0.3562 | 0.0008 | 0.0221 | 0.0203 | 65.8 | 0.0055 |
| | 175 | 0.0823 | 0.7265 | 0.4447 | 0.0014 | 0.0241 | 0.0222 | 121 | 0.0074 |
| | 250 | 0.0924 | 0.3662 | 0.5348 | 0.0019 | 0.0192 | 0.0177 | 166 | 0.0083 |
| | 500 | 0.1392 | 0.5877 | 0.7527 | 0.0025 | 0.0280 | 0.0258 | 259 | 0.0126 |
| | 750 | 0.2506 | 1.0528 | 1.3878 | 0.0047 | 0.0510 | 0.0469 | 465 | 0.0226 |
| | 1000 | 0.3749 | 1.5618 | 4.2168 | 0.0066 | 0.0958 | 0.0881 | 658 | 0.0338 |
| Crawler Tractors Composite | | 0.0789 | 0.5065 | 0.4492 | 0.0013 | 0.0227 | 0.0209 | 114 | 0.0071 |
| Crushing/Proc. E | 50 | 0.0508 | 0.3859 | 0.2899 | 0.0006 | 0.0083 | 0.0077 | 44.0 | 0.0046 |
| | 120 | 0.0506 | 0.5406 | 0.3289 | 0.0010 | 0.0140 | 0.0129 | 83.1 | 0.0046 |
| | 175 | 0.0795 | 0.9556 | 0.3830 | 0.0019 | 0.0177 | 0.0163 | 167 | 0.0072 |
| | 250 | 0.0967 | 0.4768 | 0.4357 | 0.0028 | 0.0134 | 0.0123 | 245 | 0.0087 |
| | 500 | 0.1459 | 0.6977 | 0.6163 | 0.0037 | 0.0200 | 0.0184 | 374 | 0.0132 |
| | 750 | 0.2307 | 1.1003 | 0.9907 | 0.0059 | 0.0316 | 0.0291 | 589 | 0.0208 |
| | 9999 | 0.6019 | 2.5014 | 6.6977 | 0.0131 | 0.1238 | 0.1139 | 1,308 | 0.0543 |
| Crushing/Proc. Equipment Co | | 0.0693 | 0.6187 | 0.3763 | 0.0015 | 0.0146 | 0.0134 | 132 | 0.0062 |
| Dumpers/Tender | 25 | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0297 | 0.2365 | 0.1616 | 0.0003 | 0.0035 | 0.0032 | 25.0 | 0.0027 |
| | 120 | 0.0448 | 0.4942 | 0.2638 | 0.0009 | 0.0092 | 0.0085 | 73.6 | 0.0040 |
| | 175 | 0.0518 | 0.6636 | 0.1982 | 0.0013 | 0.0091 | 0.0084 | 112 | 0.0047 |
| | 250 | 0.0647 | 0.3210 | 0.2222 | 0.0018 | 0.0074 | 0.0068 | 159 | 0.0058 |
| | 500 | 0.0946 | 0.4495 | 0.3091 | 0.0023 | 0.0107 | 0.0098 | 234 | 0.0085 |
| | 750 | 0.1569 | 0.7451 | 0.5194 | 0.0039 | 0.0178 | 0.0164 | 387 | 0.0142 |
| Excavators Composite | | 0.0559 | 0.5086 | 0.2269 | 0.0013 | 0.0086 | 0.0079 | 120 | 0.0050 |
| Forklifts | 50 | 0.0150 | 0.1361 | 0.0904 | 0.0002 | 0.0013 | 0.0012 | 14.7 | 0.0014 |
| | 120 | 0.0168 | 0.2086 | 0.0997 | 0.0004 | 0.0023 | 0.0021 | 31.2 | 0.0015 |
| | 175 | 0.0228 | 0.3310 | 0.0732 | 0.0006 | 0.0029 | 0.0026 | 56.1 | 0.0021 |
| | 250 | 0.0289 | 0.1551 | 0.0746 | 0.0009 | 0.0027 | 0.0024 | 77.1 | 0.0026 |
| | 500 | 0.0416 | 0.2123 | 0.1038 | 0.0011 | 0.0038 | 0.0035 | 111 | 0.0038 |
| Forklifts Composite | | 0.0236 | 0.2148 | 0.0860 | 0.0006 | 0.0025 | 0.0023 | 54.4 | 0.0021 |
| Generator Sets | 15 | 0.0109 | 0.0627 | 0.0768 | 0.0002 | 0.0032 | 0.0030 | 10.2 | 0.0010 |
| | 25 | 0.0216 | 0.0738 | 0.1368 | 0.0002 | 0.0055 | 0.0050 | 17.6 | 0.0019 |
| | 50 | 0.0242 | 0.2034 | 0.1881 | 0.0004 | 0.0051 | 0.0047 | 30.6 | 0.0022 |
| | 120 | 0.0340 | 0.4585 | 0.3022 | 0.0009 | 0.0122 | 0.0112 | 77.9 | 0.0031 |
| | 175 | 0.0469 | 0.7328 | 0.3291 | 0.0016 | 0.0136 | 0.0125 | 142 | 0.0042 |
| | 250 | 0.0558 | 0.3746 | 0.3885 | 0.0024 | 0.0108 | 0.0099 | 213 | 0.0050 |
| | 500 | 0.0862 | 0.5820 | 0.5697 | 0.0033 | 0.0167 | 0.0153 | 337 | 0.0078 |
| | 750 | 0.1401 | 0.9395 | 0.9382 | 0.0055 | 0.0272 | 0.0250 | 544 | 0.0126 |
| | 9999 | 0.3235 | 1.8648 | 5.2188 | 0.0105 | 0.0888 | 0.0817 | 1,049 | 0.0292 |
| Generator Sets Composite | | 0.0288 | 0.2667 | 0.2329 | 0.0007 | 0.0081 | 0.0074 | 61.0 | 0.0026 |
| Graders | 50 | 0.0382 | 0.2599 | 0.1877 | 0.0004 | 0.0063 | 0.0058 | 27.5 | 0.0034 |
| | 120 | 0.0521 | 0.5009 | 0.3219 | 0.0009 | 0.0153 | 0.0141 | 75.0 | 0.0047 |
| | 175 | 0.0652 | 0.7261 | 0.3117 | 0.0014 | 0.0157 | 0.0144 | 124 | 0.0059 |
| | 250 | 0.0781 | 0.3549 | 0.3652 | 0.0019 | 0.0129 | 0.0119 | 172 | 0.0071 |
| | 500 | 0.1023 | 0.4610 | 0.4468 | 0.0023 | 0.0165 | 0.0152 | 229 | 0.0092 |
| | 750 | 0.2167 | 0.9755 | 0.9628 | 0.0049 | 0.0353 | 0.0324 | 486 | 0.0196 |
| Graders Composite | | 0.0676 | 0.5696 | 0.3314 | 0.0015 | 0.0147 | 0.0135 | 133 | 0.0061 |
| Off-Highway Trac | 120 | 0.1108 | 0.6619 | 0.6362 | 0.0011 | 0.0455 | 0.0419 | 93.7 | 0.0100 |
| | 175 | 0.1110 | 0.7932 | 0.6639 | 0.0015 | 0.0370 | 0.0341 | 130 | 0.0100 |
| | 250 | 0.0890 | 0.3179 | 0.5983 | 0.0015 | 0.0227 | 0.0208 | 130 | 0.0080 |
| | 750 | 0.3692 | 1.5358 | 2.4157 | 0.0057 | 0.0918 | 0.0844 | 568 | 0.0333 |
| | 1000 | 0.5623 | 2.3619 | 6.0896 | 0.0082 | 0.1577 | 0.1451 | 814 | 0.0507 |
| Off-Highway Tractors Compos | | 0.1134 | 0.6101 | 0.7291 | 0.0017 | 0.0331 | 0.0305 | 151 | 0.0102 |
| Off-Highway Truc | 175 | 0.0622 | 0.7536 | 0.2376 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0056 |
| | 250 | 0.0730 | 0.3435 | 0.2521 | 0.0019 | 0.0085 | 0.0078 | 167 | 0.0066 |
| | 500 | 0.1183 | 0.5319 | 0.3878 | 0.0027 | 0.0135 | 0.0124 | 272 | 0.0107 |
| | 750 | 0.1921 | 0.8627 | 0.6384 | 0.0044 | 0.0221 | 0.0203 | 442 | 0.0173 |
| | 1000 | 0.2823 | 1.2403 | 3.1782 | 0.0063 | 0.0546 | 0.0502 | 625 | 0.0255 |
| Off-Highway Trucks Composit | | 0.1140 | 0.5385 | 0.4769 | 0.0027 | 0.0142 | 0.0131 | 260 | 0.0103 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0244 | 0.2188 | 0.1693 | 0.0004 | 0.0034 | 0.0031 | 28.0 | 0.0022 |
| | 120 | 0.0379 | 0.5045 | 0.2730 | 0.0009 | 0.0087 | 0.0080 | 80.9 | 0.0034 |
| | 175 | 0.0384 | 0.5858 | 0.1729 | 0.0012 | 0.0075 | 0.0069 | 107 | 0.0035 |
| | 500 | 0.0792 | 0.4606 | 0.3034 | 0.0025 | 0.0099 | 0.0091 | 254 | 0.0071 |
| Other Construction Equipment | | 0.0442 | 0.3474 | 0.2021 | 0.0013 | 0.0069 | 0.0063 | 123 | 0.0040 |
| Other General Inc | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0298 | 0.2099 | 0.1491 | 0.0003 | 0.0047 | 0.0043 | 21.7 | 0.0027 |
| | 120 | 0.0436 | 0.4189 | 0.2603 | 0.0007 | 0.0120 | 0.0111 | 62.0 | 0.0039 |
| | 175 | 0.0519 | 0.5684 | 0.2412 | 0.0011 | 0.0115 | 0.0106 | 95.9 | 0.0047 |
| | 250 | 0.0608 | 0.2743 | 0.2679 | 0.0015 | 0.0083 | 0.0076 | 136 | 0.0055 |
| | 500 | 0.1174 | 0.5103 | 0.4826 | 0.0026 | 0.0157 | 0.0145 | 265 | 0.0106 |
| | 750 | 0.1939 | 0.8411 | 0.8117 | 0.0044 | 0.0262 | 0.0241 | 437 | 0.0175 |
| | 1000 | 0.2627 | 1.1060 | 2.9924 | 0.0056 | 0.0579 | 0.0533 | 560 | 0.0237 |
| Other General Industrial Equip | | 0.0747 | 0.4438 | 0.3947 | 0.0016 | 0.0130 | 0.0120 | 152 | 0.0067 |
| Other Material Ha | 50 | 0.0410 | 0.2893 | 0.2073 | 0.0004 | 0.0065 | 0.0060 | 30.3 | 0.0037 |
| | 120 | 0.0421 | 0.4076 | 0.2541 | 0.0007 | 0.0117 | 0.0108 | 60.7 | 0.0038 |
| | 175 | 0.0653 | 0.7197 | 0.3067 | 0.0014 | 0.0146 | 0.0134 | 122 | 0.0059 |

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|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0642 | 0.2920 | 0.2863 | 0.0016 | 0.0088 | 0.0081 | 145 | 0.0058 |
| | 500 | 0.0837 | 0.3670 | 0.3482 | 0.0019 | 0.0113 | 0.0104 | 192 | 0.0075 |
| | 9999 | 0.3781 | 1.4596 | 3.9555 | 0.0073 | 0.0764 | 0.0703 | 741 | 0.0341 |
| Other Material Handling Equip | | 0.0696 | 0.4355 | 0.3844 | 0.0015 | 0.0124 | 0.0114 | 141 | 0.0063 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1422 | 0.0002 | 0.0053 | 0.0049 | 18.7 | 0.0020 |
| | 50 | 0.0574 | 0.2803 | 0.2102 | 0.0004 | 0.0114 | 0.0105 | 28.0 | 0.0052 |
| | 120 | 0.0662 | 0.4696 | 0.4003 | 0.0008 | 0.0263 | 0.0242 | 69.2 | 0.0060 |
| | 175 | 0.0899 | 0.7543 | 0.5238 | 0.0014 | 0.0286 | 0.0263 | 128 | 0.0081 |
| | 250 | 0.1097 | 0.4287 | 0.7020 | 0.0022 | 0.0254 | 0.0234 | 194 | 0.0099 |
| | 500 | 0.1263 | 0.5374 | 0.7572 | 0.0023 | 0.0284 | 0.0261 | 233 | 0.0114 |
| Pavers Composite | | 0.0717 | 0.4745 | 0.3858 | 0.0009 | 0.0220 | 0.0202 | 77.9 | 0.0065 |
| Paving Equipmer | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0469 | 0.2355 | 0.1789 | 0.0003 | 0.0095 | 0.0088 | 23.9 | 0.0042 |
| | 120 | 0.0503 | 0.3671 | 0.3092 | 0.0006 | 0.0200 | 0.0184 | 54.5 | 0.0045 |
| | 175 | 0.0687 | 0.5900 | 0.4021 | 0.0011 | 0.0219 | 0.0201 | 101 | 0.0062 |
| | 250 | 0.0672 | 0.2648 | 0.4289 | 0.0014 | 0.0154 | 0.0141 | 122 | 0.0061 |
| Paving Equipment Composite | | 0.0548 | 0.3993 | 0.3281 | 0.0008 | 0.0190 | 0.0175 | 68.9 | 0.0049 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0052 | 0.0301 | 0.0368 | 0.0001 | 0.0015 | 0.0014 | 4.9 | 0.0005 |
| | 25 | 0.0087 | 0.0299 | 0.0555 | 0.0001 | 0.0022 | 0.0020 | 7.1 | 0.0008 |
| | 50 | 0.0079 | 0.0810 | 0.0843 | 0.0002 | 0.0019 | 0.0018 | 14.3 | 0.0007 |
| | 120 | 0.0082 | 0.1351 | 0.0897 | 0.0003 | 0.0031 | 0.0029 | 24.1 | 0.0007 |
| Pressure Washers Composite | | 0.0066 | 0.0531 | 0.0561 | 0.0001 | 0.0019 | 0.0017 | 9.4 | 0.0006 |
| Pumps | 15 | 0.0089 | 0.0456 | 0.0560 | 0.0001 | 0.0024 | 0.0022 | 7.4 | 0.0008 |
| | 25 | 0.0244 | 0.0816 | 0.1512 | 0.0002 | 0.0061 | 0.0056 | 19.5 | 0.0022 |
| | 50 | 0.0299 | 0.2394 | 0.2138 | 0.0004 | 0.0061 | 0.0056 | 34.3 | 0.0027 |
| | 120 | 0.0365 | 0.4656 | 0.3062 | 0.0009 | 0.0129 | 0.0119 | 77.9 | 0.0033 |
| | 175 | 0.0499 | 0.7342 | 0.3301 | 0.0016 | 0.0142 | 0.0130 | 140 | 0.0045 |
| | 250 | 0.0572 | 0.3604 | 0.3745 | 0.0023 | 0.0107 | 0.0098 | 201 | 0.0052 |
| | 500 | 0.0959 | 0.6034 | 0.5922 | 0.0034 | 0.0178 | 0.0163 | 345 | 0.0087 |
| | 750 | 0.1593 | 0.9975 | 0.9991 | 0.0057 | 0.0297 | 0.0274 | 571 | 0.0144 |
| | 9999 | 0.4488 | 2.4388 | 6.8114 | 0.0136 | 0.1186 | 0.1091 | 1,355 | 0.0405 |
| Pumps Composite | | 0.0270 | 0.2617 | 0.2079 | 0.0006 | 0.0078 | 0.0072 | 49.6 | 0.0024 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0345 | 0.2258 | 0.1776 | 0.0003 | 0.0068 | 0.0062 | 26.0 | 0.0031 |
| | 120 | 0.0392 | 0.3801 | 0.2647 | 0.0007 | 0.0137 | 0.0126 | 59.0 | 0.0035 |
| | 175 | 0.0553 | 0.6096 | 0.3030 | 0.0012 | 0.0156 | 0.0143 | 108 | 0.0050 |
| | 250 | 0.0656 | 0.3037 | 0.3629 | 0.0017 | 0.0127 | 0.0116 | 153 | 0.0059 |
| | 500 | 0.0920 | 0.4189 | 0.4752 | 0.0022 | 0.0174 | 0.0160 | 219 | 0.0083 |
| Rollers Composite | | 0.0410 | 0.3763 | 0.2501 | 0.0008 | 0.0122 | 0.0113 | 67.0 | 0.0037 |
| Rough Terrain Fo | 50 | 0.0381 | 0.3041 | 0.2193 | 0.0004 | 0.0054 | 0.0049 | 33.9 | 0.0034 |
| | 120 | 0.0369 | 0.4106 | 0.2316 | 0.0007 | 0.0087 | 0.0080 | 62.4 | 0.0033 |
| | 175 | 0.0569 | 0.7229 | 0.2450 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0051 |
| | 250 | 0.0671 | 0.3372 | 0.2625 | 0.0019 | 0.0084 | 0.0077 | 171 | 0.0061 |
| | 500 | 0.0999 | 0.4838 | 0.3682 | 0.0025 | 0.0123 | 0.0113 | 257 | 0.0090 |
| Rough Terrain Forklifts Compo | | 0.0396 | 0.4430 | 0.2336 | 0.0008 | 0.0090 | 0.0083 | 70.3 | 0.0036 |
| Rubber Tired Doz | 175 | 0.1163 | 0.8019 | 0.6895 | 0.0015 | 0.0386 | 0.0355 | 129 | 0.0105 |
| | 250 | 0.1329 | 0.4624 | 0.8841 | 0.0021 | 0.0340 | 0.0312 | 183 | 0.0120 |
| | 500 | 0.1817 | 0.7490 | 1.1543 | 0.0026 | 0.0448 | 0.0412 | 265 | 0.0164 |
| | 750 | 0.2747 | 1.1262 | 1.7818 | 0.0040 | 0.0684 | 0.0629 | 399 | 0.0248 |
| | 1000 | 0.4321 | 1.7954 | 4.5523 | 0.0060 | 0.1202 | 0.1106 | 592 | 0.0390 |
| Rubber Tired Dozers Compos | | 0.1672 | 0.6620 | 1.0824 | 0.0025 | 0.0419 | 0.0385 | 239 | 0.0151 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0418 | 0.2904 | 0.2109 | 0.0004 | 0.0069 | 0.0063 | 31.1 | 0.0038 |
| | 120 | 0.0397 | 0.3916 | 0.2476 | 0.0007 | 0.0115 | 0.0105 | 58.9 | 0.0036 |
| | 175 | 0.0546 | 0.6199 | 0.2592 | 0.0012 | 0.0130 | 0.0119 | 106 | 0.0049 |
| | 250 | 0.0661 | 0.3041 | 0.3040 | 0.0017 | 0.0107 | 0.0099 | 149 | 0.0060 |
| | 500 | 0.1034 | 0.4654 | 0.4455 | 0.0023 | 0.0164 | 0.0151 | 237 | 0.0093 |
| | 750 | 0.2119 | 0.9532 | 0.9273 | 0.0049 | 0.0338 | 0.0311 | 486 | 0.0191 |
| | 1000 | 0.2701 | 1.1927 | 3.2272 | 0.0060 | 0.0615 | 0.0566 | 594 | 0.0244 |
| Rubber Tired Loaders Compos | | 0.0559 | 0.4311 | 0.2835 | 0.0012 | 0.0121 | 0.0111 | 109 | 0.0050 |
| Scrapers | 120 | 0.0887 | 0.6472 | 0.5218 | 0.0011 | 0.0330 | 0.0303 | 93.9 | 0.0080 |

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|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1025 | 0.8864 | 0.5654 | 0.0017 | 0.0307 | 0.0282 | 148 | 0.0092 |
| | 250 | 0.1187 | 0.4642 | 0.7040 | 0.0024 | 0.0254 | 0.0234 | 209 | 0.0107 |
| | 500 | 0.1755 | 0.7332 | 0.9727 | 0.0032 | 0.0364 | 0.0335 | 321 | 0.0158 |
| | 750 | 0.3043 | 1.2657 | 1.7266 | 0.0056 | 0.0638 | 0.0587 | 555 | 0.0275 |
| Scrapers Composite | | 0.1495 | 0.7187 | 0.8387 | 0.0027 | 0.0335 | 0.0308 | 262 | 0.0135 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0332 | 0.2686 | 0.2268 | 0.0005 | 0.0063 | 0.0058 | 36.2 | 0.0030 |
| | 120 | 0.0394 | 0.4898 | 0.3076 | 0.0009 | 0.0127 | 0.0116 | 80.2 | 0.0036 |
| | 175 | 0.0587 | 0.8292 | 0.3433 | 0.0017 | 0.0152 | 0.0139 | 155 | 0.0053 |
| | 250 | 0.0794 | 0.4676 | 0.4435 | 0.0029 | 0.0132 | 0.0121 | 255 | 0.0072 |
| Signal Boards Composite | | 0.0111 | 0.0909 | 0.0718 | 0.0002 | 0.0029 | 0.0026 | 16.7 | 0.0010 |
| Skid Steer Loade | 25 | 0.0167 | 0.0568 | 0.1055 | 0.0002 | 0.0040 | 0.0037 | 13.8 | 0.0015 |
| | 50 | 0.0194 | 0.1977 | 0.1446 | 0.0003 | 0.0015 | 0.0014 | 25.5 | 0.0017 |
| | 120 | 0.0175 | 0.2665 | 0.1240 | 0.0005 | 0.0022 | 0.0020 | 42.8 | 0.0016 |
| Skid Steer Loaders Composite | | 0.0186 | 0.2104 | 0.1354 | 0.0004 | 0.0019 | 0.0018 | 30.3 | 0.0017 |
| Surfacing Equipm | 50 | 0.0171 | 0.1105 | 0.0934 | 0.0002 | 0.0035 | 0.0033 | 14.1 | 0.0015 |
| | 120 | 0.0385 | 0.3950 | 0.2869 | 0.0007 | 0.0146 | 0.0134 | 63.8 | 0.0035 |
| | 175 | 0.0386 | 0.4642 | 0.2429 | 0.0010 | 0.0119 | 0.0109 | 85.8 | 0.0035 |
| | 250 | 0.0504 | 0.2604 | 0.3275 | 0.0015 | 0.0111 | 0.0103 | 135 | 0.0045 |
| | 500 | 0.0800 | 0.4236 | 0.4893 | 0.0022 | 0.0174 | 0.0160 | 221 | 0.0072 |
| | 750 | 0.1260 | 0.6643 | 0.7833 | 0.0035 | 0.0275 | 0.0253 | 347 | 0.0114 |
| Surfacing Equipment Compos | | 0.0638 | 0.3590 | 0.3924 | 0.0017 | 0.0142 | 0.0131 | 166 | 0.0058 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0308 | 0.2762 | 0.1942 | 0.0004 | 0.0033 | 0.0031 | 31.6 | 0.0028 |
| | 120 | 0.0395 | 0.4895 | 0.2530 | 0.0009 | 0.0068 | 0.0062 | 75.0 | 0.0036 |
| | 175 | 0.0565 | 0.8005 | 0.2201 | 0.0016 | 0.0084 | 0.0077 | 139 | 0.0051 |
| | 250 | 0.0587 | 0.3179 | 0.1898 | 0.0018 | 0.0062 | 0.0057 | 162 | 0.0053 |
| Sweepers/Scrubbers Composi | | 0.0410 | 0.4840 | 0.2255 | 0.0009 | 0.0061 | 0.0056 | 78.5 | 0.0037 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0045 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0316 | 0.2678 | 0.1895 | 0.0004 | 0.0037 | 0.0034 | 30.3 | 0.0029 |
| | 120 | 0.0281 | 0.3379 | 0.1761 | 0.0006 | 0.0055 | 0.0051 | 51.7 | 0.0025 |
| | 175 | 0.0420 | 0.5839 | 0.1613 | 0.0011 | 0.0072 | 0.0066 | 101 | 0.0038 |
| | 250 | 0.0633 | 0.3389 | 0.2157 | 0.0019 | 0.0073 | 0.0067 | 172 | 0.0057 |
| | 500 | 0.1263 | 0.6506 | 0.4127 | 0.0039 | 0.0144 | 0.0132 | 345 | 0.0114 |
| | 750 | 0.1896 | 0.9760 | 0.6256 | 0.0058 | 0.0216 | 0.0199 | 517 | 0.0171 |
| Tractors/Loaders/Backhoes C | | 0.0336 | 0.3586 | 0.1857 | 0.0008 | 0.0059 | 0.0054 | 66.8 | 0.0030 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0687 | 0.3197 | 0.2467 | 0.0004 | 0.0140 | 0.0129 | 32.9 | 0.0062 |
| | 120 | 0.0625 | 0.4341 | 0.3863 | 0.0008 | 0.0259 | 0.0239 | 64.9 | 0.0056 |
| | 175 | 0.1009 | 0.8327 | 0.6152 | 0.0016 | 0.0338 | 0.0311 | 144 | 0.0091 |
| | 250 | 0.1247 | 0.4925 | 0.8480 | 0.0025 | 0.0309 | 0.0285 | 223 | 0.0112 |
| | 500 | 0.1661 | 0.7370 | 1.0663 | 0.0031 | 0.0400 | 0.0368 | 311 | 0.0150 |
| | 750 | 0.3147 | 1.3882 | 2.0666 | 0.0059 | 0.0766 | 0.0705 | 587 | 0.0284 |
| Trenchers Composite | | 0.0674 | 0.4085 | 0.3481 | 0.0007 | 0.0215 | 0.0198 | 58.7 | 0.0061 |
| Welders | 15 | 0.0075 | 0.0381 | 0.0468 | 0.0001 | 0.0020 | 0.0018 | 6.2 | 0.0007 |
| | 25 | 0.0141 | 0.0473 | 0.0876 | 0.0001 | 0.0035 | 0.0033 | 11.3 | 0.0013 |
| | 50 | 0.0280 | 0.2077 | 0.1684 | 0.0003 | 0.0053 | 0.0048 | 26.0 | 0.0025 |
| | 120 | 0.0223 | 0.2476 | 0.1601 | 0.0005 | 0.0073 | 0.0067 | 39.5 | 0.0020 |
| | 175 | 0.0430 | 0.5400 | 0.2396 | 0.0011 | 0.0111 | 0.0103 | 98.2 | 0.0039 |
| | 250 | 0.0423 | 0.2236 | 0.2294 | 0.0013 | 0.0069 | 0.0064 | 119 | 0.0038 |
| | 500 | 0.0585 | 0.3040 | 0.2969 | 0.0016 | 0.0095 | 0.0087 | 168 | 0.0053 |
| Welders Composite | | 0.0214 | 0.1745 | 0.1373 | 0.0003 | 0.0052 | 0.0048 | 25.6 | 0.0019 |

## Fugitive Dust Emission Calculation Methodology

### Fugitive Dust Source Emissions - Material Handling

**Truck Loading/Unloading (Removed debris/concrete materials)**

| | | | |
|---|---|---|---|
| *Emission Factor [lb/ton] = k(0.0032) x (mean wind speed [mi/hr] / 5)* $^{1.3}$ / (moisture [%] / 2)$^{1.4}$ | | | *Reference: AP-42, Equation (1), Section 13.2.4, November 2006* |
| *k = Aerodynamic Particle Size Multiplier, $PM_{10}$* | 0.35 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *k = Aerodynamic Particle Size Multiplier, $PM_{2.5}$* | 0.053 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *Mean Wind Speed* | 15 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *Moisture* | 4.8 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *PM10 Emission Factor* | 0.0014 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |
| *PM2.5 Emission Factor* | 0.0002 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |

**Demolition (Sq. Ft)**

| | | |
|---|---|---|
| PM10, uncontrolled | 0.00042 lbs/cubic ft[1] | http://www.urbemis.com/software/URBEMIS9%20Users%20Manual%20Appendices.pdf |
| PM2.5, uncontrolled | 0.00009 lbs/cubic ft[2] | PM2.5 fraction of PM10 = 0.208; SCAQMD Appendix A - Updated CEIDARS List with PM2.5 Fractions (www.aqmd.gov/ceqa/handbook/PM2_5/PM2_5.html |

**Bulldozing**

*Emission Factor [lb/hr] = [1.0 x (silt content [%])* $^{1.5}$ / (moisture)$^{1.4}$]*Scaling Factor

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Silt Content* | 6.9 | | AP-42 Chapter 11, Table 11.9-3 for overburden |
| *Moisture* | 16.8 | | AP-42 Chapter 11, Table 11.9-3 for overburden, upper end or range |
| *$PM_{10}$ Scaling Factor* | 0.75 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *$PM_{2.5}$ Scaling Factor* | 0.105 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *PM10 Emission Factor* | 0.26 | lb/hr | |
| *PM2.5 Emission Factor* | 0.04 | lb/hr | |

**Grading and Scraping[d]**

*Emission Factor [lb/VMT] = [0.051 (S)^2.0*Scaling Factor*

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Mean Vehicle Speed (S)[a] - Miles Per Hour (MPH)* | 2 | | Assumption based on project footprint |
| *$PM_{10}$ Scaling Factor* | 0.6 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *$PM_{2.5}$ Scaling Factor* | 0.031 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *PM10 Emission Factor (Uncontrolled)* | 0.12 | lb/VMT | |
| *PM2.5 Emission Factor (Uncontrolled)* | 0.00632 | lb/VMT | |

**Stock Pile Wind Erosion**

Emission Factor [lb/day-acre] = 0.85 x (silt content [%] / 1.5) x (365 / 235) x (percentage of time unobstructed wind exceeds 12 mph / 15)
Reference: SCAQMD CEQA Air Quality Handbook (1993), Table 9-9-E

| Parameter | Value | Basis |
|---|---|---|
| Silt Content | 7.5 | SCAQMD CEQA Handbook, (1993) Table A9-9-E-1 for overburden |
| Pct. time wind > 12 mph | 17.84 | Used 17.84% from AERMET Surface File used for dispersion modeling |

| | |
|---|---|
| PM10 Emission Factor (Uncontrolled) | 7.9 lb/day-acre |
| Reduction from Watering Twice/Day | 50% |
| Controlled PM10 Emission Factor | 3.9 lb/day-acre |
| Controlled PM2.5 Emission Factor[a] | 0.8 lb/day-acre |

[a] PM2.5 emission factor [lb/hr] = PM10 emission factor [lb/hr] x PM2.5 fraction of PM10

PM2.5 Fraction of PM10 in Construction Dust = 0.208 — from Appendix A, Final–Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds, SCAQMD, October 2006

Emissions [pounds per day] = Controlled emission factor [pounds per acre-day] x Stock pile surface area [acres]

# Attachment I5  Alternative SB-1A Emissions

SB-1A - Low Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 6.29 | 45.72 | 34.52 | | 2.31 | 2.13 | 5,463 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15,326.46 | 0.82 | 7.74 | 3.28 | 0.01 | 1.02 | 0.59 | 971 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.00 | 0.03 | 0.06 | 0.00 | 0.00 | 0.00 | 20 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 | 0.83 | 7.77 | 3.34 | 0.01 | 1.02 | 0.60 | 6,454 |
| Amortized Construction | | | | | | | | | | | | | | 496 |

SB-1A - High Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 10.51 | 76.34 | 57.64 | | 3.86 | 3.55 | 9,121 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15326.46 | 1.29 | 12.15 | 5.14 | 0.02 | 1.59 | 0.93 | 1,523 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.01 | 0.04 | 0.10 | 0.00 | 0.01 | 0.00 | 30 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 | 1.30 | 12.19 | 5.24 | 0.02 | 1.60 | 0.93 | 10,674 |
| Amortized Construction | | | | | | | | | | | | | | 821 |

SB-1A - Low Sea Level

| | Daily Emissions (pounds/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **ROG** | **NOX** | **CO** | **SOX** | **PM10** | **PM2.5** | **CO2** |
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 4.90 | 30.72 | 22.16 | 0.08 | 7.49 | 1.99 | 7,219.38 |
| On-Road Motor Vehicles | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |
| *Total On-Shore Emissions* | 4.99 | 31.65 | 22.93 | 0.09 | 7.56 | 2.06 | 7,996.95 |

SB-1A - High Sea Level

| | Daily Emissions (pounds/day) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **ROG** | **NOX** | **CO** | **SOX** | **PM10** | **PM2.5** | **CO2** |
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 4.90 | 30.72 | 22.16 | 0.08 | 7.49 | 1.99 | 7,219.38 |
| On-Road Motor Vehicles | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |
| *Total On-Shore Emissions* | 4.99 | 31.65 | 22.93 | 0.09 | 7.56 | 2.06 | 7,996.95 |

## Alternative SB-1A - Construction - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| *Off-road Mobile Sources* | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| *Fugitive Dust* | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-1A - Construction - Low Sea Level

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Emissions Summary | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | | | 15,326.46 | 1.07 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | 6.28 | 0.88 | 15,326.46 | 1.07 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **11.84** | **111.42** | **47.17** | **0.15** | | | **10.45** | **4.71** | **15,326.46** | **1.07** | **lbs/day** |

| Project Length | Work Days |
|---|---|
| | 139 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Constructi on Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 820,000 | 82 | 103 | 1,180,000 | 118 | 139 | ######## | 200 | 242 |
| HSL | 880,000 | 88 | 109 | 1,970,000 | 197 | 218 | ######## | 285 | 327 |

# Alternative SB-1A - Construction - Low Sea Level

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.28 | 3.36 | 1.16 | 0.01 | 0.10 | 0.09 | - | - | 524 | 0.0231 | tons |
| Loader | 1 | 12 | | 0.09 | 0.65 | 0.38 | 0.00 | 0.03 | 0.03 | - | - | 82 | 0.0072 | tons |
| Dozer | 2 | 12 | | 0.45 | 3.73 | 1.74 | 0.00 | 0.15 | 0.14 | - | - | 363 | 0.0373 | tons |
| | | | | 0.82 | 7.74 | 3.28 | 0.01 | 0.29 | 0.27 | | | 969.32 | 0.07 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.82 | 7.74 | 3.28 | 0.01 | 0.29 | 0.27 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.82** | **7.74** | **3.28** | **0.01** | **1.02** | **0.59** | **0.73** | **0.33** | **969** | **0.068** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **971** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative SB-1A - Construction - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 118.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 6.29 | 45.72 | 34.52 | 2.31 | 2.13 | 5,463 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1A - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 139 | 55,600 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 28 | 40 | 560 | 141 | 55,920 | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-1A - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 139 | 55,600 | 0.00 | 0.026 | 0.06 | 0.00 | 0.00 | 0.00 | 21 | 19 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 28 | 40 | 560 | 141 | 55,920 | 0.00 | 0.03 | 0.06 | 0.00 | 0.00 | 0.00 | 21.45 | 19.52 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative SB-1A - Operations - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-1A - Operations - Low S

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 2 | 12 | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| | | | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | | | 7,219.38 | 0.44 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | 6.28 | 0.88 | 7,219.38 | 0.44 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **4.90** | **30.72** | **22.16** | **0.08** | | | **7.49** | **1.99** | **7,219.38** | **0.44** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 71 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 340,000 | 34 | 55 | 500,000 | 50 | 71 | 840,000 | 84 | 126 |
| HSL | 400,000 | 40 | 61 | 960,000 | 96 | 117 | ######## | 136 | 178 |

## Alternative SB-1A - Operations - Low S

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.05 | 0.04 | 0.00 | 0.00 | 0.00 | - | - | 6 | 0.0006 | tons |
| Loader | 1 | 12 | | 0.02 | 0.12 | 0.18 | 0.00 | 0.01 | 0.00 | - | - | 42 | 0.0020 | tons |
| Dozer | 2 | 12 | | 0.14 | 0.92 | 0.56 | 0.00 | 0.04 | 0.03 | - | - | 185 | 0.0117 | tons |
| | | | | 0.17 | 1.09 | 0.79 | 0.00 | 0.04 | 0.04 | | | 233.22 | 0.01 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.17 | 1.09 | 0.79 | 0.00 | 0.04 | 0.04 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.17** | **1.09** | **0.79** | **0.00** | | | **0.27** | **0.07** | **233** | **0.014** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **234** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

# Alternative SB-1A - Operations - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |

Operating Days Per Year 50.0

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.70 | 5.10 | 14.63 | 0.12 | 0.11 | 2,544 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1A - Operations - Low Sea Level Rise

**On-Road Construction Emissions**

| | | | | | | Total Daily Emissions (lbs) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
| Worker Trips | 20 | 20 | 400 | 71 | 28,400 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 |
| Total | 28 | 40 | 560 | 73 | 28,720 | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

# Alternative SB-1A - Operations - Low Sea Level Rise

## On-Road Construction Emissions

| | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Total Trips** | **Distance** | **Average Daily Mileage** | **Project Length (days)** | **Total Mileage** | **ROG** | **$NO_x$** | **CO** | **SOx** | **PM10** | **PM25** | **$CO_2$** | **Total GHG Emissions (Metric Tons)** |
| Worker Trips | 20 | 20 | 400 | 71 | 28,400 | 0.00 | 0.007 | 0.01 | 0.00 | 0.00 | 0.00 | 8 | 8 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 28 | 40 | 560 | 73 | 28,720 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 8.88 | 8.08 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

## Alternative SB-1A - Construction - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-1A - Construction - High Sea Leve

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Emissions Summary** | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | | | 15,326.46 | 1.07 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | 6.28 | 0.88 | 15,326.46 | 1.07 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **11.84** | **111.42** | **47.17** | **0.15** | | | **10.45** | **4.71** | **15,326.46** | **1.07** | **lbs/day** |

| **Project Length** | **Work Days** |
|---|---|
| | 218 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Constructi on Days |
| LSL | 820,000 | 82 | 103 | 1,180,000 | 118 | 139 | ######## | 200 | 242 |
| HSL | 880,000 | 88 | 109 | 1,970,000 | 197 | 218 | ######## | 285 | 327 |

## Alternative SB-1A - Construction - High Sea Leve

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.44 | 5.27 | 1.81 | 0.01 | 0.16 | 0.15 | - | - | 822 | 0.0362 | tons |
| Loader | 1 | 12 | | 0.14 | 1.03 | 0.60 | 0.00 | 0.05 | 0.05 | - | - | 129 | 0.0113 | tons |
| Dozer | 2 | 12 | | 0.71 | 5.85 | 2.73 | 0.01 | 0.24 | 0.22 | - | - | 569 | 0.0585 | tons |
| | | | | 1.29 | 12.15 | 5.14 | 0.02 | 0.45 | 0.42 | | | 1,520.23 | 0.11 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 1.29 | 12.15 | 5.14 | 0.02 | 0.45 | 0.42 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **1.29** | **12.15** | **5.14** | **0.02** | **1.59** | **0.93** | **1.14** | **0.51** | **1,520** | **0.106** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **1,523** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative SB-1A - Construction - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 197.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 10.51 | 76.34 | 57.64 | 3.86 | 3.55 | 9,121 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1A - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 218 | 87,200 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 28 | 40 | 560 | 220 | 87,520 | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-1A - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 218 | 87,200 | 0.00 | 0.041 | 0.10 | 0.00 | 0.01 | 0.00 | 33 | 30 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 28 | 40 | 560 | 220 | 87,520 | 0.01 | 0.04 | 0.10 | 0.00 | 0.01 | 0.00 | 33.30 | 30.30 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative SB-1A - Operations - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-1A - Operations - High

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 2 | 12 | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| | | | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | | | 7,219.38 | 0.44 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | 6.28 | 0.88 | 7,219.38 | 0.44 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **4.90** | **30.72** | **22.16** | **0.08** | | | **7.49** | **1.99** | **7,219.38** | **0.44** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 117 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 340,000 | 34 | 55 | 500,000 | 50 | 71 | 840,000 | 84 | 126 |
| HSL | 400,000 | 40 | 61 | 960,000 | 96 | 117 | ######## | 136 | 178 |

## Alternative SB-1A - Operations - High

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.08 | 0.06 | 0.00 | 0.00 | 0.00 | - | - | 9 | 0.0010 | tons |
| Loader | 1 | 12 | | 0.04 | 0.20 | 0.30 | 0.00 | 0.01 | 0.01 | - | - | 69 | 0.0032 | tons |
| Dozer | 2 | 12 | | 0.23 | 1.52 | 0.93 | 0.00 | 0.06 | 0.05 | - | - | 305 | 0.0193 | tons |
| | | | | 0.29 | 1.80 | 1.30 | 0.00 | 0.07 | 0.07 | | | 384.32 | 0.02 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.29 | 1.80 | 1.30 | 0.00 | 0.07 | 0.07 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.29** | **1.80** | **1.30** | **0.00** | | | **0.44** | **0.12** | **384** | **0.024** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **385** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

# Alternative SB-1A - Operations - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Operating Days Per Year | 96.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 1.34 | 9.79 | 28.09 | 0.23 | 0.21 | 4,884 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1A - Operations - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 117 | 46,800 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 |
| Total | 28 | 40 | 560 | 119 | 47,120 | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-1A - Operations - High Sea Level Rise

**On-Road Construction Emissions**

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 117 | 46,800 | 0.00 | 0.012 | 0.02 | 0.00 | 0.00 | 0.00 | 14 | 13 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 28 | 40 | 560 | 119 | 47,120 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 14.28 | 13.00 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

**San Diego 2015 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,169,183 | 42,600,783.75 | 7,361,743.79 | 0.045 | 1.290 | 0.136 | 302.103 | 0.047 | 0.019 | 0.004 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,466 | 179,216.55 | 31,712.66 | 0.038 | 0.215 | 0.576 | 315.879 | 0.072 | 0.043 | 0.004 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 172,849 | 6,187,162.79 | 1,061,257.19 | 0.075 | 2.505 | 0.269 | 357.183 | 0.048 | 0.021 | 0.004 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 210 | 6,179.81 | 1,102.01 | 0.066 | 0.312 | 0.691 | 314.863 | 0.099 | 0.068 | 0.004 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 423,444 | 16,224,268.59 | 2,675,454.93 | 0.037 | 1.498 | 0.192 | 432.459 | 0.047 | 0.019 | 0.005 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 187 | 5,978.69 | 1,021.81 | 0.046 | 0.252 | 0.690 | 323.109 | 0.080 | 0.050 | 0.004 | | |
| Average | | | | | | | 0.051 | 1.012 | 0.426 | 340.933 | 0.066 | 0.037 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 2,454 | 392,614.49 | 0 | 0.296 | 1.343 | 8.984 | 1699.527 | 0.231 | 0.158 | 0.017 | | |

Source: EMFAC 2011

**San Diego 2020 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED | POP | VMT | TRIPS | ROG_RUNEX | CO_RUNEX | NOX_RUNEX | CO2_RUNEX | PM10_Total | PM2_5_Total | SOX_RUNEX | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (Miles/hr) | (Vehicles) | (Miles/day) | (Trips/day) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) |
| LDA | GAS | AllMYr | AllSpeeds | 1,261,438 | 46,436,329 | 7,971,039 | 0.03 | 0.10 | 0.83 | 244.16 | 0.05 | 0.02 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,897 | 203,726 | 36,279 | 0.02 | 0.39 | 0.13 | 265.72 | 0.06 | 0.03 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 186,176 | 6,674,684 | 1,134,440 | 0.04 | 0.17 | 1.56 | 297.84 | 0.05 | 0.02 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 226 | 8,187 | 1,308 | 0.03 | 0.45 | 0.17 | 259.42 | 0.07 | 0.04 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 450,141 | 17,355,693 | 2,832,803 | 0.02 | 0.11 | 0.93 | 364.76 | 0.05 | 0.02 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 199 | 7,528 | 1,228 | 0.02 | 0.47 | 0.14 | 280.32 | 0.06 | 0.03 | 0.00 | | |
| Average | | | | | | | 0.026 | 0.283 | 0.626 | 285.370 | 0.055 | 0.027 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED | POP | VMT | TRIPS | ROG_RUNEX | CO_RUNEX | NOX_RUNEX | CO2_RUNEX | PM10_Total | PM2_5_Total | SOX_RUNEX | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (Miles/hr) | (Vehicles) | (Miles/day) | (Trips/day) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) |
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,262 | 531,839 | - | 0.22 | 1.02 | 4.20 | 1553.04 | 0.18 | 0.11 | 0.02 | | |

Source: EMFAC 2011

## 2015 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0155 | 0.0486 | 0.0902 | 0.0001 | 0.0046 | 0.0042 | 11.0 | 0.0014 |
| | 50 | 0.0480 | 0.1641 | 0.1699 | 0.0003 | 0.0129 | 0.0119 | 19.6 | 0.0043 |
| | 120 | 0.0460 | 0.2377 | 0.3272 | 0.0004 | 0.0246 | 0.0226 | 38.1 | 0.0042 |
| | 500 | 0.1026 | 0.4261 | 1.2422 | 0.0021 | 0.0368 | 0.0339 | 213 | 0.0093 |
| | 750 | 0.1912 | 0.7702 | 2.3263 | 0.0039 | 0.0680 | 0.0626 | 385 | 0.0173 |
| Aerial Lifts Composite | | 0.0439 | 0.1837 | 0.2670 | 0.0004 | 0.0167 | 0.0154 | 34.7 | 0.0040 |
| Air Compressors | 15 | 0.0108 | 0.0466 | 0.0664 | 0.0001 | 0.0040 | 0.0037 | 7.2 | 0.0010 |
| | 25 | 0.0229 | 0.0681 | 0.1247 | 0.0002 | 0.0069 | 0.0064 | 14.4 | 0.0021 |
| | 50 | 0.0747 | 0.2360 | 0.2056 | 0.0003 | 0.0183 | 0.0168 | 22.3 | 0.0067 |
| | 120 | 0.0691 | 0.3182 | 0.4334 | 0.0006 | 0.0375 | 0.0345 | 47.0 | 0.0062 |
| | 175 | 0.0903 | 0.5019 | 0.7101 | 0.0010 | 0.0388 | 0.0357 | 88.5 | 0.0082 |
| | 250 | 0.0892 | 0.2803 | 0.9294 | 0.0015 | 0.0286 | 0.0263 | 131 | 0.0080 |
| | 500 | 0.1463 | 0.4915 | 1.4297 | 0.0023 | 0.0470 | 0.0432 | 232 | 0.0132 |
| | 750 | 0.2285 | 0.7595 | 2.2932 | 0.0036 | 0.0743 | 0.0683 | 358 | 0.0206 |
| | 1000 | 0.3551 | 1.1843 | 4.4558 | 0.0049 | 0.1239 | 0.1140 | 486 | 0.0320 |
| Air Compressors Composite | | 0.0773 | 0.3257 | 0.5175 | 0.0007 | 0.0357 | 0.0329 | 63.6 | 0.0070 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1220 | 0.0002 | 0.0047 | 0.0043 | 16.0 | 0.0017 |
| | 50 | 0.0234 | 0.2235 | 0.2240 | 0.0004 | 0.0075 | 0.0069 | 31.0 | 0.0021 |
| | 120 | 0.0376 | 0.4676 | 0.3736 | 0.0009 | 0.0160 | 0.0148 | 77.1 | 0.0034 |
| | 175 | 0.0618 | 0.7540 | 0.5364 | 0.0016 | 0.0198 | 0.0182 | 141 | 0.0056 |
| | 250 | 0.0681 | 0.3425 | 0.4900 | 0.0021 | 0.0144 | 0.0132 | 188 | 0.0061 |
| | 500 | 0.1118 | 0.5511 | 0.7692 | 0.0031 | 0.0236 | 0.0217 | 311 | 0.0101 |
| | 750 | 0.2212 | 1.0888 | 1.5301 | 0.0062 | 0.0466 | 0.0429 | 615 | 0.0200 |
| | 1000 | 0.3562 | 1.6528 | 4.9704 | 0.0093 | 0.1194 | 0.1098 | 928 | 0.0321 |
| Bore/Drill Rigs Composite | | 0.0673 | 0.5022 | 0.6138 | 0.0017 | 0.0200 | 0.0184 | 165 | 0.0061 |
| Cement and Mortar Mixers | 15 | 0.0074 | 0.0386 | 0.0464 | 0.0001 | 0.0019 | 0.0018 | 6.3 | 0.0007 |
| | 25 | 0.0251 | 0.0782 | 0.1456 | 0.0002 | 0.0074 | 0.0068 | 17.6 | 0.0023 |
| Cement and Mortar Mixers Composite | | 0.0088 | 0.0419 | 0.0545 | 0.0001 | 0.0024 | 0.0022 | 7.2 | 0.0008 |
| Concrete/Industrial Saws | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0782 | 0.2745 | 0.2652 | 0.0004 | 0.0206 | 0.0189 | 30.2 | 0.0071 |
| | 120 | 0.0892 | 0.4759 | 0.6249 | 0.0009 | 0.0486 | 0.0448 | 74.1 | 0.0080 |
| | 175 | 0.1340 | 0.8674 | 1.1593 | 0.0018 | 0.0585 | 0.0538 | 160 | 0.0121 |
| Concrete/Industrial Saws Composite | | 0.0835 | 0.3982 | 0.4921 | 0.0007 | 0.0374 | 0.0345 | 58.5 | 0.0075 |
| Cranes | 50 | 0.0853 | 0.2729 | 0.2235 | 0.0003 | 0.0202 | 0.0186 | 23.2 | 0.0077 |
| | 120 | 0.0800 | 0.3559 | 0.4822 | 0.0006 | 0.0415 | 0.0382 | 50.1 | 0.0072 |
| | 175 | 0.0919 | 0.4794 | 0.6684 | 0.0009 | 0.0378 | 0.0348 | 80.3 | 0.0083 |
| | 250 | 0.0925 | 0.2713 | 0.8284 | 0.0013 | 0.0286 | 0.0263 | 112 | 0.0083 |
| | 500 | 0.1393 | 0.4663 | 1.1812 | 0.0018 | 0.0426 | 0.0392 | 180 | 0.0126 |
| | 750 | 0.2358 | 0.7835 | 2.0490 | 0.0030 | 0.0729 | 0.0671 | 303 | 0.0213 |
| | 9999 | 0.8682 | 2.8913 | 9.2743 | 0.0098 | 0.2775 | 0.2553 | 971 | 0.0783 |
| Cranes Composite | | 0.1204 | 0.4395 | 1.0200 | 0.0014 | 0.0426 | 0.0392 | 129 | 0.0109 |
| Crawler Tractors | 50 | 0.1017 | 0.3087 | 0.2464 | 0.0003 | 0.0232 | 0.0214 | 24.9 | 0.0092 |
| | 120 | 0.1143 | 0.4774 | 0.6815 | 0.0008 | 0.0579 | 0.0533 | 65.8 | 0.0103 |
| | 175 | 0.1509 | 0.7384 | 1.0951 | 0.0014 | 0.0614 | 0.0565 | 121 | 0.0136 |
| | 250 | 0.1582 | 0.4614 | 1.3531 | 0.0019 | 0.0514 | 0.0473 | 166 | 0.0143 |
| | 500 | 0.2300 | 0.8352 | 1.8987 | 0.0025 | 0.0732 | 0.0673 | 259 | 0.0207 |
| | 750 | 0.4140 | 1.4936 | 3.4863 | 0.0047 | 0.1327 | 0.1221 | 465 | 0.0374 |
| | 1000 | 0.6278 | 2.3640 | 6.6574 | 0.0066 | 0.2075 | 0.1909 | 658 | 0.0566 |
| Crawler Tractors Composite | | 0.1415 | 0.5650 | 1.0059 | 0.0013 | 0.0594 | 0.0546 | 114 | 0.0128 |
| Crushing/Proc. Equipment | 50 | 0.1392 | 0.4644 | 0.4024 | 0.0006 | 0.0346 | 0.0318 | 44.0 | 0.0126 |
| | 120 | 0.1167 | 0.5646 | 0.7374 | 0.0010 | 0.0629 | 0.0579 | 83.1 | 0.0105 |
| | 175 | 0.1654 | 0.9559 | 1.2783 | 0.0019 | 0.0700 | 0.0644 | 167 | 0.0149 |
| | 250 | 0.1646 | 0.5171 | 1.6355 | 0.0028 | 0.0506 | 0.0466 | 245 | 0.0149 |
| | 500 | 0.2358 | 0.7790 | 2.1722 | 0.0037 | 0.0722 | 0.0664 | 374 | 0.0213 |
| | 750 | 0.3723 | 1.2184 | 3.5561 | 0.0059 | 0.1154 | 0.1062 | 589 | 0.0336 |
| | 9999 | 0.9726 | 3.0901 | 11.5626 | 0.0131 | 0.3225 | 0.2967 | 1,308 | 0.0878 |
| Crushing/Proc. Equipment Composite | | 0.1465 | 0.6549 | 0.9893 | 0.0015 | 0.0607 | 0.0558 | 132 | 0.0132 |
| Dumpers/Tenders | 25 | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Dumpers/Tenders Composite | | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0650 | 0.2683 | 0.2256 | 0.0003 | 0.0167 | 0.0154 | 25.0 | 0.0059 |
| | 120 | 0.0912 | 0.5102 | 0.5787 | 0.0009 | 0.0455 | 0.0418 | 73.6 | 0.0082 |
| | 175 | 0.1052 | 0.6653 | 0.7408 | 0.0013 | 0.0405 | 0.0372 | 112 | 0.0095 |

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1117 | 0.3431 | 0.8935 | 0.0018 | 0.0297 | 0.0273 | 159 | 0.0101 |
| | 500 | 0.1577 | 0.4964 | 1.1619 | 0.0023 | 0.0413 | 0.0380 | 234 | 0.0142 |
| | 750 | 0.2630 | 0.8225 | 1.9926 | 0.0039 | 0.0698 | 0.0642 | 387 | 0.0237 |
| Excavators Composite | | 0.1064 | 0.5248 | 0.7416 | 0.0013 | 0.0379 | 0.0349 | 120 | 0.0096 |
| Forklifts | 50 | 0.0324 | 0.1522 | 0.1324 | 0.0002 | 0.0092 | 0.0084 | 14.7 | 0.0029 |
| | 120 | 0.0345 | 0.2143 | 0.2326 | 0.0004 | 0.0174 | 0.0160 | 31.2 | 0.0031 |
| | 175 | 0.0486 | 0.3316 | 0.3442 | 0.0006 | 0.0189 | 0.0174 | 56.1 | 0.0044 |
| | 250 | 0.0518 | 0.1582 | 0.4040 | 0.0009 | 0.0133 | 0.0122 | 77.1 | 0.0047 |
| | 500 | 0.0724 | 0.2164 | 0.5170 | 0.0011 | 0.0185 | 0.0171 | 111 | 0.0065 |
| Forklifts Composite | | 0.0459 | 0.2200 | 0.3163 | 0.0006 | 0.0156 | 0.0143 | 54.4 | 0.0041 |
| Generator Sets | 15 | 0.0135 | 0.0658 | 0.0929 | 0.0002 | 0.0051 | 0.0047 | 10.2 | 0.0012 |
| | 25 | 0.0247 | 0.0831 | 0.1522 | 0.0002 | 0.0080 | 0.0074 | 17.6 | 0.0022 |
| | 50 | 0.0706 | 0.2465 | 0.2628 | 0.0004 | 0.0193 | 0.0178 | 30.6 | 0.0064 |
| | 120 | 0.0910 | 0.4811 | 0.6607 | 0.0009 | 0.0484 | 0.0445 | 77.9 | 0.0082 |
| | 175 | 0.1120 | 0.7350 | 1.0463 | 0.0016 | 0.0485 | 0.0446 | 142 | 0.0101 |
| | 250 | 0.1090 | 0.4148 | 1.3776 | 0.0024 | 0.0381 | 0.0351 | 213 | 0.0098 |
| Generator Sets - 500 hp | 500 | 0.1556 | 0.6639 | 1.9429 | 0.0033 | 0.0567 | 0.0522 | 337 | 0.0140 |
| | 750 | 0.2599 | 1.0718 | 3.2483 | 0.0055 | 0.0934 | 0.0860 | 544 | 0.0234 |
| | 9999 | 0.6582 | 2.3655 | 8.9789 | 0.0105 | 0.2325 | 0.2139 | 1,049 | 0.0594 |
| Generator Sets Composite | | 0.0640 | 0.2913 | 0.4717 | 0.0007 | 0.0268 | 0.0246 | 61.0 | 0.0058 |
| Graders | 50 | 0.0897 | 0.3082 | 0.2569 | 0.0004 | 0.0217 | 0.0200 | 27.5 | 0.0081 |
| | 120 | 0.1081 | 0.5230 | 0.6726 | 0.0009 | 0.0555 | 0.0511 | 75.0 | 0.0098 |
| | 175 | 0.1299 | 0.7319 | 0.9534 | 0.0014 | 0.0526 | 0.0484 | 124 | 0.0117 |
| | 250 | 0.1326 | 0.4046 | 1.1596 | 0.0019 | 0.0400 | 0.0368 | 172 | 0.0120 |
| | 500 | 0.1666 | 0.5739 | 1.3760 | 0.0023 | 0.0496 | 0.0456 | 229 | 0.0150 |
| | 750 | 0.3549 | 1.2133 | 3.0011 | 0.0049 | 0.1066 | 0.0981 | 486 | 0.0320 |
| Graders Composite | | 0.1277 | 0.5931 | 0.9795 | 0.0015 | 0.0489 | 0.0450 | 133 | 0.0115 |
| Off-Highway Tractors | 120 | 0.1905 | 0.7051 | 1.1159 | 0.0011 | 0.0952 | 0.0876 | 93.7 | 0.0172 |
| | 175 | 0.1870 | 0.8216 | 1.3703 | 0.0015 | 0.0771 | 0.0709 | 130 | 0.0169 |
| | 250 | 0.1489 | 0.4320 | 1.2644 | 0.0015 | 0.0520 | 0.0478 | 130 | 0.0134 |
| | 750 | 0.5975 | 2.5165 | 5.0885 | 0.0057 | 0.2047 | 0.1884 | 568 | 0.0539 |
| | 1000 | 0.9006 | 3.9378 | 9.2072 | 0.0082 | 0.3063 | 0.2818 | 814 | 0.0813 |
| Off-Highway Tractors Composite | | 0.1893 | 0.7244 | 1.5085 | 0.0017 | 0.0717 | 0.0660 | 151 | 0.0171 |
| Off-Highway Trucks | 175 | 0.1259 | 0.7559 | 0.8596 | 0.0014 | 0.0477 | 0.0438 | 125 | 0.0114 |
| | 250 | 0.1252 | 0.3702 | 0.9818 | 0.0019 | 0.0328 | 0.0301 | 167 | 0.0113 |
| | 500 | 0.1960 | 0.5949 | 1.4165 | 0.0027 | 0.0505 | 0.0465 | 272 | 0.0177 |
| | 750 | 0.3198 | 0.9645 | 2.3779 | 0.0044 | 0.0835 | 0.0768 | 442 | 0.0289 |
| | 1000 | 0.4873 | 1.4801 | 5.2216 | 0.0063 | 0.1505 | 0.1385 | 625 | 0.0440 |
| Off-Highway Trucks Composite | | 0.1924 | 0.5974 | 1.4932 | 0.0027 | 0.0516 | 0.0475 | 260 | 0.0174 |
| Other Construction Equipment | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0039 | 0.0036 | 13.2 | 0.0014 |
| | 50 | 0.0597 | 0.2506 | 0.2369 | 0.0004 | 0.0162 | 0.0149 | 28.0 | 0.0054 |
| | 120 | 0.0827 | 0.5202 | 0.6012 | 0.0009 | 0.0441 | 0.0406 | 80.9 | 0.0075 |
| | 175 | 0.0796 | 0.5864 | 0.6636 | 0.0012 | 0.0331 | 0.0305 | 107 | 0.0072 |
| | 500 | 0.1310 | 0.4963 | 1.1867 | 0.0025 | 0.0394 | 0.0362 | 254 | 0.0118 |
| Other Construction Equipment Composite | | 0.0768 | 0.3645 | 0.6392 | 0.0013 | 0.0264 | 0.0243 | 123 | 0.0069 |
| Other General Industrial Equipmen | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0786 | 0.2532 | 0.2077 | 0.0003 | 0.0191 | 0.0175 | 21.7 | 0.0071 |
| | 120 | 0.0987 | 0.4387 | 0.5864 | 0.0007 | 0.0521 | 0.0480 | 62.0 | 0.0089 |
| | 175 | 0.1083 | 0.5684 | 0.7866 | 0.0011 | 0.0448 | 0.0412 | 95.9 | 0.0098 |
| | 250 | 0.1050 | 0.3015 | 0.9812 | 0.0015 | 0.0312 | 0.0287 | 136 | 0.0095 |
| | 500 | 0.1931 | 0.5811 | 1.6702 | 0.0026 | 0.0569 | 0.0524 | 265 | 0.0174 |
| | 750 | 0.3208 | 0.9578 | 2.8569 | 0.0044 | 0.0959 | 0.0883 | 437 | 0.0289 |
| | 1000 | 0.4546 | 1.4023 | 5.2482 | 0.0056 | 0.1513 | 0.1392 | 560 | 0.0410 |
| Other General Industrial Equipmen Composite | | 0.1355 | 0.4843 | 1.1215 | 0.0016 | 0.0475 | 0.0437 | 152 | 0.0122 |
| Other Material Handling Equipmen | 50 | 0.1090 | 0.3501 | 0.2887 | 0.0004 | 0.0265 | 0.0244 | 30.3 | 0.0098 |
| | 120 | 0.0959 | 0.4271 | 0.5727 | 0.0007 | 0.0509 | 0.0468 | 60.7 | 0.0087 |
| | 175 | 0.1365 | 0.7201 | 0.9997 | 0.0014 | 0.0567 | 0.0522 | 122 | 0.0123 |
| | 250 | 0.1109 | 0.3211 | 1.0483 | 0.0016 | 0.0332 | 0.0306 | 145 | 0.0100 |
| | 500 | 0.1376 | 0.4182 | 1.2042 | 0.0019 | 0.0409 | 0.0377 | 192 | 0.0124 |
| | 9999 | 0.6190 | 1.8527 | 6.9410 | 0.0073 | 0.1995 | 0.1835 | 741 | 0.0558 |
| Other Material Handling Equipment Composite | | 0.1289 | 0.4698 | 1.0967 | 0.0015 | 0.0460 | 0.0423 | 141 | 0.0116 |
| Pavers | 25 | 0.0234 | 0.0780 | 0.1458 | 0.0002 | 0.0066 | 0.0060 | 18.7 | 0.0021 |
| | 50 | 0.1198 | 0.3421 | 0.2775 | 0.0004 | 0.0271 | 0.0249 | 28.0 | 0.0108 |
| | 120 | 0.1235 | 0.4969 | 0.7477 | 0.0008 | 0.0636 | 0.0585 | 69.2 | 0.0111 |
| | 175 | 0.1608 | 0.7707 | 1.2155 | 0.0014 | 0.0673 | 0.0619 | 128 | 0.0145 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1858 | 0.5585 | 1.6747 | 0.0022 | 0.0640 | 0.0589 | 194 | 0.0168 |
| | 500 | 0.2059 | 0.8113 | 1.8097 | 0.0023 | 0.0697 | 0.0641 | 233 | 0.0186 |
| Pavers Composite | | 0.1347 | 0.5203 | 0.7607 | 0.0009 | 0.0526 | 0.0484 | 77.9 | 0.0122 |
| Paving Equipment | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0037 | 0.0034 | 12.6 | 0.0014 |
| | 50 | 0.1023 | 0.2901 | 0.2367 | 0.0003 | 0.0231 | 0.0213 | 23.9 | 0.0092 |
| | 120 | 0.0969 | 0.3891 | 0.5874 | 0.0006 | 0.0503 | 0.0462 | 54.5 | 0.0087 |
| | 175 | 0.1254 | 0.6025 | 0.9549 | 0.0011 | 0.0528 | 0.0486 | 101 | 0.0113 |
| | 250 | 0.1140 | 0.3441 | 1.0498 | 0.0014 | 0.0394 | 0.0362 | 122 | 0.0103 |
| Paving Equipment Composite | | 0.1023 | 0.4234 | 0.6842 | 0.0008 | 0.0469 | 0.0431 | 68.9 | 0.0092 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washers | 15 | 0.0065 | 0.0315 | 0.0445 | 0.0001 | 0.0024 | 0.0022 | 4.9 | 0.0006 |
| | 25 | 0.0100 | 0.0337 | 0.0617 | 0.0001 | 0.0033 | 0.0030 | 7.1 | 0.0009 |
| | 50 | 0.0251 | 0.0970 | 0.1183 | 0.0002 | 0.0077 | 0.0070 | 14.3 | 0.0023 |
| | 120 | 0.0245 | 0.1416 | 0.1947 | 0.0003 | 0.0128 | 0.0118 | 24.1 | 0.0022 |
| Pressure Washers Composite | | 0.0133 | 0.0590 | 0.0799 | 0.0001 | 0.0049 | 0.0045 | 9.4 | 0.0012 |
| | 15 | 0.0111 | 0.0479 | 0.0683 | 0.0001 | 0.0041 | 0.0038 | 7.4 | 0.0010 |
| | 25 | 0.0309 | 0.0919 | 0.1682 | 0.0002 | 0.0094 | 0.0086 | 19.5 | 0.0028 |
| | 50 | 0.0855 | 0.2910 | 0.2982 | 0.0004 | 0.0228 | 0.0210 | 34.3 | 0.0077 |
| | 120 | 0.0949 | 0.4887 | 0.6710 | 0.0009 | 0.0508 | 0.0467 | 77.9 | 0.0086 |
| | 175 | 0.1158 | 0.7365 | 1.0489 | 0.0016 | 0.0502 | 0.0462 | 140 | 0.0104 |
| | 250 | 0.1088 | 0.3998 | 1.3270 | 0.0023 | 0.0376 | 0.0346 | 201 | 0.0098 |
| Pumps | 500 | 0.1686 | 0.6929 | 2.0163 | 0.0034 | 0.0603 | 0.0555 | 345 | 0.0152 |
| | 750 | 0.2872 | 1.1454 | 3.4529 | 0.0057 | 0.1018 | 0.0937 | 571 | 0.0259 |
| | 9999 | 0.8773 | 3.1134 | 11.7387 | 0.0136 | 0.3072 | 0.2826 | 1,355 | 0.0792 |
| Pumps Composite | | 0.0621 | 0.2825 | 0.4121 | 0.0006 | 0.0267 | 0.0245 | 49.6 | 0.0056 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1018 | 0.0002 | 0.0039 | 0.0036 | 13.3 | 0.0015 |
| | 50 | 0.0871 | 0.2754 | 0.2405 | 0.0003 | 0.0209 | 0.0192 | 26.0 | 0.0079 |
| | 120 | 0.0857 | 0.4000 | 0.5498 | 0.0007 | 0.0454 | 0.0418 | 59.0 | 0.0077 |
| | 175 | 0.1104 | 0.6166 | 0.8731 | 0.0012 | 0.0470 | 0.0433 | 108 | 0.0100 |
| | 250 | 0.1107 | 0.3575 | 1.0948 | 0.0017 | 0.0368 | 0.0339 | 153 | 0.0100 |
| | 500 | 0.1468 | 0.5595 | 1.3956 | 0.0022 | 0.0487 | 0.0448 | 219 | 0.0132 |
| Rollers Composite | | 0.0851 | 0.3979 | 0.5706 | 0.0008 | 0.0386 | 0.0355 | 67.1 | 0.0077 |
| Rough Terrain Forklifts | 50 | 0.0942 | 0.3551 | 0.3066 | 0.0004 | 0.0243 | 0.0224 | 33.9 | 0.0085 |
| | 120 | 0.0801 | 0.4260 | 0.5164 | 0.0007 | 0.0420 | 0.0387 | 62.4 | 0.0072 |
| | 175 | 0.1171 | 0.7240 | 0.8746 | 0.0014 | 0.0477 | 0.0439 | 125 | 0.0106 |
| | 250 | 0.1168 | 0.3650 | 1.0385 | 0.0019 | 0.0338 | 0.0311 | 171 | 0.0105 |
| | 500 | 0.1668 | 0.5337 | 1.3642 | 0.0025 | 0.0477 | 0.0439 | 257 | 0.0150 |
| Rough Terrain Forklifts Composite | | 0.0850 | 0.4577 | 0.5588 | 0.0008 | 0.0423 | 0.0389 | 70.3 | 0.0077 |
| Rubber Tired Dozers | 175 | 0.1942 | 0.8333 | 1.3944 | 0.0015 | 0.0790 | 0.0727 | 129 | 0.0175 |
| | 250 | 0.2209 | 0.6304 | 1.8273 | 0.0021 | 0.0762 | 0.0701 | 183 | 0.0199 |
| | 500 | 0.2932 | 1.2456 | 2.3951 | 0.0026 | 0.0985 | 0.0906 | 265 | 0.0265 |
| | 750 | 0.4423 | 1.8685 | 3.6712 | 0.0040 | 0.1494 | 0.1374 | 399 | 0.0399 |
| | 1000 | 0.6883 | 3.0139 | 6.8297 | 0.0060 | 0.2311 | 0.2126 | 592 | 0.0621 |
| Rubber Tired Dozers Composite | | 0.2721 | 1.0420 | 2.2344 | 0.0025 | 0.0924 | 0.0850 | 239 | 0.0246 |
| Rubber Tired Loaders | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0049 | 0.0045 | 16.9 | 0.0018 |
| | 50 | 0.0993 | 0.3438 | 0.2888 | 0.0004 | 0.0242 | 0.0222 | 31.1 | 0.0090 |
| | 120 | 0.0835 | 0.4090 | 0.5226 | 0.0007 | 0.0431 | 0.0396 | 58.9 | 0.0075 |
| | 175 | 0.1094 | 0.6251 | 0.8077 | 0.0012 | 0.0445 | 0.0409 | 106 | 0.0099 |
| | 250 | 0.1118 | 0.3444 | 0.9890 | 0.0017 | 0.0337 | 0.0310 | 149 | 0.0101 |
| | 500 | 0.1678 | 0.5818 | 1.3980 | 0.0023 | 0.0499 | 0.0459 | 237 | 0.0151 |
| | 750 | 0.3459 | 1.1905 | 2.9534 | 0.0049 | 0.1040 | 0.0956 | 486 | 0.0312 |
| | 1000 | 0.4657 | 1.6412 | 5.2967 | 0.0060 | 0.1552 | 0.1428 | 594 | 0.0420 |
| Rubber Tired Loaders Composite | | 0.1050 | 0.4615 | 0.7838 | 0.0012 | 0.0416 | 0.0383 | 109 | 0.0095 |
| Scrapers | 120 | 0.1665 | 0.6826 | 0.9915 | 0.0011 | 0.0846 | 0.0778 | 93.9 | 0.0150 |
| | 175 | 0.1871 | 0.9030 | 1.3657 | 0.0017 | 0.0766 | 0.0704 | 148 | 0.0169 |
| | 250 | 0.2021 | 0.5906 | 1.7470 | 0.0024 | 0.0665 | 0.0612 | 209 | 0.0182 |
| | 500 | 0.2883 | 1.0688 | 2.4104 | 0.0032 | 0.0930 | 0.0855 | 321 | 0.0260 |
| | 750 | 0.5001 | 1.8419 | 4.2634 | 0.0056 | 0.1624 | 0.1494 | 555 | 0.0451 |
| Scrapers Composite | | 0.2513 | 0.9443 | 2.0647 | 0.0027 | 0.0854 | 0.0785 | 262 | 0.0227 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0931 | 0.3227 | 0.3148 | 0.0005 | 0.0243 | 0.0224 | 36.2 | 0.0084 |
| | 120 | 0.0970 | 0.5116 | 0.6762 | 0.0009 | 0.0525 | 0.0483 | 80.2 | 0.0088 |
| | 175 | 0.1290 | 0.8300 | 1.1249 | 0.0017 | 0.0559 | 0.0514 | 155 | 0.0116 |
| | 250 | 0.1416 | 0.5098 | 1.6229 | 0.0029 | 0.0474 | 0.0436 | 255 | 0.0128 |
| Signal Boards Composite | | 0.0171 | 0.0925 | 0.1250 | 0.0002 | 0.0066 | 0.0060 | 16.7 | 0.0015 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| Skid Steer Loaders | 25 | 0.0189 | 0.0601 | 0.1125 | 0.0002 | 0.0056 | 0.0052 | 13.8 | 0.0017 |
| | 50 | 0.0378 | 0.2138 | 0.2052 | 0.0003 | 0.0113 | 0.0104 | 25.5 | 0.0034 |
| | 120 | 0.0334 | 0.2710 | 0.2699 | 0.0005 | 0.0170 | 0.0156 | 42.8 | 0.0030 |
| Skid Steer Loaders Composite | | 0.0352 | 0.2220 | 0.2198 | 0.0004 | 0.0128 | 0.0118 | 30.3 | 0.0032 |
| Surfacing Equipment | 50 | 0.0408 | 0.1333 | 0.1263 | 0.0002 | 0.0101 | 0.0093 | 14.1 | 0.0037 |
| | 120 | 0.0840 | 0.4151 | 0.5756 | 0.0007 | 0.0439 | 0.0404 | 63.8 | 0.0076 |
| | 175 | 0.0787 | 0.4705 | 0.6706 | 0.0010 | 0.0335 | 0.0308 | 85.8 | 0.0071 |
| | 250 | 0.0891 | 0.3116 | 0.9338 | 0.0015 | 0.0309 | 0.0285 | 135 | 0.0080 |
| | 500 | 0.1342 | 0.5759 | 1.3809 | 0.0022 | 0.0468 | 0.0431 | 221 | 0.0121 |
| | 750 | 0.2139 | 0.9020 | 2.2264 | 0.0035 | 0.0745 | 0.0686 | 347 | 0.0193 |
| Surfacing Equipment Composite | | 0.1116 | 0.4705 | 1.0675 | 0.0017 | 0.0389 | 0.0357 | 166 | 0.0101 |
| Sweepers/Scrubbers | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0052 | 19.6 | 0.0021 |
| | 50 | 0.0782 | 0.3186 | 0.2828 | 0.0004 | 0.0211 | 0.0194 | 31.6 | 0.0071 |
| | 120 | 0.0880 | 0.5056 | 0.5893 | 0.0009 | 0.0466 | 0.0429 | 75.0 | 0.0079 |
| | 175 | 0.1193 | 0.7999 | 0.9051 | 0.0016 | 0.0488 | 0.0449 | 139 | 0.0108 |
| | 250 | 0.1029 | 0.3286 | 0.9094 | 0.0018 | 0.0289 | 0.0266 | 162 | 0.0093 |
| Sweepers/Scrubbers Composite | | 0.0913 | 0.5034 | 0.5746 | 0.0009 | 0.0387 | 0.0356 | 78.5 | 0.0082 |
| Tractors/Loaders/Backhoes | 25 | 0.0192 | 0.0653 | 0.1221 | 0.0002 | 0.0049 | 0.0045 | 15.9 | 0.0017 |
| | 50 | 0.0702 | 0.3020 | 0.2646 | 0.0004 | 0.0186 | 0.0171 | 30.3 | 0.0063 |
| | 120 | 0.0577 | 0.3480 | 0.3870 | 0.0006 | 0.0293 | 0.0270 | 51.7 | 0.0052 |
| | 175 | 0.0854 | 0.5853 | 0.6331 | 0.0011 | 0.0335 | 0.0308 | 101 | 0.0077 |
| | 250 | 0.1082 | 0.3566 | 0.9047 | 0.0019 | 0.0294 | 0.0270 | 172 | 0.0098 |
| | 500 | 0.2085 | 0.7089 | 1.6070 | 0.0039 | 0.0559 | 0.0514 | 345 | 0.0188 |
| | 750 | 0.3148 | 1.0631 | 2.4922 | 0.0058 | 0.0854 | 0.0786 | 517 | 0.0284 |
| Tractors/Loaders/Backhoes Composite | | 0.0666 | 0.3716 | 0.4501 | 0.0008 | 0.0298 | 0.0274 | 66.8 | 0.0060 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0087 | 32.9 | 0.0036 |
| | 50 | 0.1390 | 0.3900 | 0.3235 | 0.0004 | 0.0313 | 0.0288 | 32.9 | 0.0125 |
| | 120 | 0.1144 | 0.4600 | 0.7060 | 0.0008 | 0.0590 | 0.0542 | 64.9 | 0.0103 |
| | 175 | 0.1770 | 0.8534 | 1.3767 | 0.0016 | 0.0748 | 0.0688 | 144 | 0.0160 |
| | 250 | 0.2105 | 0.6510 | 1.9456 | 0.0025 | 0.0750 | 0.0690 | 223 | 0.0190 |
| | 500 | 0.2694 | 1.1349 | 2.4560 | 0.0031 | 0.0947 | 0.0871 | 311 | 0.0243 |
| | 750 | 0.5107 | 2.1334 | 4.7300 | 0.0059 | 0.1802 | 0.1658 | 587 | 0.0461 |
| Trenchers Composite | | 0.1274 | 0.4541 | 0.6043 | 0.0007 | 0.0485 | 0.0446 | 58.7 | 0.0115 |
| Welders | 15 | 0.0093 | 0.0400 | 0.0571 | 0.0001 | 0.0034 | 0.0032 | 6.2 | 0.0008 |
| | 25 | 0.0179 | 0.0532 | 0.0974 | 0.0001 | 0.0054 | 0.0050 | 11.3 | 0.0016 |
| | 50 | 0.0801 | 0.2564 | 0.2346 | 0.0003 | 0.0200 | 0.0184 | 26.0 | 0.0072 |
| | 120 | 0.0547 | 0.2606 | 0.3567 | 0.0005 | 0.0296 | 0.0273 | 39.5 | 0.0049 |
| | 175 | 0.0936 | 0.5424 | 0.7713 | 0.0011 | 0.0405 | 0.0373 | 98.2 | 0.0084 |
| | 250 | 0.0749 | 0.2483 | 0.8249 | 0.0013 | 0.0248 | 0.0228 | 119 | 0.0068 |
| | 500 | 0.0968 | 0.3491 | 1.0171 | 0.0016 | 0.0325 | 0.0299 | 168 | 0.0087 |
| Welders Composite | | 0.0534 | 0.1994 | 0.2301 | 0.0003 | 0.0187 | 0.0172 | 25.6 | 0.0048 |

## 2020 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0138 | 0.0459 | 0.0854 | 0.0001 | 0.0035 | 0.0032 | 11.0 | 0.0012 |
| | 50 | 0.0261 | 0.1436 | 0.1422 | 0.0003 | 0.0071 | 0.0065 | 19.6 | 0.0024 |
| | 120 | 0.0259 | 0.2292 | 0.2166 | 0.0004 | 0.0127 | 0.0117 | 38.1 | 0.0023 |
| | 500 | 0.0751 | 0.3804 | 0.6959 | 0.0021 | 0.0217 | 0.0199 | 213 | 0.0068 |
| | 750 | 0.1373 | 0.6877 | 1.2876 | 0.0039 | 0.0396 | 0.0365 | 385 | 0.0124 |
| Aerial Lifts Composite | | 0.0261 | 0.1696 | 0.1866 | 0.0004 | 0.0092 | 0.0084 | 34.7 | 0.0024 |
| Air Compressors | 15 | 0.0093 | 0.0451 | 0.0579 | 0.0001 | 0.0029 | 0.0027 | 7.2 | 0.0008 |
| | 25 | 0.0196 | 0.0630 | 0.1155 | 0.0002 | 0.0054 | 0.0050 | 14.4 | 0.0018 |
| | 50 | 0.0398 | 0.2030 | 0.1725 | 0.0003 | 0.0099 | 0.0091 | 22.3 | 0.0036 |
| | 120 | 0.0408 | 0.3058 | 0.2826 | 0.0006 | 0.0188 | 0.0173 | 47.0 | 0.0037 |
| | 175 | 0.0587 | 0.4989 | 0.4013 | 0.0010 | 0.0210 | 0.0193 | 88.5 | 0.0053 |
| | 250 | 0.0669 | 0.2592 | 0.5067 | 0.0015 | 0.0163 | 0.0150 | 131 | 0.0060 |
| | 500 | 0.1146 | 0.4395 | 0.7970 | 0.0023 | 0.0276 | 0.0254 | 232 | 0.0103 |
| | 750 | 0.1777 | 0.6792 | 1.2615 | 0.0036 | 0.0432 | 0.0398 | 358 | 0.0160 |
| | 1000 | 0.2641 | 0.9959 | 3.2946 | 0.0049 | 0.0804 | 0.0740 | 486 | 0.0238 |
| Air Compressors Composite | | 0.0483 | 0.3077 | 0.3255 | 0.0007 | 0.0185 | 0.0170 | 63.6 | 0.0044 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0196 | 0.2205 | 0.1756 | 0.0004 | 0.0020 | 0.0018 | 31.0 | 0.0018 |
| | 120 | 0.0280 | 0.4662 | 0.2329 | 0.0009 | 0.0040 | 0.0037 | 77.1 | 0.0025 |
| | 175 | 0.0402 | 0.7542 | 0.1862 | 0.0016 | 0.0051 | 0.0047 | 141 | 0.0036 |
| | 250 | 0.0474 | 0.3426 | 0.1617 | 0.0021 | 0.0044 | 0.0040 | 188 | 0.0043 |
| | 500 | 0.0784 | 0.5512 | 0.2622 | 0.0031 | 0.0072 | 0.0066 | 311 | 0.0071 |
| | 750 | 0.1549 | 1.0891 | 0.5202 | 0.0062 | 0.0143 | 0.0131 | 615 | 0.0140 |
| | 1000 | 0.2442 | 1.6437 | 3.9853 | 0.0093 | 0.0530 | 0.0488 | 928 | 0.0220 |
| Bore/Drill Rigs Composite | | 0.0480 | 0.5008 | 0.3439 | 0.0017 | 0.0062 | 0.0057 | 165 | 0.0043 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0223 | 0.0741 | 0.1372 | 0.0002 | 0.0058 | 0.0053 | 17.6 | 0.0020 |
| Cement and Mortar Mixers Co | | 0.0086 | 0.0415 | 0.0536 | 0.0001 | 0.0021 | 0.0020 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0424 | 0.2420 | 0.2231 | 0.0004 | 0.0113 | 0.0104 | 30.2 | 0.0038 |
| | 120 | 0.0524 | 0.4613 | 0.4128 | 0.0009 | 0.0249 | 0.0229 | 74.1 | 0.0047 |
| | 175 | 0.0865 | 0.8662 | 0.6554 | 0.0018 | 0.0323 | 0.0297 | 160 | 0.0078 |
| Concrete/Industrial Saws Com | | 0.0484 | 0.3783 | 0.3410 | 0.0007 | 0.0196 | 0.0180 | 58.5 | 0.0044 |
| Cranes | 50 | 0.0532 | 0.2423 | 0.1894 | 0.0003 | 0.0121 | 0.0111 | 23.2 | 0.0048 |
| | 120 | 0.0542 | 0.3446 | 0.3317 | 0.0006 | 0.0240 | 0.0221 | 50.1 | 0.0049 |
| | 175 | 0.0648 | 0.4754 | 0.4071 | 0.0009 | 0.0223 | 0.0206 | 80.3 | 0.0058 |
| | 250 | 0.0704 | 0.2440 | 0.4949 | 0.0013 | 0.0170 | 0.0157 | 112 | 0.0064 |
| | 500 | 0.1087 | 0.3839 | 0.7047 | 0.0018 | 0.0257 | 0.0236 | 180 | 0.0098 |
| | 750 | 0.1837 | 0.6455 | 1.2225 | 0.0030 | 0.0439 | 0.0404 | 303 | 0.0166 |
| | 9999 | 0.6702 | 2.1934 | 7.0436 | 0.0098 | 0.1797 | 0.1654 | 971 | 0.0605 |
| Cranes Composite | | 0.0898 | 0.3917 | 0.6610 | 0.0014 | 0.0256 | 0.0236 | 129 | 0.0081 |
| Crawler Tractors | 50 | 0.0699 | 0.2771 | 0.2107 | 0.0003 | 0.0150 | 0.0138 | 24.9 | 0.0063 |
| | 120 | 0.0831 | 0.4628 | 0.4896 | 0.0008 | 0.0371 | 0.0341 | 65.8 | 0.0075 |
| | 175 | 0.1123 | 0.7302 | 0.7150 | 0.0014 | 0.0398 | 0.0366 | 121 | 0.0101 |
| | 250 | 0.1188 | 0.3966 | 0.8681 | 0.0019 | 0.0315 | 0.0290 | 166 | 0.0107 |
| | 500 | 0.1759 | 0.6665 | 1.2170 | 0.0025 | 0.0455 | 0.0419 | 259 | 0.0159 |
| | 750 | 0.3168 | 1.1935 | 2.2429 | 0.0047 | 0.0828 | 0.0762 | 465 | 0.0286 |
| | 1000 | 0.4836 | 1.8458 | 5.2162 | 0.0066 | 0.1425 | 0.1311 | 658 | 0.0436 |
| Crawler Tractors Composite | | 0.1049 | 0.5260 | 0.6772 | 0.0013 | 0.0378 | 0.0348 | 114 | 0.0095 |
| Crushing/Proc. E | 50 | 0.0734 | 0.4036 | 0.3367 | 0.0006 | 0.0181 | 0.0166 | 44.0 | 0.0066 |
| | 120 | 0.0692 | 0.5446 | 0.4754 | 0.0010 | 0.0302 | 0.0278 | 83.1 | 0.0062 |
| | 175 | 0.1083 | 0.9519 | 0.7042 | 0.0019 | 0.0368 | 0.0338 | 167 | 0.0098 |
| | 250 | 0.1245 | 0.4844 | 0.8670 | 0.0028 | 0.0282 | 0.0259 | 245 | 0.0112 |
| | 500 | 0.1852 | 0.7092 | 1.1829 | 0.0037 | 0.0416 | 0.0383 | 374 | 0.0167 |
| | 750 | 0.2912 | 1.1167 | 1.9026 | 0.0059 | 0.0655 | 0.0603 | 589 | 0.0263 |
| | 9999 | 0.7584 | 2.6528 | 8.5119 | 0.0131 | 0.2049 | 0.1885 | 1,308 | 0.0684 |
| Crushing/Proc. Equipment Co | | 0.0934 | 0.6247 | 0.5983 | 0.0015 | 0.0310 | 0.0285 | 132 | 0.0084 |
| Dumpers/Tender | 25 | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0384 | 0.2446 | 0.1862 | 0.0003 | 0.0080 | 0.0074 | 25.0 | 0.0035 |
| | 120 | 0.0583 | 0.4979 | 0.3717 | 0.0009 | 0.0206 | 0.0189 | 73.6 | 0.0053 |
| | 175 | 0.0703 | 0.6637 | 0.3868 | 0.0013 | 0.0195 | 0.0179 | 112 | 0.0063 |
| | 250 | 0.0828 | 0.3276 | 0.4493 | 0.0018 | 0.0154 | 0.0141 | 159 | 0.0075 |
| | 500 | 0.1198 | 0.4591 | 0.6028 | 0.0023 | 0.0219 | 0.0202 | 234 | 0.0108 |
| | 750 | 0.1987 | 0.7606 | 1.0153 | 0.0039 | 0.0365 | 0.0336 | 387 | 0.0179 |
| Excavators Composite | | 0.0733 | 0.5124 | 0.4042 | 0.0013 | 0.0184 | 0.0169 | 120 | 0.0066 |
| Forklifts | 50 | 0.0191 | 0.1400 | 0.1084 | 0.0002 | 0.0039 | 0.0036 | 14.7 | 0.0017 |
| | 120 | 0.0225 | 0.2102 | 0.1443 | 0.0004 | 0.0074 | 0.0068 | 31.2 | 0.0020 |
| | 175 | 0.0336 | 0.3315 | 0.1772 | 0.0006 | 0.0087 | 0.0080 | 56.1 | 0.0030 |
| | 250 | 0.0385 | 0.1554 | 0.1887 | 0.0009 | 0.0062 | 0.0057 | 77.1 | 0.0035 |
| | 500 | 0.0548 | 0.2126 | 0.2528 | 0.0011 | 0.0088 | 0.0081 | 111 | 0.0049 |
| Forklifts Composite | | 0.0320 | 0.2160 | 0.1691 | 0.0006 | 0.0070 | 0.0065 | 54.4 | 0.0029 |
| Generator Sets | 15 | 0.0116 | 0.0638 | 0.0814 | 0.0002 | 0.0038 | 0.0035 | 10.2 | 0.0011 |
| | 25 | 0.0224 | 0.0769 | 0.1410 | 0.0002 | 0.0064 | 0.0059 | 17.6 | 0.0020 |
| | 50 | 0.0379 | 0.2161 | 0.2199 | 0.0004 | 0.0106 | 0.0098 | 30.6 | 0.0034 |
| | 120 | 0.0506 | 0.4641 | 0.4378 | 0.0009 | 0.0250 | 0.0230 | 77.9 | 0.0046 |
| | 175 | 0.0676 | 0.7323 | 0.5990 | 0.0016 | 0.0266 | 0.0245 | 142 | 0.0061 |
| | 250 | 0.0747 | 0.3844 | 0.7614 | 0.0024 | 0.0218 | 0.0200 | 213 | 0.0067 |
| | 500 | 0.1125 | 0.5968 | 1.0874 | 0.0033 | 0.0333 | 0.0307 | 337 | 0.0102 |
| | 750 | 0.1842 | 0.9634 | 1.7962 | 0.0055 | 0.0544 | 0.0500 | 544 | 0.0166 |
| | 9999 | 0.4502 | 2.0059 | 6.6947 | 0.0105 | 0.1476 | 0.1358 | 1,049 | 0.0406 |
| Generator Sets Composite | | 0.0395 | 0.2732 | 0.3232 | 0.0007 | 0.0150 | 0.0138 | 61.0 | 0.0036 |
| Graders | 50 | 0.0563 | 0.2762 | 0.2156 | 0.0004 | 0.0124 | 0.0114 | 27.5 | 0.0051 |
| | 120 | 0.0738 | 0.5090 | 0.4568 | 0.0009 | 0.0311 | 0.0286 | 75.0 | 0.0067 |
| | 175 | 0.0918 | 0.7282 | 0.5622 | 0.0014 | 0.0303 | 0.0279 | 124 | 0.0083 |
| | 250 | 0.0999 | 0.3683 | 0.6701 | 0.0019 | 0.0230 | 0.0211 | 172 | 0.0090 |
| | 500 | 0.1284 | 0.4966 | 0.7982 | 0.0023 | 0.0288 | 0.0265 | 229 | 0.0116 |
| | 750 | 0.2731 | 1.0508 | 1.7425 | 0.0049 | 0.0621 | 0.0571 | 486 | 0.0246 |
| Graders Composite | | 0.0919 | 0.5765 | 0.5823 | 0.0015 | 0.0280 | 0.0258 | 133 | 0.0083 |
| Off-Highway Trac | 120 | 0.1455 | 0.6789 | 0.8421 | 0.0011 | 0.0674 | 0.0621 | 93.7 | 0.0131 |
| | 175 | 0.1455 | 0.8025 | 0.9712 | 0.0015 | 0.0547 | 0.0503 | 130 | 0.0131 |
| | 250 | 0.1147 | 0.3614 | 0.8843 | 0.0015 | 0.0348 | 0.0321 | 130 | 0.0103 |
| | 750 | 0.4683 | 1.8825 | 3.5643 | 0.0057 | 0.1391 | 0.1280 | 568 | 0.0423 |
| | 1000 | 0.7129 | 2.9445 | 7.4279 | 0.0082 | 0.2214 | 0.2037 | 814 | 0.0643 |
| Off-Highway Tractors Compos | | 0.1470 | 0.6517 | 1.0657 | 0.0017 | 0.0497 | 0.0457 | 151 | 0.0133 |
| Off-Highway Truc | 175 | 0.0837 | 0.7538 | 0.4564 | 0.0014 | 0.0234 | 0.0215 | 125 | 0.0076 |
| | 250 | 0.0927 | 0.3514 | 0.5042 | 0.0019 | 0.0173 | 0.0159 | 167 | 0.0084 |
| | 500 | 0.1488 | 0.5446 | 0.7481 | 0.0027 | 0.0273 | 0.0251 | 272 | 0.0134 |
| | 750 | 0.2416 | 0.8831 | 1.2347 | 0.0044 | 0.0446 | 0.0411 | 442 | 0.0218 |
| | 1000 | 0.3613 | 1.2913 | 3.8920 | 0.0063 | 0.0903 | 0.0831 | 625 | 0.0326 |
| Off-Highway Trucks Composit | | 0.1443 | 0.5514 | 0.8306 | 0.0027 | 0.0280 | 0.0258 | 260 | 0.0130 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0328 | 0.2267 | 0.1956 | 0.0004 | 0.0078 | 0.0072 | 28.0 | 0.0030 |
| | 120 | 0.0501 | 0.5080 | 0.3835 | 0.0009 | 0.0199 | 0.0183 | 80.9 | 0.0045 |
| | 175 | 0.0524 | 0.5859 | 0.3414 | 0.0012 | 0.0164 | 0.0151 | 107 | 0.0047 |
| | 500 | 0.1012 | 0.4676 | 0.6065 | 0.0025 | 0.0212 | 0.0195 | 254 | 0.0091 |
| Other Construction Equipment | | 0.0563 | 0.3508 | 0.3519 | 0.0013 | 0.0139 | 0.0128 | 122 | 0.0051 |
| Other General Ind | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0431 | 0.2211 | 0.1744 | 0.0003 | 0.0101 | 0.0093 | 21.7 | 0.0039 |
| | 120 | 0.0602 | 0.4232 | 0.3810 | 0.0007 | 0.0256 | 0.0236 | 62.0 | 0.0054 |
| | 175 | 0.0721 | 0.5668 | 0.4439 | 0.0011 | 0.0237 | 0.0218 | 95.9 | 0.0065 |
| | 250 | 0.0791 | 0.2804 | 0.5318 | 0.0015 | 0.0173 | 0.0159 | 136 | 0.0071 |
| | 500 | 0.1506 | 0.5217 | 0.9276 | 0.0026 | 0.0326 | 0.0300 | 265 | 0.0136 |
| | 750 | 0.2490 | 0.8599 | 1.5657 | 0.0044 | 0.0543 | 0.0500 | 437 | 0.0225 |
| | 1000 | 0.3467 | 1.1855 | 3.8628 | 0.0056 | 0.0969 | 0.0892 | 560 | 0.0313 |
| Other General Industrial Equip | | 0.0983 | 0.4517 | 0.6661 | 0.0016 | 0.0262 | 0.0241 | 152 | 0.0089 |
| Other Material Ha | 50 | 0.0595 | 0.3049 | 0.2425 | 0.0004 | 0.0141 | 0.0130 | 30.3 | 0.0054 |
| | 120 | 0.0583 | 0.4117 | 0.3720 | 0.0007 | 0.0250 | 0.0230 | 60.7 | 0.0053 |
| | 175 | 0.0907 | 0.7176 | 0.5642 | 0.0014 | 0.0301 | 0.0277 | 122 | 0.0082 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0836 | 0.2984 | 0.5684 | 0.0016 | 0.0185 | 0.0170 | 145 | 0.0075 |
| | 500 | 0.1074 | 0.3752 | 0.6692 | 0.0019 | 0.0235 | 0.0216 | 192 | 0.0097 |
| | 9999 | 0.4910 | 1.5647 | 5.1082 | 0.0073 | 0.1280 | 0.1177 | 741 | 0.0443 |
| Other Material Handling Equip | | 0.0924 | 0.4429 | 0.6500 | 0.0015 | 0.0252 | 0.0232 | 141 | 0.0083 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1427 | 0.0002 | 0.0055 | 0.0051 | 18.7 | 0.0020 |
| | 50 | 0.0834 | 0.3055 | 0.2398 | 0.0004 | 0.0184 | 0.0169 | 28.0 | 0.0075 |
| | 120 | 0.0910 | 0.4805 | 0.5471 | 0.0008 | 0.0428 | 0.0394 | 69.2 | 0.0082 |
| | 175 | 0.1217 | 0.7599 | 0.8187 | 0.0014 | 0.0459 | 0.0422 | 128 | 0.0110 |
| | 250 | 0.1411 | 0.4713 | 1.1106 | 0.0022 | 0.0407 | 0.0375 | 194 | 0.0127 |
| | 500 | 0.1595 | 0.6305 | 1.1959 | 0.0023 | 0.0450 | 0.0414 | 233 | 0.0144 |
| Pavers Composite | | 0.0989 | 0.4920 | 0.5450 | 0.0009 | 0.0355 | 0.0326 | 77.9 | 0.0089 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0702 | 0.2577 | 0.2043 | 0.0003 | 0.0157 | 0.0144 | 23.9 | 0.0063 |
| | 120 | 0.0708 | 0.3762 | 0.4280 | 0.0006 | 0.0337 | 0.0310 | 54.5 | 0.0064 |
| | 175 | 0.0944 | 0.5945 | 0.6403 | 0.0011 | 0.0360 | 0.0331 | 101 | 0.0085 |
| | 250 | 0.0864 | 0.2894 | 0.6928 | 0.0014 | 0.0249 | 0.0229 | 122 | 0.0078 |
| Paving Equipment Composite | | 0.0757 | 0.4084 | 0.4807 | 0.0008 | 0.0315 | 0.0290 | 68.9 | 0.0068 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0056 | 0.0305 | 0.0390 | 0.0001 | 0.0018 | 0.0017 | 4.9 | 0.0005 |
| | 25 | 0.0091 | 0.0312 | 0.0572 | 0.0001 | 0.0026 | 0.0024 | 7.1 | 0.0008 |
| | 50 | 0.0128 | 0.0856 | 0.0986 | 0.0002 | 0.0041 | 0.0038 | 14.3 | 0.0012 |
| | 120 | 0.0128 | 0.1367 | 0.1293 | 0.0003 | 0.0065 | 0.0060 | 24.1 | 0.0012 |
| Pressure Washers Composite | | 0.0085 | 0.0549 | 0.0650 | 0.0001 | 0.0030 | 0.0027 | 9.4 | 0.0008 |
| Pumps | 15 | 0.0096 | 0.0464 | 0.0595 | 0.0001 | 0.0030 | 0.0028 | 7.4 | 0.0009 |
| | 25 | 0.0265 | 0.0850 | 0.1558 | 0.0002 | 0.0073 | 0.0067 | 19.5 | 0.0024 |
| | 50 | 0.0465 | 0.2546 | 0.2497 | 0.0004 | 0.0126 | 0.0116 | 34.3 | 0.0042 |
| | 120 | 0.0537 | 0.4713 | 0.4442 | 0.0009 | 0.0263 | 0.0242 | 77.9 | 0.0048 |
| | 175 | 0.0712 | 0.7336 | 0.6007 | 0.0016 | 0.0277 | 0.0255 | 140 | 0.0064 |
| | 250 | 0.0760 | 0.3700 | 0.7338 | 0.0023 | 0.0215 | 0.0198 | 201 | 0.0069 |
| | 500 | 0.1241 | 0.6189 | 1.1297 | 0.0034 | 0.0355 | 0.0327 | 345 | 0.0112 |
| | 750 | 0.2075 | 1.0232 | 1.9114 | 0.0057 | 0.0594 | 0.0547 | 571 | 0.0187 |
| | 9999 | 0.6127 | 2.6255 | 8.7489 | 0.0136 | 0.1961 | 0.1804 | 1,355 | 0.0553 |
| Pumps Composite | | 0.0376 | 0.2674 | 0.2854 | 0.0006 | 0.0147 | 0.0135 | 49.6 | 0.0034 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0543 | 0.2436 | 0.2039 | 0.0003 | 0.0128 | 0.0117 | 26.0 | 0.0049 |
| | 120 | 0.0576 | 0.3873 | 0.3799 | 0.0007 | 0.0270 | 0.0249 | 59.0 | 0.0052 |
| | 175 | 0.0774 | 0.6114 | 0.5331 | 0.0012 | 0.0286 | 0.0263 | 108 | 0.0070 |
| | 250 | 0.0842 | 0.3201 | 0.6581 | 0.0017 | 0.0223 | 0.0205 | 153 | 0.0076 |
| | 500 | 0.1151 | 0.4607 | 0.8354 | 0.0022 | 0.0299 | 0.0275 | 219 | 0.0104 |
| Rollers Composite | | 0.0584 | 0.3837 | 0.3793 | 0.0008 | 0.0232 | 0.0214 | 67.0 | 0.0053 |
| Rough Terrain Fo | 50 | 0.0520 | 0.3171 | 0.2556 | 0.0004 | 0.0122 | 0.0113 | 33.9 | 0.0047 |
| | 120 | 0.0495 | 0.4142 | 0.3326 | 0.0007 | 0.0197 | 0.0181 | 62.4 | 0.0045 |
| | 175 | 0.0788 | 0.7229 | 0.4710 | 0.0014 | 0.0245 | 0.0226 | 125 | 0.0071 |
| | 250 | 0.0881 | 0.3442 | 0.5378 | 0.0019 | 0.0182 | 0.0168 | 171 | 0.0079 |
| | 500 | 0.1296 | 0.4936 | 0.7287 | 0.0025 | 0.0265 | 0.0244 | 257 | 0.0117 |
| Rough Terrain Forklifts Compo | | 0.0533 | 0.4464 | 0.3494 | 0.0008 | 0.0201 | 0.0185 | 70.3 | 0.0048 |
| Rubber Tired Doz | 175 | 0.1509 | 0.8124 | 0.9962 | 0.0015 | 0.0561 | 0.0516 | 129 | 0.0136 |
| | 250 | 0.1701 | 0.5279 | 1.2898 | 0.0021 | 0.0516 | 0.0474 | 183 | 0.0153 |
| | 500 | 0.2291 | 0.9276 | 1.6868 | 0.0026 | 0.0673 | 0.0619 | 265 | 0.0207 |
| | 750 | 0.3461 | 1.3934 | 2.5948 | 0.0040 | 0.1024 | 0.0942 | 399 | 0.0312 |
| | 1000 | 0.5438 | 2.2500 | 5.5311 | 0.0060 | 0.1672 | 0.1539 | 592 | 0.0491 |
| Rubber Tired Dozers Compos | | 0.2118 | 0.8006 | 1.5773 | 0.0025 | 0.0630 | 0.0580 | 239 | 0.0191 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0615 | 0.3080 | 0.2424 | 0.0004 | 0.0137 | 0.0126 | 31.1 | 0.0055 |
| | 120 | 0.0563 | 0.3977 | 0.3529 | 0.0007 | 0.0237 | 0.0218 | 58.9 | 0.0051 |
| | 175 | 0.0767 | 0.6215 | 0.4713 | 0.0012 | 0.0253 | 0.0233 | 106 | 0.0069 |
| | 250 | 0.0848 | 0.3159 | 0.5655 | 0.0017 | 0.0194 | 0.0179 | 149 | 0.0077 |
| | 500 | 0.1302 | 0.5016 | 0.8032 | 0.0023 | 0.0291 | 0.0268 | 237 | 0.0118 |
| | 750 | 0.2680 | 1.0271 | 1.6958 | 0.0049 | 0.0606 | 0.0558 | 486 | 0.0242 |
| | 1000 | 0.3484 | 1.3166 | 4.0040 | 0.0060 | 0.0983 | 0.0904 | 594 | 0.0314 |
| Rubber Tired Loaders Compos | | 0.0753 | 0.4406 | 0.4747 | 0.0012 | 0.0235 | 0.0216 | 109 | 0.0068 |
| Scrapers | 120 | 0.1218 | 0.6612 | 0.7170 | 0.0011 | 0.0551 | 0.0507 | 93.9 | 0.0110 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1400 | 0.8921 | 0.9020 | 0.0017 | 0.0505 | 0.0464 | 148 | 0.0126 |
| | 250 | 0.1522 | 0.5044 | 1.1344 | 0.0024 | 0.0412 | 0.0379 | 209 | 0.0137 |
| | 500 | 0.2211 | 0.8455 | 1.5615 | 0.0032 | 0.0584 | 0.0537 | 321 | 0.0200 |
| | 750 | 0.3839 | 1.4588 | 2.7734 | 0.0056 | 0.1024 | 0.0942 | 555 | 0.0346 |
| Scrapers Composite | | 0.1914 | 0.7938 | 1.3434 | 0.0027 | 0.0541 | 0.0497 | 262 | 0.0173 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0502 | 0.2833 | 0.2631 | 0.0005 | 0.0131 | 0.0121 | 36.2 | 0.0045 |
| | 120 | 0.0558 | 0.4946 | 0.4424 | 0.0009 | 0.0264 | 0.0243 | 80.2 | 0.0050 |
| | 175 | 0.0811 | 0.8276 | 0.6279 | 0.0017 | 0.0302 | 0.0277 | 155 | 0.0073 |
| | 250 | 0.1022 | 0.4765 | 0.8737 | 0.0029 | 0.0266 | 0.0245 | 255 | 0.0092 |
| Signal Boards Composite | | 0.0129 | 0.0912 | 0.0912 | 0.0002 | 0.0042 | 0.0038 | 16.7 | 0.0012 |
| Skid Steer Loade | 25 | 0.0171 | 0.0575 | 0.1070 | 0.0002 | 0.0044 | 0.0040 | 13.8 | 0.0015 |
| | 50 | 0.0230 | 0.2006 | 0.1655 | 0.0003 | 0.0043 | 0.0040 | 25.5 | 0.0021 |
| | 120 | 0.0218 | 0.2673 | 0.1647 | 0.0005 | 0.0064 | 0.0059 | 42.8 | 0.0020 |
| Skid Steer Loaders Composite | | 0.0222 | 0.2125 | 0.1614 | 0.0004 | 0.0050 | 0.0046 | 30.3 | 0.0020 |
| Surfacing Equipm | 50 | 0.0265 | 0.1191 | 0.1069 | 0.0002 | 0.0063 | 0.0058 | 14.1 | 0.0024 |
| | 120 | 0.0570 | 0.4028 | 0.4035 | 0.0007 | 0.0271 | 0.0250 | 63.8 | 0.0051 |
| | 175 | 0.0550 | 0.4663 | 0.4168 | 0.0010 | 0.0210 | 0.0193 | 85.8 | 0.0050 |
| | 250 | 0.0652 | 0.2754 | 0.5719 | 0.0015 | 0.0188 | 0.0173 | 135 | 0.0059 |
| | 500 | 0.1008 | 0.4728 | 0.8400 | 0.0022 | 0.0288 | 0.0265 | 221 | 0.0091 |
| | 750 | 0.1599 | 0.7413 | 1.3593 | 0.0035 | 0.0459 | 0.0423 | 347 | 0.0144 |
| Surfacing Equipment Compos | | 0.0823 | 0.3953 | 0.6593 | 0.0017 | 0.0239 | 0.0220 | 166 | 0.0074 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0430 | 0.2898 | 0.2365 | 0.0004 | 0.0098 | 0.0090 | 31.6 | 0.0039 |
| | 120 | 0.0555 | 0.4959 | 0.3694 | 0.0009 | 0.0210 | 0.0193 | 75.0 | 0.0050 |
| | 175 | 0.0845 | 0.8043 | 0.4869 | 0.0016 | 0.0253 | 0.0233 | 139 | 0.0076 |
| | 250 | 0.0803 | 0.3198 | 0.4530 | 0.0018 | 0.0152 | 0.0140 | 162 | 0.0072 |
| Sweepers/Scrubbers Compos | | 0.0584 | 0.4916 | 0.3563 | 0.0009 | 0.0183 | 0.0169 | 78.5 | 0.0053 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0046 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0407 | 0.2760 | 0.2179 | 0.0004 | 0.0087 | 0.0080 | 30.3 | 0.0037 |
| | 120 | 0.0366 | 0.3402 | 0.2466 | 0.0006 | 0.0129 | 0.0119 | 51.7 | 0.0033 |
| | 175 | 0.0571 | 0.5841 | 0.3220 | 0.0011 | 0.0159 | 0.0146 | 101 | 0.0052 |
| | 250 | 0.0813 | 0.3445 | 0.4427 | 0.0019 | 0.0151 | 0.0139 | 172 | 0.0073 |
| | 500 | 0.1606 | 0.6642 | 0.8132 | 0.0039 | 0.0294 | 0.0270 | 345 | 0.0145 |
| | 750 | 0.2409 | 0.9959 | 1.2387 | 0.0058 | 0.0443 | 0.0408 | 517 | 0.0217 |
| Tractors/Loaders/Backhoes C | | 0.0436 | 0.3616 | 0.2744 | 0.0008 | 0.0134 | 0.0124 | 66.8 | 0.0039 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0990 | 0.3495 | 0.2804 | 0.0004 | 0.0218 | 0.0201 | 32.9 | 0.0089 |
| | 120 | 0.0849 | 0.4443 | 0.5223 | 0.0008 | 0.0408 | 0.0375 | 64.9 | 0.0077 |
| | 175 | 0.1346 | 0.8393 | 0.9412 | 0.0016 | 0.0521 | 0.0479 | 144 | 0.0121 |
| | 250 | 0.1600 | 0.5472 | 1.3120 | 0.0025 | 0.0487 | 0.0448 | 223 | 0.0144 |
| | 500 | 0.2092 | 0.8710 | 1.6487 | 0.0031 | 0.0623 | 0.0573 | 311 | 0.0189 |
| | 750 | 0.3964 | 1.6395 | 3.1894 | 0.0059 | 0.1191 | 0.1095 | 587 | 0.0358 |
| Trenchers Composite | | 0.0933 | 0.4270 | 0.4575 | 0.0007 | 0.0336 | 0.0309 | 58.7 | 0.0084 |
| Welders | 15 | 0.0080 | 0.0388 | 0.0498 | 0.0001 | 0.0025 | 0.0023 | 6.2 | 0.0007 |
| | 25 | 0.0153 | 0.0492 | 0.0903 | 0.0001 | 0.0042 | 0.0039 | 11.3 | 0.0014 |
| | 50 | 0.0435 | 0.2219 | 0.1968 | 0.0003 | 0.0110 | 0.0102 | 26.0 | 0.0039 |
| | 120 | 0.0321 | 0.2508 | 0.2344 | 0.0005 | 0.0153 | 0.0140 | 39.5 | 0.0029 |
| | 175 | 0.0600 | 0.5396 | 0.4393 | 0.0011 | 0.0223 | 0.0205 | 98.2 | 0.0054 |
| | 250 | 0.0551 | 0.2294 | 0.4536 | 0.0013 | 0.0142 | 0.0130 | 119 | 0.0050 |
| | 500 | 0.0748 | 0.3117 | 0.5690 | 0.0016 | 0.0192 | 0.0176 | 168 | 0.0067 |
| Welders Composite | | 0.0310 | 0.1816 | 0.1735 | 0.0003 | 0.0102 | 0.0094 | 25.6 | 0.0028 |

**San Diego 2025 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,343,732.35 | ########### | 8,492,736.38 | 0.02 | 0.71 | 0.09 | 223.96 | 0.05 | 0.04 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 6,282.20 | 213,159.29 | 39,008.92 | 0.01 | 0.09 | 0.31 | 246.18 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 198,419.75 | 7,123,689.46 | 1,204,641.90 | 0.02 | 1.09 | 0.12 | 276.49 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 240.83 | 8,707.20 | 1,432.14 | 0.02 | 0.13 | 0.37 | 242.28 | 0.06 | 0.05 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 479,791.14 | ########### | 3,017,273.36 | 0.01 | 0.73 | 0.08 | 343.84 | 0.05 | 0.04 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 211.77 | 7,665.63 | 1,309.49 | 0.02 | 0.11 | 0.40 | 268.51 | 0.06 | 0.05 | 0.00 | | |
| Average | | | | | | | 0.019 | 0.478 | 0.227 | 266.878 | 0.052 | 0.042 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,476 | 582,978 | - | 0.22 | 1.01 | 2.06 | 1541.82 | 0.07 | 0.10 | 0.02 | | |

Source: EMFAC 2011

## 2025 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0132 | 0.0451 | 0.0838 | 0.0001 | 0.0032 | 0.0030 | 11.0 | 0.0012 |
| | 50 | 0.0168 | 0.1351 | 0.1218 | 0.0003 | 0.0035 | 0.0032 | 19.6 | 0.0015 |
| | 120 | 0.0176 | 0.2265 | 0.1496 | 0.0004 | 0.0063 | 0.0058 | 38.1 | 0.0016 |
| | 500 | 0.0580 | 0.3710 | 0.3660 | 0.0021 | 0.0109 | 0.0100 | 213 | 0.0052 |
| | 750 | 0.1054 | 0.6706 | 0.6753 | 0.0039 | 0.0199 | 0.0183 | 385 | 0.0095 |
| Aerial Lifts Composite | | 0.0184 | 0.1646 | 0.1366 | 0.0004 | 0.0048 | 0.0044 | 34.7 | 0.0017 |
| Air Compressors | 15 | 0.0087 | 0.0444 | 0.0545 | 0.0001 | 0.0023 | 0.0022 | 7.2 | 0.0008 |
| | 25 | 0.0181 | 0.0605 | 0.1121 | 0.0002 | 0.0045 | 0.0042 | 14.4 | 0.0016 |
| | 50 | 0.0263 | 0.1911 | 0.1476 | 0.0003 | 0.0047 | 0.0043 | 22.3 | 0.0024 |
| | 120 | 0.0289 | 0.3023 | 0.1928 | 0.0006 | 0.0088 | 0.0081 | 47.0 | 0.0026 |
| | 175 | 0.0424 | 0.4998 | 0.2187 | 0.0010 | 0.0104 | 0.0095 | 88.5 | 0.0038 |
| | 250 | 0.0514 | 0.2531 | 0.2553 | 0.0015 | 0.0078 | 0.0072 | 131 | 0.0046 |
| | 500 | 0.0894 | 0.4292 | 0.4150 | 0.0023 | 0.0134 | 0.0123 | 232 | 0.0081 |
| | 750 | 0.1385 | 0.6633 | 0.6545 | 0.0036 | 0.0210 | 0.0193 | 358 | 0.0125 |
| | 1000 | 0.1999 | 0.9265 | 2.5439 | 0.0049 | 0.0483 | 0.0444 | 486 | 0.0180 |
| Air Compressors Composite | | 0.0349 | 0.3027 | 0.2104 | 0.0007 | 0.0088 | 0.0081 | 63.6 | 0.0031 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0190 | 0.2200 | 0.1662 | 0.0004 | 0.0009 | 0.0008 | 31.0 | 0.0017 |
| | 120 | 0.0252 | 0.4660 | 0.1955 | 0.0009 | 0.0020 | 0.0018 | 77.1 | 0.0023 |
| | 175 | 0.0324 | 0.7542 | 0.0787 | 0.0016 | 0.0030 | 0.0027 | 141 | 0.0029 |
| | 250 | 0.0427 | 0.3426 | 0.0981 | 0.0021 | 0.0035 | 0.0032 | 188 | 0.0039 |
| | 500 | 0.0706 | 0.5512 | 0.1622 | 0.0031 | 0.0058 | 0.0054 | 311 | 0.0064 |
| | 750 | 0.1396 | 1.0891 | 0.3204 | 0.0062 | 0.0115 | 0.0106 | 615 | 0.0126 |
| | 1000 | 0.2115 | 1.6437 | 3.8912 | 0.0093 | 0.0364 | 0.0335 | 928 | 0.0191 |
| Bore/Drill Rigs Composite | | 0.0428 | 0.5007 | 0.2864 | 0.0017 | 0.0042 | 0.0038 | 165 | 0.0039 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0213 | 0.0724 | 0.1346 | 0.0002 | 0.0052 | 0.0048 | 17.6 | 0.0019 |
| Cement and Mortar Mixers Co | | 0.0085 | 0.0414 | 0.0534 | 0.0001 | 0.0021 | 0.0019 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0279 | 0.2284 | 0.1910 | 0.0004 | 0.0053 | 0.0049 | 30.2 | 0.0025 |
| | 120 | 0.0370 | 0.4561 | 0.2840 | 0.0009 | 0.0117 | 0.0108 | 74.1 | 0.0033 |
| | 175 | 0.0623 | 0.8663 | 0.3523 | 0.0018 | 0.0160 | 0.0147 | 160 | 0.0056 |
| Concrete/Industrial Saws Com | | 0.0337 | 0.3706 | 0.2471 | 0.0007 | 0.0093 | 0.0086 | 58.5 | 0.0030 |
| Cranes | 50 | 0.0350 | 0.2256 | 0.1644 | 0.0003 | 0.0062 | 0.0057 | 23.2 | 0.0032 |
| | 120 | 0.0376 | 0.3384 | 0.2298 | 0.0006 | 0.0120 | 0.0111 | 50.1 | 0.0034 |
| | 175 | 0.0462 | 0.4744 | 0.2300 | 0.0009 | 0.0120 | 0.0110 | 80.3 | 0.0042 |
| | 250 | 0.0544 | 0.2316 | 0.2705 | 0.0013 | 0.0094 | 0.0087 | 112 | 0.0049 |
| | 500 | 0.0858 | 0.3535 | 0.3977 | 0.0018 | 0.0146 | 0.0134 | 180 | 0.0077 |
| | 750 | 0.1446 | 0.5947 | 0.6821 | 0.0030 | 0.0248 | 0.0228 | 303 | 0.0130 |
| | 9999 | 0.5219 | 1.9715 | 5.5760 | 0.0098 | 0.1146 | 0.1055 | 971 | 0.0471 |
| Cranes Composite | | 0.0681 | 0.3738 | 0.4223 | 0.0014 | 0.0143 | 0.0132 | 129 | 0.0061 |
| Crawler Tractors | 50 | 0.0487 | 0.2566 | 0.1842 | 0.0003 | 0.0090 | 0.0083 | 24.9 | 0.0044 |
| | 120 | 0.0609 | 0.4537 | 0.3562 | 0.0008 | 0.0221 | 0.0203 | 65.8 | 0.0055 |
| | 175 | 0.0823 | 0.7265 | 0.4447 | 0.0014 | 0.0241 | 0.0222 | 121 | 0.0074 |
| | 250 | 0.0924 | 0.3662 | 0.5348 | 0.0019 | 0.0192 | 0.0177 | 166 | 0.0083 |
| | 500 | 0.1392 | 0.5877 | 0.7527 | 0.0025 | 0.0280 | 0.0258 | 259 | 0.0126 |
| | 750 | 0.2506 | 1.0528 | 1.3878 | 0.0047 | 0.0510 | 0.0469 | 465 | 0.0226 |
| | 1000 | 0.3749 | 1.5618 | 4.2168 | 0.0066 | 0.0958 | 0.0881 | 658 | 0.0338 |
| Crawler Tractors Composite | | 0.0789 | 0.5065 | 0.4492 | 0.0013 | 0.0227 | 0.0209 | 114 | 0.0071 |
| Crushing/Proc. E | 50 | 0.0508 | 0.3859 | 0.2899 | 0.0006 | 0.0083 | 0.0077 | 44.0 | 0.0046 |
| | 120 | 0.0506 | 0.5406 | 0.3289 | 0.0010 | 0.0140 | 0.0129 | 83.1 | 0.0046 |
| | 175 | 0.0795 | 0.9556 | 0.3830 | 0.0019 | 0.0177 | 0.0163 | 167 | 0.0072 |
| | 250 | 0.0967 | 0.4768 | 0.4357 | 0.0028 | 0.0134 | 0.0123 | 245 | 0.0087 |
| | 500 | 0.1459 | 0.6977 | 0.6163 | 0.0037 | 0.0200 | 0.0184 | 374 | 0.0132 |
| | 750 | 0.2307 | 1.1003 | 0.9907 | 0.0059 | 0.0316 | 0.0291 | 589 | 0.0208 |
| | 9999 | 0.6019 | 2.5014 | 6.6977 | 0.0131 | 0.1238 | 0.1139 | 1,308 | 0.0543 |
| Crushing/Proc. Equipment Co | | 0.0693 | 0.6187 | 0.3763 | 0.0015 | 0.0146 | 0.0134 | 132 | 0.0062 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0297 | 0.2365 | 0.1616 | 0.0003 | 0.0035 | 0.0032 | 25.0 | 0.0027 |
| | 120 | 0.0448 | 0.4942 | 0.2638 | 0.0009 | 0.0092 | 0.0085 | 73.6 | 0.0040 |
| | 175 | 0.0518 | 0.6636 | 0.1982 | 0.0013 | 0.0091 | 0.0084 | 112 | 0.0047 |
| | 250 | 0.0647 | 0.3210 | 0.2222 | 0.0018 | 0.0074 | 0.0068 | 159 | 0.0058 |
| | 500 | 0.0946 | 0.4495 | 0.3091 | 0.0023 | 0.0107 | 0.0098 | 234 | 0.0085 |
| | 750 | 0.1569 | 0.7451 | 0.5194 | 0.0039 | 0.0178 | 0.0164 | 387 | 0.0142 |
| Excavators Composite | | 0.0559 | 0.5086 | 0.2269 | 0.0013 | 0.0086 | 0.0079 | 120 | 0.0050 |
| Forklifts | 50 | 0.0150 | 0.1361 | 0.0904 | 0.0002 | 0.0013 | 0.0012 | 14.7 | 0.0014 |
| | 120 | 0.0168 | 0.2086 | 0.0997 | 0.0004 | 0.0023 | 0.0021 | 31.2 | 0.0015 |
| | 175 | 0.0228 | 0.3310 | 0.0732 | 0.0006 | 0.0029 | 0.0026 | 56.1 | 0.0021 |
| | 250 | 0.0289 | 0.1551 | 0.0746 | 0.0009 | 0.0027 | 0.0024 | 77.1 | 0.0026 |
| | 500 | 0.0416 | 0.2123 | 0.1038 | 0.0011 | 0.0038 | 0.0035 | 111 | 0.0038 |
| Forklifts Composite | | 0.0236 | 0.2148 | 0.0860 | 0.0006 | 0.0025 | 0.0023 | 54.4 | 0.0021 |
| Generator Sets | 15 | 0.0109 | 0.0627 | 0.0768 | 0.0002 | 0.0032 | 0.0030 | 10.2 | 0.0010 |
| | 25 | 0.0216 | 0.0738 | 0.1368 | 0.0002 | 0.0055 | 0.0050 | 17.6 | 0.0019 |
| | 50 | 0.0242 | 0.2034 | 0.1881 | 0.0004 | 0.0051 | 0.0047 | 30.6 | 0.0022 |
| | 120 | 0.0340 | 0.4585 | 0.3022 | 0.0009 | 0.0122 | 0.0112 | 77.9 | 0.0031 |
| | 175 | 0.0469 | 0.7328 | 0.3291 | 0.0016 | 0.0136 | 0.0125 | 142 | 0.0042 |
| | 250 | 0.0558 | 0.3746 | 0.3885 | 0.0024 | 0.0108 | 0.0099 | 213 | 0.0050 |
| | 500 | 0.0862 | 0.5820 | 0.5697 | 0.0033 | 0.0167 | 0.0153 | 337 | 0.0078 |
| | 750 | 0.1401 | 0.9395 | 0.9382 | 0.0055 | 0.0272 | 0.0250 | 544 | 0.0126 |
| | 9999 | 0.3235 | 1.8648 | 5.2188 | 0.0105 | 0.0888 | 0.0817 | 1,049 | 0.0292 |
| Generator Sets Composite | | 0.0288 | 0.2667 | 0.2329 | 0.0007 | 0.0081 | 0.0074 | 61.0 | 0.0026 |
| Graders | 50 | 0.0382 | 0.2599 | 0.1877 | 0.0004 | 0.0063 | 0.0058 | 27.5 | 0.0034 |
| | 120 | 0.0521 | 0.5009 | 0.3219 | 0.0009 | 0.0153 | 0.0141 | 75.0 | 0.0047 |
| | 175 | 0.0652 | 0.7261 | 0.3117 | 0.0014 | 0.0157 | 0.0144 | 124 | 0.0059 |
| | 250 | 0.0781 | 0.3549 | 0.3652 | 0.0019 | 0.0129 | 0.0119 | 172 | 0.0071 |
| | 500 | 0.1023 | 0.4610 | 0.4468 | 0.0023 | 0.0165 | 0.0152 | 229 | 0.0092 |
| | 750 | 0.2167 | 0.9755 | 0.9628 | 0.0049 | 0.0353 | 0.0324 | 486 | 0.0196 |
| Graders Composite | | 0.0676 | 0.5696 | 0.3314 | 0.0015 | 0.0147 | 0.0135 | 133 | 0.0061 |
| Off-Highway Trac | 120 | 0.1108 | 0.6619 | 0.6362 | 0.0011 | 0.0455 | 0.0419 | 93.7 | 0.0100 |
| | 175 | 0.1110 | 0.7932 | 0.6639 | 0.0015 | 0.0370 | 0.0341 | 130 | 0.0100 |
| | 250 | 0.0890 | 0.3179 | 0.5983 | 0.0015 | 0.0227 | 0.0208 | 130 | 0.0080 |
| | 750 | 0.3692 | 1.5358 | 2.4157 | 0.0057 | 0.0918 | 0.0844 | 568 | 0.0333 |
| | 1000 | 0.5623 | 2.3619 | 6.0896 | 0.0082 | 0.1577 | 0.1451 | 814 | 0.0507 |
| Off-Highway Tractors Compos | | 0.1134 | 0.6101 | 0.7291 | 0.0017 | 0.0331 | 0.0305 | 151 | 0.0102 |
| Off-Highway Truc | 175 | 0.0622 | 0.7536 | 0.2376 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0056 |
| | 250 | 0.0730 | 0.3435 | 0.2521 | 0.0019 | 0.0085 | 0.0078 | 167 | 0.0066 |
| | 500 | 0.1183 | 0.5319 | 0.3878 | 0.0027 | 0.0135 | 0.0124 | 272 | 0.0107 |
| | 750 | 0.1921 | 0.8627 | 0.6384 | 0.0044 | 0.0221 | 0.0203 | 442 | 0.0173 |
| | 1000 | 0.2823 | 1.2403 | 3.1782 | 0.0063 | 0.0546 | 0.0502 | 625 | 0.0255 |
| Off-Highway Trucks Composit | | 0.1140 | 0.5385 | 0.4769 | 0.0027 | 0.0142 | 0.0131 | 260 | 0.0103 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0244 | 0.2188 | 0.1693 | 0.0004 | 0.0034 | 0.0031 | 28.0 | 0.0022 |
| | 120 | 0.0379 | 0.5045 | 0.2730 | 0.0009 | 0.0087 | 0.0080 | 80.9 | 0.0034 |
| | 175 | 0.0384 | 0.5858 | 0.1729 | 0.0012 | 0.0075 | 0.0069 | 107 | 0.0035 |
| | 500 | 0.0792 | 0.4606 | 0.3034 | 0.0025 | 0.0099 | 0.0091 | 254 | 0.0071 |
| Other Construction Equipment | | 0.0442 | 0.3474 | 0.2021 | 0.0013 | 0.0069 | 0.0063 | 123 | 0.0040 |
| Other General Ind | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0298 | 0.2099 | 0.1491 | 0.0003 | 0.0047 | 0.0043 | 21.7 | 0.0027 |
| | 120 | 0.0436 | 0.4189 | 0.2603 | 0.0007 | 0.0120 | 0.0111 | 62.0 | 0.0039 |
| | 175 | 0.0519 | 0.5684 | 0.2412 | 0.0011 | 0.0115 | 0.0106 | 95.9 | 0.0047 |
| | 250 | 0.0608 | 0.2743 | 0.2679 | 0.0015 | 0.0083 | 0.0076 | 136 | 0.0055 |
| | 500 | 0.1174 | 0.5103 | 0.4826 | 0.0026 | 0.0157 | 0.0145 | 265 | 0.0106 |
| | 750 | 0.1939 | 0.8411 | 0.8117 | 0.0044 | 0.0262 | 0.0241 | 437 | 0.0175 |
| | 1000 | 0.2627 | 1.1060 | 2.9924 | 0.0056 | 0.0579 | 0.0533 | 560 | 0.0237 |
| Other General Industrial Equip | | 0.0747 | 0.4438 | 0.3947 | 0.0016 | 0.0130 | 0.0120 | 152 | 0.0067 |
| Other Material Ha | 50 | 0.0410 | 0.2893 | 0.2073 | 0.0004 | 0.0065 | 0.0060 | 30.3 | 0.0037 |
| | 120 | 0.0421 | 0.4076 | 0.2541 | 0.0007 | 0.0117 | 0.0108 | 60.7 | 0.0038 |
| | 175 | 0.0653 | 0.7197 | 0.3067 | 0.0014 | 0.0146 | 0.0134 | 122 | 0.0059 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0642 | 0.2920 | 0.2863 | 0.0016 | 0.0088 | 0.0081 | 145 | 0.0058 |
| | 500 | 0.0837 | 0.3670 | 0.3482 | 0.0019 | 0.0113 | 0.0104 | 192 | 0.0075 |
| | 9999 | 0.3781 | 1.4596 | 3.9555 | 0.0073 | 0.0764 | 0.0703 | 741 | 0.0341 |
| Other Material Handling Equip | | 0.0696 | 0.4355 | 0.3844 | 0.0015 | 0.0124 | 0.0114 | 141 | 0.0063 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1422 | 0.0002 | 0.0053 | 0.0049 | 18.7 | 0.0020 |
| | 50 | 0.0574 | 0.2803 | 0.2102 | 0.0004 | 0.0114 | 0.0105 | 28.0 | 0.0052 |
| | 120 | 0.0662 | 0.4696 | 0.4003 | 0.0008 | 0.0263 | 0.0242 | 69.2 | 0.0060 |
| | 175 | 0.0899 | 0.7543 | 0.5238 | 0.0014 | 0.0286 | 0.0263 | 128 | 0.0081 |
| | 250 | 0.1097 | 0.4287 | 0.7020 | 0.0022 | 0.0254 | 0.0234 | 194 | 0.0099 |
| | 500 | 0.1263 | 0.5374 | 0.7572 | 0.0023 | 0.0284 | 0.0261 | 233 | 0.0114 |
| Pavers Composite | | 0.0717 | 0.4745 | 0.3858 | 0.0009 | 0.0220 | 0.0202 | 77.9 | 0.0065 |
| Paving Equipmer | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0469 | 0.2355 | 0.1789 | 0.0003 | 0.0095 | 0.0088 | 23.9 | 0.0042 |
| | 120 | 0.0503 | 0.3671 | 0.3092 | 0.0006 | 0.0200 | 0.0184 | 54.5 | 0.0045 |
| | 175 | 0.0687 | 0.5900 | 0.4021 | 0.0011 | 0.0219 | 0.0201 | 101 | 0.0062 |
| | 250 | 0.0672 | 0.2648 | 0.4289 | 0.0014 | 0.0154 | 0.0141 | 122 | 0.0061 |
| Paving Equipment Composite | | 0.0548 | 0.3993 | 0.3281 | 0.0008 | 0.0190 | 0.0175 | 68.9 | 0.0049 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0052 | 0.0301 | 0.0368 | 0.0001 | 0.0015 | 0.0014 | 4.9 | 0.0005 |
| | 25 | 0.0087 | 0.0299 | 0.0555 | 0.0001 | 0.0022 | 0.0020 | 7.1 | 0.0008 |
| | 50 | 0.0079 | 0.0810 | 0.0843 | 0.0002 | 0.0019 | 0.0018 | 14.3 | 0.0007 |
| | 120 | 0.0082 | 0.1351 | 0.0897 | 0.0003 | 0.0031 | 0.0029 | 24.1 | 0.0007 |
| Pressure Washers Composite | | 0.0066 | 0.0531 | 0.0561 | 0.0001 | 0.0019 | 0.0017 | 9.4 | 0.0006 |
| Pumps | 15 | 0.0089 | 0.0456 | 0.0560 | 0.0001 | 0.0024 | 0.0022 | 7.4 | 0.0008 |
| | 25 | 0.0244 | 0.0816 | 0.1512 | 0.0002 | 0.0061 | 0.0056 | 19.5 | 0.0022 |
| | 50 | 0.0299 | 0.2394 | 0.2138 | 0.0004 | 0.0061 | 0.0056 | 34.3 | 0.0027 |
| | 120 | 0.0365 | 0.4656 | 0.3062 | 0.0009 | 0.0129 | 0.0119 | 77.9 | 0.0033 |
| | 175 | 0.0499 | 0.7342 | 0.3301 | 0.0016 | 0.0142 | 0.0130 | 140 | 0.0045 |
| | 250 | 0.0572 | 0.3604 | 0.3745 | 0.0023 | 0.0107 | 0.0098 | 201 | 0.0052 |
| | 500 | 0.0959 | 0.6034 | 0.5922 | 0.0034 | 0.0178 | 0.0163 | 345 | 0.0087 |
| | 750 | 0.1593 | 0.9975 | 0.9991 | 0.0057 | 0.0297 | 0.0274 | 571 | 0.0144 |
| | 9999 | 0.4488 | 2.4388 | 6.8114 | 0.0136 | 0.1186 | 0.1091 | 1,355 | 0.0405 |
| Pumps Composite | | 0.0270 | 0.2617 | 0.2079 | 0.0006 | 0.0078 | 0.0072 | 49.6 | 0.0024 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0345 | 0.2258 | 0.1776 | 0.0003 | 0.0068 | 0.0062 | 26.0 | 0.0031 |
| | 120 | 0.0392 | 0.3801 | 0.2647 | 0.0007 | 0.0137 | 0.0126 | 59.0 | 0.0035 |
| | 175 | 0.0553 | 0.6096 | 0.3030 | 0.0012 | 0.0156 | 0.0143 | 108 | 0.0050 |
| | 250 | 0.0656 | 0.3037 | 0.3629 | 0.0017 | 0.0127 | 0.0116 | 153 | 0.0059 |
| | 500 | 0.0920 | 0.4189 | 0.4752 | 0.0022 | 0.0174 | 0.0160 | 219 | 0.0083 |
| Rollers Composite | | 0.0410 | 0.3763 | 0.2501 | 0.0008 | 0.0122 | 0.0113 | 67.0 | 0.0037 |
| Rough Terrain Fo | 50 | 0.0381 | 0.3041 | 0.2193 | 0.0004 | 0.0054 | 0.0049 | 33.9 | 0.0034 |
| | 120 | 0.0369 | 0.4106 | 0.2316 | 0.0007 | 0.0087 | 0.0080 | 62.4 | 0.0033 |
| | 175 | 0.0569 | 0.7229 | 0.2450 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0051 |
| | 250 | 0.0671 | 0.3372 | 0.2625 | 0.0019 | 0.0084 | 0.0077 | 171 | 0.0061 |
| | 500 | 0.0999 | 0.4838 | 0.3682 | 0.0025 | 0.0123 | 0.0113 | 257 | 0.0090 |
| Rough Terrain Forklifts Compo | | 0.0396 | 0.4430 | 0.2336 | 0.0008 | 0.0090 | 0.0083 | 70.3 | 0.0036 |
| Rubber Tired Doz | 175 | 0.1163 | 0.8019 | 0.6895 | 0.0015 | 0.0386 | 0.0355 | 129 | 0.0105 |
| | 250 | 0.1329 | 0.4624 | 0.8841 | 0.0021 | 0.0340 | 0.0312 | 183 | 0.0120 |
| | 500 | 0.1817 | 0.7490 | 1.1543 | 0.0026 | 0.0448 | 0.0412 | 265 | 0.0164 |
| | 750 | 0.2747 | 1.1262 | 1.7818 | 0.0040 | 0.0684 | 0.0629 | 399 | 0.0248 |
| | 1000 | 0.4321 | 1.7954 | 4.5523 | 0.0060 | 0.1202 | 0.1106 | 592 | 0.0390 |
| Rubber Tired Dozers Compos | | 0.1672 | 0.6620 | 1.0824 | 0.0025 | 0.0419 | 0.0385 | 239 | 0.0151 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0418 | 0.2904 | 0.2109 | 0.0004 | 0.0069 | 0.0063 | 31.1 | 0.0038 |
| | 120 | 0.0397 | 0.3916 | 0.2476 | 0.0007 | 0.0115 | 0.0105 | 58.9 | 0.0036 |
| | 175 | 0.0546 | 0.6199 | 0.2592 | 0.0012 | 0.0130 | 0.0119 | 106 | 0.0049 |
| | 250 | 0.0661 | 0.3041 | 0.3040 | 0.0017 | 0.0107 | 0.0099 | 149 | 0.0060 |
| | 500 | 0.1034 | 0.4654 | 0.4455 | 0.0023 | 0.0164 | 0.0151 | 237 | 0.0093 |
| | 750 | 0.2119 | 0.9532 | 0.9273 | 0.0049 | 0.0338 | 0.0311 | 486 | 0.0191 |
| | 1000 | 0.2701 | 1.1927 | 3.2272 | 0.0060 | 0.0615 | 0.0566 | 594 | 0.0244 |
| Rubber Tired Loaders Compos | | 0.0559 | 0.4311 | 0.2835 | 0.0012 | 0.0121 | 0.0111 | 109 | 0.0050 |
| Scrapers | 120 | 0.0887 | 0.6472 | 0.5218 | 0.0011 | 0.0330 | 0.0303 | 93.9 | 0.0080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1025 | 0.8864 | 0.5654 | 0.0017 | 0.0307 | 0.0282 | 148 | 0.0092 |
| | 250 | 0.1187 | 0.4642 | 0.7040 | 0.0024 | 0.0254 | 0.0234 | 209 | 0.0107 |
| | 500 | 0.1755 | 0.7332 | 0.9727 | 0.0032 | 0.0364 | 0.0335 | 321 | 0.0158 |
| | 750 | 0.3043 | 1.2657 | 1.7266 | 0.0056 | 0.0638 | 0.0587 | 555 | 0.0275 |
| Scrapers Composite | | 0.1495 | 0.7187 | 0.8387 | 0.0027 | 0.0335 | 0.0308 | 262 | 0.0135 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0332 | 0.2686 | 0.2268 | 0.0005 | 0.0063 | 0.0058 | 36.2 | 0.0030 |
| | 120 | 0.0394 | 0.4898 | 0.3076 | 0.0009 | 0.0127 | 0.0116 | 80.2 | 0.0036 |
| | 175 | 0.0587 | 0.8292 | 0.3433 | 0.0017 | 0.0152 | 0.0139 | 155 | 0.0053 |
| | 250 | 0.0794 | 0.4676 | 0.4435 | 0.0029 | 0.0132 | 0.0121 | 255 | 0.0072 |
| Signal Boards Composite | | 0.0111 | 0.0909 | 0.0718 | 0.0002 | 0.0029 | 0.0026 | 16.7 | 0.0010 |
| Skid Steer Loade | 25 | 0.0167 | 0.0568 | 0.1055 | 0.0002 | 0.0040 | 0.0037 | 13.8 | 0.0015 |
| | 50 | 0.0194 | 0.1977 | 0.1446 | 0.0003 | 0.0015 | 0.0014 | 25.5 | 0.0017 |
| | 120 | 0.0175 | 0.2665 | 0.1240 | 0.0005 | 0.0022 | 0.0020 | 42.8 | 0.0016 |
| Skid Steer Loaders Composite | | 0.0186 | 0.2104 | 0.1354 | 0.0004 | 0.0019 | 0.0018 | 30.3 | 0.0017 |
| Surfacing Equipm | 50 | 0.0171 | 0.1105 | 0.0934 | 0.0002 | 0.0035 | 0.0033 | 14.1 | 0.0015 |
| | 120 | 0.0385 | 0.3950 | 0.2869 | 0.0007 | 0.0146 | 0.0134 | 63.8 | 0.0035 |
| | 175 | 0.0386 | 0.4642 | 0.2429 | 0.0010 | 0.0119 | 0.0109 | 85.8 | 0.0035 |
| | 250 | 0.0504 | 0.2604 | 0.3275 | 0.0015 | 0.0111 | 0.0103 | 135 | 0.0045 |
| | 500 | 0.0800 | 0.4236 | 0.4893 | 0.0022 | 0.0174 | 0.0160 | 221 | 0.0072 |
| | 750 | 0.1260 | 0.6643 | 0.7833 | 0.0035 | 0.0275 | 0.0253 | 347 | 0.0114 |
| Surfacing Equipment Compos | | 0.0638 | 0.3590 | 0.3924 | 0.0017 | 0.0142 | 0.0131 | 166 | 0.0058 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0308 | 0.2762 | 0.1942 | 0.0004 | 0.0033 | 0.0031 | 31.6 | 0.0028 |
| | 120 | 0.0395 | 0.4895 | 0.2530 | 0.0009 | 0.0068 | 0.0062 | 75.0 | 0.0036 |
| | 175 | 0.0565 | 0.8005 | 0.2201 | 0.0016 | 0.0084 | 0.0077 | 139 | 0.0051 |
| | 250 | 0.0587 | 0.3179 | 0.1898 | 0.0018 | 0.0062 | 0.0057 | 162 | 0.0053 |
| Sweepers/Scrubbers Compos | | 0.0410 | 0.4840 | 0.2255 | 0.0009 | 0.0061 | 0.0056 | 78.5 | 0.0037 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0045 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0316 | 0.2678 | 0.1895 | 0.0004 | 0.0037 | 0.0034 | 30.3 | 0.0029 |
| | 120 | 0.0281 | 0.3379 | 0.1761 | 0.0006 | 0.0055 | 0.0051 | 51.7 | 0.0025 |
| | 175 | 0.0420 | 0.5839 | 0.1613 | 0.0011 | 0.0072 | 0.0066 | 101 | 0.0038 |
| | 250 | 0.0633 | 0.3389 | 0.2157 | 0.0019 | 0.0073 | 0.0067 | 172 | 0.0057 |
| | 500 | 0.1263 | 0.6506 | 0.4127 | 0.0039 | 0.0144 | 0.0132 | 345 | 0.0114 |
| | 750 | 0.1896 | 0.9760 | 0.6256 | 0.0058 | 0.0216 | 0.0199 | 517 | 0.0171 |
| Tractors/Loaders/Backhoes C | | 0.0336 | 0.3586 | 0.1857 | 0.0008 | 0.0059 | 0.0054 | 66.8 | 0.0030 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0687 | 0.3197 | 0.2467 | 0.0004 | 0.0140 | 0.0129 | 32.9 | 0.0062 |
| | 120 | 0.0625 | 0.4341 | 0.3863 | 0.0008 | 0.0259 | 0.0239 | 64.9 | 0.0056 |
| | 175 | 0.1009 | 0.8327 | 0.6152 | 0.0016 | 0.0338 | 0.0311 | 144 | 0.0091 |
| | 250 | 0.1247 | 0.4925 | 0.8480 | 0.0025 | 0.0309 | 0.0285 | 223 | 0.0112 |
| | 500 | 0.1661 | 0.7370 | 1.0663 | 0.0031 | 0.0400 | 0.0368 | 311 | 0.0150 |
| | 750 | 0.3147 | 1.3882 | 2.0666 | 0.0059 | 0.0766 | 0.0705 | 587 | 0.0284 |
| Trenchers Composite | | 0.0674 | 0.4085 | 0.3481 | 0.0007 | 0.0215 | 0.0198 | 58.7 | 0.0061 |
| Welders | 15 | 0.0075 | 0.0381 | 0.0468 | 0.0001 | 0.0020 | 0.0018 | 6.2 | 0.0007 |
| | 25 | 0.0141 | 0.0473 | 0.0876 | 0.0001 | 0.0035 | 0.0033 | 11.3 | 0.0013 |
| | 50 | 0.0280 | 0.2077 | 0.1684 | 0.0003 | 0.0053 | 0.0048 | 26.0 | 0.0025 |
| | 120 | 0.0223 | 0.2476 | 0.1601 | 0.0005 | 0.0073 | 0.0067 | 39.5 | 0.0020 |
| | 175 | 0.0430 | 0.5400 | 0.2396 | 0.0011 | 0.0111 | 0.0103 | 98.2 | 0.0039 |
| | 250 | 0.0423 | 0.2236 | 0.2294 | 0.0013 | 0.0069 | 0.0064 | 119 | 0.0038 |
| | 500 | 0.0585 | 0.3040 | 0.2969 | 0.0016 | 0.0095 | 0.0087 | 168 | 0.0053 |
| Welders Composite | | 0.0214 | 0.1745 | 0.1373 | 0.0003 | 0.0052 | 0.0048 | 25.6 | 0.0019 |

## Fugitive Dust Emission Calculation Methodology

### Fugitive Dust Source Emissions - Material Handling

**Truck Loading/Unloading (Removed debris/concrete materials)**

*Emission Factor [lb/ton] = k(0.0032) x (mean wind speed [mi/hr] / 5)* $^{1.3}$ / (moisture [%] / 2)$^{1.4}$

*Reference: AP-42, Equation (1), Section 13.2.4, November 2006*

| | | | |
|---|---|---|---|
| *k = Aerodynamic Particle Size Multiplier, $PM_{10}$* | 0.35 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *k = Aerodynamic Particle Size Multiplier, $PM_{2.5}$* | 0.053 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *Mean Wind Speed* | 15 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *Moisture* | 4.8 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *PM10 Emission Factor* | 0.0014 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |
| *PM2.5 Emission Factor* | 0.0002 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |

**Demolition (Sq. Ft)**

| | | |
|---|---|---|
| PM10, uncontrolled | 0.00042 lbs/cubic ft[1] | http://www.urbemis.com/software/URBEMIS9%20Users%20Manual%20Appendices.pdf |
| PM2.5, uncontrolled | 0.00009 lbs/cubic ft[2] | PM2.5 fraction of PM10 = 0.208; SCAQMD Appendix A - Updated CEIDARS List with PM2.5 Fractions (www.aqmd.gov/ceqa/handbook/PM2_5/PM2_5.html |

**Bulldozing**

*Emission Factor [lb/hr] = [1.0 x (silt content [%])* $^{1.5}$ / (moisture)$^{1.4}$]*Scaling Factor

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Silt Content* | 6.9 | | AP-42 Chapter 11, Table 11.9-3 for overburden |
| *Moisture* | 16.8 | | AP-42 Chapter 11, Table 11.9-3 for overburden, upper end or range |
| *$PM_{10}$ Scaling Factor* | 0.75 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *$PM_{2.5}$ Scaling Factor* | 0.105 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *PM10 Emission Factor* | 0.26 | lb/hr | |
| *PM2.5 Emission Factor* | 0.04 | lb/hr | |

**Grading and Scraping**[d]

*Emission Factor [lb/VMT] = [0.051 (S)^2.0*Scaling Factor*

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Mean Vehicle Speed (S)[a] - Miles Per Hour (MPH)* | 2 | | Assumption based on project footprint |
| *$PM_{10}$ Scaling Factor* | 0.6 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *$PM_{2.5}$ Scaling Factor* | 0.031 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *PM10 Emission Factor (Uncontrolled)* | 0.12 | lb/VMT | |
| *PM2.5 Emission Factor (Uncontrolled)* | 0.00632 | lb/VMT | |

**Stock Pile Wind Erosion**

Emission Factor [lb/day-acre] = 0.85 x (silt content [%] / 1.5) x (365 / 235) x (percentage of time unobstructed wind exceeds 12 mph / 15)
Reference: SCAQMD CEQA Air Quality Handbook (1993), Table 9-9-E

| Parameter | Value | Basis |
|---|---|---|
| Silt Content | 7.5 | SCAQMD CEQA Handbook, (1993) Table A9-9-E-1 for overburden |
| Pct. time wind > 12 mph | 17.84 | Used 17.84% from AERMET Surface File used for dispersion modeling |

| | |
|---|---|
| PM10 Emission Factor (Uncontrolled) | 7.9 lb/day-acre |
| Reduction from Watering Twice/Day | 50% |
| Controlled PM10 Emission Factor | 3.9 lb/day-acre |
| Controlled PM2.5 Emission Factor[a] | 0.8 lb/day-acre |

[a] PM2.5 emission factor [lb/hr] = PM10 emission factor [lb/hr] x PM2.5 fraction of PM10

PM2.5 Fraction of PM10 in Construction Dust = 0.208 from Appendix A, Final–Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds, SCAQMD, October 2006

Emissions [pounds per day] = Controlled emission factor [pounds per acre-day] x Stock pile surface area [acres]

# Attachment I6 Alternative SB-1B Emissions

EN1B - LSL

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 2.19 | 15.89 | 12.00 | | 0.80 | 0.74 | 1,898 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15,326.46 | 0.37 | 3.45 | 1.46 | 0.00 | 0.45 | 0.26 | 433 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.00 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 9 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 | 0.37 | 3.47 | 1.49 | 0.00 | 0.45 | 0.27 | 2,340 |
| Amortized Construction | | | | | | | | | | | | | | 468 |

EN1B - HSL

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 2.51 | 18.21 | 13.75 | | 0.92 | 0.85 | 2,176 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15,326.46 | 0.40 | 3.79 | 1.60 | 0.01 | 0.50 | 0.29 | 475 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.00 | 0.02 | 0.03 | 0.00 | 0.00 | 0.00 | 10 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 | 0.40 | 3.80 | 1.63 | 0.01 | 0.50 | 0.29 | 2,661 |
| Amortized Construction | | | | | | | | | | | | | | 532 |

SB2B - LSL

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 4.59 | 33.32 | 25.16 | | 1.69 | 1.55 | 3,982 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15,326.46 | 1.19 | 11.20 | 4.74 | 0.02 | 1.47 | 0.86 | 1,404 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.00 | 0.04 | 0.09 | 0.00 | 0.01 | 0.00 | 28 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 | 1.19 | 11.24 | 4.83 | 0.02 | 1.47 | 0.86 | 5,414 |
| Amortized Construction | | | | | | | | | | | | | | 541 |

BS-2B - HSL

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 5.17 | 37.59 | 28.38 | | 1.90 | 1.75 | 4,491 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15326.46 | 1.30 | 12.26 | 5.19 | 0.02 | 1.61 | 0.94 | 1,537 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.01 | 0.04 | 0.10 | 0.00 | 0.01 | 0.00 | 31 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 | 1.31 | 12.30 | 5.29 | 0.02 | 1.61 | 0.94 | 6,058 |
| Amortized Construction | | | | | | | | | | | | | | 606 |

EN1B - LSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 6.22 | 44.98 | 25.61 | 0.08 | 8.15 | 2.60 | 7,219.52 |
| On-Road Motor Vehicles | 0.10 | 2.03 | 0.61 | 0.01 | 0.11 | 0.06 | 797.79 |
| *Total On-Shore Emissions* | 6.32 | 47.01 | 26.22 | 0.09 | 8.26 | 2.66 | 8,017.32 |

E1BN - HSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 6.22 | 44.98 | 25.61 | 0.08 | 8.15 | 2.60 | 7219.52 |
| On-Road Motor Vehicles | 0.10 | 2.03 | 0.61 | 0.01 | 0.11 | 0.06 | 797.79 |
| *Total On-Shore Emissions* | 6.32 | 47.01 | 26.22 | 0.09 | 8.26 | 2.66 | 8,017.32 |

SB1B - LSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 4.90 | 30.72 | 22.16 | 0.08 | 7.49 | 1.99 | 7,219.38 |
| On-Road Motor Vehicles | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |
| *Total On-Shore Emissions* | 4.99 | 31.65 | 22.93 | 0.09 | 7.56 | 2.06 | 7,996.95 |

SB1B - HSL

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 4.90 | 30.72 | 22.16 | 0.08 | 7.49 | 1.99 | 7,219.38 |
| On-Road Motor Vehicles | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |
| *Total On-Shore Emissions* | 4.99 | 31.65 | 22.93 | 0.09 | 7.56 | 2.06 | 7,996.95 |

## Alternative SB-1B - Construction - Low Sea Level Rise

**Emission Factor**

| Source Description | Number | Usage Factor | Unit | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

**Emissions Summary**

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8.285 | 0.37 | lbs/dav |
| Loader | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1.303 | 0.11 | lbs/dav |
| Dozer | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5.738 | 0.59 | lbs/dav |
| | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | | | 15,326.46 | 1.07 | lbs/day |
| Bulldozing | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/dav |
| **Peak Daily Emissions Summary, Uncontrolled =** | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | 6.28 | 0.88 | 15,326.46 | 1.07 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | **11.84** | **111.42** | **47.17** | **0.15** | | | **10.45** | **4.71** | **15,326.46** | **1.07** | **lbs/day** |

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump | 0.41 | 4.86 | 1.67 | 0.01 | 0.15 | 0.13 | - | - | 758 | 0.0334 | tons |
| Loader | 0.13 | 0.95 | 0.56 | 0.00 | 0.05 | 0.05 | - | - | 119 | 0.0104 | tons |
| Dozer | 0.66 | 5.39 | 2.51 | 0.01 | 0.22 | 0.21 | - | - | 525 | 0.0539 | tons |
| | 1.19 | 11.20 | 4.74 | 0.02 | 0.42 | 0.39 | | | 1,401.68 | 0.10 | tons |
| Bulldozing | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | 1.19 | 11.20 | 4.74 | 0.02 | 0.42 | 0.39 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | **1.19** | **11.20** | **4.74** | **0.02** | **1.47** | **0.86** | **1.05** | **0.47** | **1,402** | **0.098** | tons |
| | | | | | | | | | **Total GHG Emissions** | **1,404** | tons |

| Project Length | Work Days |
|---|---|
| | 201 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Constructi on Days |
| LSL | 410,000 | 41 | 62 | 860,000 | 86 | 201 | ######## | 127 | 263 |
| HSL | 470,000 | 47 | 68 | 970,000 | 97 | 220 | ######## | 144 | 288 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warm |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Ph

# Alternative SB-1B - Construction - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| Construction Days Per Year | 86.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 4.59 | 33.32 | 25.16 | 1.69 | 1.55 | 3,982 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1B - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | | | | | | Total Daily Emissions (lbs) | | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 201 | 80,400 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 | 0.00 | 0.038 | 0.09 | 0.00 | 0.01 | 0.00 | 30 | 27 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 28 | 40 | 560 | 203 | 80,720 | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.00 | 0.04 | 0.09 | 0.00 | 0.01 | 0.00 | 30.75 | 27.98 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-1B - Operation  Low Sea Level Rise

**Emission Factor**

| Source Description | Number | Usage Factor | Unit | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Off-road Mobile Sources* | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| *Fugitive Dust* | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |

**Emissions Summary**

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | | | 7,219.38 | 0.44 | lbs/day |
| Bulldozing | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | 6.28 | 0.88 | 7,219.38 | 0.44 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | **4.90** | **30.72** | **22.16** | **0.08** | | | **7.49** | **1.99** | **7,219.38** | **0.44** | **lbs/day** |

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump | 0.01 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 | - | - | 5 | 0.0005 | tons |
| Loader | 0.02 | 0.10 | 0.14 | 0.00 | 0.00 | 0.00 | - | - | 33 | 0.0015 | tons |
| Dozer | 0.11 | 0.73 | 0.44 | 0.00 | 0.03 | 0.03 | - | - | 146 | 0.0092 | tons |
| | 0.14 | 0.86 | 0.62 | 0.00 | 0.03 | 0.03 | | | 183.95 | 0.01 | tons |
| Bulldozing | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | 0.14 | 0.86 | 0.62 | 0.00 | 0.03 | 0.03 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | **0.14** | **0.86** | **0.62** | **0.00** | | | **0.21** | **0.06** | **184** | **0.011** | tons |
| | | | | | | | | | **Total GHG Emissions** | **184** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC:  Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC:  Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

| Project Length | Workdays |
|---|---|
| | 56 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 260,000 | 26 | 47 | 350,000 | 35 | 56 | 610,000 | 61 | 103 |
| HSL | 330,000 | 33 | 54 | 500,000 | 50 | 71 | 830,000 | 83 | 125 |

## Alternative SB- 1B - Operations - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| Operating Days Per Year | 35.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.49 | 3.57 | 10.24 | 0.08 | 0.08 | 1,781 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1B - Operations - Low Sea Level Rise

### On-Road Construction Emissions

| | | | | | | Total Daily Emissions (lbs) | | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 56 | 22,400 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 | 0.00 | 0.006 | 0.01 | 0.00 | 0.00 | 0.00 | 7 | 6 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 28 | 40 | 560 | 58 | 22,720 | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 7.12 | 6.48 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-1B - Construction - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

| Source Description | Emissions Summary ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | |
| Pump | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8.285 | 0.37 | lbs/day |
| Loader | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1.303 | 0.11 | lbs/day |
| Dozer | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5.738 | 0.59 | lbs/day |
| | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | | | 15,326.46 | 1.07 | lbs/day |
| | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | |
| Bulldozing | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | 6.28 | 0.88 | 15,326.46 | 1.07 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | **11.84** | **111.42** | **47.17** | **0.15** | | | **10.45** | **4.71** | **15,326.46** | **1.07** | **lbs/day** |

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | |
| Pump | 0.45 | 5.32 | 1.83 | 0.01 | 0.16 | 0.15 | - | - | 829 | 0.0365 | tons |
| Loader | 0.14 | 1.03 | 0.61 | 0.00 | 0.05 | 0.05 | - | - | 130 | 0.0114 | tons |
| Dozer | 0.72 | 5.90 | 2.75 | 0.01 | 0.24 | 0.22 | - | - | 574 | 0.0590 | tons |
| | 1.30 | 12.26 | 5.19 | 0.02 | 0.46 | 0.42 | | | 1,534.18 | 0.11 | tons |
| | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | |
| Bulldozing | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | 1.30 | 12.26 | 5.19 | 0.02 | 0.46 | 0.42 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | **1.30** | **12.26** | **5.19** | **0.02** | **1.61** | **0.94** | **1.15** | **0.52** | **1,534** | **0.107** | tons |
| | | | | | | | | | **Total GHG Emissions** | **1,537** | tons |

| Project Length | Work Days |
|---|---|
| | 220 |

| | Encinitas Volume | Dredging Days | Construction Days | Solana Beach Volume | Dredging Days | Construction Days | Total Volume | Dredging Days | Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 410,000 | 41 | 62 | 860,000 | 86 | 201 | ######## | 127 | 263 |
| HSL | 470,000 | 47 | 68 | 970,000 | 97 | 220 | ######## | 144 | 288 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warm |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Ph

# Alternative SB-1B - Construction - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| Construction Days Per Year | 97.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 5.17 | 37.59 | 28.38 | 1.90 | 1.75 | 4,491 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1B - Construction \- High Sea Level Rise

**On-Road Construction Emissions**

| | | | | | | Total Daily Emissions (lbs) | | | | | | | | | Total Emission (tons) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 220 | 88,000 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 | 0.00 | 0.041 | 0.10 | 0.00 | 0.01 | 0.00 | 33 | 30 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 28 | 40 | 560 | 222 | 88,320 | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 | 0.01 | 0.04 | 0.10 | 0.00 | 0.01 | 0.00 | 33.60 | 30.58 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

# Alternative SB-1B - Operations - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

| Source Description | Emissions Summary ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | | | 7,219.38 | 0.44 | lbs/day |
| Bulldozing | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | 6.28 | 0.88 | 7,219.38 | 0.44 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | **4.90** | **30.72** | **22.16** | **0.08** | | | **7.49** | **1.99** | **7,219.38** | **0.44** | **lbs/day** |

| Source Description | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump | 0.01 | 0.05 | 0.04 | 0.00 | 0.00 | 0.00 | - | - | 6 | 0.0006 | tons |
| Loader | 0.02 | 0.12 | 0.18 | 0.00 | 0.01 | 0.00 | - | - | 42 | 0.0020 | tons |
| Dozer | 0.14 | 0.92 | 0.56 | 0.00 | 0.04 | 0.03 | - | - | 185 | 0.0117 | tons |
| | 0.17 | 1.09 | 0.79 | 0.00 | 0.04 | 0.04 | | | 233.22 | 0.01 | tons |
| Bulldozing | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | 0.17 | 1.09 | 0.79 | 0.00 | 0.04 | 0.04 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | **0.17** | **1.09** | **0.79** | **0.00** | | | **0.27** | **0.07** | **233** | **0.014** | tons |
| | | | | | | | | | **Total GHG Emissions** | **234** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

| Project Length | Workdays |
|---|---|
| | 71 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 260,000 | 26 | 47 | 350,000 | 35 | 56 | 610,000 | 61 | 103 |
| HSL | 330,000 | 33 | 54 | 500,000 | 50 | 71 | 830,000 | 83 | 125 |

## Alternative SB - 1B - Operations   High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Operating Days Per Year | 50.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.70 | 5.10 | 14.63 | 0.12 | 0.11 | 2,544 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1B - Operations - High Sea Level Rise

**On-Road Construction Emissions**

| | | | | | | Total Daily Emissions (lbs) | | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 71 | 28,400 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 | 0.00 | 0.007 | 0.01 | 0.00 | 0.00 | 0.00 | 8 | 8 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 28 | 40 | 560 | 73 | 28,720 | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 8.88 | 8.08 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

**San Diego 2015 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,169,183 | 42,600,783.75 | 7,361,743.79 | 0.045 | 1.290 | 0.136 | 302.103 | 0.047 | 0.019 | 0.004 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,466 | 179,216.55 | 31,712.66 | 0.038 | 0.215 | 0.576 | 315.879 | 0.072 | 0.043 | 0.004 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 172,849 | 6,187,162.79 | 1,061,257.19 | 0.075 | 2.505 | 0.269 | 357.183 | 0.048 | 0.021 | 0.004 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 210 | 6,179.81 | 1,102.01 | 0.066 | 0.312 | 0.691 | 314.863 | 0.099 | 0.068 | 0.004 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 423,444 | 16,224,268.59 | 2,675,454.93 | 0.037 | 1.498 | 0.192 | 432.459 | 0.047 | 0.019 | 0.005 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 187 | 5,978.69 | 1,021.81 | 0.046 | 0.252 | 0.690 | 323.109 | 0.080 | 0.050 | 0.004 | | |
| Average | | | | | | | 0.051 | 1.012 | 0.426 | 340.933 | 0.066 | 0.037 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 2,454 | 392,614.49 | 0 | 0.296 | 1.343 | 8.984 | 1699.527 | 0.231 | 0.158 | 0.017 | | |

Source: EMFAC 2011

**San Diego 2020 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,261,438 | 46,436,329 | 7,971,039 | 0.03 | 0.10 | 0.83 | 244.16 | 0.05 | 0.02 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,897 | 203,726 | 36,279 | 0.02 | 0.39 | 0.13 | 265.72 | 0.06 | 0.03 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 186,176 | 6,674,684 | 1,134,440 | 0.04 | 0.17 | 1.56 | 297.84 | 0.05 | 0.02 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 226 | 8,187 | 1,308 | 0.03 | 0.45 | 0.17 | 259.42 | 0.07 | 0.04 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 450,141 | 17,355,693 | 2,832,803 | 0.02 | 0.11 | 0.93 | 364.76 | 0.05 | 0.02 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 199 | 7,528 | 1,228 | 0.02 | 0.47 | 0.14 | 280.32 | 0.06 | 0.03 | 0.00 | | |
| Average | | | | | | | 0.026 | 0.283 | 0.626 | 285.370 | 0.055 | 0.027 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,262 | 531,839 | - | 0.22 | 1.02 | 4.20 | 1553.04 | 0.18 | 0.11 | 0.02 | | |

Source: EMFAC 2011

## 2015 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0155 | 0.0486 | 0.0902 | 0.0001 | 0.0046 | 0.0042 | 11.0 | 0.0014 |
| | 50 | 0.0480 | 0.1641 | 0.1699 | 0.0003 | 0.0129 | 0.0119 | 19.6 | 0.0043 |
| | 120 | 0.0460 | 0.2377 | 0.3272 | 0.0004 | 0.0246 | 0.0226 | 38.1 | 0.0042 |
| | 500 | 0.1026 | 0.4261 | 1.2422 | 0.0021 | 0.0368 | 0.0339 | 213 | 0.0093 |
| | 750 | 0.1912 | 0.7702 | 2.3263 | 0.0039 | 0.0680 | 0.0626 | 385 | 0.0173 |
| Aerial Lifts Composite | | 0.0439 | 0.1837 | 0.2670 | 0.0004 | 0.0167 | 0.0154 | 34.7 | 0.0040 |
| Air Compressors | 15 | 0.0108 | 0.0466 | 0.0664 | 0.0001 | 0.0040 | 0.0037 | 7.2 | 0.0010 |
| | 25 | 0.0229 | 0.0681 | 0.1247 | 0.0002 | 0.0069 | 0.0064 | 14.4 | 0.0021 |
| | 50 | 0.0747 | 0.2360 | 0.2056 | 0.0003 | 0.0183 | 0.0168 | 22.3 | 0.0067 |
| | 120 | 0.0691 | 0.3182 | 0.4334 | 0.0006 | 0.0375 | 0.0345 | 47.0 | 0.0062 |
| | 175 | 0.0903 | 0.5019 | 0.7101 | 0.0010 | 0.0388 | 0.0357 | 88.5 | 0.0082 |
| | 250 | 0.0892 | 0.2803 | 0.9294 | 0.0015 | 0.0286 | 0.0263 | 131 | 0.0080 |
| | 500 | 0.1463 | 0.4915 | 1.4297 | 0.0023 | 0.0470 | 0.0432 | 232 | 0.0132 |
| | 750 | 0.2285 | 0.7595 | 2.2932 | 0.0036 | 0.0743 | 0.0683 | 358 | 0.0206 |
| | 1000 | 0.3551 | 1.1843 | 4.4558 | 0.0049 | 0.1239 | 0.1140 | 486 | 0.0320 |
| Air Compressors Composite | | 0.0773 | 0.3257 | 0.5175 | 0.0007 | 0.0357 | 0.0329 | 63.6 | 0.0070 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1220 | 0.0002 | 0.0047 | 0.0043 | 16.0 | 0.0017 |
| | 50 | 0.0234 | 0.2235 | 0.2240 | 0.0004 | 0.0075 | 0.0069 | 31.0 | 0.0021 |
| | 120 | 0.0376 | 0.4676 | 0.3736 | 0.0009 | 0.0160 | 0.0148 | 77.1 | 0.0034 |
| | 175 | 0.0618 | 0.7540 | 0.5364 | 0.0016 | 0.0198 | 0.0182 | 141 | 0.0056 |
| | 250 | 0.0681 | 0.3425 | 0.4900 | 0.0021 | 0.0144 | 0.0132 | 188 | 0.0061 |
| | 500 | 0.1118 | 0.5511 | 0.7692 | 0.0031 | 0.0236 | 0.0217 | 311 | 0.0101 |
| | 750 | 0.2212 | 1.0888 | 1.5301 | 0.0062 | 0.0466 | 0.0429 | 615 | 0.0200 |
| | 1000 | 0.3562 | 1.6528 | 4.9704 | 0.0093 | 0.1194 | 0.1098 | 928 | 0.0321 |
| Bore/Drill Rigs Composite | | 0.0673 | 0.5022 | 0.6138 | 0.0017 | 0.0200 | 0.0184 | 165 | 0.0061 |
| Cement and Mortar Mixers | 15 | 0.0074 | 0.0386 | 0.0464 | 0.0001 | 0.0019 | 0.0018 | 6.3 | 0.0007 |
| | 25 | 0.0251 | 0.0782 | 0.1456 | 0.0002 | 0.0074 | 0.0068 | 17.6 | 0.0023 |
| Cement and Mortar Mixers Composite | | 0.0088 | 0.0419 | 0.0545 | 0.0001 | 0.0024 | 0.0022 | 7.2 | 0.0008 |
| Concrete/Industrial Saws | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0782 | 0.2745 | 0.2652 | 0.0004 | 0.0206 | 0.0189 | 30.2 | 0.0071 |
| | 120 | 0.0892 | 0.4759 | 0.6249 | 0.0009 | 0.0486 | 0.0448 | 74.1 | 0.0080 |
| | 175 | 0.1340 | 0.8674 | 1.1593 | 0.0018 | 0.0585 | 0.0538 | 160 | 0.0121 |
| Concrete/Industrial Saws Composite | | 0.0835 | 0.3982 | 0.4921 | 0.0007 | 0.0374 | 0.0345 | 58.5 | 0.0075 |
| Cranes | 50 | 0.0853 | 0.2729 | 0.2235 | 0.0003 | 0.0202 | 0.0186 | 23.2 | 0.0077 |
| | 120 | 0.0800 | 0.3559 | 0.4822 | 0.0006 | 0.0415 | 0.0382 | 50.1 | 0.0072 |
| | 175 | 0.0919 | 0.4794 | 0.6684 | 0.0009 | 0.0378 | 0.0348 | 80.3 | 0.0083 |
| | 250 | 0.0925 | 0.2713 | 0.8284 | 0.0013 | 0.0286 | 0.0263 | 112 | 0.0083 |
| | 500 | 0.1393 | 0.4663 | 1.1812 | 0.0018 | 0.0426 | 0.0392 | 180 | 0.0126 |
| | 750 | 0.2358 | 0.7835 | 2.0490 | 0.0030 | 0.0729 | 0.0671 | 303 | 0.0213 |
| | 9999 | 0.8682 | 2.8913 | 9.2743 | 0.0098 | 0.2775 | 0.2553 | 971 | 0.0783 |
| Cranes Composite | | 0.1204 | 0.4395 | 1.0200 | 0.0014 | 0.0426 | 0.0392 | 129 | 0.0109 |
| Crawler Tractors | 50 | 0.1017 | 0.3087 | 0.2464 | 0.0003 | 0.0232 | 0.0214 | 24.9 | 0.0092 |
| | 120 | 0.1143 | 0.4774 | 0.6815 | 0.0008 | 0.0579 | 0.0533 | 65.8 | 0.0103 |
| | 175 | 0.1509 | 0.7384 | 1.0951 | 0.0014 | 0.0614 | 0.0565 | 121 | 0.0136 |
| | 250 | 0.1582 | 0.4614 | 1.3531 | 0.0019 | 0.0514 | 0.0473 | 166 | 0.0143 |
| | 500 | 0.2300 | 0.8352 | 1.8987 | 0.0025 | 0.0732 | 0.0673 | 259 | 0.0207 |
| | 750 | 0.4140 | 1.4936 | 3.4863 | 0.0047 | 0.1327 | 0.1221 | 465 | 0.0374 |
| | 1000 | 0.6278 | 2.3640 | 6.6574 | 0.0066 | 0.2075 | 0.1909 | 658 | 0.0566 |
| Crawler Tractors Composite | | 0.1415 | 0.5650 | 1.0059 | 0.0013 | 0.0594 | 0.0546 | 114 | 0.0128 |
| Crushing/Proc. Equipment | 50 | 0.1392 | 0.4644 | 0.4024 | 0.0006 | 0.0346 | 0.0318 | 44.0 | 0.0126 |
| | 120 | 0.1167 | 0.5646 | 0.7374 | 0.0010 | 0.0629 | 0.0579 | 83.1 | 0.0105 |
| | 175 | 0.1654 | 0.9559 | 1.2783 | 0.0019 | 0.0700 | 0.0644 | 167 | 0.0149 |
| | 250 | 0.1646 | 0.5171 | 1.6355 | 0.0028 | 0.0506 | 0.0466 | 245 | 0.0149 |
| | 500 | 0.2358 | 0.7790 | 2.1722 | 0.0037 | 0.0722 | 0.0664 | 374 | 0.0213 |
| | 750 | 0.3723 | 1.2184 | 3.5561 | 0.0059 | 0.1154 | 0.1062 | 589 | 0.0336 |
| | 9999 | 0.9726 | 3.0901 | 11.5626 | 0.0131 | 0.3225 | 0.2967 | 1,308 | 0.0878 |
| Crushing/Proc. Equipment Composite | | 0.1465 | 0.6549 | 0.9893 | 0.0015 | 0.0607 | 0.0558 | 132 | 0.0132 |
| Dumpers/Tenders | 25 | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Dumpers/Tenders Composite | | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0650 | 0.2683 | 0.2256 | 0.0003 | 0.0167 | 0.0154 | 25.0 | 0.0059 |
| | 120 | 0.0912 | 0.5102 | 0.5787 | 0.0009 | 0.0455 | 0.0418 | 73.6 | 0.0082 |
| | 175 | 0.1052 | 0.6653 | 0.7408 | 0.0013 | 0.0405 | 0.0372 | 112 | 0.0095 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1117 | 0.3431 | 0.8935 | 0.0018 | 0.0297 | 0.0273 | 159 | 0.0101 |
| | 500 | 0.1577 | 0.4964 | 1.1619 | 0.0023 | 0.0413 | 0.0380 | 234 | 0.0142 |
| | 750 | 0.2630 | 0.8225 | 1.9926 | 0.0039 | 0.0698 | 0.0642 | 387 | 0.0237 |
| Excavators Composite | | 0.1064 | 0.5248 | 0.7416 | 0.0013 | 0.0379 | 0.0349 | 120 | 0.0096 |
| Forklifts | 50 | 0.0324 | 0.1522 | 0.1324 | 0.0002 | 0.0092 | 0.0084 | 14.7 | 0.0029 |
| | 120 | 0.0345 | 0.2143 | 0.2326 | 0.0004 | 0.0174 | 0.0160 | 31.2 | 0.0031 |
| | 175 | 0.0486 | 0.3316 | 0.3442 | 0.0006 | 0.0189 | 0.0174 | 56.1 | 0.0044 |
| | 250 | 0.0518 | 0.1582 | 0.4040 | 0.0009 | 0.0133 | 0.0122 | 77.1 | 0.0047 |
| | 500 | 0.0724 | 0.2164 | 0.5170 | 0.0011 | 0.0185 | 0.0171 | 111 | 0.0065 |
| Forklifts Composite | | 0.0459 | 0.2200 | 0.3163 | 0.0006 | 0.0156 | 0.0143 | 54.4 | 0.0041 |
| Generator Sets | 15 | 0.0135 | 0.0658 | 0.0929 | 0.0002 | 0.0051 | 0.0047 | 10.2 | 0.0012 |
| | 25 | 0.0247 | 0.0831 | 0.1522 | 0.0002 | 0.0080 | 0.0074 | 17.6 | 0.0022 |
| | 50 | 0.0706 | 0.2465 | 0.2628 | 0.0004 | 0.0193 | 0.0178 | 30.6 | 0.0064 |
| | 120 | 0.0910 | 0.4811 | 0.6607 | 0.0009 | 0.0484 | 0.0445 | 77.9 | 0.0082 |
| | 175 | 0.1120 | 0.7350 | 1.0463 | 0.0016 | 0.0485 | 0.0446 | 142 | 0.0101 |
| | 250 | 0.1090 | 0.4148 | 1.3776 | 0.0024 | 0.0381 | 0.0351 | 213 | 0.0098 |
| Generator Sets - 500 hp | 500 | 0.1556 | 0.6639 | 1.9429 | 0.0033 | 0.0567 | 0.0522 | 337 | 0.0140 |
| | 750 | 0.2599 | 1.0718 | 3.2483 | 0.0055 | 0.0934 | 0.0860 | 544 | 0.0234 |
| | 9999 | 0.6582 | 2.3655 | 8.9789 | 0.0105 | 0.2325 | 0.2139 | 1,049 | 0.0594 |
| Generator Sets Composite | | 0.0640 | 0.2913 | 0.4717 | 0.0007 | 0.0268 | 0.0246 | 61.0 | 0.0058 |
| Graders | 50 | 0.0897 | 0.3082 | 0.2569 | 0.0004 | 0.0217 | 0.0200 | 27.5 | 0.0081 |
| | 120 | 0.1081 | 0.5230 | 0.6726 | 0.0009 | 0.0555 | 0.0511 | 75.0 | 0.0098 |
| | 175 | 0.1299 | 0.7319 | 0.9534 | 0.0014 | 0.0526 | 0.0484 | 124 | 0.0117 |
| | 250 | 0.1326 | 0.4046 | 1.1596 | 0.0019 | 0.0400 | 0.0368 | 172 | 0.0120 |
| | 500 | 0.1666 | 0.5739 | 1.3760 | 0.0023 | 0.0496 | 0.0456 | 229 | 0.0150 |
| | 750 | 0.3549 | 1.2133 | 3.0011 | 0.0049 | 0.1066 | 0.0981 | 486 | 0.0320 |
| Graders Composite | | 0.1277 | 0.5931 | 0.9795 | 0.0015 | 0.0489 | 0.0450 | 133 | 0.0115 |
| Off-Highway Tractors | 120 | 0.1905 | 0.7051 | 1.1159 | 0.0011 | 0.0952 | 0.0876 | 93.7 | 0.0172 |
| | 175 | 0.1870 | 0.8216 | 1.3703 | 0.0015 | 0.0771 | 0.0709 | 130 | 0.0169 |
| | 250 | 0.1489 | 0.4320 | 1.2644 | 0.0015 | 0.0520 | 0.0478 | 130 | 0.0134 |
| | 750 | 0.5975 | 2.5165 | 5.0885 | 0.0057 | 0.2047 | 0.1884 | 568 | 0.0539 |
| | 1000 | 0.9006 | 3.9378 | 9.2072 | 0.0082 | 0.3063 | 0.2818 | 814 | 0.0813 |
| Off-Highway Tractors Composite | | 0.1893 | 0.7244 | 1.5085 | 0.0017 | 0.0717 | 0.0660 | 151 | 0.0171 |
| Off-Highway Trucks | 175 | 0.1259 | 0.7559 | 0.8596 | 0.0014 | 0.0477 | 0.0438 | 125 | 0.0114 |
| | 250 | 0.1252 | 0.3702 | 0.9818 | 0.0019 | 0.0328 | 0.0301 | 167 | 0.0113 |
| | 500 | 0.1960 | 0.5949 | 1.4165 | 0.0027 | 0.0505 | 0.0465 | 272 | 0.0177 |
| | 750 | 0.3198 | 0.9645 | 2.3779 | 0.0044 | 0.0835 | 0.0768 | 442 | 0.0289 |
| | 1000 | 0.4873 | 1.4801 | 5.2216 | 0.0063 | 0.1505 | 0.1385 | 625 | 0.0440 |
| Off-Highway Trucks Composite | | 0.1924 | 0.5974 | 1.4932 | 0.0027 | 0.0516 | 0.0475 | 260 | 0.0174 |
| Other Construction Equipment | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0039 | 0.0036 | 13.2 | 0.0014 |
| | 50 | 0.0597 | 0.2506 | 0.2369 | 0.0004 | 0.0162 | 0.0149 | 28.0 | 0.0054 |
| | 120 | 0.0827 | 0.5202 | 0.6012 | 0.0009 | 0.0441 | 0.0406 | 80.9 | 0.0075 |
| | 175 | 0.0796 | 0.5864 | 0.6636 | 0.0012 | 0.0331 | 0.0305 | 107 | 0.0072 |
| | 500 | 0.1310 | 0.4963 | 1.1867 | 0.0025 | 0.0394 | 0.0362 | 254 | 0.0118 |
| Other Construction Equipment Composite | | 0.0768 | 0.3645 | 0.6392 | 0.0013 | 0.0264 | 0.0243 | 123 | 0.0069 |
| Other General Industrial Equipmen | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0786 | 0.2532 | 0.2077 | 0.0003 | 0.0191 | 0.0175 | 21.7 | 0.0071 |
| | 120 | 0.0987 | 0.4387 | 0.5864 | 0.0007 | 0.0521 | 0.0480 | 62.0 | 0.0089 |
| | 175 | 0.1083 | 0.5684 | 0.7866 | 0.0011 | 0.0448 | 0.0412 | 95.9 | 0.0098 |
| | 250 | 0.1050 | 0.3015 | 0.9812 | 0.0015 | 0.0312 | 0.0287 | 136 | 0.0095 |
| | 500 | 0.1931 | 0.5811 | 1.6702 | 0.0026 | 0.0569 | 0.0524 | 265 | 0.0174 |
| | 750 | 0.3208 | 0.9578 | 2.8569 | 0.0044 | 0.0959 | 0.0883 | 437 | 0.0289 |
| | 1000 | 0.4546 | 1.4023 | 5.2482 | 0.0056 | 0.1513 | 0.1392 | 560 | 0.0410 |
| Other General Industrial Equipmen Composite | | 0.1355 | 0.4843 | 1.1215 | 0.0016 | 0.0475 | 0.0437 | 152 | 0.0122 |
| Other Material Handling Equipmen | 50 | 0.1090 | 0.3501 | 0.2887 | 0.0004 | 0.0265 | 0.0244 | 30.3 | 0.0098 |
| | 120 | 0.0959 | 0.4271 | 0.5727 | 0.0007 | 0.0509 | 0.0468 | 60.7 | 0.0087 |
| | 175 | 0.1365 | 0.7201 | 0.9997 | 0.0014 | 0.0567 | 0.0522 | 122 | 0.0123 |
| | 250 | 0.1109 | 0.3211 | 1.0483 | 0.0016 | 0.0332 | 0.0306 | 145 | 0.0100 |
| | 500 | 0.1376 | 0.4182 | 1.2042 | 0.0019 | 0.0409 | 0.0377 | 192 | 0.0124 |
| | 9999 | 0.6190 | 1.8527 | 6.9410 | 0.0073 | 0.1995 | 0.1835 | 741 | 0.0558 |
| Other Material Handling Equipment Composite | | 0.1289 | 0.4698 | 1.0967 | 0.0015 | 0.0460 | 0.0423 | 141 | 0.0116 |
| Pavers | 25 | 0.0234 | 0.0780 | 0.1458 | 0.0002 | 0.0066 | 0.0060 | 18.7 | 0.0021 |
| | 50 | 0.1198 | 0.3421 | 0.2775 | 0.0004 | 0.0271 | 0.0249 | 28.0 | 0.0108 |
| | 120 | 0.1235 | 0.4969 | 0.7477 | 0.0008 | 0.0636 | 0.0585 | 69.2 | 0.0111 |
| | 175 | 0.1608 | 0.7707 | 1.2155 | 0.0014 | 0.0673 | 0.0619 | 128 | 0.0145 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1858 | 0.5585 | 1.6747 | 0.0022 | 0.0640 | 0.0589 | 194 | 0.0168 |
| | 500 | 0.2059 | 0.8113 | 1.8097 | 0.0023 | 0.0697 | 0.0641 | 233 | 0.0186 |
| Pavers Composite | | 0.1347 | 0.5203 | 0.7607 | 0.0009 | 0.0526 | 0.0484 | 77.9 | 0.0122 |
| Paving Equipment | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0037 | 0.0034 | 12.6 | 0.0014 |
| | 50 | 0.1023 | 0.2901 | 0.2367 | 0.0003 | 0.0231 | 0.0213 | 23.9 | 0.0092 |
| | 120 | 0.0969 | 0.3891 | 0.5874 | 0.0006 | 0.0503 | 0.0462 | 54.5 | 0.0087 |
| | 175 | 0.1254 | 0.6025 | 0.9549 | 0.0011 | 0.0528 | 0.0486 | 101 | 0.0113 |
| | 250 | 0.1140 | 0.3441 | 1.0498 | 0.0014 | 0.0394 | 0.0362 | 122 | 0.0103 |
| Paving Equipment Composite | | 0.1023 | 0.4234 | 0.6842 | 0.0008 | 0.0469 | 0.0431 | 68.9 | 0.0092 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washers | 15 | 0.0065 | 0.0315 | 0.0445 | 0.0001 | 0.0024 | 0.0022 | 4.9 | 0.0006 |
| | 25 | 0.0100 | 0.0337 | 0.0617 | 0.0001 | 0.0033 | 0.0030 | 7.1 | 0.0009 |
| | 50 | 0.0251 | 0.0970 | 0.1183 | 0.0002 | 0.0077 | 0.0070 | 14.3 | 0.0023 |
| | 120 | 0.0245 | 0.1416 | 0.1947 | 0.0003 | 0.0128 | 0.0118 | 24.1 | 0.0022 |
| Pressure Washers Composite | | 0.0133 | 0.0590 | 0.0799 | 0.0001 | 0.0049 | 0.0045 | 9.4 | 0.0012 |
| | 15 | 0.0111 | 0.0479 | 0.0683 | 0.0001 | 0.0041 | 0.0038 | 7.4 | 0.0010 |
| | 25 | 0.0309 | 0.0919 | 0.1682 | 0.0002 | 0.0094 | 0.0086 | 19.5 | 0.0028 |
| | 50 | 0.0855 | 0.2910 | 0.2982 | 0.0004 | 0.0228 | 0.0210 | 34.3 | 0.0077 |
| | 120 | 0.0949 | 0.4887 | 0.6710 | 0.0009 | 0.0508 | 0.0467 | 77.9 | 0.0086 |
| | 175 | 0.1158 | 0.7365 | 1.0489 | 0.0016 | 0.0502 | 0.0462 | 140 | 0.0104 |
| | 250 | 0.1088 | 0.3998 | 1.3270 | 0.0023 | 0.0376 | 0.0346 | 201 | 0.0098 |
| Pumps | 500 | 0.1686 | 0.6929 | 2.0163 | 0.0034 | 0.0603 | 0.0555 | 345 | 0.0152 |
| | 750 | 0.2872 | 1.1454 | 3.4529 | 0.0057 | 0.1018 | 0.0937 | 571 | 0.0259 |
| | 9999 | 0.8773 | 3.1134 | 11.7387 | 0.0136 | 0.3072 | 0.2826 | 1,355 | 0.0792 |
| Pumps Composite | | 0.0621 | 0.2825 | 0.4121 | 0.0006 | 0.0267 | 0.0245 | 49.6 | 0.0056 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1018 | 0.0002 | 0.0039 | 0.0036 | 13.3 | 0.0015 |
| | 50 | 0.0871 | 0.2754 | 0.2405 | 0.0003 | 0.0209 | 0.0192 | 26.0 | 0.0079 |
| | 120 | 0.0857 | 0.4000 | 0.5498 | 0.0007 | 0.0454 | 0.0418 | 59.0 | 0.0077 |
| | 175 | 0.1104 | 0.6166 | 0.8731 | 0.0012 | 0.0470 | 0.0433 | 108 | 0.0100 |
| | 250 | 0.1107 | 0.3575 | 1.0948 | 0.0017 | 0.0368 | 0.0339 | 153 | 0.0100 |
| | 500 | 0.1468 | 0.5595 | 1.3956 | 0.0022 | 0.0487 | 0.0448 | 219 | 0.0132 |
| Rollers Composite | | 0.0851 | 0.3979 | 0.5706 | 0.0008 | 0.0386 | 0.0355 | 67.1 | 0.0077 |
| Rough Terrain Forklifts | 50 | 0.0942 | 0.3551 | 0.3066 | 0.0004 | 0.0243 | 0.0224 | 33.9 | 0.0085 |
| | 120 | 0.0801 | 0.4260 | 0.5164 | 0.0007 | 0.0420 | 0.0387 | 62.4 | 0.0072 |
| | 175 | 0.1171 | 0.7240 | 0.8746 | 0.0014 | 0.0477 | 0.0439 | 125 | 0.0106 |
| | 250 | 0.1168 | 0.3650 | 1.0385 | 0.0019 | 0.0338 | 0.0311 | 171 | 0.0105 |
| | 500 | 0.1668 | 0.5337 | 1.3642 | 0.0025 | 0.0477 | 0.0439 | 257 | 0.0150 |
| Rough Terrain Forklifts Composite | | 0.0850 | 0.4577 | 0.5588 | 0.0008 | 0.0423 | 0.0389 | 70.3 | 0.0077 |
| Rubber Tired Dozers | 175 | 0.1942 | 0.8333 | 1.3944 | 0.0015 | 0.0790 | 0.0727 | 129 | 0.0175 |
| | 250 | 0.2209 | 0.6304 | 1.8273 | 0.0021 | 0.0762 | 0.0701 | 183 | 0.0199 |
| | 500 | 0.2932 | 1.2456 | 2.3951 | 0.0026 | 0.0985 | 0.0906 | 265 | 0.0265 |
| | 750 | 0.4423 | 1.8685 | 3.6712 | 0.0040 | 0.1494 | 0.1374 | 399 | 0.0399 |
| | 1000 | 0.6883 | 3.0139 | 6.8297 | 0.0060 | 0.2311 | 0.2126 | 592 | 0.0621 |
| Rubber Tired Dozers Composite | | 0.2721 | 1.0420 | 2.2344 | 0.0025 | 0.0924 | 0.0850 | 239 | 0.0246 |
| Rubber Tired Loaders | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0049 | 0.0045 | 16.9 | 0.0018 |
| | 50 | 0.0993 | 0.3438 | 0.2888 | 0.0004 | 0.0242 | 0.0222 | 31.1 | 0.0090 |
| | 120 | 0.0835 | 0.4090 | 0.5226 | 0.0007 | 0.0431 | 0.0396 | 58.9 | 0.0075 |
| | 175 | 0.1094 | 0.6251 | 0.8077 | 0.0012 | 0.0445 | 0.0409 | 106 | 0.0099 |
| | 250 | 0.1118 | 0.3444 | 0.9890 | 0.0017 | 0.0337 | 0.0310 | 149 | 0.0101 |
| | 500 | 0.1678 | 0.5818 | 1.3980 | 0.0023 | 0.0499 | 0.0459 | 237 | 0.0151 |
| | 750 | 0.3459 | 1.1905 | 2.9534 | 0.0049 | 0.1040 | 0.0956 | 486 | 0.0312 |
| | 1000 | 0.4657 | 1.6412 | 5.2967 | 0.0060 | 0.1552 | 0.1428 | 594 | 0.0420 |
| Rubber Tired Loaders Composite | | 0.1050 | 0.4615 | 0.7838 | 0.0012 | 0.0416 | 0.0383 | 109 | 0.0095 |
| Scrapers | 120 | 0.1665 | 0.6826 | 0.9915 | 0.0011 | 0.0846 | 0.0778 | 93.9 | 0.0150 |
| | 175 | 0.1871 | 0.9030 | 1.3657 | 0.0017 | 0.0766 | 0.0704 | 148 | 0.0169 |
| | 250 | 0.2021 | 0.5906 | 1.7470 | 0.0024 | 0.0665 | 0.0612 | 209 | 0.0182 |
| | 500 | 0.2883 | 1.0688 | 2.4104 | 0.0032 | 0.0930 | 0.0855 | 321 | 0.0260 |
| | 750 | 0.5001 | 1.8419 | 4.2634 | 0.0056 | 0.1624 | 0.1494 | 555 | 0.0451 |
| Scrapers Composite | | 0.2513 | 0.9443 | 2.0647 | 0.0027 | 0.0854 | 0.0785 | 262 | 0.0227 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0931 | 0.3227 | 0.3148 | 0.0005 | 0.0243 | 0.0224 | 36.2 | 0.0084 |
| | 120 | 0.0970 | 0.5116 | 0.6762 | 0.0009 | 0.0525 | 0.0483 | 80.2 | 0.0088 |
| | 175 | 0.1290 | 0.8300 | 1.1249 | 0.0017 | 0.0559 | 0.0514 | 155 | 0.0116 |
| | 250 | 0.1416 | 0.5098 | 1.6229 | 0.0029 | 0.0474 | 0.0436 | 255 | 0.0128 |
| Signal Boards Composite | | 0.0171 | 0.0925 | 0.1250 | 0.0002 | 0.0066 | 0.0060 | 16.7 | 0.0015 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| Skid Steer Loaders | 25 | 0.0189 | 0.0601 | 0.1125 | 0.0002 | 0.0056 | 0.0052 | 13.8 | 0.0017 |
| | 50 | 0.0378 | 0.2138 | 0.2052 | 0.0003 | 0.0113 | 0.0104 | 25.5 | 0.0034 |
| | 120 | 0.0334 | 0.2710 | 0.2699 | 0.0005 | 0.0170 | 0.0156 | 42.8 | 0.0030 |
| Skid Steer Loaders Composite | | 0.0352 | 0.2220 | 0.2198 | 0.0004 | 0.0128 | 0.0118 | 30.3 | 0.0032 |
| Surfacing Equipment | 50 | 0.0408 | 0.1333 | 0.1263 | 0.0002 | 0.0101 | 0.0093 | 14.1 | 0.0037 |
| | 120 | 0.0840 | 0.4151 | 0.5756 | 0.0007 | 0.0439 | 0.0404 | 63.8 | 0.0076 |
| | 175 | 0.0787 | 0.4705 | 0.6706 | 0.0010 | 0.0335 | 0.0308 | 85.8 | 0.0071 |
| | 250 | 0.0891 | 0.3116 | 0.9338 | 0.0015 | 0.0309 | 0.0285 | 135 | 0.0080 |
| | 500 | 0.1342 | 0.5759 | 1.3809 | 0.0022 | 0.0468 | 0.0431 | 221 | 0.0121 |
| | 750 | 0.2139 | 0.9020 | 2.2264 | 0.0035 | 0.0745 | 0.0686 | 347 | 0.0193 |
| Surfacing Equipment Composite | | 0.1116 | 0.4705 | 1.0675 | 0.0017 | 0.0389 | 0.0357 | 166 | 0.0101 |
| Sweepers/Scrubbers | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0052 | 19.6 | 0.0021 |
| | 50 | 0.0782 | 0.3186 | 0.2828 | 0.0004 | 0.0211 | 0.0194 | 31.6 | 0.0071 |
| | 120 | 0.0880 | 0.5056 | 0.5893 | 0.0009 | 0.0466 | 0.0429 | 75.0 | 0.0079 |
| | 175 | 0.1193 | 0.7999 | 0.9051 | 0.0016 | 0.0488 | 0.0449 | 139 | 0.0108 |
| | 250 | 0.1029 | 0.3286 | 0.9094 | 0.0018 | 0.0289 | 0.0266 | 162 | 0.0093 |
| Sweepers/Scrubbers Composite | | 0.0913 | 0.5034 | 0.5746 | 0.0009 | 0.0387 | 0.0356 | 78.5 | 0.0082 |
| Tractors/Loaders/Backhoes | 25 | 0.0192 | 0.0653 | 0.1221 | 0.0002 | 0.0049 | 0.0045 | 15.9 | 0.0017 |
| | 50 | 0.0702 | 0.3020 | 0.2646 | 0.0004 | 0.0186 | 0.0171 | 30.3 | 0.0063 |
| | 120 | 0.0577 | 0.3480 | 0.3870 | 0.0006 | 0.0293 | 0.0270 | 51.7 | 0.0052 |
| | 175 | 0.0854 | 0.5853 | 0.6331 | 0.0011 | 0.0335 | 0.0308 | 101 | 0.0077 |
| | 250 | 0.1082 | 0.3566 | 0.9047 | 0.0019 | 0.0294 | 0.0270 | 172 | 0.0098 |
| | 500 | 0.2085 | 0.7089 | 1.6070 | 0.0039 | 0.0559 | 0.0514 | 345 | 0.0188 |
| | 750 | 0.3148 | 1.0631 | 2.4922 | 0.0058 | 0.0854 | 0.0786 | 517 | 0.0284 |
| Tractors/Loaders/Backhoes Composite | | 0.0666 | 0.3716 | 0.4501 | 0.0008 | 0.0298 | 0.0274 | 66.8 | 0.0060 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0087 | 32.9 | 0.0036 |
| | 50 | 0.1390 | 0.3900 | 0.3235 | 0.0004 | 0.0313 | 0.0288 | 32.9 | 0.0125 |
| | 120 | 0.1144 | 0.4600 | 0.7060 | 0.0008 | 0.0590 | 0.0542 | 64.9 | 0.0103 |
| | 175 | 0.1770 | 0.8534 | 1.3767 | 0.0016 | 0.0748 | 0.0688 | 144 | 0.0160 |
| | 250 | 0.2105 | 0.6510 | 1.9456 | 0.0025 | 0.0750 | 0.0690 | 223 | 0.0190 |
| | 500 | 0.2694 | 1.1349 | 2.4560 | 0.0031 | 0.0947 | 0.0871 | 311 | 0.0243 |
| | 750 | 0.5107 | 2.1334 | 4.7300 | 0.0059 | 0.1802 | 0.1658 | 587 | 0.0461 |
| Trenchers Composite | | 0.1274 | 0.4541 | 0.6043 | 0.0007 | 0.0485 | 0.0446 | 58.7 | 0.0115 |
| Welders | 15 | 0.0093 | 0.0400 | 0.0571 | 0.0001 | 0.0034 | 0.0032 | 6.2 | 0.0008 |
| | 25 | 0.0179 | 0.0532 | 0.0974 | 0.0001 | 0.0054 | 0.0050 | 11.3 | 0.0016 |
| | 50 | 0.0801 | 0.2564 | 0.2346 | 0.0003 | 0.0200 | 0.0184 | 26.0 | 0.0072 |
| | 120 | 0.0547 | 0.2606 | 0.3567 | 0.0005 | 0.0296 | 0.0273 | 39.5 | 0.0049 |
| | 175 | 0.0936 | 0.5424 | 0.7713 | 0.0011 | 0.0405 | 0.0373 | 98.2 | 0.0084 |
| | 250 | 0.0749 | 0.2483 | 0.8249 | 0.0013 | 0.0248 | 0.0228 | 119 | 0.0068 |
| | 500 | 0.0968 | 0.3491 | 1.0171 | 0.0016 | 0.0325 | 0.0299 | 168 | 0.0087 |
| Welders Composite | | 0.0534 | 0.1994 | 0.2301 | 0.0003 | 0.0187 | 0.0172 | 25.6 | 0.0048 |

## 2020 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0138 | 0.0459 | 0.0854 | 0.0001 | 0.0035 | 0.0032 | 11.0 | 0.0012 |
| | 50 | 0.0261 | 0.1436 | 0.1422 | 0.0003 | 0.0071 | 0.0065 | 19.6 | 0.0024 |
| | 120 | 0.0259 | 0.2292 | 0.2166 | 0.0004 | 0.0127 | 0.0117 | 38.1 | 0.0023 |
| | 500 | 0.0751 | 0.3804 | 0.6959 | 0.0021 | 0.0217 | 0.0199 | 213 | 0.0068 |
| | 750 | 0.1373 | 0.6877 | 1.2876 | 0.0039 | 0.0396 | 0.0365 | 385 | 0.0124 |
| Aerial Lifts Composite | | 0.0261 | 0.1696 | 0.1866 | 0.0004 | 0.0092 | 0.0084 | 34.7 | 0.0024 |
| Air Compressors | 15 | 0.0093 | 0.0451 | 0.0579 | 0.0001 | 0.0029 | 0.0027 | 7.2 | 0.0008 |
| | 25 | 0.0196 | 0.0630 | 0.1155 | 0.0002 | 0.0054 | 0.0050 | 14.4 | 0.0018 |
| | 50 | 0.0398 | 0.2030 | 0.1725 | 0.0003 | 0.0099 | 0.0091 | 22.3 | 0.0036 |
| | 120 | 0.0408 | 0.3058 | 0.2826 | 0.0006 | 0.0188 | 0.0173 | 47.0 | 0.0037 |
| | 175 | 0.0587 | 0.4989 | 0.4013 | 0.0010 | 0.0210 | 0.0193 | 88.5 | 0.0053 |
| | 250 | 0.0669 | 0.2592 | 0.5067 | 0.0015 | 0.0163 | 0.0150 | 131 | 0.0060 |
| | 500 | 0.1146 | 0.4395 | 0.7970 | 0.0023 | 0.0276 | 0.0254 | 232 | 0.0103 |
| | 750 | 0.1777 | 0.6792 | 1.2615 | 0.0036 | 0.0432 | 0.0398 | 358 | 0.0160 |
| | 1000 | 0.2641 | 0.9959 | 3.2946 | 0.0049 | 0.0804 | 0.0740 | 486 | 0.0238 |
| Air Compressors Composite | | 0.0483 | 0.3077 | 0.3255 | 0.0007 | 0.0185 | 0.0170 | 63.6 | 0.0044 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0196 | 0.2205 | 0.1756 | 0.0004 | 0.0020 | 0.0018 | 31.0 | 0.0018 |
| | 120 | 0.0280 | 0.4662 | 0.2329 | 0.0009 | 0.0040 | 0.0037 | 77.1 | 0.0025 |
| | 175 | 0.0402 | 0.7542 | 0.1862 | 0.0016 | 0.0051 | 0.0047 | 141 | 0.0036 |
| | 250 | 0.0474 | 0.3426 | 0.1617 | 0.0021 | 0.0044 | 0.0040 | 188 | 0.0043 |
| | 500 | 0.0784 | 0.5512 | 0.2622 | 0.0031 | 0.0072 | 0.0066 | 311 | 0.0071 |
| | 750 | 0.1549 | 1.0891 | 0.5202 | 0.0062 | 0.0143 | 0.0131 | 615 | 0.0140 |
| | 1000 | 0.2442 | 1.6437 | 3.9853 | 0.0093 | 0.0530 | 0.0488 | 928 | 0.0220 |
| Bore/Drill Rigs Composite | | 0.0480 | 0.5008 | 0.3439 | 0.0017 | 0.0062 | 0.0057 | 165 | 0.0043 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0223 | 0.0741 | 0.1372 | 0.0002 | 0.0058 | 0.0053 | 17.6 | 0.0020 |
| Cement and Mortar Mixers Co | | 0.0086 | 0.0415 | 0.0536 | 0.0001 | 0.0021 | 0.0020 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0424 | 0.2420 | 0.2231 | 0.0004 | 0.0113 | 0.0104 | 30.2 | 0.0038 |
| | 120 | 0.0524 | 0.4613 | 0.4128 | 0.0009 | 0.0249 | 0.0229 | 74.1 | 0.0047 |
| | 175 | 0.0865 | 0.8662 | 0.6554 | 0.0018 | 0.0323 | 0.0297 | 160 | 0.0078 |
| Concrete/Industrial Saws Com | | 0.0484 | 0.3783 | 0.3410 | 0.0007 | 0.0196 | 0.0180 | 58.5 | 0.0044 |
| Cranes | 50 | 0.0532 | 0.2423 | 0.1894 | 0.0003 | 0.0121 | 0.0111 | 23.2 | 0.0048 |
| | 120 | 0.0542 | 0.3446 | 0.3317 | 0.0006 | 0.0240 | 0.0221 | 50.1 | 0.0049 |
| | 175 | 0.0648 | 0.4754 | 0.4071 | 0.0009 | 0.0223 | 0.0206 | 80.3 | 0.0058 |
| | 250 | 0.0704 | 0.2440 | 0.4949 | 0.0013 | 0.0170 | 0.0157 | 112 | 0.0064 |
| | 500 | 0.1087 | 0.3839 | 0.7047 | 0.0018 | 0.0257 | 0.0236 | 180 | 0.0098 |
| | 750 | 0.1837 | 0.6455 | 1.2225 | 0.0030 | 0.0439 | 0.0404 | 303 | 0.0166 |
| | 9999 | 0.6702 | 2.1934 | 7.0436 | 0.0098 | 0.1797 | 0.1654 | 971 | 0.0605 |
| Cranes Composite | | 0.0898 | 0.3917 | 0.6610 | 0.0014 | 0.0256 | 0.0236 | 129 | 0.0081 |
| Crawler Tractors | 50 | 0.0699 | 0.2771 | 0.2107 | 0.0003 | 0.0150 | 0.0138 | 24.9 | 0.0063 |
| | 120 | 0.0831 | 0.4628 | 0.4896 | 0.0008 | 0.0371 | 0.0341 | 65.8 | 0.0075 |
| | 175 | 0.1123 | 0.7302 | 0.7150 | 0.0014 | 0.0398 | 0.0366 | 121 | 0.0101 |
| | 250 | 0.1188 | 0.3966 | 0.8681 | 0.0019 | 0.0315 | 0.0290 | 166 | 0.0107 |
| | 500 | 0.1759 | 0.6665 | 1.2170 | 0.0025 | 0.0455 | 0.0419 | 259 | 0.0159 |
| | 750 | 0.3168 | 1.1935 | 2.2429 | 0.0047 | 0.0828 | 0.0762 | 465 | 0.0286 |
| | 1000 | 0.4836 | 1.8458 | 5.2162 | 0.0066 | 0.1425 | 0.1311 | 658 | 0.0436 |
| Crawler Tractors Composite | | 0.1049 | 0.5260 | 0.6772 | 0.0013 | 0.0378 | 0.0348 | 114 | 0.0095 |
| Crushing/Proc. E | 50 | 0.0734 | 0.4036 | 0.3367 | 0.0006 | 0.0181 | 0.0166 | 44.0 | 0.0066 |
| | 120 | 0.0692 | 0.5446 | 0.4754 | 0.0010 | 0.0302 | 0.0278 | 83.1 | 0.0062 |
| | 175 | 0.1083 | 0.9519 | 0.7042 | 0.0019 | 0.0368 | 0.0338 | 167 | 0.0098 |
| | 250 | 0.1245 | 0.4844 | 0.8670 | 0.0028 | 0.0282 | 0.0259 | 245 | 0.0112 |
| | 500 | 0.1852 | 0.7092 | 1.1829 | 0.0037 | 0.0416 | 0.0383 | 374 | 0.0167 |
| | 750 | 0.2912 | 1.1167 | 1.9026 | 0.0059 | 0.0655 | 0.0603 | 589 | 0.0263 |
| | 9999 | 0.7584 | 2.6528 | 8.5119 | 0.0131 | 0.2049 | 0.1885 | 1,308 | 0.0684 |
| Crushing/Proc. Equipment Co | | 0.0934 | 0.6247 | 0.5983 | 0.0015 | 0.0310 | 0.0285 | 132 | 0.0084 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0384 | 0.2446 | 0.1862 | 0.0003 | 0.0080 | 0.0074 | 25.0 | 0.0035 |
| | 120 | 0.0583 | 0.4979 | 0.3717 | 0.0009 | 0.0206 | 0.0189 | 73.6 | 0.0053 |
| | 175 | 0.0703 | 0.6637 | 0.3868 | 0.0013 | 0.0195 | 0.0179 | 112 | 0.0063 |
| | 250 | 0.0828 | 0.3276 | 0.4493 | 0.0018 | 0.0154 | 0.0141 | 159 | 0.0075 |
| | 500 | 0.1198 | 0.4591 | 0.6028 | 0.0023 | 0.0219 | 0.0202 | 234 | 0.0108 |
| | 750 | 0.1987 | 0.7606 | 1.0153 | 0.0039 | 0.0365 | 0.0336 | 387 | 0.0179 |
| Excavators Composite | | 0.0733 | 0.5124 | 0.4042 | 0.0013 | 0.0184 | 0.0169 | 120 | 0.0066 |
| Forklifts | 50 | 0.0191 | 0.1400 | 0.1084 | 0.0002 | 0.0039 | 0.0036 | 14.7 | 0.0017 |
| | 120 | 0.0225 | 0.2102 | 0.1443 | 0.0004 | 0.0074 | 0.0068 | 31.2 | 0.0020 |
| | 175 | 0.0336 | 0.3315 | 0.1772 | 0.0006 | 0.0087 | 0.0080 | 56.1 | 0.0030 |
| | 250 | 0.0385 | 0.1554 | 0.1887 | 0.0009 | 0.0062 | 0.0057 | 77.1 | 0.0035 |
| | 500 | 0.0548 | 0.2126 | 0.2528 | 0.0011 | 0.0088 | 0.0081 | 111 | 0.0049 |
| Forklifts Composite | | 0.0320 | 0.2160 | 0.1691 | 0.0006 | 0.0070 | 0.0065 | 54.4 | 0.0029 |
| Generator Sets | 15 | 0.0116 | 0.0638 | 0.0814 | 0.0002 | 0.0038 | 0.0035 | 10.2 | 0.0011 |
| | 25 | 0.0224 | 0.0769 | 0.1410 | 0.0002 | 0.0064 | 0.0059 | 17.6 | 0.0020 |
| | 50 | 0.0379 | 0.2161 | 0.2199 | 0.0004 | 0.0106 | 0.0098 | 30.6 | 0.0034 |
| | 120 | 0.0506 | 0.4641 | 0.4378 | 0.0009 | 0.0250 | 0.0230 | 77.9 | 0.0046 |
| | 175 | 0.0676 | 0.7323 | 0.5990 | 0.0016 | 0.0266 | 0.0245 | 142 | 0.0061 |
| | 250 | 0.0747 | 0.3844 | 0.7614 | 0.0024 | 0.0218 | 0.0200 | 213 | 0.0067 |
| | 500 | 0.1125 | 0.5968 | 1.0874 | 0.0033 | 0.0333 | 0.0307 | 337 | 0.0102 |
| | 750 | 0.1842 | 0.9634 | 1.7962 | 0.0055 | 0.0544 | 0.0500 | 544 | 0.0166 |
| | 9999 | 0.4502 | 2.0059 | 6.6947 | 0.0105 | 0.1476 | 0.1358 | 1,049 | 0.0406 |
| Generator Sets Composite | | 0.0395 | 0.2732 | 0.3232 | 0.0007 | 0.0150 | 0.0138 | 61.0 | 0.0036 |
| Graders | 50 | 0.0563 | 0.2762 | 0.2156 | 0.0004 | 0.0124 | 0.0114 | 27.5 | 0.0051 |
| | 120 | 0.0738 | 0.5090 | 0.4568 | 0.0009 | 0.0311 | 0.0286 | 75.0 | 0.0067 |
| | 175 | 0.0918 | 0.7282 | 0.5622 | 0.0014 | 0.0303 | 0.0279 | 124 | 0.0083 |
| | 250 | 0.0999 | 0.3683 | 0.6701 | 0.0019 | 0.0230 | 0.0211 | 172 | 0.0090 |
| | 500 | 0.1284 | 0.4966 | 0.7982 | 0.0023 | 0.0288 | 0.0265 | 229 | 0.0116 |
| | 750 | 0.2731 | 1.0508 | 1.7425 | 0.0049 | 0.0621 | 0.0571 | 486 | 0.0246 |
| Graders Composite | | 0.0919 | 0.5765 | 0.5823 | 0.0015 | 0.0280 | 0.0258 | 133 | 0.0083 |
| Off-Highway Trac | 120 | 0.1455 | 0.6789 | 0.8421 | 0.0011 | 0.0674 | 0.0621 | 93.7 | 0.0131 |
| | 175 | 0.1455 | 0.8025 | 0.9712 | 0.0015 | 0.0547 | 0.0503 | 130 | 0.0131 |
| | 250 | 0.1147 | 0.3614 | 0.8843 | 0.0015 | 0.0348 | 0.0321 | 130 | 0.0103 |
| | 750 | 0.4683 | 1.8825 | 3.5643 | 0.0057 | 0.1391 | 0.1280 | 568 | 0.0423 |
| | 1000 | 0.7129 | 2.9445 | 7.4279 | 0.0082 | 0.2214 | 0.2037 | 814 | 0.0643 |
| Off-Highway Tractors Compos | | 0.1470 | 0.6517 | 1.0657 | 0.0017 | 0.0497 | 0.0457 | 151 | 0.0133 |
| Off-Highway Truc | 175 | 0.0837 | 0.7538 | 0.4564 | 0.0014 | 0.0234 | 0.0215 | 125 | 0.0076 |
| | 250 | 0.0927 | 0.3514 | 0.5042 | 0.0019 | 0.0173 | 0.0159 | 167 | 0.0084 |
| | 500 | 0.1488 | 0.5446 | 0.7481 | 0.0027 | 0.0273 | 0.0251 | 272 | 0.0134 |
| | 750 | 0.2416 | 0.8831 | 1.2347 | 0.0044 | 0.0446 | 0.0411 | 442 | 0.0218 |
| | 1000 | 0.3613 | 1.2913 | 3.8920 | 0.0063 | 0.0903 | 0.0831 | 625 | 0.0326 |
| Off-Highway Trucks Composit | | 0.1443 | 0.5514 | 0.8306 | 0.0027 | 0.0280 | 0.0258 | 260 | 0.0130 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0328 | 0.2267 | 0.1956 | 0.0004 | 0.0078 | 0.0072 | 28.0 | 0.0030 |
| | 120 | 0.0501 | 0.5080 | 0.3835 | 0.0009 | 0.0199 | 0.0183 | 80.9 | 0.0045 |
| | 175 | 0.0524 | 0.5859 | 0.3414 | 0.0012 | 0.0164 | 0.0151 | 107 | 0.0047 |
| | 500 | 0.1012 | 0.4676 | 0.6065 | 0.0025 | 0.0212 | 0.0195 | 254 | 0.0091 |
| Other Construction Equipment | | 0.0563 | 0.3508 | 0.3519 | 0.0013 | 0.0139 | 0.0128 | 122 | 0.0051 |
| Other General In | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0431 | 0.2211 | 0.1744 | 0.0003 | 0.0101 | 0.0093 | 21.7 | 0.0039 |
| | 120 | 0.0602 | 0.4232 | 0.3810 | 0.0007 | 0.0256 | 0.0236 | 62.0 | 0.0054 |
| | 175 | 0.0721 | 0.5668 | 0.4439 | 0.0011 | 0.0237 | 0.0218 | 95.9 | 0.0065 |
| | 250 | 0.0791 | 0.2804 | 0.5318 | 0.0015 | 0.0173 | 0.0159 | 136 | 0.0071 |
| | 500 | 0.1506 | 0.5217 | 0.9276 | 0.0026 | 0.0326 | 0.0300 | 265 | 0.0136 |
| | 750 | 0.2490 | 0.8599 | 1.5657 | 0.0044 | 0.0543 | 0.0500 | 437 | 0.0225 |
| | 1000 | 0.3467 | 1.1855 | 3.8628 | 0.0056 | 0.0969 | 0.0892 | 560 | 0.0313 |
| Other General Industrial Equip | | 0.0983 | 0.4517 | 0.6661 | 0.0016 | 0.0262 | 0.0241 | 152 | 0.0089 |
| Other Material Ha | 50 | 0.0595 | 0.3049 | 0.2425 | 0.0004 | 0.0141 | 0.0130 | 30.3 | 0.0054 |
| | 120 | 0.0583 | 0.4117 | 0.3720 | 0.0007 | 0.0250 | 0.0230 | 60.7 | 0.0053 |
| | 175 | 0.0907 | 0.7176 | 0.5642 | 0.0014 | 0.0301 | 0.0277 | 122 | 0.0082 |

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|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0836 | 0.2984 | 0.5684 | 0.0016 | 0.0185 | 0.0170 | 145 | 0.0075 |
| | 500 | 0.1074 | 0.3752 | 0.6692 | 0.0019 | 0.0235 | 0.0216 | 192 | 0.0097 |
| | 9999 | 0.4910 | 1.5647 | 5.1082 | 0.0073 | 0.1280 | 0.1177 | 741 | 0.0443 |
| Other Material Handling Equip | | 0.0924 | 0.4429 | 0.6500 | 0.0015 | 0.0252 | 0.0232 | 141 | 0.0083 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1427 | 0.0002 | 0.0055 | 0.0051 | 18.7 | 0.0020 |
| | 50 | 0.0834 | 0.3055 | 0.2398 | 0.0004 | 0.0184 | 0.0169 | 28.0 | 0.0075 |
| | 120 | 0.0910 | 0.4805 | 0.5471 | 0.0008 | 0.0428 | 0.0394 | 69.2 | 0.0082 |
| | 175 | 0.1217 | 0.7599 | 0.8187 | 0.0014 | 0.0459 | 0.0422 | 128 | 0.0110 |
| | 250 | 0.1411 | 0.4713 | 1.1106 | 0.0022 | 0.0407 | 0.0375 | 194 | 0.0127 |
| | 500 | 0.1595 | 0.6305 | 1.1959 | 0.0023 | 0.0450 | 0.0414 | 233 | 0.0144 |
| Pavers Composite | | 0.0989 | 0.4920 | 0.5450 | 0.0009 | 0.0355 | 0.0326 | 77.9 | 0.0089 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0702 | 0.2577 | 0.2043 | 0.0003 | 0.0157 | 0.0144 | 23.9 | 0.0063 |
| | 120 | 0.0708 | 0.3762 | 0.4280 | 0.0006 | 0.0337 | 0.0310 | 54.5 | 0.0064 |
| | 175 | 0.0944 | 0.5945 | 0.6403 | 0.0011 | 0.0360 | 0.0331 | 101 | 0.0085 |
| | 250 | 0.0864 | 0.2894 | 0.6928 | 0.0014 | 0.0249 | 0.0229 | 122 | 0.0078 |
| Paving Equipment Composite | | 0.0757 | 0.4084 | 0.4807 | 0.0008 | 0.0315 | 0.0290 | 68.9 | 0.0068 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0056 | 0.0305 | 0.0390 | 0.0001 | 0.0018 | 0.0017 | 4.9 | 0.0005 |
| | 25 | 0.0091 | 0.0312 | 0.0572 | 0.0001 | 0.0026 | 0.0024 | 7.1 | 0.0008 |
| | 50 | 0.0128 | 0.0856 | 0.0986 | 0.0002 | 0.0041 | 0.0038 | 14.3 | 0.0012 |
| | 120 | 0.0128 | 0.1367 | 0.1293 | 0.0003 | 0.0065 | 0.0060 | 24.1 | 0.0012 |
| Pressure Washers Composite | | 0.0085 | 0.0549 | 0.0650 | 0.0001 | 0.0030 | 0.0027 | 9.4 | 0.0008 |
| Pumps | 15 | 0.0096 | 0.0464 | 0.0595 | 0.0001 | 0.0030 | 0.0028 | 7.4 | 0.0009 |
| | 25 | 0.0265 | 0.0850 | 0.1558 | 0.0002 | 0.0073 | 0.0067 | 19.5 | 0.0024 |
| | 50 | 0.0465 | 0.2546 | 0.2497 | 0.0004 | 0.0126 | 0.0116 | 34.3 | 0.0042 |
| | 120 | 0.0537 | 0.4713 | 0.4442 | 0.0009 | 0.0263 | 0.0242 | 77.9 | 0.0048 |
| | 175 | 0.0712 | 0.7336 | 0.6007 | 0.0016 | 0.0277 | 0.0255 | 140 | 0.0064 |
| | 250 | 0.0760 | 0.3700 | 0.7338 | 0.0023 | 0.0215 | 0.0198 | 201 | 0.0069 |
| | 500 | 0.1241 | 0.6189 | 1.1297 | 0.0034 | 0.0355 | 0.0327 | 345 | 0.0112 |
| | 750 | 0.2075 | 1.0232 | 1.9114 | 0.0057 | 0.0594 | 0.0547 | 571 | 0.0187 |
| | 9999 | 0.6127 | 2.6255 | 8.7489 | 0.0136 | 0.1961 | 0.1804 | 1,355 | 0.0553 |
| Pumps Composite | | 0.0376 | 0.2674 | 0.2854 | 0.0006 | 0.0147 | 0.0135 | 49.6 | 0.0034 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0543 | 0.2436 | 0.2039 | 0.0003 | 0.0128 | 0.0117 | 26.0 | 0.0049 |
| | 120 | 0.0576 | 0.3873 | 0.3799 | 0.0007 | 0.0270 | 0.0249 | 59.0 | 0.0052 |
| | 175 | 0.0774 | 0.6114 | 0.5331 | 0.0012 | 0.0286 | 0.0263 | 108 | 0.0070 |
| | 250 | 0.0842 | 0.3201 | 0.6581 | 0.0017 | 0.0223 | 0.0205 | 153 | 0.0076 |
| | 500 | 0.1151 | 0.4607 | 0.8354 | 0.0022 | 0.0299 | 0.0275 | 219 | 0.0104 |
| Rollers Composite | | 0.0584 | 0.3837 | 0.3793 | 0.0008 | 0.0232 | 0.0214 | 67.0 | 0.0053 |
| Rough Terrain Fo | 50 | 0.0520 | 0.3171 | 0.2556 | 0.0004 | 0.0122 | 0.0113 | 33.9 | 0.0047 |
| | 120 | 0.0495 | 0.4142 | 0.3326 | 0.0007 | 0.0197 | 0.0181 | 62.4 | 0.0045 |
| | 175 | 0.0788 | 0.7229 | 0.4710 | 0.0014 | 0.0245 | 0.0226 | 125 | 0.0071 |
| | 250 | 0.0881 | 0.3442 | 0.5378 | 0.0019 | 0.0182 | 0.0168 | 171 | 0.0079 |
| | 500 | 0.1296 | 0.4936 | 0.7287 | 0.0025 | 0.0265 | 0.0244 | 257 | 0.0117 |
| Rough Terrain Forklifts Compo | | 0.0533 | 0.4464 | 0.3494 | 0.0008 | 0.0201 | 0.0185 | 70.3 | 0.0048 |
| Rubber Tired Doz | 175 | 0.1509 | 0.8124 | 0.9962 | 0.0015 | 0.0561 | 0.0516 | 129 | 0.0136 |
| | 250 | 0.1701 | 0.5279 | 1.2898 | 0.0021 | 0.0516 | 0.0474 | 183 | 0.0153 |
| | 500 | 0.2291 | 0.9276 | 1.6868 | 0.0026 | 0.0673 | 0.0619 | 265 | 0.0207 |
| | 750 | 0.3461 | 1.3934 | 2.5948 | 0.0040 | 0.1024 | 0.0942 | 399 | 0.0312 |
| | 1000 | 0.5438 | 2.2500 | 5.5311 | 0.0060 | 0.1672 | 0.1539 | 592 | 0.0491 |
| Rubber Tired Dozers Compos | | 0.2118 | 0.8006 | 1.5773 | 0.0025 | 0.0630 | 0.0580 | 239 | 0.0191 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0615 | 0.3080 | 0.2424 | 0.0004 | 0.0137 | 0.0126 | 31.1 | 0.0055 |
| | 120 | 0.0563 | 0.3977 | 0.3529 | 0.0007 | 0.0237 | 0.0218 | 58.9 | 0.0051 |
| | 175 | 0.0767 | 0.6215 | 0.4713 | 0.0012 | 0.0253 | 0.0233 | 106 | 0.0069 |
| | 250 | 0.0848 | 0.3159 | 0.5655 | 0.0017 | 0.0194 | 0.0179 | 149 | 0.0077 |
| | 500 | 0.1302 | 0.5016 | 0.8032 | 0.0023 | 0.0291 | 0.0268 | 237 | 0.0118 |
| | 750 | 0.2680 | 1.0271 | 1.6958 | 0.0049 | 0.0606 | 0.0558 | 486 | 0.0242 |
| | 1000 | 0.3484 | 1.3166 | 4.0040 | 0.0060 | 0.0983 | 0.0904 | 594 | 0.0314 |
| Rubber Tired Loaders Compos | | 0.0753 | 0.4406 | 0.4747 | 0.0012 | 0.0235 | 0.0216 | 109 | 0.0068 |
| Scrapers | 120 | 0.1218 | 0.6612 | 0.7170 | 0.0011 | 0.0551 | 0.0507 | 93.9 | 0.0110 |

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|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1400 | 0.8921 | 0.9020 | 0.0017 | 0.0505 | 0.0464 | 148 | 0.0126 |
| | 250 | 0.1522 | 0.5044 | 1.1344 | 0.0024 | 0.0412 | 0.0379 | 209 | 0.0137 |
| | 500 | 0.2211 | 0.8455 | 1.5615 | 0.0032 | 0.0584 | 0.0537 | 321 | 0.0200 |
| | 750 | 0.3839 | 1.4588 | 2.7734 | 0.0056 | 0.1024 | 0.0942 | 555 | 0.0346 |
| Scrapers Composite | | 0.1914 | 0.7938 | 1.3434 | 0.0027 | 0.0541 | 0.0497 | 262 | 0.0173 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0502 | 0.2833 | 0.2631 | 0.0005 | 0.0131 | 0.0121 | 36.2 | 0.0045 |
| | 120 | 0.0558 | 0.4946 | 0.4424 | 0.0009 | 0.0264 | 0.0243 | 80.2 | 0.0050 |
| | 175 | 0.0811 | 0.8276 | 0.6279 | 0.0017 | 0.0302 | 0.0277 | 155 | 0.0073 |
| | 250 | 0.1022 | 0.4765 | 0.8737 | 0.0029 | 0.0266 | 0.0245 | 255 | 0.0092 |
| Signal Boards Composite | | 0.0129 | 0.0912 | 0.0912 | 0.0002 | 0.0042 | 0.0038 | 16.7 | 0.0012 |
| Skid Steer Loade | 25 | 0.0171 | 0.0575 | 0.1070 | 0.0002 | 0.0044 | 0.0040 | 13.8 | 0.0015 |
| | 50 | 0.0230 | 0.2006 | 0.1655 | 0.0003 | 0.0043 | 0.0040 | 25.5 | 0.0021 |
| | 120 | 0.0218 | 0.2673 | 0.1647 | 0.0005 | 0.0064 | 0.0059 | 42.8 | 0.0020 |
| Skid Steer Loaders Composite | | 0.0222 | 0.2125 | 0.1614 | 0.0004 | 0.0050 | 0.0046 | 30.3 | 0.0020 |
| Surfacing Equipm | 50 | 0.0265 | 0.1191 | 0.1069 | 0.0002 | 0.0063 | 0.0058 | 14.1 | 0.0024 |
| | 120 | 0.0570 | 0.4028 | 0.4035 | 0.0007 | 0.0271 | 0.0250 | 63.8 | 0.0051 |
| | 175 | 0.0550 | 0.4663 | 0.4168 | 0.0010 | 0.0210 | 0.0193 | 85.8 | 0.0050 |
| | 250 | 0.0652 | 0.2754 | 0.5719 | 0.0015 | 0.0188 | 0.0173 | 135 | 0.0059 |
| | 500 | 0.1008 | 0.4728 | 0.8400 | 0.0022 | 0.0288 | 0.0265 | 221 | 0.0091 |
| | 750 | 0.1599 | 0.7413 | 1.3593 | 0.0035 | 0.0459 | 0.0423 | 347 | 0.0144 |
| Surfacing Equipment Compos | | 0.0823 | 0.3953 | 0.6593 | 0.0017 | 0.0239 | 0.0220 | 166 | 0.0074 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0430 | 0.2898 | 0.2365 | 0.0004 | 0.0098 | 0.0090 | 31.6 | 0.0039 |
| | 120 | 0.0555 | 0.4959 | 0.3694 | 0.0009 | 0.0210 | 0.0193 | 75.0 | 0.0050 |
| | 175 | 0.0845 | 0.8043 | 0.4869 | 0.0016 | 0.0253 | 0.0233 | 139 | 0.0076 |
| | 250 | 0.0803 | 0.3198 | 0.4530 | 0.0018 | 0.0152 | 0.0140 | 162 | 0.0072 |
| Sweepers/Scrubbers Compos | | 0.0584 | 0.4916 | 0.3563 | 0.0009 | 0.0183 | 0.0169 | 78.5 | 0.0053 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0046 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0407 | 0.2760 | 0.2179 | 0.0004 | 0.0087 | 0.0080 | 30.3 | 0.0037 |
| | 120 | 0.0366 | 0.3402 | 0.2466 | 0.0006 | 0.0129 | 0.0119 | 51.7 | 0.0033 |
| | 175 | 0.0571 | 0.5841 | 0.3220 | 0.0011 | 0.0159 | 0.0146 | 101 | 0.0052 |
| | 250 | 0.0813 | 0.3445 | 0.4427 | 0.0019 | 0.0151 | 0.0139 | 172 | 0.0073 |
| | 500 | 0.1606 | 0.6642 | 0.8132 | 0.0039 | 0.0294 | 0.0270 | 345 | 0.0145 |
| | 750 | 0.2409 | 0.9959 | 1.2387 | 0.0058 | 0.0443 | 0.0408 | 517 | 0.0217 |
| Tractors/Loaders/Backhoes C | | 0.0436 | 0.3616 | 0.2744 | 0.0008 | 0.0134 | 0.0124 | 66.8 | 0.0039 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0990 | 0.3495 | 0.2804 | 0.0004 | 0.0218 | 0.0201 | 32.9 | 0.0089 |
| | 120 | 0.0849 | 0.4443 | 0.5223 | 0.0008 | 0.0408 | 0.0375 | 64.9 | 0.0077 |
| | 175 | 0.1346 | 0.8393 | 0.9412 | 0.0016 | 0.0521 | 0.0479 | 144 | 0.0121 |
| | 250 | 0.1600 | 0.5472 | 1.3120 | 0.0025 | 0.0487 | 0.0448 | 223 | 0.0144 |
| | 500 | 0.2092 | 0.8710 | 1.6487 | 0.0031 | 0.0623 | 0.0573 | 311 | 0.0189 |
| | 750 | 0.3964 | 1.6395 | 3.1894 | 0.0059 | 0.1191 | 0.1095 | 587 | 0.0358 |
| Trenchers Composite | | 0.0933 | 0.4270 | 0.4575 | 0.0007 | 0.0336 | 0.0309 | 58.7 | 0.0084 |
| Welders | 15 | 0.0080 | 0.0388 | 0.0498 | 0.0001 | 0.0025 | 0.0023 | 6.2 | 0.0007 |
| | 25 | 0.0153 | 0.0492 | 0.0903 | 0.0001 | 0.0042 | 0.0039 | 11.3 | 0.0014 |
| | 50 | 0.0435 | 0.2219 | 0.1968 | 0.0003 | 0.0110 | 0.0102 | 26.0 | 0.0039 |
| | 120 | 0.0321 | 0.2508 | 0.2344 | 0.0005 | 0.0153 | 0.0140 | 39.5 | 0.0029 |
| | 175 | 0.0600 | 0.5396 | 0.4393 | 0.0011 | 0.0223 | 0.0205 | 98.2 | 0.0054 |
| | 250 | 0.0551 | 0.2294 | 0.4536 | 0.0013 | 0.0142 | 0.0130 | 119 | 0.0050 |
| | 500 | 0.0748 | 0.3117 | 0.5690 | 0.0016 | 0.0192 | 0.0176 | 168 | 0.0067 |
| Welders Composite | | 0.0310 | 0.1816 | 0.1735 | 0.0003 | 0.0102 | 0.0094 | 25.6 | 0.0028 |

**San Diego 2025 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,343,732.35 | ########### | 8,492,736.38 | 0.02 | 0.71 | 0.09 | 223.96 | 0.05 | 0.04 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 6,282.20 | 213,159.29 | 39,008.92 | 0.01 | 0.09 | 0.31 | 246.18 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 198,419.75 | 7,123,689.46 | 1,204,641.90 | 0.02 | 1.09 | 0.12 | 276.49 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 240.83 | 8,707.20 | 1,432.14 | 0.02 | 0.13 | 0.37 | 242.28 | 0.06 | 0.05 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 479,791.14 | ########### | 3,017,273.36 | 0.01 | 0.73 | 0.08 | 343.84 | 0.05 | 0.04 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 211.77 | 7,665.63 | 1,309.49 | 0.02 | 0.11 | 0.40 | 268.51 | 0.06 | 0.05 | 0.00 | | |
| Average | | | | | | | 0.019 | 0.478 | 0.227 | 266.878 | 0.052 | 0.042 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,476 | 582,978 | - | 0.22 | 1.01 | 2.06 | 1541.82 | 0.07 | 0.10 | 0.02 | | |

Source: EMFAC 2011

## 2025 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0132 | 0.0451 | 0.0838 | 0.0001 | 0.0032 | 0.0030 | 11.0 | 0.0012 |
| | 50 | 0.0168 | 0.1351 | 0.1218 | 0.0003 | 0.0035 | 0.0032 | 19.6 | 0.0015 |
| | 120 | 0.0176 | 0.2265 | 0.1496 | 0.0004 | 0.0063 | 0.0058 | 38.1 | 0.0016 |
| | 500 | 0.0580 | 0.3710 | 0.3660 | 0.0021 | 0.0109 | 0.0100 | 213 | 0.0052 |
| | 750 | 0.1054 | 0.6706 | 0.6753 | 0.0039 | 0.0199 | 0.0183 | 385 | 0.0095 |
| Aerial Lifts Composite | | 0.0184 | 0.1646 | 0.1366 | 0.0004 | 0.0048 | 0.0044 | 34.7 | 0.0017 |
| Air Compressors | 15 | 0.0087 | 0.0444 | 0.0545 | 0.0001 | 0.0023 | 0.0022 | 7.2 | 0.0008 |
| | 25 | 0.0181 | 0.0605 | 0.1121 | 0.0002 | 0.0045 | 0.0042 | 14.4 | 0.0016 |
| | 50 | 0.0263 | 0.1911 | 0.1476 | 0.0003 | 0.0047 | 0.0043 | 22.3 | 0.0024 |
| | 120 | 0.0289 | 0.3023 | 0.1928 | 0.0006 | 0.0088 | 0.0081 | 47.0 | 0.0026 |
| | 175 | 0.0424 | 0.4998 | 0.2187 | 0.0010 | 0.0104 | 0.0095 | 88.5 | 0.0038 |
| | 250 | 0.0514 | 0.2531 | 0.2553 | 0.0015 | 0.0078 | 0.0072 | 131 | 0.0046 |
| | 500 | 0.0894 | 0.4292 | 0.4150 | 0.0023 | 0.0134 | 0.0123 | 232 | 0.0081 |
| | 750 | 0.1385 | 0.6633 | 0.6545 | 0.0036 | 0.0210 | 0.0193 | 358 | 0.0125 |
| | 1000 | 0.1999 | 0.9265 | 2.5439 | 0.0049 | 0.0483 | 0.0444 | 486 | 0.0180 |
| Air Compressors Composite | | 0.0349 | 0.3027 | 0.2104 | 0.0007 | 0.0088 | 0.0081 | 63.6 | 0.0031 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0190 | 0.2200 | 0.1662 | 0.0004 | 0.0009 | 0.0008 | 31.0 | 0.0017 |
| | 120 | 0.0252 | 0.4660 | 0.1955 | 0.0009 | 0.0020 | 0.0018 | 77.1 | 0.0023 |
| | 175 | 0.0324 | 0.7542 | 0.0787 | 0.0016 | 0.0030 | 0.0027 | 141 | 0.0029 |
| | 250 | 0.0427 | 0.3426 | 0.0981 | 0.0021 | 0.0035 | 0.0032 | 188 | 0.0039 |
| | 500 | 0.0706 | 0.5512 | 0.1622 | 0.0031 | 0.0058 | 0.0054 | 311 | 0.0064 |
| | 750 | 0.1396 | 1.0891 | 0.3204 | 0.0062 | 0.0115 | 0.0106 | 615 | 0.0126 |
| | 1000 | 0.2115 | 1.6437 | 3.8912 | 0.0093 | 0.0364 | 0.0335 | 928 | 0.0191 |
| Bore/Drill Rigs Composite | | 0.0428 | 0.5007 | 0.2864 | 0.0017 | 0.0042 | 0.0038 | 165 | 0.0039 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0213 | 0.0724 | 0.1346 | 0.0002 | 0.0052 | 0.0048 | 17.6 | 0.0019 |
| Cement and Mortar Mixers Co | | 0.0085 | 0.0414 | 0.0534 | 0.0001 | 0.0021 | 0.0019 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0279 | 0.2284 | 0.1910 | 0.0004 | 0.0053 | 0.0049 | 30.2 | 0.0025 |
| | 120 | 0.0370 | 0.4561 | 0.2840 | 0.0009 | 0.0117 | 0.0108 | 74.1 | 0.0033 |
| | 175 | 0.0623 | 0.8663 | 0.3523 | 0.0018 | 0.0160 | 0.0147 | 160 | 0.0056 |
| Concrete/Industrial Saws Com | | 0.0337 | 0.3706 | 0.2471 | 0.0007 | 0.0093 | 0.0086 | 58.5 | 0.0030 |
| Cranes | 50 | 0.0350 | 0.2256 | 0.1644 | 0.0003 | 0.0062 | 0.0057 | 23.2 | 0.0032 |
| | 120 | 0.0376 | 0.3384 | 0.2298 | 0.0006 | 0.0120 | 0.0111 | 50.1 | 0.0034 |
| | 175 | 0.0462 | 0.4744 | 0.2300 | 0.0009 | 0.0120 | 0.0110 | 80.3 | 0.0042 |
| | 250 | 0.0544 | 0.2316 | 0.2705 | 0.0013 | 0.0094 | 0.0087 | 112 | 0.0049 |
| | 500 | 0.0858 | 0.3535 | 0.3977 | 0.0018 | 0.0146 | 0.0134 | 180 | 0.0077 |
| | 750 | 0.1446 | 0.5947 | 0.6821 | 0.0030 | 0.0248 | 0.0228 | 303 | 0.0130 |
| | 9999 | 0.5219 | 1.9715 | 5.5760 | 0.0098 | 0.1146 | 0.1055 | 971 | 0.0471 |
| Cranes Composite | | 0.0681 | 0.3738 | 0.4223 | 0.0014 | 0.0143 | 0.0132 | 129 | 0.0061 |
| Crawler Tractors | 50 | 0.0487 | 0.2566 | 0.1842 | 0.0003 | 0.0090 | 0.0083 | 24.9 | 0.0044 |
| | 120 | 0.0609 | 0.4537 | 0.3562 | 0.0008 | 0.0221 | 0.0203 | 65.8 | 0.0055 |
| | 175 | 0.0823 | 0.7265 | 0.4447 | 0.0014 | 0.0241 | 0.0222 | 121 | 0.0074 |
| | 250 | 0.0924 | 0.3662 | 0.5348 | 0.0019 | 0.0192 | 0.0177 | 166 | 0.0083 |
| | 500 | 0.1392 | 0.5877 | 0.7527 | 0.0025 | 0.0280 | 0.0258 | 259 | 0.0126 |
| | 750 | 0.2506 | 1.0528 | 1.3878 | 0.0047 | 0.0510 | 0.0469 | 465 | 0.0226 |
| | 1000 | 0.3749 | 1.5618 | 4.2168 | 0.0066 | 0.0958 | 0.0881 | 658 | 0.0338 |
| Crawler Tractors Composite | | 0.0789 | 0.5065 | 0.4492 | 0.0013 | 0.0227 | 0.0209 | 114 | 0.0071 |
| Crushing/Proc. E | 50 | 0.0508 | 0.3859 | 0.2899 | 0.0006 | 0.0083 | 0.0077 | 44.0 | 0.0046 |
| | 120 | 0.0506 | 0.5406 | 0.3289 | 0.0010 | 0.0140 | 0.0129 | 83.1 | 0.0046 |
| | 175 | 0.0795 | 0.9556 | 0.3830 | 0.0019 | 0.0177 | 0.0163 | 167 | 0.0072 |
| | 250 | 0.0967 | 0.4768 | 0.4357 | 0.0028 | 0.0134 | 0.0123 | 245 | 0.0087 |
| | 500 | 0.1459 | 0.6977 | 0.6163 | 0.0037 | 0.0200 | 0.0184 | 374 | 0.0132 |
| | 750 | 0.2307 | 1.1003 | 0.9907 | 0.0059 | 0.0316 | 0.0291 | 589 | 0.0208 |
| | 9999 | 0.6019 | 2.5014 | 6.6977 | 0.0131 | 0.1238 | 0.1139 | 1,308 | 0.0543 |
| Crushing/Proc. Equipment Co | | 0.0693 | 0.6187 | 0.3763 | 0.0015 | 0.0146 | 0.0134 | 132 | 0.0062 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0297 | 0.2365 | 0.1616 | 0.0003 | 0.0035 | 0.0032 | 25.0 | 0.0027 |
| | 120 | 0.0448 | 0.4942 | 0.2638 | 0.0009 | 0.0092 | 0.0085 | 73.6 | 0.0040 |
| | 175 | 0.0518 | 0.6636 | 0.1982 | 0.0013 | 0.0091 | 0.0084 | 112 | 0.0047 |
| | 250 | 0.0647 | 0.3210 | 0.2222 | 0.0018 | 0.0074 | 0.0068 | 159 | 0.0058 |
| | 500 | 0.0946 | 0.4495 | 0.3091 | 0.0023 | 0.0107 | 0.0098 | 234 | 0.0085 |
| | 750 | 0.1569 | 0.7451 | 0.5194 | 0.0039 | 0.0178 | 0.0164 | 387 | 0.0142 |
| Excavators Composite | | 0.0559 | 0.5086 | 0.2269 | 0.0013 | 0.0086 | 0.0079 | 120 | 0.0050 |
| Forklifts | 50 | 0.0150 | 0.1361 | 0.0904 | 0.0002 | 0.0013 | 0.0012 | 14.7 | 0.0014 |
| | 120 | 0.0168 | 0.2086 | 0.0997 | 0.0004 | 0.0023 | 0.0021 | 31.2 | 0.0015 |
| | 175 | 0.0228 | 0.3310 | 0.0732 | 0.0006 | 0.0029 | 0.0026 | 56.1 | 0.0021 |
| | 250 | 0.0289 | 0.1551 | 0.0746 | 0.0009 | 0.0027 | 0.0024 | 77.1 | 0.0026 |
| | 500 | 0.0416 | 0.2123 | 0.1038 | 0.0011 | 0.0038 | 0.0035 | 111 | 0.0038 |
| Forklifts Composite | | 0.0236 | 0.2148 | 0.0860 | 0.0006 | 0.0025 | 0.0023 | 54.4 | 0.0021 |
| Generator Sets | 15 | 0.0109 | 0.0627 | 0.0768 | 0.0002 | 0.0032 | 0.0030 | 10.2 | 0.0010 |
| | 25 | 0.0216 | 0.0738 | 0.1368 | 0.0002 | 0.0055 | 0.0050 | 17.6 | 0.0019 |
| | 50 | 0.0242 | 0.2034 | 0.1881 | 0.0004 | 0.0051 | 0.0047 | 30.6 | 0.0022 |
| | 120 | 0.0340 | 0.4585 | 0.3022 | 0.0009 | 0.0122 | 0.0112 | 77.9 | 0.0031 |
| | 175 | 0.0469 | 0.7328 | 0.3291 | 0.0016 | 0.0136 | 0.0125 | 142 | 0.0042 |
| | 250 | 0.0558 | 0.3746 | 0.3885 | 0.0024 | 0.0108 | 0.0099 | 213 | 0.0050 |
| | 500 | 0.0862 | 0.5820 | 0.5697 | 0.0033 | 0.0167 | 0.0153 | 337 | 0.0078 |
| | 750 | 0.1401 | 0.9395 | 0.9382 | 0.0055 | 0.0272 | 0.0250 | 544 | 0.0126 |
| | 9999 | 0.3235 | 1.8648 | 5.2188 | 0.0105 | 0.0888 | 0.0817 | 1,049 | 0.0292 |
| Generator Sets Composite | | 0.0288 | 0.2667 | 0.2329 | 0.0007 | 0.0081 | 0.0074 | 61.0 | 0.0026 |
| Graders | 50 | 0.0382 | 0.2599 | 0.1877 | 0.0004 | 0.0063 | 0.0058 | 27.5 | 0.0034 |
| | 120 | 0.0521 | 0.5009 | 0.3219 | 0.0009 | 0.0153 | 0.0141 | 75.0 | 0.0047 |
| | 175 | 0.0652 | 0.7261 | 0.3117 | 0.0014 | 0.0157 | 0.0144 | 124 | 0.0059 |
| | 250 | 0.0781 | 0.3549 | 0.3652 | 0.0019 | 0.0129 | 0.0119 | 172 | 0.0071 |
| | 500 | 0.1023 | 0.4610 | 0.4468 | 0.0023 | 0.0165 | 0.0152 | 229 | 0.0092 |
| | 750 | 0.2167 | 0.9755 | 0.9628 | 0.0049 | 0.0353 | 0.0324 | 486 | 0.0196 |
| Graders Composite | | 0.0676 | 0.5696 | 0.3314 | 0.0015 | 0.0147 | 0.0135 | 133 | 0.0061 |
| Off-Highway Trac | 120 | 0.1108 | 0.6619 | 0.6362 | 0.0011 | 0.0455 | 0.0419 | 93.7 | 0.0100 |
| | 175 | 0.1110 | 0.7932 | 0.6639 | 0.0015 | 0.0370 | 0.0341 | 130 | 0.0100 |
| | 250 | 0.0890 | 0.3179 | 0.5983 | 0.0015 | 0.0227 | 0.0208 | 130 | 0.0080 |
| | 750 | 0.3692 | 1.5358 | 2.4157 | 0.0057 | 0.0918 | 0.0844 | 568 | 0.0333 |
| | 1000 | 0.5623 | 2.3619 | 6.0896 | 0.0082 | 0.1577 | 0.1451 | 814 | 0.0507 |
| Off-Highway Tractors Compos | | 0.1134 | 0.6101 | 0.7291 | 0.0017 | 0.0331 | 0.0305 | 151 | 0.0102 |
| Off-Highway Truc | 175 | 0.0622 | 0.7536 | 0.2376 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0056 |
| | 250 | 0.0730 | 0.3435 | 0.2521 | 0.0019 | 0.0085 | 0.0078 | 167 | 0.0066 |
| | 500 | 0.1183 | 0.5319 | 0.3878 | 0.0027 | 0.0135 | 0.0124 | 272 | 0.0107 |
| | 750 | 0.1921 | 0.8627 | 0.6384 | 0.0044 | 0.0221 | 0.0203 | 442 | 0.0173 |
| | 1000 | 0.2823 | 1.2403 | 3.1782 | 0.0063 | 0.0546 | 0.0502 | 625 | 0.0255 |
| Off-Highway Trucks Composit | | 0.1140 | 0.5385 | 0.4769 | 0.0027 | 0.0142 | 0.0131 | 260 | 0.0103 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0244 | 0.2188 | 0.1693 | 0.0004 | 0.0034 | 0.0031 | 28.0 | 0.0022 |
| | 120 | 0.0379 | 0.5045 | 0.2730 | 0.0009 | 0.0087 | 0.0080 | 80.9 | 0.0034 |
| | 175 | 0.0384 | 0.5858 | 0.1729 | 0.0012 | 0.0075 | 0.0069 | 107 | 0.0035 |
| | 500 | 0.0792 | 0.4606 | 0.3034 | 0.0025 | 0.0099 | 0.0091 | 254 | 0.0071 |
| Other Construction Equipment | | 0.0442 | 0.3474 | 0.2021 | 0.0013 | 0.0069 | 0.0063 | 123 | 0.0040 |
| Other General Ind | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0298 | 0.2099 | 0.1491 | 0.0003 | 0.0047 | 0.0043 | 21.7 | 0.0027 |
| | 120 | 0.0436 | 0.4189 | 0.2603 | 0.0007 | 0.0120 | 0.0111 | 62.0 | 0.0039 |
| | 175 | 0.0519 | 0.5684 | 0.2412 | 0.0011 | 0.0115 | 0.0106 | 95.9 | 0.0047 |
| | 250 | 0.0608 | 0.2743 | 0.2679 | 0.0015 | 0.0083 | 0.0076 | 136 | 0.0055 |
| | 500 | 0.1174 | 0.5103 | 0.4826 | 0.0026 | 0.0157 | 0.0145 | 265 | 0.0106 |
| | 750 | 0.1939 | 0.8411 | 0.8117 | 0.0044 | 0.0262 | 0.0241 | 437 | 0.0175 |
| | 1000 | 0.2627 | 1.1060 | 2.9924 | 0.0056 | 0.0579 | 0.0533 | 560 | 0.0237 |
| Other General Industrial Equip | | 0.0747 | 0.4438 | 0.3947 | 0.0016 | 0.0130 | 0.0120 | 152 | 0.0067 |
| Other Material Ha | 50 | 0.0410 | 0.2893 | 0.2073 | 0.0004 | 0.0065 | 0.0060 | 30.3 | 0.0037 |
| | 120 | 0.0421 | 0.4076 | 0.2541 | 0.0007 | 0.0117 | 0.0108 | 60.7 | 0.0038 |
| | 175 | 0.0653 | 0.7197 | 0.3067 | 0.0014 | 0.0146 | 0.0134 | 122 | 0.0059 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0642 | 0.2920 | 0.2863 | 0.0016 | 0.0088 | 0.0081 | 145 | 0.0058 |
| | 500 | 0.0837 | 0.3670 | 0.3482 | 0.0019 | 0.0113 | 0.0104 | 192 | 0.0075 |
| | 9999 | 0.3781 | 1.4596 | 3.9555 | 0.0073 | 0.0764 | 0.0703 | 741 | 0.0341 |
| Other Material Handling Equip | | 0.0696 | 0.4355 | 0.3844 | 0.0015 | 0.0124 | 0.0114 | 141 | 0.0063 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1422 | 0.0002 | 0.0053 | 0.0049 | 18.7 | 0.0020 |
| | 50 | 0.0574 | 0.2803 | 0.2102 | 0.0004 | 0.0114 | 0.0105 | 28.0 | 0.0052 |
| | 120 | 0.0662 | 0.4696 | 0.4003 | 0.0008 | 0.0263 | 0.0242 | 69.2 | 0.0060 |
| | 175 | 0.0899 | 0.7543 | 0.5238 | 0.0014 | 0.0286 | 0.0263 | 128 | 0.0081 |
| | 250 | 0.1097 | 0.4287 | 0.7020 | 0.0022 | 0.0254 | 0.0234 | 194 | 0.0099 |
| | 500 | 0.1263 | 0.5374 | 0.7572 | 0.0023 | 0.0284 | 0.0261 | 233 | 0.0114 |
| Pavers Composite | | 0.0717 | 0.4745 | 0.3858 | 0.0009 | 0.0220 | 0.0202 | 77.9 | 0.0065 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0469 | 0.2355 | 0.1789 | 0.0003 | 0.0095 | 0.0088 | 23.9 | 0.0042 |
| | 120 | 0.0503 | 0.3671 | 0.3092 | 0.0006 | 0.0200 | 0.0184 | 54.5 | 0.0045 |
| | 175 | 0.0687 | 0.5900 | 0.4021 | 0.0011 | 0.0219 | 0.0201 | 101 | 0.0062 |
| | 250 | 0.0672 | 0.2648 | 0.4289 | 0.0014 | 0.0154 | 0.0141 | 122 | 0.0061 |
| Paving Equipment Composite | | 0.0548 | 0.3993 | 0.3281 | 0.0008 | 0.0190 | 0.0175 | 68.9 | 0.0049 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0052 | 0.0301 | 0.0368 | 0.0001 | 0.0015 | 0.0014 | 4.9 | 0.0005 |
| | 25 | 0.0087 | 0.0299 | 0.0555 | 0.0001 | 0.0022 | 0.0020 | 7.1 | 0.0008 |
| | 50 | 0.0079 | 0.0810 | 0.0843 | 0.0002 | 0.0019 | 0.0018 | 14.3 | 0.0007 |
| | 120 | 0.0082 | 0.1351 | 0.0897 | 0.0003 | 0.0031 | 0.0029 | 24.1 | 0.0007 |
| Pressure Washers Composite | | 0.0066 | 0.0531 | 0.0561 | 0.0001 | 0.0019 | 0.0017 | 9.4 | 0.0006 |
| Pumps | 15 | 0.0089 | 0.0456 | 0.0560 | 0.0001 | 0.0024 | 0.0022 | 7.4 | 0.0008 |
| | 25 | 0.0244 | 0.0816 | 0.1512 | 0.0002 | 0.0061 | 0.0056 | 19.5 | 0.0022 |
| | 50 | 0.0299 | 0.2394 | 0.2138 | 0.0004 | 0.0061 | 0.0056 | 34.3 | 0.0027 |
| | 120 | 0.0365 | 0.4656 | 0.3062 | 0.0009 | 0.0129 | 0.0119 | 77.9 | 0.0033 |
| | 175 | 0.0499 | 0.7342 | 0.3301 | 0.0016 | 0.0142 | 0.0130 | 140 | 0.0045 |
| | 250 | 0.0572 | 0.3604 | 0.3745 | 0.0023 | 0.0107 | 0.0098 | 201 | 0.0052 |
| | 500 | 0.0959 | 0.6034 | 0.5922 | 0.0034 | 0.0178 | 0.0163 | 345 | 0.0087 |
| | 750 | 0.1593 | 0.9975 | 0.9991 | 0.0057 | 0.0297 | 0.0274 | 571 | 0.0144 |
| | 9999 | 0.4488 | 2.4388 | 6.8114 | 0.0136 | 0.1186 | 0.1091 | 1,355 | 0.0405 |
| Pumps Composite | | 0.0270 | 0.2617 | 0.2079 | 0.0006 | 0.0078 | 0.0072 | 49.6 | 0.0024 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0345 | 0.2258 | 0.1776 | 0.0003 | 0.0068 | 0.0062 | 26.0 | 0.0031 |
| | 120 | 0.0392 | 0.3801 | 0.2647 | 0.0007 | 0.0137 | 0.0126 | 59.0 | 0.0035 |
| | 175 | 0.0553 | 0.6096 | 0.3030 | 0.0012 | 0.0156 | 0.0143 | 108 | 0.0050 |
| | 250 | 0.0656 | 0.3037 | 0.3629 | 0.0017 | 0.0127 | 0.0116 | 153 | 0.0059 |
| | 500 | 0.0920 | 0.4189 | 0.4752 | 0.0022 | 0.0174 | 0.0160 | 219 | 0.0083 |
| Rollers Composite | | 0.0410 | 0.3763 | 0.2501 | 0.0008 | 0.0122 | 0.0113 | 67.0 | 0.0037 |
| Rough Terrain Fo | 50 | 0.0381 | 0.3041 | 0.2193 | 0.0004 | 0.0054 | 0.0049 | 33.9 | 0.0034 |
| | 120 | 0.0369 | 0.4106 | 0.2316 | 0.0007 | 0.0087 | 0.0080 | 62.4 | 0.0033 |
| | 175 | 0.0569 | 0.7229 | 0.2450 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0051 |
| | 250 | 0.0671 | 0.3372 | 0.2625 | 0.0019 | 0.0084 | 0.0077 | 171 | 0.0061 |
| | 500 | 0.0999 | 0.4838 | 0.3682 | 0.0025 | 0.0123 | 0.0113 | 257 | 0.0090 |
| Rough Terrain Forklifts Compo | | 0.0396 | 0.4430 | 0.2336 | 0.0008 | 0.0090 | 0.0083 | 70.3 | 0.0036 |
| Rubber Tired Doz | 175 | 0.1163 | 0.8019 | 0.6895 | 0.0015 | 0.0386 | 0.0355 | 129 | 0.0105 |
| | 250 | 0.1329 | 0.4624 | 0.8841 | 0.0021 | 0.0340 | 0.0312 | 183 | 0.0120 |
| | 500 | 0.1817 | 0.7490 | 1.1543 | 0.0026 | 0.0448 | 0.0412 | 265 | 0.0164 |
| | 750 | 0.2747 | 1.1262 | 1.7818 | 0.0040 | 0.0684 | 0.0629 | 399 | 0.0248 |
| | 1000 | 0.4321 | 1.7954 | 4.5523 | 0.0060 | 0.1202 | 0.1106 | 592 | 0.0390 |
| Rubber Tired Dozers Compos | | 0.1672 | 0.6620 | 1.0824 | 0.0025 | 0.0419 | 0.0385 | 239 | 0.0151 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0418 | 0.2904 | 0.2109 | 0.0004 | 0.0069 | 0.0063 | 31.1 | 0.0038 |
| | 120 | 0.0397 | 0.3916 | 0.2476 | 0.0007 | 0.0115 | 0.0105 | 58.9 | 0.0036 |
| | 175 | 0.0546 | 0.6199 | 0.2592 | 0.0012 | 0.0130 | 0.0119 | 106 | 0.0049 |
| | 250 | 0.0661 | 0.3041 | 0.3040 | 0.0017 | 0.0107 | 0.0099 | 149 | 0.0060 |
| | 500 | 0.1034 | 0.4654 | 0.4455 | 0.0023 | 0.0164 | 0.0151 | 237 | 0.0093 |
| | 750 | 0.2119 | 0.9532 | 0.9273 | 0.0049 | 0.0338 | 0.0311 | 486 | 0.0191 |
| | 1000 | 0.2701 | 1.1927 | 3.2272 | 0.0060 | 0.0615 | 0.0566 | 594 | 0.0244 |
| Rubber Tired Loaders Compos | | 0.0559 | 0.4311 | 0.2835 | 0.0012 | 0.0121 | 0.0111 | 109 | 0.0050 |
| Scrapers | 120 | 0.0887 | 0.6472 | 0.5218 | 0.0011 | 0.0330 | 0.0303 | 93.9 | 0.0080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1025 | 0.8864 | 0.5654 | 0.0017 | 0.0307 | 0.0282 | 148 | 0.0092 |
| | 250 | 0.1187 | 0.4642 | 0.7040 | 0.0024 | 0.0254 | 0.0234 | 209 | 0.0107 |
| | 500 | 0.1755 | 0.7332 | 0.9727 | 0.0032 | 0.0364 | 0.0335 | 321 | 0.0158 |
| | 750 | 0.3043 | 1.2657 | 1.7266 | 0.0056 | 0.0638 | 0.0587 | 555 | 0.0275 |
| Scrapers Composite | | 0.1495 | 0.7187 | 0.8387 | 0.0027 | 0.0335 | 0.0308 | 262 | 0.0135 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0332 | 0.2686 | 0.2268 | 0.0005 | 0.0063 | 0.0058 | 36.2 | 0.0030 |
| | 120 | 0.0394 | 0.4898 | 0.3076 | 0.0009 | 0.0127 | 0.0116 | 80.2 | 0.0036 |
| | 175 | 0.0587 | 0.8292 | 0.3433 | 0.0017 | 0.0152 | 0.0139 | 155 | 0.0053 |
| | 250 | 0.0794 | 0.4676 | 0.4435 | 0.0029 | 0.0132 | 0.0121 | 255 | 0.0072 |
| Signal Boards Composite | | 0.0111 | 0.0909 | 0.0718 | 0.0002 | 0.0029 | 0.0026 | 16.7 | 0.0010 |
| Skid Steer Loade | 25 | 0.0167 | 0.0568 | 0.1055 | 0.0002 | 0.0040 | 0.0037 | 13.8 | 0.0015 |
| | 50 | 0.0194 | 0.1977 | 0.1446 | 0.0003 | 0.0015 | 0.0014 | 25.5 | 0.0017 |
| | 120 | 0.0175 | 0.2665 | 0.1240 | 0.0005 | 0.0022 | 0.0020 | 42.8 | 0.0016 |
| Skid Steer Loaders Composite | | 0.0186 | 0.2104 | 0.1354 | 0.0004 | 0.0019 | 0.0018 | 30.3 | 0.0017 |
| Surfacing Equipm | 50 | 0.0171 | 0.1105 | 0.0934 | 0.0002 | 0.0035 | 0.0033 | 14.1 | 0.0015 |
| | 120 | 0.0385 | 0.3950 | 0.2869 | 0.0007 | 0.0146 | 0.0134 | 63.8 | 0.0035 |
| | 175 | 0.0386 | 0.4642 | 0.2429 | 0.0010 | 0.0119 | 0.0109 | 85.8 | 0.0035 |
| | 250 | 0.0504 | 0.2604 | 0.3275 | 0.0015 | 0.0111 | 0.0103 | 135 | 0.0045 |
| | 500 | 0.0800 | 0.4236 | 0.4893 | 0.0022 | 0.0174 | 0.0160 | 221 | 0.0072 |
| | 750 | 0.1260 | 0.6643 | 0.7833 | 0.0035 | 0.0275 | 0.0253 | 347 | 0.0114 |
| Surfacing Equipment Compos | | 0.0638 | 0.3590 | 0.3924 | 0.0017 | 0.0142 | 0.0131 | 166 | 0.0058 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0308 | 0.2762 | 0.1942 | 0.0004 | 0.0033 | 0.0031 | 31.6 | 0.0028 |
| | 120 | 0.0395 | 0.4895 | 0.2530 | 0.0009 | 0.0068 | 0.0062 | 75.0 | 0.0036 |
| | 175 | 0.0565 | 0.8005 | 0.2201 | 0.0016 | 0.0084 | 0.0077 | 139 | 0.0051 |
| | 250 | 0.0587 | 0.3179 | 0.1898 | 0.0018 | 0.0062 | 0.0057 | 162 | 0.0053 |
| Sweepers/Scrubbers Compos | | 0.0410 | 0.4840 | 0.2255 | 0.0009 | 0.0061 | 0.0056 | 78.5 | 0.0037 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0045 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0316 | 0.2678 | 0.1895 | 0.0004 | 0.0037 | 0.0034 | 30.3 | 0.0029 |
| | 120 | 0.0281 | 0.3379 | 0.1761 | 0.0006 | 0.0055 | 0.0051 | 51.7 | 0.0025 |
| | 175 | 0.0420 | 0.5839 | 0.1613 | 0.0011 | 0.0072 | 0.0066 | 101 | 0.0038 |
| | 250 | 0.0633 | 0.3389 | 0.2157 | 0.0019 | 0.0073 | 0.0067 | 172 | 0.0057 |
| | 500 | 0.1263 | 0.6506 | 0.4127 | 0.0039 | 0.0144 | 0.0132 | 345 | 0.0114 |
| | 750 | 0.1896 | 0.9760 | 0.6256 | 0.0058 | 0.0216 | 0.0199 | 517 | 0.0171 |
| Tractors/Loaders/Backhoes C | | 0.0336 | 0.3586 | 0.1857 | 0.0008 | 0.0059 | 0.0054 | 66.8 | 0.0030 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0687 | 0.3197 | 0.2467 | 0.0004 | 0.0140 | 0.0129 | 32.9 | 0.0062 |
| | 120 | 0.0625 | 0.4341 | 0.3863 | 0.0008 | 0.0259 | 0.0239 | 64.9 | 0.0056 |
| | 175 | 0.1009 | 0.8327 | 0.6152 | 0.0016 | 0.0338 | 0.0311 | 144 | 0.0091 |
| | 250 | 0.1247 | 0.4925 | 0.8480 | 0.0025 | 0.0309 | 0.0285 | 223 | 0.0112 |
| | 500 | 0.1661 | 0.7370 | 1.0663 | 0.0031 | 0.0400 | 0.0368 | 311 | 0.0150 |
| | 750 | 0.3147 | 1.3882 | 2.0666 | 0.0059 | 0.0766 | 0.0705 | 587 | 0.0284 |
| Trenchers Composite | | 0.0674 | 0.4085 | 0.3481 | 0.0007 | 0.0215 | 0.0198 | 58.7 | 0.0061 |
| Welders | 15 | 0.0075 | 0.0381 | 0.0468 | 0.0001 | 0.0020 | 0.0018 | 6.2 | 0.0007 |
| | 25 | 0.0141 | 0.0473 | 0.0876 | 0.0001 | 0.0035 | 0.0033 | 11.3 | 0.0013 |
| | 50 | 0.0280 | 0.2077 | 0.1684 | 0.0003 | 0.0053 | 0.0048 | 26.0 | 0.0025 |
| | 120 | 0.0223 | 0.2476 | 0.1601 | 0.0005 | 0.0073 | 0.0067 | 39.5 | 0.0020 |
| | 175 | 0.0430 | 0.5400 | 0.2396 | 0.0011 | 0.0111 | 0.0103 | 98.2 | 0.0039 |
| | 250 | 0.0423 | 0.2236 | 0.2294 | 0.0013 | 0.0069 | 0.0064 | 119 | 0.0038 |
| | 500 | 0.0585 | 0.3040 | 0.2969 | 0.0016 | 0.0095 | 0.0087 | 168 | 0.0053 |
| Welders Composite | | 0.0214 | 0.1745 | 0.1373 | 0.0003 | 0.0052 | 0.0048 | 25.6 | 0.0019 |

## Fugitive Dust Emission Calculation Methodology

### Fugitive Dust Source Emissions - Material Handling

**Truck Loading/Unloading (Removed debris/concrete materials)**

*Emission Factor [lb/ton] = k(0.0032) x (mean wind speed [mi/hr] / 5)* $^{1.3}$ / (moisture [%] / 2) $^{1.4}$

*Reference: AP-42, Equation (1), Section 13.2.4, November 2006*

| | | | |
|---|---|---|---|
| *k = Aerodynamic Particle Size Multiplier,* $PM_{10}$ | 0.35 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *k = Aerodynamic Particle Size Multiplier,* $PM_{2.5}$ | 0.053 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *Mean Wind Speed* | 15 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *Moisture* | 4.8 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *PM10 Emission Factor* | 0.0014 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |
| *PM2.5 Emission Factor* | 0.0002 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |

**Demolition (Sq. Ft)**

| | | | |
|---|---|---|---|
| PM10, uncontrolled | 0.00042 | lbs/cubic ft[1] | http://www.urbemis.com/software/URBEMIS9%20Users%20Manual%20Appendices.pdf |
| PM2.5, uncontrolled | 0.00009 | lbs/cubic ft[2] | PM2.5 fraction of PM10 = 0.208; SCAQMD Appendix A - Updated CEIDARS List with PM2.5 Fractions (www.aqmd.gov/ceqa/handbook/PM2_5/PM2_5.html |

**Bulldozing**

*Emission Factor [lb/hr] = [1.0 x (silt content [%])* $^{1.5}$ / (moisture) $^{1.4}$]*Scaling Factor

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Silt Content* | 6.9 | | AP-42 Chapter 11, Table 11.9-3 for overburden |
| *Moisture* | 16.8 | | AP-42 Chapter 11, Table 11.9-3 for overburden, upper end or range |
| $PM_{10}$ *Scaling Factor* | 0.75 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| $PM_{2.5}$ *Scaling Factor* | 0.105 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *PM10 Emission Factor* | 0.26 | lb/hr | |
| *PM2.5 Emission Factor* | 0.04 | lb/hr | |

**Grading and Scraping[d]**

*Emission Factor [lb/VMT] = [0.051 (S)^2.0*Scaling Factor*

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Mean Vehicle Speed (S)[a] - Miles Per Hour (MPH)* | 2 | | Assumption based on project footprint |
| $PM_{10}$ *Scaling Factor* | 0.6 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| $PM_{2.5}$ *Scaling Factor* | 0.031 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *PM10 Emission Factor (Uncontrolled)* | 0.12 | lb/VMT | |
| *PM2.5 Emission Factor (Uncontrolled)* | 0.00632 | lb/VMT | |

**Stock Pile Wind Erosion**

Emission Factor [lb/day-acre] = 0.85 x (silt content [%] / 1.5) x (365 / 235) x (percentage of time unobstructed wind exceeds 12 mph / 15)
Reference: SCAQMD CEQA Air Quality Handbook (1993), Table 9-9-E

| Parameter | Value | Basis |
|---|---|---|
| Silt Content | 7.5 | SCAQMD CEQA Handbook, (1993) Table A9-9-E-1 for overburden |
| Pct. time wind > 12 mph | 17.84 | Used 17.84% from AERMET Surface File used for dispersion modeling |

| | | |
|---|---|---|
| PM10 Emission Factor (Uncontrolled) | 7.9 | lb/day-acre |
| Reduction from Watering Twice/Day | 50% | |
| Controlled PM10 Emission Factor | 3.9 | lb/day-acre |
| Controlled PM2.5 Emission Factor[a] | 0.8 | lb/day-acre |

[a] PM2.5 emission factor [lb/hr] = PM10 emission factor [lb/hr] x PM2.5 fraction of PM10

PM2.5 Fraction of PM10 in Construction Dust = 0.208 from Appendix A, Final–Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds, SCAQMD, October 2006

Emissions [pounds per day] = Controlled emission factor [pounds per acre-day] x Stock pile surface area [acres]

# Attachment I7 Alternative SB-1C Emissions

SB-1C - Low Sea Level\

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15,326.46 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 |
| Amortized Construction | | | | | | | |

Annual Emissions (tons/year)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 2.93 | 21.31 | 16.09 | | 1.08 | 0.99 | 2,546 |
| Construction Off-Road Equipment | 0.45 | 4.23 | 1.79 | 0.01 | 0.56 | 0.32 | 531 |
| On-Road Motor Vehicles | 0.00 | 0.02 | 0.03 | 0.00 | 0.00 | 0.00 | 11 |
| *Total On-Shore Emissions* | 0.45 | 4.25 | 1.83 | 0.01 | 0.56 | 0.33 | 3,088 |
| Amortized Construction | | | | | | | 309 |

SB-1C - High Sea Level

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 |
| Construction Off-Road Equipment | 11.84 | 111.42 | 47.17 | 0.15 | 10.45 | 4.71 | 15326.46 |
| On-Road Motor Vehicles | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |
| *Total On-Shore Emissions* | 11.99 | 114.96 | 48.54 | 0.16 | 10.59 | 4.80 | 16,224.71 |
| Amortized Construction | | | | | | | |

Annual Emissions (tons/year)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 3.52 | 25.57 | 19.31 | | 1.29 | 1.19 | 3,056 |
| Construction Off-Road Equipment | 0.51 | 4.85 | 2.05 | 0.01 | 0.64 | 0.37 | 608 |
| On-Road Motor Vehicles | 0.00 | 0.02 | 0.04 | 0.00 | 0.00 | 0.00 | 12 |
| *Total On-Shore Emissions* | 0.52 | 4.87 | 2.09 | 0.01 | 0.64 | 0.37 | 3,676 |
| Amortized Construction | | | | | | | 368 |

SB-1C - Low Sea Level\

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 4.90 | 30.72 | 22.16 | 0.08 | 7.49 | 1.99 | 7,219.38 |
| On-Road Motor Vehicles | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |
| *Total On-Shore Emissions* | 4.99 | 31.65 | 22.93 | 0.09 | 7.56 | 2.06 | 7,996.95 |

SB-1C - High Sea Level

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 4.90 | 30.72 | 22.16 | 0.08 | 7.49 | 1.99 | 7,219.38 |
| On-Road Motor Vehicles | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |
| *Total On-Shore Emissions* | 4.99 | 31.65 | 22.93 | 0.09 | 7.56 | 2.06 | 7,996.95 |

## Alternative SB-1C - Construction - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-1C - Construction - Low Sea Level

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Emissions Summary | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | | | 15,326.46 | 1.07 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | 6.28 | 0.88 | 15,326.46 | 1.07 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **11.84** | **111.42** | **47.17** | **0.15** | | | **10.45** | **4.71** | **15,326.46** | **1.07** | **lbs/day** |

| Project Length | Work Days |
|---|---|
| | 76 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | | | | 550,000 | 55 | 76 | 550,000 | 55 | 76 |
| HSL | | | | 660,000 | 66 | 87 | 660,000 | 66 | 87 |

## Alternative SB-1C - Construction - Low Sea Level

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.15 | 1.84 | 0.63 | 0.00 | 0.06 | 0.05 | - | - | 286 | 0.0126 | tons |
| Loader | 1 | 12 | | 0.05 | 0.36 | 0.21 | 0.00 | 0.02 | 0.02 | - | - | 45 | 0.0039 | tons |
| Dozer | 2 | 12 | | 0.25 | 2.04 | 0.95 | 0.00 | 0.08 | 0.08 | - | - | 198 | 0.0204 | tons |
| | | | | 0.45 | 4.23 | 1.79 | 0.01 | 0.16 | 0.15 | | | 529.99 | 0.04 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.45 | 4.23 | 1.79 | 0.01 | 0.16 | 0.15 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.45** | **4.23** | **1.79** | **0.01** | **0.56** | **0.32** | **0.40** | **0.18** | **530** | **0.037** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **531** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative SB-1C - Construction - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 55.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 2.93 | 21.31 | 16.09 | 1.08 | 0.99 | 2,546 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1C - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 76 | 30,400 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 28 | 40 | 560 | 78 | 30,720 | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-1C - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 76 | 30,400 | 0.00 | 0.014 | 0.03 | 0.00 | 0.00 | 0.00 | 11 | 10 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 28 | 40 | 560 | 78 | 30,720 | 0.00 | 0.02 | 0.03 | 0.00 | 0.00 | 0.00 | 12.00 | 10.92 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative SB-1C - Operations - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-1C - Operations - Low S

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 2 | 12 | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| | | | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | | | 7,219.38 | 0.44 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | 6.28 | 0.88 | 7,219.38 | 0.44 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **4.90** | **30.72** | **22.16** | **0.08** | | | **7.49** | **1.99** | **7,219.38** | **0.44** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 52 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | | | | 310,000 | 31 | 52 | 310,000 | 31 | 52 |
| HSL | | | | 460,000 | 46 | 67 | 460,000 | 46 | 67 |

## Alternative SB-1C - Operations - Low S

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | - | - | 4 | 0.0005 | tons |
| Loader | 1 | 12 | | 0.02 | 0.09 | 0.13 | 0.00 | 0.00 | 0.00 | - | - | 31 | 0.0014 | tons |
| Dozer | 2 | 12 | | 0.10 | 0.68 | 0.41 | 0.00 | 0.03 | 0.02 | - | - | 136 | 0.0086 | tons |
| | | | | 0.13 | 0.80 | 0.58 | 0.00 | 0.03 | 0.03 | | | 170.81 | 0.01 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.13 | 0.80 | 0.58 | 0.00 | 0.03 | 0.03 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.13** | **0.80** | **0.58** | **0.00** | | | **0.19** | **0.05** | **171** | **0.010** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **171** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

## Alternative SB-1C - Operations - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Operating Days Per Year | 31.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.43 | 3.16 | 9.07 | 0.07 | 0.07 | 1,577 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1C - Operations - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 52 | 20,800 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 |
| Total | 28 | 40 | 560 | 54 | 21,120 | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-1C - Operations - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 52 | 20,800 | 0.00 | 0.005 | 0.01 | 0.00 | 0.00 | 0.00 | 6 | 6 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 28 | 40 | 560 | 54 | 21,120 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 6.65 | 6.05 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

## Alternative SB-1C - Construction - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-1C - Construction - High Sea Leve

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Emissions Summary | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | | | 15,326.46 | 1.07 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 11.84 | 111.42 | 47.17 | 0.15 | 4.17 | 3.83 | 6.28 | 0.88 | 15,326.46 | 1.07 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **11.84** | **111.42** | **47.17** | **0.15** | | | **10.45** | **4.71** | **15,326.46** | **1.07** | **lbs/day** |

| Project Length | Work Days |
|---|---|
| | 87 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | | | | 550,000 | 55 | 76 | 550,000 | 55 | 76 |
| HSL | | | | 660,000 | 66 | 87 | 660,000 | 66 | 87 |

## Alternative SB-1C - Construction - High Sea Leve

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.18 | 2.10 | 0.72 | 0.00 | 0.06 | 0.06 | - | - | 328 | 0.0145 | tons |
| Loader | 1 | 12 | | 0.05 | 0.41 | 0.24 | 0.00 | 0.02 | 0.02 | - | - | 52 | 0.0045 | tons |
| Dozer | 2 | 12 | | 0.28 | 2.33 | 1.09 | 0.00 | 0.10 | 0.09 | - | - | 227 | 0.0233 | tons |
| | | | | 0.51 | 4.85 | 2.05 | 0.01 | 0.18 | 0.17 | | | 606.70 | 0.04 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.51 | 4.85 | 2.05 | 0.01 | 0.18 | 0.17 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.51** | **4.85** | **2.05** | **0.01** | **0.64** | **0.37** | **0.45** | **0.20** | **607** | **0.042** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **608** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative SB-1C - Construction - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| Construction Days Per Year | 66.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 3.52 | 25.57 | 19.31 | 1.29 | 1.19 | 3,056 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

# Alternative SB-1C - Construction - High Sea Level Rise

## On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 87 | 34,800 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 28 | 40 | 560 | 89 | 35,120 | 0.15 | 3.54 | 1.36 | 0.01 | 0.14 | 0.09 | 898.25 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-1C - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 87 | 34,800 | 0.00 | 0.016 | 0.04 | 0.00 | 0.00 | 0.00 | 13 | 12 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 28 | 40 | 560 | 89 | 35,120 | 0.00 | 0.02 | 0.04 | 0.00 | 0.00 | 0.00 | 13.65 | 12.42 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative SB-1C - Operations - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

# Alternative SB-1C - Operations - High

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 2 | 12 | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| | | | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | | | 7,219.38 | 0.44 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 4.90 | 30.72 | 22.16 | 0.08 | 1.21 | 1.11 | 6.28 | 0.88 | 7,219.38 | 0.44 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **4.90** | **30.72** | **22.16** | **0.08** | | | **7.49** | **1.99** | **7,219.38** | **0.44** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 67 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | | | | 310,000 | 31 | 52 | 310,000 | 31 | 52 |
| HSL | | | | 460,000 | 46 | 67 | 460,000 | 46 | 67 |

## Alternative SB-1C - Operations - High

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.05 | 0.04 | 0.00 | 0.00 | 0.00 | - | - | 5 | 0.0006 | tons |
| Loader | 1 | 12 | | 0.02 | 0.11 | 0.17 | 0.00 | 0.00 | 0.00 | - | - | 40 | 0.0018 | tons |
| Dozer | 2 | 12 | | 0.13 | 0.87 | 0.53 | 0.00 | 0.03 | 0.03 | - | - | 175 | 0.0110 | tons |
| | | | | 0.16 | 1.03 | 0.74 | 0.00 | 0.04 | 0.04 | | | 220.08 | 0.01 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.16 | 1.03 | 0.74 | 0.00 | 0.04 | 0.04 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.16** | **1.03** | **0.74** | **0.00** | | | **0.25** | **0.07** | **220** | **0.013** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **220** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

# Alternative SB-1C - Operations - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |

Operating Days Per Year 46.0

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.64 | 4.69 | 13.46 | 0.11 | 0.10 | 2,340 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-1C - Operations - High Sea Level Rise

**On-Road Construction Emissions**

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 67 | 26,800 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 |
| Total | 28 | 40 | 560 | 69 | 27,120 | 0.09 | 0.93 | 0.78 | 0.01 | 0.07 | 0.07 | 777.57 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-1C - Operations - High Sea Level Rise

**On-Road Construction Emissions**

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 67 | 26,800 | 0.00 | 0.007 | 0.01 | 0.00 | 0.00 | 0.00 | 8 | 7 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 28 | 40 | 560 | 69 | 27,120 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 8.41 | 7.65 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

**San Diego 2015 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,169,183 | 42,600,783.75 | 7,361,743.79 | 0.045 | 1.290 | 0.136 | 302.103 | 0.047 | 0.019 | 0.004 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,466 | 179,216.55 | 31,712.66 | 0.038 | 0.215 | 0.576 | 315.879 | 0.072 | 0.043 | 0.004 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 172,849 | 6,187,162.79 | 1,061,257.19 | 0.075 | 2.505 | 0.269 | 357.183 | 0.048 | 0.021 | 0.004 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 210 | 6,179.81 | 1,102.01 | 0.066 | 0.312 | 0.691 | 314.863 | 0.099 | 0.068 | 0.004 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 423,444 | 16,224,268.59 | 2,675,454.93 | 0.037 | 1.498 | 0.192 | 432.459 | 0.047 | 0.019 | 0.005 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 187 | 5,978.69 | 1,021.81 | 0.046 | 0.252 | 0.690 | 323.109 | 0.080 | 0.050 | 0.004 | | |
| Average | | | | | | | 0.051 | 1.012 | 0.426 | 340.933 | 0.066 | 0.037 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 2,454 | 392,614.49 | 0 | 0.296 | 1.343 | 8.984 | 1699.527 | 0.231 | 0.158 | 0.017 | | |

Source: EMFAC 2011

**San Diego 2020 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,261,438 | 46,436,329 | 7,971,039 | 0.03 | 0.10 | 0.83 | 244.16 | 0.05 | 0.02 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,897 | 203,726 | 36,279 | 0.02 | 0.39 | 0.13 | 265.72 | 0.06 | 0.03 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 186,176 | 6,674,684 | 1,134,440 | 0.04 | 0.17 | 1.56 | 297.84 | 0.05 | 0.02 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 226 | 8,187 | 1,308 | 0.03 | 0.45 | 0.17 | 259.42 | 0.07 | 0.04 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 450,141 | 17,355,693 | 2,832,803 | 0.02 | 0.11 | 0.93 | 364.76 | 0.05 | 0.02 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 199 | 7,528 | 1,228 | 0.02 | 0.47 | 0.14 | 280.32 | 0.06 | 0.03 | 0.00 | | |
| Average | | | | | | | 0.026 | 0.283 | 0.626 | 285.370 | 0.055 | 0.027 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,262 | 531,839 | - | 0.22 | 1.02 | 4.20 | 1553.04 | 0.18 | 0.11 | 0.02 | | |

Source: EMFAC 2011

## 2015 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0155 | 0.0486 | 0.0902 | 0.0001 | 0.0046 | 0.0042 | 11.0 | 0.0014 |
| | 50 | 0.0480 | 0.1641 | 0.1699 | 0.0003 | 0.0129 | 0.0119 | 19.6 | 0.0043 |
| | 120 | 0.0460 | 0.2377 | 0.3272 | 0.0004 | 0.0246 | 0.0226 | 38.1 | 0.0042 |
| | 500 | 0.1026 | 0.4261 | 1.2422 | 0.0021 | 0.0368 | 0.0339 | 213 | 0.0093 |
| | 750 | 0.1912 | 0.7702 | 2.3263 | 0.0039 | 0.0680 | 0.0626 | 385 | 0.0173 |
| Aerial Lifts Composite | | 0.0439 | 0.1837 | 0.2670 | 0.0004 | 0.0167 | 0.0154 | 34.7 | 0.0040 |
| Air Compressors | 15 | 0.0108 | 0.0466 | 0.0664 | 0.0001 | 0.0040 | 0.0037 | 7.2 | 0.0010 |
| | 25 | 0.0229 | 0.0681 | 0.1247 | 0.0002 | 0.0069 | 0.0064 | 14.4 | 0.0021 |
| | 50 | 0.0747 | 0.2360 | 0.2056 | 0.0003 | 0.0183 | 0.0168 | 22.3 | 0.0067 |
| | 120 | 0.0691 | 0.3182 | 0.4334 | 0.0006 | 0.0375 | 0.0345 | 47.0 | 0.0062 |
| | 175 | 0.0903 | 0.5019 | 0.7101 | 0.0010 | 0.0388 | 0.0357 | 88.5 | 0.0082 |
| | 250 | 0.0892 | 0.2803 | 0.9294 | 0.0015 | 0.0286 | 0.0263 | 131 | 0.0080 |
| | 500 | 0.1463 | 0.4915 | 1.4297 | 0.0023 | 0.0470 | 0.0432 | 232 | 0.0132 |
| | 750 | 0.2285 | 0.7595 | 2.2932 | 0.0036 | 0.0743 | 0.0683 | 358 | 0.0206 |
| | 1000 | 0.3551 | 1.1843 | 4.4558 | 0.0049 | 0.1239 | 0.1140 | 486 | 0.0320 |
| Air Compressors Composite | | 0.0773 | 0.3257 | 0.5175 | 0.0007 | 0.0357 | 0.0329 | 63.6 | 0.0070 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1220 | 0.0002 | 0.0047 | 0.0043 | 16.0 | 0.0017 |
| | 50 | 0.0234 | 0.2235 | 0.2240 | 0.0004 | 0.0075 | 0.0069 | 31.0 | 0.0021 |
| | 120 | 0.0376 | 0.4676 | 0.3736 | 0.0009 | 0.0160 | 0.0148 | 77.1 | 0.0034 |
| | 175 | 0.0618 | 0.7540 | 0.5364 | 0.0016 | 0.0198 | 0.0182 | 141 | 0.0056 |
| | 250 | 0.0681 | 0.3425 | 0.4900 | 0.0021 | 0.0144 | 0.0132 | 188 | 0.0061 |
| | 500 | 0.1118 | 0.5511 | 0.7692 | 0.0031 | 0.0236 | 0.0217 | 311 | 0.0101 |
| | 750 | 0.2212 | 1.0888 | 1.5301 | 0.0062 | 0.0466 | 0.0429 | 615 | 0.0200 |
| | 1000 | 0.3562 | 1.6528 | 4.9704 | 0.0093 | 0.1194 | 0.1098 | 928 | 0.0321 |
| Bore/Drill Rigs Composite | | 0.0673 | 0.5022 | 0.6138 | 0.0017 | 0.0200 | 0.0184 | 165 | 0.0061 |
| Cement and Mortar Mixers | 15 | 0.0074 | 0.0386 | 0.0464 | 0.0001 | 0.0019 | 0.0018 | 6.3 | 0.0007 |
| | 25 | 0.0251 | 0.0782 | 0.1456 | 0.0002 | 0.0074 | 0.0068 | 17.6 | 0.0023 |
| Cement and Mortar Mixers Composite | | 0.0088 | 0.0419 | 0.0545 | 0.0001 | 0.0024 | 0.0022 | 7.2 | 0.0008 |
| Concrete/Industrial Saws | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0782 | 0.2745 | 0.2652 | 0.0004 | 0.0206 | 0.0189 | 30.2 | 0.0071 |
| | 120 | 0.0892 | 0.4759 | 0.6249 | 0.0009 | 0.0486 | 0.0448 | 74.1 | 0.0080 |
| | 175 | 0.1340 | 0.8674 | 1.1593 | 0.0018 | 0.0585 | 0.0538 | 160 | 0.0121 |
| Concrete/Industrial Saws Composite | | 0.0835 | 0.3982 | 0.4921 | 0.0007 | 0.0374 | 0.0345 | 58.5 | 0.0075 |
| Cranes | 50 | 0.0853 | 0.2729 | 0.2235 | 0.0003 | 0.0202 | 0.0186 | 23.2 | 0.0077 |
| | 120 | 0.0800 | 0.3559 | 0.4822 | 0.0006 | 0.0415 | 0.0382 | 50.1 | 0.0072 |
| | 175 | 0.0919 | 0.4794 | 0.6684 | 0.0009 | 0.0378 | 0.0348 | 80.3 | 0.0083 |
| | 250 | 0.0925 | 0.2713 | 0.8284 | 0.0013 | 0.0286 | 0.0263 | 112 | 0.0083 |
| | 500 | 0.1393 | 0.4663 | 1.1812 | 0.0018 | 0.0426 | 0.0392 | 180 | 0.0126 |
| | 750 | 0.2358 | 0.7835 | 2.0490 | 0.0030 | 0.0729 | 0.0671 | 303 | 0.0213 |
| | 9999 | 0.8682 | 2.8913 | 9.2743 | 0.0098 | 0.2775 | 0.2553 | 971 | 0.0783 |
| Cranes Composite | | 0.1204 | 0.4395 | 1.0200 | 0.0014 | 0.0426 | 0.0392 | 129 | 0.0109 |
| Crawler Tractors | 50 | 0.1017 | 0.3087 | 0.2464 | 0.0003 | 0.0232 | 0.0214 | 24.9 | 0.0092 |
| | 120 | 0.1143 | 0.4774 | 0.6815 | 0.0008 | 0.0579 | 0.0533 | 65.8 | 0.0103 |
| | 175 | 0.1509 | 0.7384 | 1.0951 | 0.0014 | 0.0614 | 0.0565 | 121 | 0.0136 |
| | 250 | 0.1582 | 0.4614 | 1.3531 | 0.0019 | 0.0514 | 0.0473 | 166 | 0.0143 |
| | 500 | 0.2300 | 0.8352 | 1.8987 | 0.0025 | 0.0732 | 0.0673 | 259 | 0.0207 |
| | 750 | 0.4140 | 1.4936 | 3.4863 | 0.0047 | 0.1327 | 0.1221 | 465 | 0.0374 |
| | 1000 | 0.6278 | 2.3640 | 6.6574 | 0.0066 | 0.2075 | 0.1909 | 658 | 0.0566 |
| Crawler Tractors Composite | | 0.1415 | 0.5650 | 1.0059 | 0.0013 | 0.0594 | 0.0546 | 114 | 0.0128 |
| Crushing/Proc. Equipment | 50 | 0.1392 | 0.4644 | 0.4024 | 0.0006 | 0.0346 | 0.0318 | 44.0 | 0.0126 |
| | 120 | 0.1167 | 0.5646 | 0.7374 | 0.0010 | 0.0629 | 0.0579 | 83.1 | 0.0105 |
| | 175 | 0.1654 | 0.9559 | 1.2783 | 0.0019 | 0.0700 | 0.0644 | 167 | 0.0149 |
| | 250 | 0.1646 | 0.5171 | 1.6355 | 0.0028 | 0.0506 | 0.0466 | 245 | 0.0149 |
| | 500 | 0.2358 | 0.7790 | 2.1722 | 0.0037 | 0.0722 | 0.0664 | 374 | 0.0213 |
| | 750 | 0.3723 | 1.2184 | 3.5561 | 0.0059 | 0.1154 | 0.1062 | 589 | 0.0336 |
| | 9999 | 0.9726 | 3.0901 | 11.5626 | 0.0131 | 0.3225 | 0.2967 | 1,308 | 0.0878 |
| Crushing/Proc. Equipment Composite | | 0.1465 | 0.6549 | 0.9893 | 0.0015 | 0.0607 | 0.0558 | 132 | 0.0132 |
| Dumpers/Tenders | 25 | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Dumpers/Tenders Composite | | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0650 | 0.2683 | 0.2256 | 0.0003 | 0.0167 | 0.0154 | 25.0 | 0.0059 |
| | 120 | 0.0912 | 0.5102 | 0.5787 | 0.0009 | 0.0455 | 0.0418 | 73.6 | 0.0082 |
| | 175 | 0.1052 | 0.6653 | 0.7408 | 0.0013 | 0.0405 | 0.0372 | 112 | 0.0095 |

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1117 | 0.3431 | 0.8935 | 0.0018 | 0.0297 | 0.0273 | 159 | 0.0101 |
| | 500 | 0.1577 | 0.4964 | 1.1619 | 0.0023 | 0.0413 | 0.0380 | 234 | 0.0142 |
| | 750 | 0.2630 | 0.8225 | 1.9926 | 0.0039 | 0.0698 | 0.0642 | 387 | 0.0237 |
| Excavators Composite | | 0.1064 | 0.5248 | 0.7416 | 0.0013 | 0.0379 | 0.0349 | 120 | 0.0096 |
| Forklifts | 50 | 0.0324 | 0.1522 | 0.1324 | 0.0002 | 0.0092 | 0.0084 | 14.7 | 0.0029 |
| | 120 | 0.0345 | 0.2143 | 0.2326 | 0.0004 | 0.0174 | 0.0160 | 31.2 | 0.0031 |
| | 175 | 0.0486 | 0.3316 | 0.3442 | 0.0006 | 0.0189 | 0.0174 | 56.1 | 0.0044 |
| | 250 | 0.0518 | 0.1582 | 0.4040 | 0.0009 | 0.0133 | 0.0122 | 77.1 | 0.0047 |
| | 500 | 0.0724 | 0.2164 | 0.5170 | 0.0011 | 0.0185 | 0.0171 | 111 | 0.0065 |
| Forklifts Composite | | 0.0459 | 0.2200 | 0.3163 | 0.0006 | 0.0156 | 0.0143 | 54.4 | 0.0041 |
| Generator Sets | 15 | 0.0135 | 0.0658 | 0.0929 | 0.0002 | 0.0051 | 0.0047 | 10.2 | 0.0012 |
| | 25 | 0.0247 | 0.0831 | 0.1522 | 0.0002 | 0.0080 | 0.0074 | 17.6 | 0.0022 |
| | 50 | 0.0706 | 0.2465 | 0.2628 | 0.0004 | 0.0193 | 0.0178 | 30.6 | 0.0064 |
| | 120 | 0.0910 | 0.4811 | 0.6607 | 0.0009 | 0.0484 | 0.0445 | 77.9 | 0.0082 |
| | 175 | 0.1120 | 0.7350 | 1.0463 | 0.0016 | 0.0485 | 0.0446 | 142 | 0.0101 |
| | 250 | 0.1090 | 0.4148 | 1.3776 | 0.0024 | 0.0381 | 0.0351 | 213 | 0.0098 |
| Generator Sets - 500 hp | 500 | 0.1556 | 0.6639 | 1.9429 | 0.0033 | 0.0567 | 0.0522 | 337 | 0.0140 |
| | 750 | 0.2599 | 1.0718 | 3.2483 | 0.0055 | 0.0934 | 0.0860 | 544 | 0.0234 |
| | 9999 | 0.6582 | 2.3655 | 8.9789 | 0.0105 | 0.2325 | 0.2139 | 1,049 | 0.0594 |
| Generator Sets Composite | | 0.0640 | 0.2913 | 0.4717 | 0.0007 | 0.0268 | 0.0246 | 61.0 | 0.0058 |
| Graders | 50 | 0.0897 | 0.3082 | 0.2569 | 0.0004 | 0.0217 | 0.0200 | 27.5 | 0.0081 |
| | 120 | 0.1081 | 0.5230 | 0.6726 | 0.0009 | 0.0555 | 0.0511 | 75.0 | 0.0098 |
| | 175 | 0.1299 | 0.7319 | 0.9534 | 0.0014 | 0.0526 | 0.0484 | 124 | 0.0117 |
| | 250 | 0.1326 | 0.4046 | 1.1596 | 0.0019 | 0.0400 | 0.0368 | 172 | 0.0120 |
| | 500 | 0.1666 | 0.5739 | 1.3760 | 0.0023 | 0.0496 | 0.0456 | 229 | 0.0150 |
| | 750 | 0.3549 | 1.2133 | 3.0011 | 0.0049 | 0.1066 | 0.0981 | 486 | 0.0320 |
| Graders Composite | | 0.1277 | 0.5931 | 0.9795 | 0.0015 | 0.0489 | 0.0450 | 133 | 0.0115 |
| Off-Highway Tractors | 120 | 0.1905 | 0.7051 | 1.1159 | 0.0011 | 0.0952 | 0.0876 | 93.7 | 0.0172 |
| | 175 | 0.1870 | 0.8216 | 1.3703 | 0.0015 | 0.0771 | 0.0709 | 130 | 0.0169 |
| | 250 | 0.1489 | 0.4320 | 1.2644 | 0.0015 | 0.0520 | 0.0478 | 130 | 0.0134 |
| | 750 | 0.5975 | 2.5165 | 5.0885 | 0.0057 | 0.2047 | 0.1884 | 568 | 0.0539 |
| | 1000 | 0.9006 | 3.9378 | 9.2072 | 0.0082 | 0.3063 | 0.2818 | 814 | 0.0813 |
| Off-Highway Tractors Composite | | 0.1893 | 0.7244 | 1.5085 | 0.0017 | 0.0717 | 0.0660 | 151 | 0.0171 |
| Off-Highway Trucks | 175 | 0.1259 | 0.7559 | 0.8596 | 0.0014 | 0.0477 | 0.0438 | 125 | 0.0114 |
| | 250 | 0.1252 | 0.3702 | 0.9818 | 0.0019 | 0.0328 | 0.0301 | 167 | 0.0113 |
| | 500 | 0.1960 | 0.5949 | 1.4165 | 0.0027 | 0.0505 | 0.0465 | 272 | 0.0177 |
| | 750 | 0.3198 | 0.9645 | 2.3779 | 0.0044 | 0.0835 | 0.0768 | 442 | 0.0289 |
| | 1000 | 0.4873 | 1.4801 | 5.2216 | 0.0063 | 0.1505 | 0.1385 | 625 | 0.0440 |
| Off-Highway Trucks Composite | | 0.1924 | 0.5974 | 1.4932 | 0.0027 | 0.0516 | 0.0475 | 260 | 0.0174 |
| Other Construction Equipment | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0039 | 0.0036 | 13.2 | 0.0014 |
| | 50 | 0.0597 | 0.2506 | 0.2369 | 0.0004 | 0.0162 | 0.0149 | 28.0 | 0.0054 |
| | 120 | 0.0827 | 0.5202 | 0.6012 | 0.0009 | 0.0441 | 0.0406 | 80.9 | 0.0075 |
| | 175 | 0.0796 | 0.5864 | 0.6636 | 0.0012 | 0.0331 | 0.0305 | 107 | 0.0072 |
| | 500 | 0.1310 | 0.4963 | 1.1867 | 0.0025 | 0.0394 | 0.0362 | 254 | 0.0118 |
| Other Construction Equipment Composite | | 0.0768 | 0.3645 | 0.6392 | 0.0013 | 0.0264 | 0.0243 | 123 | 0.0069 |
| Other General Industrial Equipmen | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0786 | 0.2532 | 0.2077 | 0.0003 | 0.0191 | 0.0175 | 21.7 | 0.0071 |
| | 120 | 0.0987 | 0.4387 | 0.5864 | 0.0007 | 0.0521 | 0.0480 | 62.0 | 0.0089 |
| | 175 | 0.1083 | 0.5684 | 0.7866 | 0.0011 | 0.0448 | 0.0412 | 95.9 | 0.0098 |
| | 250 | 0.1050 | 0.3015 | 0.9812 | 0.0015 | 0.0312 | 0.0287 | 136 | 0.0095 |
| | 500 | 0.1931 | 0.5811 | 1.6702 | 0.0026 | 0.0569 | 0.0524 | 265 | 0.0174 |
| | 750 | 0.3208 | 0.9578 | 2.8569 | 0.0044 | 0.0959 | 0.0883 | 437 | 0.0289 |
| | 1000 | 0.4546 | 1.4023 | 5.2482 | 0.0056 | 0.1513 | 0.1392 | 560 | 0.0410 |
| Other General Industrial Equipmen Composite | | 0.1355 | 0.4843 | 1.1215 | 0.0016 | 0.0475 | 0.0437 | 152 | 0.0122 |
| Other Material Handling Equipmen | 50 | 0.1090 | 0.3501 | 0.2887 | 0.0004 | 0.0265 | 0.0244 | 30.3 | 0.0098 |
| | 120 | 0.0959 | 0.4271 | 0.5727 | 0.0007 | 0.0509 | 0.0468 | 60.7 | 0.0087 |
| | 175 | 0.1365 | 0.7201 | 0.9997 | 0.0014 | 0.0567 | 0.0522 | 122 | 0.0123 |
| | 250 | 0.1109 | 0.3211 | 1.0483 | 0.0016 | 0.0332 | 0.0306 | 145 | 0.0100 |
| | 500 | 0.1376 | 0.4182 | 1.2042 | 0.0019 | 0.0409 | 0.0377 | 192 | 0.0124 |
| | 9999 | 0.6190 | 1.8527 | 6.9410 | 0.0073 | 0.1995 | 0.1835 | 741 | 0.0558 |
| Other Material Handling Equipment Composite | | 0.1289 | 0.4698 | 1.0967 | 0.0015 | 0.0460 | 0.0423 | 141 | 0.0116 |
| Pavers | 25 | 0.0234 | 0.0780 | 0.1458 | 0.0002 | 0.0066 | 0.0060 | 18.7 | 0.0021 |
| | 50 | 0.1198 | 0.3421 | 0.2775 | 0.0004 | 0.0271 | 0.0249 | 28.0 | 0.0108 |
| | 120 | 0.1235 | 0.4969 | 0.7477 | 0.0008 | 0.0636 | 0.0585 | 69.2 | 0.0111 |
| | 175 | 0.1608 | 0.7707 | 1.2155 | 0.0014 | 0.0673 | 0.0619 | 128 | 0.0145 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1858 | 0.5585 | 1.6747 | 0.0022 | 0.0640 | 0.0589 | 194 | 0.0168 |
| | 500 | 0.2059 | 0.8113 | 1.8097 | 0.0023 | 0.0697 | 0.0641 | 233 | 0.0186 |
| Pavers Composite | | 0.1347 | 0.5203 | 0.7607 | 0.0009 | 0.0526 | 0.0484 | 77.9 | 0.0122 |
| Paving Equipment | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0037 | 0.0034 | 12.6 | 0.0014 |
| | 50 | 0.1023 | 0.2901 | 0.2367 | 0.0003 | 0.0231 | 0.0213 | 23.9 | 0.0092 |
| | 120 | 0.0969 | 0.3891 | 0.5874 | 0.0006 | 0.0503 | 0.0462 | 54.5 | 0.0087 |
| | 175 | 0.1254 | 0.6025 | 0.9549 | 0.0011 | 0.0528 | 0.0486 | 101 | 0.0113 |
| | 250 | 0.1140 | 0.3441 | 1.0498 | 0.0014 | 0.0394 | 0.0362 | 122 | 0.0103 |
| Paving Equipment Composite | | 0.1023 | 0.4234 | 0.6842 | 0.0008 | 0.0469 | 0.0431 | 68.9 | 0.0092 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washers | 15 | 0.0065 | 0.0315 | 0.0445 | 0.0001 | 0.0024 | 0.0022 | 4.9 | 0.0006 |
| | 25 | 0.0100 | 0.0337 | 0.0617 | 0.0001 | 0.0033 | 0.0030 | 7.1 | 0.0009 |
| | 50 | 0.0251 | 0.0970 | 0.1183 | 0.0002 | 0.0077 | 0.0070 | 14.3 | 0.0023 |
| | 120 | 0.0245 | 0.1416 | 0.1947 | 0.0003 | 0.0128 | 0.0118 | 24.1 | 0.0022 |
| Pressure Washers Composite | | 0.0133 | 0.0590 | 0.0799 | 0.0001 | 0.0049 | 0.0045 | 9.4 | 0.0012 |
| | 15 | 0.0111 | 0.0479 | 0.0683 | 0.0001 | 0.0041 | 0.0038 | 7.4 | 0.0010 |
| | 25 | 0.0309 | 0.0919 | 0.1682 | 0.0002 | 0.0094 | 0.0086 | 19.5 | 0.0028 |
| | 50 | 0.0855 | 0.2910 | 0.2982 | 0.0004 | 0.0228 | 0.0210 | 34.3 | 0.0077 |
| | 120 | 0.0949 | 0.4887 | 0.6710 | 0.0009 | 0.0508 | 0.0467 | 77.9 | 0.0086 |
| | 175 | 0.1158 | 0.7365 | 1.0489 | 0.0016 | 0.0502 | 0.0462 | 140 | 0.0104 |
| | 250 | 0.1088 | 0.3998 | 1.3270 | 0.0023 | 0.0376 | 0.0346 | 201 | 0.0098 |
| Pumps | 500 | 0.1686 | 0.6929 | 2.0163 | 0.0034 | 0.0603 | 0.0555 | 345 | 0.0152 |
| | 750 | 0.2872 | 1.1454 | 3.4529 | 0.0057 | 0.1018 | 0.0937 | 571 | 0.0259 |
| | 9999 | 0.8773 | 3.1134 | 11.7387 | 0.0136 | 0.3072 | 0.2826 | 1,355 | 0.0792 |
| Pumps Composite | | 0.0621 | 0.2825 | 0.4121 | 0.0006 | 0.0267 | 0.0245 | 49.6 | 0.0056 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1018 | 0.0002 | 0.0039 | 0.0036 | 13.3 | 0.0015 |
| | 50 | 0.0871 | 0.2754 | 0.2405 | 0.0003 | 0.0209 | 0.0192 | 26.0 | 0.0079 |
| | 120 | 0.0857 | 0.4000 | 0.5498 | 0.0007 | 0.0454 | 0.0418 | 59.0 | 0.0077 |
| | 175 | 0.1104 | 0.6166 | 0.8731 | 0.0012 | 0.0470 | 0.0433 | 108 | 0.0100 |
| | 250 | 0.1107 | 0.3575 | 1.0948 | 0.0017 | 0.0368 | 0.0339 | 153 | 0.0100 |
| | 500 | 0.1468 | 0.5595 | 1.3956 | 0.0022 | 0.0487 | 0.0448 | 219 | 0.0132 |
| Rollers Composite | | 0.0851 | 0.3979 | 0.5706 | 0.0008 | 0.0386 | 0.0355 | 67.1 | 0.0077 |
| Rough Terrain Forklifts | 50 | 0.0942 | 0.3551 | 0.3066 | 0.0004 | 0.0243 | 0.0224 | 33.9 | 0.0085 |
| | 120 | 0.0801 | 0.4260 | 0.5164 | 0.0007 | 0.0420 | 0.0387 | 62.4 | 0.0072 |
| | 175 | 0.1171 | 0.7240 | 0.8746 | 0.0014 | 0.0477 | 0.0439 | 125 | 0.0106 |
| | 250 | 0.1168 | 0.3650 | 1.0385 | 0.0019 | 0.0338 | 0.0311 | 171 | 0.0105 |
| | 500 | 0.1668 | 0.5337 | 1.3642 | 0.0025 | 0.0477 | 0.0439 | 257 | 0.0150 |
| Rough Terrain Forklifts Composite | | 0.0850 | 0.4577 | 0.5588 | 0.0008 | 0.0423 | 0.0389 | 70.3 | 0.0077 |
| Rubber Tired Dozers | 175 | 0.1942 | 0.8333 | 1.3944 | 0.0015 | 0.0790 | 0.0727 | 129 | 0.0175 |
| | 250 | 0.2209 | 0.6304 | 1.8273 | 0.0021 | 0.0762 | 0.0701 | 183 | 0.0199 |
| | 500 | 0.2932 | 1.2456 | 2.3951 | 0.0026 | 0.0985 | 0.0906 | 265 | 0.0265 |
| | 750 | 0.4423 | 1.8685 | 3.6712 | 0.0040 | 0.1494 | 0.1374 | 399 | 0.0399 |
| | 1000 | 0.6883 | 3.0139 | 6.8297 | 0.0060 | 0.2311 | 0.2126 | 592 | 0.0621 |
| Rubber Tired Dozers Composite | | 0.2721 | 1.0420 | 2.2344 | 0.0025 | 0.0924 | 0.0850 | 239 | 0.0246 |
| Rubber Tired Loaders | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0049 | 0.0045 | 16.9 | 0.0018 |
| | 50 | 0.0993 | 0.3438 | 0.2888 | 0.0004 | 0.0242 | 0.0222 | 31.1 | 0.0090 |
| | 120 | 0.0835 | 0.4090 | 0.5226 | 0.0007 | 0.0431 | 0.0396 | 58.9 | 0.0075 |
| | 175 | 0.1094 | 0.6251 | 0.8077 | 0.0012 | 0.0445 | 0.0409 | 106 | 0.0099 |
| | 250 | 0.1118 | 0.3444 | 0.9890 | 0.0017 | 0.0337 | 0.0310 | 149 | 0.0101 |
| | 500 | 0.1678 | 0.5818 | 1.3980 | 0.0023 | 0.0499 | 0.0459 | 237 | 0.0151 |
| | 750 | 0.3459 | 1.1905 | 2.9534 | 0.0049 | 0.1040 | 0.0956 | 486 | 0.0312 |
| | 1000 | 0.4657 | 1.6412 | 5.2967 | 0.0060 | 0.1552 | 0.1428 | 594 | 0.0420 |
| Rubber Tired Loaders Composite | | 0.1050 | 0.4615 | 0.7838 | 0.0012 | 0.0416 | 0.0383 | 109 | 0.0095 |
| Scrapers | 120 | 0.1665 | 0.6826 | 0.9915 | 0.0011 | 0.0846 | 0.0778 | 93.9 | 0.0150 |
| | 175 | 0.1871 | 0.9030 | 1.3657 | 0.0017 | 0.0766 | 0.0704 | 148 | 0.0169 |
| | 250 | 0.2021 | 0.5906 | 1.7470 | 0.0024 | 0.0665 | 0.0612 | 209 | 0.0182 |
| | 500 | 0.2883 | 1.0688 | 2.4104 | 0.0032 | 0.0930 | 0.0855 | 321 | 0.0260 |
| | 750 | 0.5001 | 1.8419 | 4.2634 | 0.0056 | 0.1624 | 0.1494 | 555 | 0.0451 |
| Scrapers Composite | | 0.2513 | 0.9443 | 2.0647 | 0.0027 | 0.0854 | 0.0785 | 262 | 0.0227 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0931 | 0.3227 | 0.3148 | 0.0005 | 0.0243 | 0.0224 | 36.2 | 0.0084 |
| | 120 | 0.0970 | 0.5116 | 0.6762 | 0.0009 | 0.0525 | 0.0483 | 80.2 | 0.0088 |
| | 175 | 0.1290 | 0.8300 | 1.1249 | 0.0017 | 0.0559 | 0.0514 | 155 | 0.0116 |
| | 250 | 0.1416 | 0.5098 | 1.6229 | 0.0029 | 0.0474 | 0.0436 | 255 | 0.0128 |
| Signal Boards Composite | | 0.0171 | 0.0925 | 0.1250 | 0.0002 | 0.0066 | 0.0060 | 16.7 | 0.0015 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| Skid Steer Loaders | 25 | 0.0189 | 0.0601 | 0.1125 | 0.0002 | 0.0056 | 0.0052 | 13.8 | 0.0017 |
| | 50 | 0.0378 | 0.2138 | 0.2052 | 0.0003 | 0.0113 | 0.0104 | 25.5 | 0.0034 |
| | 120 | 0.0334 | 0.2710 | 0.2699 | 0.0005 | 0.0170 | 0.0156 | 42.8 | 0.0030 |
| Skid Steer Loaders Composite | | 0.0352 | 0.2220 | 0.2198 | 0.0004 | 0.0128 | 0.0118 | 30.3 | 0.0032 |
| Surfacing Equipment | 50 | 0.0408 | 0.1333 | 0.1263 | 0.0002 | 0.0101 | 0.0093 | 14.1 | 0.0037 |
| | 120 | 0.0840 | 0.4151 | 0.5756 | 0.0007 | 0.0439 | 0.0404 | 63.8 | 0.0076 |
| | 175 | 0.0787 | 0.4705 | 0.6706 | 0.0010 | 0.0335 | 0.0308 | 85.8 | 0.0071 |
| | 250 | 0.0891 | 0.3116 | 0.9338 | 0.0015 | 0.0309 | 0.0285 | 135 | 0.0080 |
| | 500 | 0.1342 | 0.5759 | 1.3809 | 0.0022 | 0.0468 | 0.0431 | 221 | 0.0121 |
| | 750 | 0.2139 | 0.9020 | 2.2264 | 0.0035 | 0.0745 | 0.0686 | 347 | 0.0193 |
| Surfacing Equipment Composite | | 0.1116 | 0.4705 | 1.0675 | 0.0017 | 0.0389 | 0.0357 | 166 | 0.0101 |
| Sweepers/Scrubbers | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0052 | 19.6 | 0.0021 |
| | 50 | 0.0782 | 0.3186 | 0.2828 | 0.0004 | 0.0211 | 0.0194 | 31.6 | 0.0071 |
| | 120 | 0.0880 | 0.5056 | 0.5893 | 0.0009 | 0.0466 | 0.0429 | 75.0 | 0.0079 |
| | 175 | 0.1193 | 0.7999 | 0.9051 | 0.0016 | 0.0488 | 0.0449 | 139 | 0.0108 |
| | 250 | 0.1029 | 0.3286 | 0.9094 | 0.0018 | 0.0289 | 0.0266 | 162 | 0.0093 |
| Sweepers/Scrubbers Composite | | 0.0913 | 0.5034 | 0.5746 | 0.0009 | 0.0387 | 0.0356 | 78.5 | 0.0082 |
| Tractors/Loaders/Backhoes | 25 | 0.0192 | 0.0653 | 0.1221 | 0.0002 | 0.0049 | 0.0045 | 15.9 | 0.0017 |
| | 50 | 0.0702 | 0.3020 | 0.2646 | 0.0004 | 0.0186 | 0.0171 | 30.3 | 0.0063 |
| | 120 | 0.0577 | 0.3480 | 0.3870 | 0.0006 | 0.0293 | 0.0270 | 51.7 | 0.0052 |
| | 175 | 0.0854 | 0.5853 | 0.6331 | 0.0011 | 0.0335 | 0.0308 | 101 | 0.0077 |
| | 250 | 0.1082 | 0.3566 | 0.9047 | 0.0019 | 0.0294 | 0.0270 | 172 | 0.0098 |
| | 500 | 0.2085 | 0.7089 | 1.6070 | 0.0039 | 0.0559 | 0.0514 | 345 | 0.0188 |
| | 750 | 0.3148 | 1.0631 | 2.4922 | 0.0058 | 0.0854 | 0.0786 | 517 | 0.0284 |
| Tractors/Loaders/Backhoes Composite | | 0.0666 | 0.3716 | 0.4501 | 0.0008 | 0.0298 | 0.0274 | 66.8 | 0.0060 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0087 | 32.9 | 0.0036 |
| | 50 | 0.1390 | 0.3900 | 0.3235 | 0.0004 | 0.0313 | 0.0288 | 32.9 | 0.0125 |
| | 120 | 0.1144 | 0.4600 | 0.7060 | 0.0008 | 0.0590 | 0.0542 | 64.9 | 0.0103 |
| | 175 | 0.1770 | 0.8534 | 1.3767 | 0.0016 | 0.0748 | 0.0688 | 144 | 0.0160 |
| | 250 | 0.2105 | 0.6510 | 1.9456 | 0.0025 | 0.0750 | 0.0690 | 223 | 0.0190 |
| | 500 | 0.2694 | 1.1349 | 2.4560 | 0.0031 | 0.0947 | 0.0871 | 311 | 0.0243 |
| | 750 | 0.5107 | 2.1334 | 4.7300 | 0.0059 | 0.1802 | 0.1658 | 587 | 0.0461 |
| Trenchers Composite | | 0.1274 | 0.4541 | 0.6043 | 0.0007 | 0.0485 | 0.0446 | 58.7 | 0.0115 |
| Welders | 15 | 0.0093 | 0.0400 | 0.0571 | 0.0001 | 0.0034 | 0.0032 | 6.2 | 0.0008 |
| | 25 | 0.0179 | 0.0532 | 0.0974 | 0.0001 | 0.0054 | 0.0050 | 11.3 | 0.0016 |
| | 50 | 0.0801 | 0.2564 | 0.2346 | 0.0003 | 0.0200 | 0.0184 | 26.0 | 0.0072 |
| | 120 | 0.0547 | 0.2606 | 0.3567 | 0.0005 | 0.0296 | 0.0273 | 39.5 | 0.0049 |
| | 175 | 0.0936 | 0.5424 | 0.7713 | 0.0011 | 0.0405 | 0.0373 | 98.2 | 0.0084 |
| | 250 | 0.0749 | 0.2483 | 0.8249 | 0.0013 | 0.0248 | 0.0228 | 119 | 0.0068 |
| | 500 | 0.0968 | 0.3491 | 1.0171 | 0.0016 | 0.0325 | 0.0299 | 168 | 0.0087 |
| Welders Composite | | 0.0534 | 0.1994 | 0.2301 | 0.0003 | 0.0187 | 0.0172 | 25.6 | 0.0048 |

## 2020 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0138 | 0.0459 | 0.0854 | 0.0001 | 0.0035 | 0.0032 | 11.0 | 0.0012 |
| | 50 | 0.0261 | 0.1436 | 0.1422 | 0.0003 | 0.0071 | 0.0065 | 19.6 | 0.0024 |
| | 120 | 0.0259 | 0.2292 | 0.2166 | 0.0004 | 0.0127 | 0.0117 | 38.1 | 0.0023 |
| | 500 | 0.0751 | 0.3804 | 0.6959 | 0.0021 | 0.0217 | 0.0199 | 213 | 0.0068 |
| | 750 | 0.1373 | 0.6877 | 1.2876 | 0.0039 | 0.0396 | 0.0365 | 385 | 0.0124 |
| Aerial Lifts Composite | | 0.0261 | 0.1696 | 0.1866 | 0.0004 | 0.0092 | 0.0084 | 34.7 | 0.0024 |
| Air Compressors | 15 | 0.0093 | 0.0451 | 0.0579 | 0.0001 | 0.0029 | 0.0027 | 7.2 | 0.0008 |
| | 25 | 0.0196 | 0.0630 | 0.1155 | 0.0002 | 0.0054 | 0.0050 | 14.4 | 0.0018 |
| | 50 | 0.0398 | 0.2030 | 0.1725 | 0.0003 | 0.0099 | 0.0091 | 22.3 | 0.0036 |
| | 120 | 0.0408 | 0.3058 | 0.2826 | 0.0006 | 0.0188 | 0.0173 | 47.0 | 0.0037 |
| | 175 | 0.0587 | 0.4989 | 0.4013 | 0.0010 | 0.0210 | 0.0193 | 88.5 | 0.0053 |
| | 250 | 0.0669 | 0.2592 | 0.5067 | 0.0015 | 0.0163 | 0.0150 | 131 | 0.0060 |
| | 500 | 0.1146 | 0.4395 | 0.7970 | 0.0023 | 0.0276 | 0.0254 | 232 | 0.0103 |
| | 750 | 0.1777 | 0.6792 | 1.2615 | 0.0036 | 0.0432 | 0.0398 | 358 | 0.0160 |
| | 1000 | 0.2641 | 0.9959 | 3.2946 | 0.0049 | 0.0804 | 0.0740 | 486 | 0.0238 |
| Air Compressors Composite | | 0.0483 | 0.3077 | 0.3255 | 0.0007 | 0.0185 | 0.0170 | 63.6 | 0.0044 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0196 | 0.2205 | 0.1756 | 0.0004 | 0.0020 | 0.0018 | 31.0 | 0.0018 |
| | 120 | 0.0280 | 0.4662 | 0.2329 | 0.0009 | 0.0040 | 0.0037 | 77.1 | 0.0025 |
| | 175 | 0.0402 | 0.7542 | 0.1862 | 0.0016 | 0.0051 | 0.0047 | 141 | 0.0036 |
| | 250 | 0.0474 | 0.3426 | 0.1617 | 0.0021 | 0.0044 | 0.0040 | 188 | 0.0043 |
| | 500 | 0.0784 | 0.5512 | 0.2622 | 0.0031 | 0.0072 | 0.0066 | 311 | 0.0071 |
| | 750 | 0.1549 | 1.0891 | 0.5202 | 0.0062 | 0.0143 | 0.0131 | 615 | 0.0140 |
| | 1000 | 0.2442 | 1.6437 | 3.9853 | 0.0093 | 0.0530 | 0.0488 | 928 | 0.0220 |
| Bore/Drill Rigs Composite | | 0.0480 | 0.5008 | 0.3439 | 0.0017 | 0.0062 | 0.0057 | 165 | 0.0043 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0223 | 0.0741 | 0.1372 | 0.0002 | 0.0058 | 0.0053 | 17.6 | 0.0020 |
| Cement and Mortar Mixers Co | | 0.0086 | 0.0415 | 0.0536 | 0.0001 | 0.0021 | 0.0020 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0424 | 0.2420 | 0.2231 | 0.0004 | 0.0113 | 0.0104 | 30.2 | 0.0038 |
| | 120 | 0.0524 | 0.4613 | 0.4128 | 0.0009 | 0.0249 | 0.0229 | 74.1 | 0.0047 |
| | 175 | 0.0865 | 0.8662 | 0.6554 | 0.0018 | 0.0323 | 0.0297 | 160 | 0.0078 |
| Concrete/Industrial Saws Com | | 0.0484 | 0.3783 | 0.3410 | 0.0007 | 0.0196 | 0.0180 | 58.5 | 0.0044 |
| Cranes | 50 | 0.0532 | 0.2423 | 0.1894 | 0.0003 | 0.0121 | 0.0111 | 23.2 | 0.0048 |
| | 120 | 0.0542 | 0.3446 | 0.3317 | 0.0006 | 0.0240 | 0.0221 | 50.1 | 0.0049 |
| | 175 | 0.0648 | 0.4754 | 0.4071 | 0.0009 | 0.0223 | 0.0206 | 80.3 | 0.0058 |
| | 250 | 0.0704 | 0.2440 | 0.4949 | 0.0013 | 0.0170 | 0.0157 | 112 | 0.0064 |
| | 500 | 0.1087 | 0.3839 | 0.7047 | 0.0018 | 0.0257 | 0.0236 | 180 | 0.0098 |
| | 750 | 0.1837 | 0.6455 | 1.2225 | 0.0030 | 0.0439 | 0.0404 | 303 | 0.0166 |
| | 9999 | 0.6702 | 2.1934 | 7.0436 | 0.0098 | 0.1797 | 0.1654 | 971 | 0.0605 |
| Cranes Composite | | 0.0898 | 0.3917 | 0.6610 | 0.0014 | 0.0256 | 0.0236 | 129 | 0.0081 |
| Crawler Tractors | 50 | 0.0699 | 0.2771 | 0.2107 | 0.0003 | 0.0150 | 0.0138 | 24.9 | 0.0063 |
| | 120 | 0.0831 | 0.4628 | 0.4896 | 0.0008 | 0.0371 | 0.0341 | 65.8 | 0.0075 |
| | 175 | 0.1123 | 0.7302 | 0.7150 | 0.0014 | 0.0398 | 0.0366 | 121 | 0.0101 |
| | 250 | 0.1188 | 0.3966 | 0.8681 | 0.0019 | 0.0315 | 0.0290 | 166 | 0.0107 |
| | 500 | 0.1759 | 0.6665 | 1.2170 | 0.0025 | 0.0455 | 0.0419 | 259 | 0.0159 |
| | 750 | 0.3168 | 1.1935 | 2.2429 | 0.0047 | 0.0828 | 0.0762 | 465 | 0.0286 |
| | 1000 | 0.4836 | 1.8458 | 5.2162 | 0.0066 | 0.1425 | 0.1311 | 658 | 0.0436 |
| Crawler Tractors Composite | | 0.1049 | 0.5260 | 0.6772 | 0.0013 | 0.0378 | 0.0348 | 114 | 0.0095 |
| Crushing/Proc. E | 50 | 0.0734 | 0.4036 | 0.3367 | 0.0006 | 0.0181 | 0.0166 | 44.0 | 0.0066 |
| | 120 | 0.0692 | 0.5446 | 0.4754 | 0.0010 | 0.0302 | 0.0278 | 83.1 | 0.0062 |
| | 175 | 0.1083 | 0.9519 | 0.7042 | 0.0019 | 0.0368 | 0.0338 | 167 | 0.0098 |
| | 250 | 0.1245 | 0.4844 | 0.8670 | 0.0028 | 0.0282 | 0.0259 | 245 | 0.0112 |
| | 500 | 0.1852 | 0.7092 | 1.1829 | 0.0037 | 0.0416 | 0.0383 | 374 | 0.0167 |
| | 750 | 0.2912 | 1.1167 | 1.9026 | 0.0059 | 0.0655 | 0.0603 | 589 | 0.0263 |
| | 9999 | 0.7584 | 2.6528 | 8.5119 | 0.0131 | 0.2049 | 0.1885 | 1,308 | 0.0684 |
| Crushing/Proc. Equipment Co | | 0.0934 | 0.6247 | 0.5983 | 0.0015 | 0.0310 | 0.0285 | 132 | 0.0084 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0384 | 0.2446 | 0.1862 | 0.0003 | 0.0080 | 0.0074 | 25.0 | 0.0035 |
| | 120 | 0.0583 | 0.4979 | 0.3717 | 0.0009 | 0.0206 | 0.0189 | 73.6 | 0.0053 |
| | 175 | 0.0703 | 0.6637 | 0.3868 | 0.0013 | 0.0195 | 0.0179 | 112 | 0.0063 |
| | 250 | 0.0828 | 0.3276 | 0.4493 | 0.0018 | 0.0154 | 0.0141 | 159 | 0.0075 |
| | 500 | 0.1198 | 0.4591 | 0.6028 | 0.0023 | 0.0219 | 0.0202 | 234 | 0.0108 |
| | 750 | 0.1987 | 0.7606 | 1.0153 | 0.0039 | 0.0365 | 0.0336 | 387 | 0.0179 |
| Excavators Composite | | 0.0733 | 0.5124 | 0.4042 | 0.0013 | 0.0184 | 0.0169 | 120 | 0.0066 |
| Forklifts | 50 | 0.0191 | 0.1400 | 0.1084 | 0.0002 | 0.0039 | 0.0036 | 14.7 | 0.0017 |
| | 120 | 0.0225 | 0.2102 | 0.1443 | 0.0004 | 0.0074 | 0.0068 | 31.2 | 0.0020 |
| | 175 | 0.0336 | 0.3315 | 0.1772 | 0.0006 | 0.0087 | 0.0080 | 56.1 | 0.0030 |
| | 250 | 0.0385 | 0.1554 | 0.1887 | 0.0009 | 0.0062 | 0.0057 | 77.1 | 0.0035 |
| | 500 | 0.0548 | 0.2126 | 0.2528 | 0.0011 | 0.0088 | 0.0081 | 111 | 0.0049 |
| Forklifts Composite | | 0.0320 | 0.2160 | 0.1691 | 0.0006 | 0.0070 | 0.0065 | 54.4 | 0.0029 |
| Generator Sets | 15 | 0.0116 | 0.0638 | 0.0814 | 0.0002 | 0.0038 | 0.0035 | 10.2 | 0.0011 |
| | 25 | 0.0224 | 0.0769 | 0.1410 | 0.0002 | 0.0064 | 0.0059 | 17.6 | 0.0020 |
| | 50 | 0.0379 | 0.2161 | 0.2199 | 0.0004 | 0.0106 | 0.0098 | 30.6 | 0.0034 |
| | 120 | 0.0506 | 0.4641 | 0.4378 | 0.0009 | 0.0250 | 0.0230 | 77.9 | 0.0046 |
| | 175 | 0.0676 | 0.7323 | 0.5990 | 0.0016 | 0.0266 | 0.0245 | 142 | 0.0061 |
| | 250 | 0.0747 | 0.3844 | 0.7614 | 0.0024 | 0.0218 | 0.0200 | 213 | 0.0067 |
| | 500 | 0.1125 | 0.5968 | 1.0874 | 0.0033 | 0.0333 | 0.0307 | 337 | 0.0102 |
| | 750 | 0.1842 | 0.9634 | 1.7962 | 0.0055 | 0.0544 | 0.0500 | 544 | 0.0166 |
| | 9999 | 0.4502 | 2.0059 | 6.6947 | 0.0105 | 0.1476 | 0.1358 | 1,049 | 0.0406 |
| Generator Sets Composite | | 0.0395 | 0.2732 | 0.3232 | 0.0007 | 0.0150 | 0.0138 | 61.0 | 0.0036 |
| Graders | 50 | 0.0563 | 0.2762 | 0.2156 | 0.0004 | 0.0124 | 0.0114 | 27.5 | 0.0051 |
| | 120 | 0.0738 | 0.5090 | 0.4568 | 0.0009 | 0.0311 | 0.0286 | 75.0 | 0.0067 |
| | 175 | 0.0918 | 0.7282 | 0.5622 | 0.0014 | 0.0303 | 0.0279 | 124 | 0.0083 |
| | 250 | 0.0999 | 0.3683 | 0.6701 | 0.0019 | 0.0230 | 0.0211 | 172 | 0.0090 |
| | 500 | 0.1284 | 0.4966 | 0.7982 | 0.0023 | 0.0288 | 0.0265 | 229 | 0.0116 |
| | 750 | 0.2731 | 1.0508 | 1.7425 | 0.0049 | 0.0621 | 0.0571 | 486 | 0.0246 |
| Graders Composite | | 0.0919 | 0.5765 | 0.5823 | 0.0015 | 0.0280 | 0.0258 | 133 | 0.0083 |
| Off-Highway Trac | 120 | 0.1455 | 0.6789 | 0.8421 | 0.0011 | 0.0674 | 0.0621 | 93.7 | 0.0131 |
| | 175 | 0.1455 | 0.8025 | 0.9712 | 0.0015 | 0.0547 | 0.0503 | 130 | 0.0131 |
| | 250 | 0.1147 | 0.3614 | 0.8843 | 0.0015 | 0.0348 | 0.0321 | 130 | 0.0103 |
| | 750 | 0.4683 | 1.8825 | 3.5643 | 0.0057 | 0.1391 | 0.1280 | 568 | 0.0423 |
| | 1000 | 0.7129 | 2.9445 | 7.4279 | 0.0082 | 0.2214 | 0.2037 | 814 | 0.0643 |
| Off-Highway Tractors Compos | | 0.1470 | 0.6517 | 1.0657 | 0.0017 | 0.0497 | 0.0457 | 151 | 0.0133 |
| Off-Highway Truc | 175 | 0.0837 | 0.7538 | 0.4564 | 0.0014 | 0.0234 | 0.0215 | 125 | 0.0076 |
| | 250 | 0.0927 | 0.3514 | 0.5042 | 0.0019 | 0.0173 | 0.0159 | 167 | 0.0084 |
| | 500 | 0.1488 | 0.5446 | 0.7481 | 0.0027 | 0.0273 | 0.0251 | 272 | 0.0134 |
| | 750 | 0.2416 | 0.8831 | 1.2347 | 0.0044 | 0.0446 | 0.0411 | 442 | 0.0218 |
| | 1000 | 0.3613 | 1.2913 | 3.8920 | 0.0063 | 0.0903 | 0.0831 | 625 | 0.0326 |
| Off-Highway Trucks Composit | | 0.1443 | 0.5514 | 0.8306 | 0.0027 | 0.0280 | 0.0258 | 260 | 0.0130 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0328 | 0.2267 | 0.1956 | 0.0004 | 0.0078 | 0.0072 | 28.0 | 0.0030 |
| | 120 | 0.0501 | 0.5080 | 0.3835 | 0.0009 | 0.0199 | 0.0183 | 80.9 | 0.0045 |
| | 175 | 0.0524 | 0.5859 | 0.3414 | 0.0012 | 0.0164 | 0.0151 | 107 | 0.0047 |
| | 500 | 0.1012 | 0.4676 | 0.6065 | 0.0025 | 0.0212 | 0.0195 | 254 | 0.0091 |
| Other Construction Equipment | | 0.0563 | 0.3508 | 0.3519 | 0.0013 | 0.0139 | 0.0128 | 122 | 0.0051 |
| Other General Ind | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0431 | 0.2211 | 0.1744 | 0.0003 | 0.0101 | 0.0093 | 21.7 | 0.0039 |
| | 120 | 0.0602 | 0.4232 | 0.3810 | 0.0007 | 0.0256 | 0.0236 | 62.0 | 0.0054 |
| | 175 | 0.0721 | 0.5668 | 0.4439 | 0.0011 | 0.0237 | 0.0218 | 95.9 | 0.0065 |
| | 250 | 0.0791 | 0.2804 | 0.5318 | 0.0015 | 0.0173 | 0.0159 | 136 | 0.0071 |
| | 500 | 0.1506 | 0.5217 | 0.9276 | 0.0026 | 0.0326 | 0.0300 | 265 | 0.0136 |
| | 750 | 0.2490 | 0.8599 | 1.5657 | 0.0044 | 0.0543 | 0.0500 | 437 | 0.0225 |
| | 1000 | 0.3467 | 1.1855 | 3.8628 | 0.0056 | 0.0969 | 0.0892 | 560 | 0.0313 |
| Other General Industrial Equip | | 0.0983 | 0.4517 | 0.6661 | 0.0016 | 0.0262 | 0.0241 | 152 | 0.0089 |
| Other Material Ha | 50 | 0.0595 | 0.3049 | 0.2425 | 0.0004 | 0.0141 | 0.0130 | 30.3 | 0.0054 |
| | 120 | 0.0583 | 0.4117 | 0.3720 | 0.0007 | 0.0250 | 0.0230 | 60.7 | 0.0053 |
| | 175 | 0.0907 | 0.7176 | 0.5642 | 0.0014 | 0.0301 | 0.0277 | 122 | 0.0082 |

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|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0836 | 0.2984 | 0.5684 | 0.0016 | 0.0185 | 0.0170 | 145 | 0.0075 |
| | 500 | 0.1074 | 0.3752 | 0.6692 | 0.0019 | 0.0235 | 0.0216 | 192 | 0.0097 |
| | 9999 | 0.4910 | 1.5647 | 5.1082 | 0.0073 | 0.1280 | 0.1177 | 741 | 0.0443 |
| Other Material Handling Equip | | 0.0924 | 0.4429 | 0.6500 | 0.0015 | 0.0252 | 0.0232 | 141 | 0.0083 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1427 | 0.0002 | 0.0055 | 0.0051 | 18.7 | 0.0020 |
| | 50 | 0.0834 | 0.3055 | 0.2398 | 0.0004 | 0.0184 | 0.0169 | 28.0 | 0.0075 |
| | 120 | 0.0910 | 0.4805 | 0.5471 | 0.0008 | 0.0428 | 0.0394 | 69.2 | 0.0082 |
| | 175 | 0.1217 | 0.7599 | 0.8187 | 0.0014 | 0.0459 | 0.0422 | 128 | 0.0110 |
| | 250 | 0.1411 | 0.4713 | 1.1106 | 0.0022 | 0.0407 | 0.0375 | 194 | 0.0127 |
| | 500 | 0.1595 | 0.6305 | 1.1959 | 0.0023 | 0.0450 | 0.0414 | 233 | 0.0144 |
| Pavers Composite | | 0.0989 | 0.4920 | 0.5450 | 0.0009 | 0.0355 | 0.0326 | 77.9 | 0.0089 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0702 | 0.2577 | 0.2043 | 0.0003 | 0.0157 | 0.0144 | 23.9 | 0.0063 |
| | 120 | 0.0708 | 0.3762 | 0.4280 | 0.0006 | 0.0337 | 0.0310 | 54.5 | 0.0064 |
| | 175 | 0.0944 | 0.5945 | 0.6403 | 0.0011 | 0.0360 | 0.0331 | 101 | 0.0085 |
| | 250 | 0.0864 | 0.2894 | 0.6928 | 0.0014 | 0.0249 | 0.0229 | 122 | 0.0078 |
| Paving Equipment Composite | | 0.0757 | 0.4084 | 0.4807 | 0.0008 | 0.0315 | 0.0290 | 68.9 | 0.0068 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0056 | 0.0305 | 0.0390 | 0.0001 | 0.0018 | 0.0017 | 4.9 | 0.0005 |
| | 25 | 0.0091 | 0.0312 | 0.0572 | 0.0001 | 0.0026 | 0.0024 | 7.1 | 0.0008 |
| | 50 | 0.0128 | 0.0856 | 0.0986 | 0.0002 | 0.0041 | 0.0038 | 14.3 | 0.0012 |
| | 120 | 0.0128 | 0.1367 | 0.1293 | 0.0003 | 0.0065 | 0.0060 | 24.1 | 0.0012 |
| Pressure Washers Composite | | 0.0085 | 0.0549 | 0.0650 | 0.0001 | 0.0030 | 0.0027 | 9.4 | 0.0008 |
| Pumps | 15 | 0.0096 | 0.0464 | 0.0595 | 0.0001 | 0.0030 | 0.0028 | 7.4 | 0.0009 |
| | 25 | 0.0265 | 0.0850 | 0.1558 | 0.0002 | 0.0073 | 0.0067 | 19.5 | 0.0024 |
| | 50 | 0.0465 | 0.2546 | 0.2497 | 0.0004 | 0.0126 | 0.0116 | 34.3 | 0.0042 |
| | 120 | 0.0537 | 0.4713 | 0.4442 | 0.0009 | 0.0263 | 0.0242 | 77.9 | 0.0048 |
| | 175 | 0.0712 | 0.7336 | 0.6007 | 0.0016 | 0.0277 | 0.0255 | 140 | 0.0064 |
| | 250 | 0.0760 | 0.3700 | 0.7338 | 0.0023 | 0.0215 | 0.0198 | 201 | 0.0069 |
| | 500 | 0.1241 | 0.6189 | 1.1297 | 0.0034 | 0.0355 | 0.0327 | 345 | 0.0112 |
| | 750 | 0.2075 | 1.0232 | 1.9114 | 0.0057 | 0.0594 | 0.0547 | 571 | 0.0187 |
| | 9999 | 0.6127 | 2.6255 | 8.7489 | 0.0136 | 0.1961 | 0.1804 | 1,355 | 0.0553 |
| Pumps Composite | | 0.0376 | 0.2674 | 0.2854 | 0.0006 | 0.0147 | 0.0135 | 49.6 | 0.0034 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0543 | 0.2436 | 0.2039 | 0.0003 | 0.0128 | 0.0117 | 26.0 | 0.0049 |
| | 120 | 0.0576 | 0.3873 | 0.3799 | 0.0007 | 0.0270 | 0.0249 | 59.0 | 0.0052 |
| | 175 | 0.0774 | 0.6114 | 0.5331 | 0.0012 | 0.0286 | 0.0263 | 108 | 0.0070 |
| | 250 | 0.0842 | 0.3201 | 0.6581 | 0.0017 | 0.0223 | 0.0205 | 153 | 0.0076 |
| | 500 | 0.1151 | 0.4607 | 0.8354 | 0.0022 | 0.0299 | 0.0275 | 219 | 0.0104 |
| Rollers Composite | | 0.0584 | 0.3837 | 0.3793 | 0.0008 | 0.0232 | 0.0214 | 67.0 | 0.0053 |
| Rough Terrain Fo | 50 | 0.0520 | 0.3171 | 0.2556 | 0.0004 | 0.0122 | 0.0113 | 33.9 | 0.0047 |
| | 120 | 0.0495 | 0.4142 | 0.3326 | 0.0007 | 0.0197 | 0.0181 | 62.4 | 0.0045 |
| | 175 | 0.0788 | 0.7229 | 0.4710 | 0.0014 | 0.0245 | 0.0226 | 125 | 0.0071 |
| | 250 | 0.0881 | 0.3442 | 0.5378 | 0.0019 | 0.0182 | 0.0168 | 171 | 0.0079 |
| | 500 | 0.1296 | 0.4936 | 0.7287 | 0.0025 | 0.0265 | 0.0244 | 257 | 0.0117 |
| Rough Terrain Forklifts Compo | | 0.0533 | 0.4464 | 0.3494 | 0.0008 | 0.0201 | 0.0185 | 70.3 | 0.0048 |
| Rubber Tired Doz | 175 | 0.1509 | 0.8124 | 0.9962 | 0.0015 | 0.0561 | 0.0516 | 129 | 0.0136 |
| | 250 | 0.1701 | 0.5279 | 1.2898 | 0.0021 | 0.0516 | 0.0474 | 183 | 0.0153 |
| | 500 | 0.2291 | 0.9276 | 1.6868 | 0.0026 | 0.0673 | 0.0619 | 265 | 0.0207 |
| | 750 | 0.3461 | 1.3934 | 2.5948 | 0.0040 | 0.1024 | 0.0942 | 399 | 0.0312 |
| | 1000 | 0.5438 | 2.2500 | 5.5311 | 0.0060 | 0.1672 | 0.1539 | 592 | 0.0491 |
| Rubber Tired Dozers Compos | | 0.2118 | 0.8006 | 1.5773 | 0.0025 | 0.0630 | 0.0580 | 239 | 0.0191 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0615 | 0.3080 | 0.2424 | 0.0004 | 0.0137 | 0.0126 | 31.1 | 0.0055 |
| | 120 | 0.0563 | 0.3977 | 0.3529 | 0.0007 | 0.0237 | 0.0218 | 58.9 | 0.0051 |
| | 175 | 0.0767 | 0.6215 | 0.4713 | 0.0012 | 0.0253 | 0.0233 | 106 | 0.0069 |
| | 250 | 0.0848 | 0.3159 | 0.5655 | 0.0017 | 0.0194 | 0.0179 | 149 | 0.0077 |
| | 500 | 0.1302 | 0.5016 | 0.8032 | 0.0023 | 0.0291 | 0.0268 | 237 | 0.0118 |
| | 750 | 0.2680 | 1.0271 | 1.6958 | 0.0049 | 0.0606 | 0.0558 | 486 | 0.0242 |
| | 1000 | 0.3484 | 1.3166 | 4.0040 | 0.0060 | 0.0983 | 0.0904 | 594 | 0.0314 |
| Rubber Tired Loaders Compos | | 0.0753 | 0.4406 | 0.4747 | 0.0012 | 0.0235 | 0.0216 | 109 | 0.0068 |
| Scrapers | 120 | 0.1218 | 0.6612 | 0.7170 | 0.0011 | 0.0551 | 0.0507 | 93.9 | 0.0110 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1400 | 0.8921 | 0.9020 | 0.0017 | 0.0505 | 0.0464 | 148 | 0.0126 |
| | 250 | 0.1522 | 0.5044 | 1.1344 | 0.0024 | 0.0412 | 0.0379 | 209 | 0.0137 |
| | 500 | 0.2211 | 0.8455 | 1.5615 | 0.0032 | 0.0584 | 0.0537 | 321 | 0.0200 |
| | 750 | 0.3839 | 1.4588 | 2.7734 | 0.0056 | 0.1024 | 0.0942 | 555 | 0.0346 |
| Scrapers Composite | | 0.1914 | 0.7938 | 1.3434 | 0.0027 | 0.0541 | 0.0497 | 262 | 0.0173 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0502 | 0.2833 | 0.2631 | 0.0005 | 0.0131 | 0.0121 | 36.2 | 0.0045 |
| | 120 | 0.0558 | 0.4946 | 0.4424 | 0.0009 | 0.0264 | 0.0243 | 80.2 | 0.0050 |
| | 175 | 0.0811 | 0.8276 | 0.6279 | 0.0017 | 0.0302 | 0.0277 | 155 | 0.0073 |
| | 250 | 0.1022 | 0.4765 | 0.8737 | 0.0029 | 0.0266 | 0.0245 | 255 | 0.0092 |
| Signal Boards Composite | | 0.0129 | 0.0912 | 0.0912 | 0.0002 | 0.0042 | 0.0038 | 16.7 | 0.0012 |
| Skid Steer Loade | 25 | 0.0171 | 0.0575 | 0.1070 | 0.0002 | 0.0044 | 0.0040 | 13.8 | 0.0015 |
| | 50 | 0.0230 | 0.2006 | 0.1655 | 0.0003 | 0.0043 | 0.0040 | 25.5 | 0.0021 |
| | 120 | 0.0218 | 0.2673 | 0.1647 | 0.0005 | 0.0064 | 0.0059 | 42.8 | 0.0020 |
| Skid Steer Loaders Composite | | 0.0222 | 0.2125 | 0.1614 | 0.0004 | 0.0050 | 0.0046 | 30.3 | 0.0020 |
| Surfacing Equipm | 50 | 0.0265 | 0.1191 | 0.1069 | 0.0002 | 0.0063 | 0.0058 | 14.1 | 0.0024 |
| | 120 | 0.0570 | 0.4028 | 0.4035 | 0.0007 | 0.0271 | 0.0250 | 63.8 | 0.0051 |
| | 175 | 0.0550 | 0.4663 | 0.4168 | 0.0010 | 0.0210 | 0.0193 | 85.8 | 0.0050 |
| | 250 | 0.0652 | 0.2754 | 0.5719 | 0.0015 | 0.0188 | 0.0173 | 135 | 0.0059 |
| | 500 | 0.1008 | 0.4728 | 0.8400 | 0.0022 | 0.0288 | 0.0265 | 221 | 0.0091 |
| | 750 | 0.1599 | 0.7413 | 1.3593 | 0.0035 | 0.0459 | 0.0423 | 347 | 0.0144 |
| Surfacing Equipment Compos | | 0.0823 | 0.3953 | 0.6593 | 0.0017 | 0.0239 | 0.0220 | 166 | 0.0074 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0430 | 0.2898 | 0.2365 | 0.0004 | 0.0098 | 0.0090 | 31.6 | 0.0039 |
| | 120 | 0.0555 | 0.4959 | 0.3694 | 0.0009 | 0.0210 | 0.0193 | 75.0 | 0.0050 |
| | 175 | 0.0845 | 0.8043 | 0.4869 | 0.0016 | 0.0253 | 0.0233 | 139 | 0.0076 |
| | 250 | 0.0803 | 0.3198 | 0.4530 | 0.0018 | 0.0152 | 0.0140 | 162 | 0.0072 |
| Sweepers/Scrubbers Compos | | 0.0584 | 0.4916 | 0.3563 | 0.0009 | 0.0183 | 0.0169 | 78.5 | 0.0053 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0046 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0407 | 0.2760 | 0.2179 | 0.0004 | 0.0087 | 0.0080 | 30.3 | 0.0037 |
| | 120 | 0.0366 | 0.3402 | 0.2466 | 0.0006 | 0.0129 | 0.0119 | 51.7 | 0.0033 |
| | 175 | 0.0571 | 0.5841 | 0.3220 | 0.0011 | 0.0159 | 0.0146 | 101 | 0.0052 |
| | 250 | 0.0813 | 0.3445 | 0.4427 | 0.0019 | 0.0151 | 0.0139 | 172 | 0.0073 |
| | 500 | 0.1606 | 0.6642 | 0.8132 | 0.0039 | 0.0294 | 0.0270 | 345 | 0.0145 |
| | 750 | 0.2409 | 0.9959 | 1.2387 | 0.0058 | 0.0443 | 0.0408 | 517 | 0.0217 |
| Tractors/Loaders/Backhoes C | | 0.0436 | 0.3616 | 0.2744 | 0.0008 | 0.0134 | 0.0124 | 66.8 | 0.0039 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0990 | 0.3495 | 0.2804 | 0.0004 | 0.0218 | 0.0201 | 32.9 | 0.0089 |
| | 120 | 0.0849 | 0.4443 | 0.5223 | 0.0008 | 0.0408 | 0.0375 | 64.9 | 0.0077 |
| | 175 | 0.1346 | 0.8393 | 0.9412 | 0.0016 | 0.0521 | 0.0479 | 144 | 0.0121 |
| | 250 | 0.1600 | 0.5472 | 1.3120 | 0.0025 | 0.0487 | 0.0448 | 223 | 0.0144 |
| | 500 | 0.2092 | 0.8710 | 1.6487 | 0.0031 | 0.0623 | 0.0573 | 311 | 0.0189 |
| | 750 | 0.3964 | 1.6395 | 3.1894 | 0.0059 | 0.1191 | 0.1095 | 587 | 0.0358 |
| Trenchers Composite | | 0.0933 | 0.4270 | 0.4575 | 0.0007 | 0.0336 | 0.0309 | 58.7 | 0.0084 |
| Welders | 15 | 0.0080 | 0.0388 | 0.0498 | 0.0001 | 0.0025 | 0.0023 | 6.2 | 0.0007 |
| | 25 | 0.0153 | 0.0492 | 0.0903 | 0.0001 | 0.0042 | 0.0039 | 11.3 | 0.0014 |
| | 50 | 0.0435 | 0.2219 | 0.1968 | 0.0003 | 0.0110 | 0.0102 | 26.0 | 0.0039 |
| | 120 | 0.0321 | 0.2508 | 0.2344 | 0.0005 | 0.0153 | 0.0140 | 39.5 | 0.0029 |
| | 175 | 0.0600 | 0.5396 | 0.4393 | 0.0011 | 0.0223 | 0.0205 | 98.2 | 0.0054 |
| | 250 | 0.0551 | 0.2294 | 0.4536 | 0.0013 | 0.0142 | 0.0130 | 119 | 0.0050 |
| | 500 | 0.0748 | 0.3117 | 0.5690 | 0.0016 | 0.0192 | 0.0176 | 168 | 0.0067 |
| Welders Composite | | 0.0310 | 0.1816 | 0.1735 | 0.0003 | 0.0102 | 0.0094 | 25.6 | 0.0028 |

**San Diego 2025 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,343,732.35 | ########### | 8,492,736.38 | 0.02 | 0.71 | 0.09 | 223.96 | 0.05 | 0.04 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 6,282.20 | 213,159.29 | 39,008.92 | 0.01 | 0.09 | 0.31 | 246.18 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 198,419.75 | 7,123,689.46 | 1,204,641.90 | 0.02 | 1.09 | 0.12 | 276.49 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 240.83 | 8,707.20 | 1,432.14 | 0.02 | 0.13 | 0.37 | 242.28 | 0.06 | 0.05 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 479,791.14 | ########### | 3,017,273.36 | 0.01 | 0.73 | 0.08 | 343.84 | 0.05 | 0.04 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 211.77 | 7,665.63 | 1,309.49 | 0.02 | 0.11 | 0.40 | 268.51 | 0.06 | 0.05 | 0.00 | | |
| Average | | | | | | | 0.019 | 0.478 | 0.227 | 266.878 | 0.052 | 0.042 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,476 | 582,978 | - | 0.22 | 1.01 | 2.06 | 1541.82 | 0.07 | 0.10 | 0.02 | | |

Source: EMFAC 2011

## 2025 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0132 | 0.0451 | 0.0838 | 0.0001 | 0.0032 | 0.0030 | 11.0 | 0.0012 |
| | 50 | 0.0168 | 0.1351 | 0.1218 | 0.0003 | 0.0035 | 0.0032 | 19.6 | 0.0015 |
| | 120 | 0.0176 | 0.2265 | 0.1496 | 0.0004 | 0.0063 | 0.0058 | 38.1 | 0.0016 |
| | 500 | 0.0580 | 0.3710 | 0.3660 | 0.0021 | 0.0109 | 0.0100 | 213 | 0.0052 |
| | 750 | 0.1054 | 0.6706 | 0.6753 | 0.0039 | 0.0199 | 0.0183 | 385 | 0.0095 |
| Aerial Lifts Composite | | 0.0184 | 0.1646 | 0.1366 | 0.0004 | 0.0048 | 0.0044 | 34.7 | 0.0017 |
| Air Compressors | 15 | 0.0087 | 0.0444 | 0.0545 | 0.0001 | 0.0023 | 0.0022 | 7.2 | 0.0008 |
| | 25 | 0.0181 | 0.0605 | 0.1121 | 0.0002 | 0.0045 | 0.0042 | 14.4 | 0.0016 |
| | 50 | 0.0263 | 0.1911 | 0.1476 | 0.0003 | 0.0047 | 0.0043 | 22.3 | 0.0024 |
| | 120 | 0.0289 | 0.3023 | 0.1928 | 0.0006 | 0.0088 | 0.0081 | 47.0 | 0.0026 |
| | 175 | 0.0424 | 0.4998 | 0.2187 | 0.0010 | 0.0104 | 0.0095 | 88.5 | 0.0038 |
| | 250 | 0.0514 | 0.2531 | 0.2553 | 0.0015 | 0.0078 | 0.0072 | 131 | 0.0046 |
| | 500 | 0.0894 | 0.4292 | 0.4150 | 0.0023 | 0.0134 | 0.0123 | 232 | 0.0081 |
| | 750 | 0.1385 | 0.6633 | 0.6545 | 0.0036 | 0.0210 | 0.0193 | 358 | 0.0125 |
| | 1000 | 0.1999 | 0.9265 | 2.5439 | 0.0049 | 0.0483 | 0.0444 | 486 | 0.0180 |
| Air Compressors Composite | | 0.0349 | 0.3027 | 0.2104 | 0.0007 | 0.0088 | 0.0081 | 63.6 | 0.0031 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0190 | 0.2200 | 0.1662 | 0.0004 | 0.0009 | 0.0008 | 31.0 | 0.0017 |
| | 120 | 0.0252 | 0.4660 | 0.1955 | 0.0009 | 0.0020 | 0.0018 | 77.1 | 0.0023 |
| | 175 | 0.0324 | 0.7542 | 0.0787 | 0.0016 | 0.0030 | 0.0027 | 141 | 0.0029 |
| | 250 | 0.0427 | 0.3426 | 0.0981 | 0.0021 | 0.0035 | 0.0032 | 188 | 0.0039 |
| | 500 | 0.0706 | 0.5512 | 0.1622 | 0.0031 | 0.0058 | 0.0054 | 311 | 0.0064 |
| | 750 | 0.1396 | 1.0891 | 0.3204 | 0.0062 | 0.0115 | 0.0106 | 615 | 0.0126 |
| | 1000 | 0.2115 | 1.6437 | 3.8912 | 0.0093 | 0.0364 | 0.0335 | 928 | 0.0191 |
| Bore/Drill Rigs Composite | | 0.0428 | 0.5007 | 0.2864 | 0.0017 | 0.0042 | 0.0038 | 165 | 0.0039 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0213 | 0.0724 | 0.1346 | 0.0002 | 0.0052 | 0.0048 | 17.6 | 0.0019 |
| Cement and Mortar Mixers Co | | 0.0085 | 0.0414 | 0.0534 | 0.0001 | 0.0021 | 0.0019 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0279 | 0.2284 | 0.1910 | 0.0004 | 0.0053 | 0.0049 | 30.2 | 0.0025 |
| | 120 | 0.0370 | 0.4561 | 0.2840 | 0.0009 | 0.0117 | 0.0108 | 74.1 | 0.0033 |
| | 175 | 0.0623 | 0.8663 | 0.3523 | 0.0018 | 0.0160 | 0.0147 | 160 | 0.0056 |
| Concrete/Industrial Saws Com | | 0.0337 | 0.3706 | 0.2471 | 0.0007 | 0.0093 | 0.0086 | 58.5 | 0.0030 |
| Cranes | 50 | 0.0350 | 0.2256 | 0.1644 | 0.0003 | 0.0062 | 0.0057 | 23.2 | 0.0032 |
| | 120 | 0.0376 | 0.3384 | 0.2298 | 0.0006 | 0.0120 | 0.0111 | 50.1 | 0.0034 |
| | 175 | 0.0462 | 0.4744 | 0.2300 | 0.0009 | 0.0120 | 0.0110 | 80.3 | 0.0042 |
| | 250 | 0.0544 | 0.2316 | 0.2705 | 0.0013 | 0.0094 | 0.0087 | 112 | 0.0049 |
| | 500 | 0.0858 | 0.3535 | 0.3977 | 0.0018 | 0.0146 | 0.0134 | 180 | 0.0077 |
| | 750 | 0.1446 | 0.5947 | 0.6821 | 0.0030 | 0.0248 | 0.0228 | 303 | 0.0130 |
| | 9999 | 0.5219 | 1.9715 | 5.5760 | 0.0098 | 0.1146 | 0.1055 | 971 | 0.0471 |
| Cranes Composite | | 0.0681 | 0.3738 | 0.4223 | 0.0014 | 0.0143 | 0.0132 | 129 | 0.0061 |
| Crawler Tractors | 50 | 0.0487 | 0.2566 | 0.1842 | 0.0003 | 0.0090 | 0.0083 | 24.9 | 0.0044 |
| | 120 | 0.0609 | 0.4537 | 0.3562 | 0.0008 | 0.0221 | 0.0203 | 65.8 | 0.0055 |
| | 175 | 0.0823 | 0.7265 | 0.4447 | 0.0014 | 0.0241 | 0.0222 | 121 | 0.0074 |
| | 250 | 0.0924 | 0.3662 | 0.5348 | 0.0019 | 0.0192 | 0.0177 | 166 | 0.0083 |
| | 500 | 0.1392 | 0.5877 | 0.7527 | 0.0025 | 0.0280 | 0.0258 | 259 | 0.0126 |
| | 750 | 0.2506 | 1.0528 | 1.3878 | 0.0047 | 0.0510 | 0.0469 | 465 | 0.0226 |
| | 1000 | 0.3749 | 1.5618 | 4.2168 | 0.0066 | 0.0958 | 0.0881 | 658 | 0.0338 |
| Crawler Tractors Composite | | 0.0789 | 0.5065 | 0.4492 | 0.0013 | 0.0227 | 0.0209 | 114 | 0.0071 |
| Crushing/Proc. E | 50 | 0.0508 | 0.3859 | 0.2899 | 0.0006 | 0.0083 | 0.0077 | 44.0 | 0.0046 |
| | 120 | 0.0506 | 0.5406 | 0.3289 | 0.0010 | 0.0140 | 0.0129 | 83.1 | 0.0046 |
| | 175 | 0.0795 | 0.9556 | 0.3830 | 0.0019 | 0.0177 | 0.0163 | 167 | 0.0072 |
| | 250 | 0.0967 | 0.4768 | 0.4357 | 0.0028 | 0.0134 | 0.0123 | 245 | 0.0087 |
| | 500 | 0.1459 | 0.6977 | 0.6163 | 0.0037 | 0.0200 | 0.0184 | 374 | 0.0132 |
| | 750 | 0.2307 | 1.1003 | 0.9907 | 0.0059 | 0.0316 | 0.0291 | 589 | 0.0208 |
| | 9999 | 0.6019 | 2.5014 | 6.6977 | 0.0131 | 0.1238 | 0.1139 | 1,308 | 0.0543 |
| Crushing/Proc. Equipment Co | | 0.0693 | 0.6187 | 0.3763 | 0.0015 | 0.0146 | 0.0134 | 132 | 0.0062 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0297 | 0.2365 | 0.1616 | 0.0003 | 0.0035 | 0.0032 | 25.0 | 0.0027 |
| | 120 | 0.0448 | 0.4942 | 0.2638 | 0.0009 | 0.0092 | 0.0085 | 73.6 | 0.0040 |
| | 175 | 0.0518 | 0.6636 | 0.1982 | 0.0013 | 0.0091 | 0.0084 | 112 | 0.0047 |
| | 250 | 0.0647 | 0.3210 | 0.2222 | 0.0018 | 0.0074 | 0.0068 | 159 | 0.0058 |
| | 500 | 0.0946 | 0.4495 | 0.3091 | 0.0023 | 0.0107 | 0.0098 | 234 | 0.0085 |
| | 750 | 0.1569 | 0.7451 | 0.5194 | 0.0039 | 0.0178 | 0.0164 | 387 | 0.0142 |
| Excavators Composite | | 0.0559 | 0.5086 | 0.2269 | 0.0013 | 0.0086 | 0.0079 | 120 | 0.0050 |
| Forklifts | 50 | 0.0150 | 0.1361 | 0.0904 | 0.0002 | 0.0013 | 0.0012 | 14.7 | 0.0014 |
| | 120 | 0.0168 | 0.2086 | 0.0997 | 0.0004 | 0.0023 | 0.0021 | 31.2 | 0.0015 |
| | 175 | 0.0228 | 0.3310 | 0.0732 | 0.0006 | 0.0029 | 0.0026 | 56.1 | 0.0021 |
| | 250 | 0.0289 | 0.1551 | 0.0746 | 0.0009 | 0.0027 | 0.0024 | 77.1 | 0.0026 |
| | 500 | 0.0416 | 0.2123 | 0.1038 | 0.0011 | 0.0038 | 0.0035 | 111 | 0.0038 |
| Forklifts Composite | | 0.0236 | 0.2148 | 0.0860 | 0.0006 | 0.0025 | 0.0023 | 54.4 | 0.0021 |
| Generator Sets | 15 | 0.0109 | 0.0627 | 0.0768 | 0.0002 | 0.0032 | 0.0030 | 10.2 | 0.0010 |
| | 25 | 0.0216 | 0.0738 | 0.1368 | 0.0002 | 0.0055 | 0.0050 | 17.6 | 0.0019 |
| | 50 | 0.0242 | 0.2034 | 0.1881 | 0.0004 | 0.0051 | 0.0047 | 30.6 | 0.0022 |
| | 120 | 0.0340 | 0.4585 | 0.3022 | 0.0009 | 0.0122 | 0.0112 | 77.9 | 0.0031 |
| | 175 | 0.0469 | 0.7328 | 0.3291 | 0.0016 | 0.0136 | 0.0125 | 142 | 0.0042 |
| | 250 | 0.0558 | 0.3746 | 0.3885 | 0.0024 | 0.0108 | 0.0099 | 213 | 0.0050 |
| | 500 | 0.0862 | 0.5820 | 0.5697 | 0.0033 | 0.0167 | 0.0153 | 337 | 0.0078 |
| | 750 | 0.1401 | 0.9395 | 0.9382 | 0.0055 | 0.0272 | 0.0250 | 544 | 0.0126 |
| | 9999 | 0.3235 | 1.8648 | 5.2188 | 0.0105 | 0.0888 | 0.0817 | 1,049 | 0.0292 |
| Generator Sets Composite | | 0.0288 | 0.2667 | 0.2329 | 0.0007 | 0.0081 | 0.0074 | 61.0 | 0.0026 |
| Graders | 50 | 0.0382 | 0.2599 | 0.1877 | 0.0004 | 0.0063 | 0.0058 | 27.5 | 0.0034 |
| | 120 | 0.0521 | 0.5009 | 0.3219 | 0.0009 | 0.0153 | 0.0141 | 75.0 | 0.0047 |
| | 175 | 0.0652 | 0.7261 | 0.3117 | 0.0014 | 0.0157 | 0.0144 | 124 | 0.0059 |
| | 250 | 0.0781 | 0.3549 | 0.3652 | 0.0019 | 0.0129 | 0.0119 | 172 | 0.0071 |
| | 500 | 0.1023 | 0.4610 | 0.4468 | 0.0023 | 0.0165 | 0.0152 | 229 | 0.0092 |
| | 750 | 0.2167 | 0.9755 | 0.9628 | 0.0049 | 0.0353 | 0.0324 | 486 | 0.0196 |
| Graders Composite | | 0.0676 | 0.5696 | 0.3314 | 0.0015 | 0.0147 | 0.0135 | 133 | 0.0061 |
| Off-Highway Trac | 120 | 0.1108 | 0.6619 | 0.6362 | 0.0011 | 0.0455 | 0.0419 | 93.7 | 0.0100 |
| | 175 | 0.1110 | 0.7932 | 0.6639 | 0.0015 | 0.0370 | 0.0341 | 130 | 0.0100 |
| | 250 | 0.0890 | 0.3179 | 0.5983 | 0.0015 | 0.0227 | 0.0208 | 130 | 0.0080 |
| | 750 | 0.3692 | 1.5358 | 2.4157 | 0.0057 | 0.0918 | 0.0844 | 568 | 0.0333 |
| | 1000 | 0.5623 | 2.3619 | 6.0896 | 0.0082 | 0.1577 | 0.1451 | 814 | 0.0507 |
| Off-Highway Tractors Compos | | 0.1134 | 0.6101 | 0.7291 | 0.0017 | 0.0331 | 0.0305 | 151 | 0.0102 |
| Off-Highway Truc | 175 | 0.0622 | 0.7536 | 0.2376 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0056 |
| | 250 | 0.0730 | 0.3435 | 0.2521 | 0.0019 | 0.0085 | 0.0078 | 167 | 0.0066 |
| | 500 | 0.1183 | 0.5319 | 0.3878 | 0.0027 | 0.0135 | 0.0124 | 272 | 0.0107 |
| | 750 | 0.1921 | 0.8627 | 0.6384 | 0.0044 | 0.0221 | 0.0203 | 442 | 0.0173 |
| | 1000 | 0.2823 | 1.2403 | 3.1782 | 0.0063 | 0.0546 | 0.0502 | 625 | 0.0255 |
| Off-Highway Trucks Composit | | 0.1140 | 0.5385 | 0.4769 | 0.0027 | 0.0142 | 0.0131 | 260 | 0.0103 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0244 | 0.2188 | 0.1693 | 0.0004 | 0.0034 | 0.0031 | 28.0 | 0.0022 |
| | 120 | 0.0379 | 0.5045 | 0.2730 | 0.0009 | 0.0087 | 0.0080 | 80.9 | 0.0034 |
| | 175 | 0.0384 | 0.5858 | 0.1729 | 0.0012 | 0.0075 | 0.0069 | 107 | 0.0035 |
| | 500 | 0.0792 | 0.4606 | 0.3034 | 0.0025 | 0.0099 | 0.0091 | 254 | 0.0071 |
| Other Construction Equipment | | 0.0442 | 0.3474 | 0.2021 | 0.0013 | 0.0069 | 0.0063 | 123 | 0.0040 |
| Other General Inc | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0298 | 0.2099 | 0.1491 | 0.0003 | 0.0047 | 0.0043 | 21.7 | 0.0027 |
| | 120 | 0.0436 | 0.4189 | 0.2603 | 0.0007 | 0.0120 | 0.0111 | 62.0 | 0.0039 |
| | 175 | 0.0519 | 0.5684 | 0.2412 | 0.0011 | 0.0115 | 0.0106 | 95.9 | 0.0047 |
| | 250 | 0.0608 | 0.2743 | 0.2679 | 0.0015 | 0.0083 | 0.0076 | 136 | 0.0055 |
| | 500 | 0.1174 | 0.5103 | 0.4826 | 0.0026 | 0.0157 | 0.0145 | 265 | 0.0106 |
| | 750 | 0.1939 | 0.8411 | 0.8117 | 0.0044 | 0.0262 | 0.0241 | 437 | 0.0175 |
| | 1000 | 0.2627 | 1.1060 | 2.9924 | 0.0056 | 0.0579 | 0.0533 | 560 | 0.0237 |
| Other General Industrial Equip | | 0.0747 | 0.4438 | 0.3947 | 0.0016 | 0.0130 | 0.0120 | 152 | 0.0067 |
| Other Material Ha | 50 | 0.0410 | 0.2893 | 0.2073 | 0.0004 | 0.0065 | 0.0060 | 30.3 | 0.0037 |
| | 120 | 0.0421 | 0.4076 | 0.2541 | 0.0007 | 0.0117 | 0.0108 | 60.7 | 0.0038 |
| | 175 | 0.0653 | 0.7197 | 0.3067 | 0.0014 | 0.0146 | 0.0134 | 122 | 0.0059 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0642 | 0.2920 | 0.2863 | 0.0016 | 0.0088 | 0.0081 | 145 | 0.0058 |
| | 500 | 0.0837 | 0.3670 | 0.3482 | 0.0019 | 0.0113 | 0.0104 | 192 | 0.0075 |
| | 9999 | 0.3781 | 1.4596 | 3.9555 | 0.0073 | 0.0764 | 0.0703 | 741 | 0.0341 |
| Other Material Handling Equip | | 0.0696 | 0.4355 | 0.3844 | 0.0015 | 0.0124 | 0.0114 | 141 | 0.0063 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1422 | 0.0002 | 0.0053 | 0.0049 | 18.7 | 0.0020 |
| | 50 | 0.0574 | 0.2803 | 0.2102 | 0.0004 | 0.0114 | 0.0105 | 28.0 | 0.0052 |
| | 120 | 0.0662 | 0.4696 | 0.4003 | 0.0008 | 0.0263 | 0.0242 | 69.2 | 0.0060 |
| | 175 | 0.0899 | 0.7543 | 0.5238 | 0.0014 | 0.0286 | 0.0263 | 128 | 0.0081 |
| | 250 | 0.1097 | 0.4287 | 0.7020 | 0.0022 | 0.0254 | 0.0234 | 194 | 0.0099 |
| | 500 | 0.1263 | 0.5374 | 0.7572 | 0.0023 | 0.0284 | 0.0261 | 233 | 0.0114 |
| Pavers Composite | | 0.0717 | 0.4745 | 0.3858 | 0.0009 | 0.0220 | 0.0202 | 77.9 | 0.0065 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0469 | 0.2355 | 0.1789 | 0.0003 | 0.0095 | 0.0088 | 23.9 | 0.0042 |
| | 120 | 0.0503 | 0.3671 | 0.3092 | 0.0006 | 0.0200 | 0.0184 | 54.5 | 0.0045 |
| | 175 | 0.0687 | 0.5900 | 0.4021 | 0.0011 | 0.0219 | 0.0201 | 101 | 0.0062 |
| | 250 | 0.0672 | 0.2648 | 0.4289 | 0.0014 | 0.0154 | 0.0141 | 122 | 0.0061 |
| Paving Equipment Composite | | 0.0548 | 0.3993 | 0.3281 | 0.0008 | 0.0190 | 0.0175 | 68.9 | 0.0049 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0052 | 0.0301 | 0.0368 | 0.0001 | 0.0015 | 0.0014 | 4.9 | 0.0005 |
| | 25 | 0.0087 | 0.0299 | 0.0555 | 0.0001 | 0.0022 | 0.0020 | 7.1 | 0.0008 |
| | 50 | 0.0079 | 0.0810 | 0.0843 | 0.0002 | 0.0019 | 0.0018 | 14.3 | 0.0007 |
| | 120 | 0.0082 | 0.1351 | 0.0897 | 0.0003 | 0.0031 | 0.0029 | 24.1 | 0.0007 |
| Pressure Washers Composite | | 0.0066 | 0.0531 | 0.0561 | 0.0001 | 0.0019 | 0.0017 | 9.4 | 0.0006 |
| Pumps | 15 | 0.0089 | 0.0456 | 0.0560 | 0.0001 | 0.0024 | 0.0022 | 7.4 | 0.0008 |
| | 25 | 0.0244 | 0.0816 | 0.1512 | 0.0002 | 0.0061 | 0.0056 | 19.5 | 0.0022 |
| | 50 | 0.0299 | 0.2394 | 0.2138 | 0.0004 | 0.0061 | 0.0056 | 34.3 | 0.0027 |
| | 120 | 0.0365 | 0.4656 | 0.3062 | 0.0009 | 0.0129 | 0.0119 | 77.9 | 0.0033 |
| | 175 | 0.0499 | 0.7342 | 0.3301 | 0.0016 | 0.0142 | 0.0130 | 140 | 0.0045 |
| | 250 | 0.0572 | 0.3604 | 0.3745 | 0.0023 | 0.0107 | 0.0098 | 201 | 0.0052 |
| | 500 | 0.0959 | 0.6034 | 0.5922 | 0.0034 | 0.0178 | 0.0163 | 345 | 0.0087 |
| | 750 | 0.1593 | 0.9975 | 0.9991 | 0.0057 | 0.0297 | 0.0274 | 571 | 0.0144 |
| | 9999 | 0.4488 | 2.4388 | 6.8114 | 0.0136 | 0.1186 | 0.1091 | 1,355 | 0.0405 |
| Pumps Composite | | 0.0270 | 0.2617 | 0.2079 | 0.0006 | 0.0078 | 0.0072 | 49.6 | 0.0024 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0345 | 0.2258 | 0.1776 | 0.0003 | 0.0068 | 0.0062 | 26.0 | 0.0031 |
| | 120 | 0.0392 | 0.3801 | 0.2647 | 0.0007 | 0.0137 | 0.0126 | 59.0 | 0.0035 |
| | 175 | 0.0553 | 0.6096 | 0.3030 | 0.0012 | 0.0156 | 0.0143 | 108 | 0.0050 |
| | 250 | 0.0656 | 0.3037 | 0.3629 | 0.0017 | 0.0127 | 0.0116 | 153 | 0.0059 |
| | 500 | 0.0920 | 0.4189 | 0.4752 | 0.0022 | 0.0174 | 0.0160 | 219 | 0.0083 |
| Rollers Composite | | 0.0410 | 0.3763 | 0.2501 | 0.0008 | 0.0122 | 0.0113 | 67.0 | 0.0037 |
| Rough Terrain Fo | 50 | 0.0381 | 0.3041 | 0.2193 | 0.0004 | 0.0054 | 0.0049 | 33.9 | 0.0034 |
| | 120 | 0.0369 | 0.4106 | 0.2316 | 0.0007 | 0.0087 | 0.0080 | 62.4 | 0.0033 |
| | 175 | 0.0569 | 0.7229 | 0.2450 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0051 |
| | 250 | 0.0671 | 0.3372 | 0.2625 | 0.0019 | 0.0084 | 0.0077 | 171 | 0.0061 |
| | 500 | 0.0999 | 0.4838 | 0.3682 | 0.0025 | 0.0123 | 0.0113 | 257 | 0.0090 |
| Rough Terrain Forklifts Compo | | 0.0396 | 0.4430 | 0.2336 | 0.0008 | 0.0090 | 0.0083 | 70.3 | 0.0036 |
| Rubber Tired Doz | 175 | 0.1163 | 0.8019 | 0.6895 | 0.0015 | 0.0386 | 0.0355 | 129 | 0.0105 |
| | 250 | 0.1329 | 0.4624 | 0.8841 | 0.0021 | 0.0340 | 0.0312 | 183 | 0.0120 |
| | 500 | 0.1817 | 0.7490 | 1.1543 | 0.0026 | 0.0448 | 0.0412 | 265 | 0.0164 |
| | 750 | 0.2747 | 1.1262 | 1.7818 | 0.0040 | 0.0684 | 0.0629 | 399 | 0.0248 |
| | 1000 | 0.4321 | 1.7954 | 4.5523 | 0.0060 | 0.1202 | 0.1106 | 592 | 0.0390 |
| Rubber Tired Dozers Compos | | 0.1672 | 0.6620 | 1.0824 | 0.0025 | 0.0419 | 0.0385 | 239 | 0.0151 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0418 | 0.2904 | 0.2109 | 0.0004 | 0.0069 | 0.0063 | 31.1 | 0.0038 |
| | 120 | 0.0397 | 0.3916 | 0.2476 | 0.0007 | 0.0115 | 0.0105 | 58.9 | 0.0036 |
| | 175 | 0.0546 | 0.6199 | 0.2592 | 0.0012 | 0.0130 | 0.0119 | 106 | 0.0049 |
| | 250 | 0.0661 | 0.3041 | 0.3040 | 0.0017 | 0.0107 | 0.0099 | 149 | 0.0060 |
| | 500 | 0.1034 | 0.4654 | 0.4455 | 0.0023 | 0.0164 | 0.0151 | 237 | 0.0093 |
| | 750 | 0.2119 | 0.9532 | 0.9273 | 0.0049 | 0.0338 | 0.0311 | 486 | 0.0191 |
| | 1000 | 0.2701 | 1.1927 | 3.2272 | 0.0060 | 0.0615 | 0.0566 | 594 | 0.0244 |
| Rubber Tired Loaders Compos | | 0.0559 | 0.4311 | 0.2835 | 0.0012 | 0.0121 | 0.0111 | 109 | 0.0050 |
| Scrapers | 120 | 0.0887 | 0.6472 | 0.5218 | 0.0011 | 0.0330 | 0.0303 | 93.9 | 0.0080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1025 | 0.8864 | 0.5654 | 0.0017 | 0.0307 | 0.0282 | 148 | 0.0092 |
| | 250 | 0.1187 | 0.4642 | 0.7040 | 0.0024 | 0.0254 | 0.0234 | 209 | 0.0107 |
| | 500 | 0.1755 | 0.7332 | 0.9727 | 0.0032 | 0.0364 | 0.0335 | 321 | 0.0158 |
| | 750 | 0.3043 | 1.2657 | 1.7266 | 0.0056 | 0.0638 | 0.0587 | 555 | 0.0275 |
| Scrapers Composite | | 0.1495 | 0.7187 | 0.8387 | 0.0027 | 0.0335 | 0.0308 | 262 | 0.0135 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0332 | 0.2686 | 0.2268 | 0.0005 | 0.0063 | 0.0058 | 36.2 | 0.0030 |
| | 120 | 0.0394 | 0.4898 | 0.3076 | 0.0009 | 0.0127 | 0.0116 | 80.2 | 0.0036 |
| | 175 | 0.0587 | 0.8292 | 0.3433 | 0.0017 | 0.0152 | 0.0139 | 155 | 0.0053 |
| | 250 | 0.0794 | 0.4676 | 0.4435 | 0.0029 | 0.0132 | 0.0121 | 255 | 0.0072 |
| Signal Boards Composite | | 0.0111 | 0.0909 | 0.0718 | 0.0002 | 0.0029 | 0.0026 | 16.7 | 0.0010 |
| Skid Steer Loade | 25 | 0.0167 | 0.0568 | 0.1055 | 0.0002 | 0.0040 | 0.0037 | 13.8 | 0.0015 |
| | 50 | 0.0194 | 0.1977 | 0.1446 | 0.0003 | 0.0015 | 0.0014 | 25.5 | 0.0017 |
| | 120 | 0.0175 | 0.2665 | 0.1240 | 0.0005 | 0.0022 | 0.0020 | 42.8 | 0.0016 |
| Skid Steer Loaders Composite | | 0.0186 | 0.2104 | 0.1354 | 0.0004 | 0.0019 | 0.0018 | 30.3 | 0.0017 |
| Surfacing Equipm | 50 | 0.0171 | 0.1105 | 0.0934 | 0.0002 | 0.0035 | 0.0033 | 14.1 | 0.0015 |
| | 120 | 0.0385 | 0.3950 | 0.2869 | 0.0007 | 0.0146 | 0.0134 | 63.8 | 0.0035 |
| | 175 | 0.0386 | 0.4642 | 0.2429 | 0.0010 | 0.0119 | 0.0109 | 85.8 | 0.0035 |
| | 250 | 0.0504 | 0.2604 | 0.3275 | 0.0015 | 0.0111 | 0.0103 | 135 | 0.0045 |
| | 500 | 0.0800 | 0.4236 | 0.4893 | 0.0022 | 0.0174 | 0.0160 | 221 | 0.0072 |
| | 750 | 0.1260 | 0.6643 | 0.7833 | 0.0035 | 0.0275 | 0.0253 | 347 | 0.0114 |
| Surfacing Equipment Compos | | 0.0638 | 0.3590 | 0.3924 | 0.0017 | 0.0142 | 0.0131 | 166 | 0.0058 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0308 | 0.2762 | 0.1942 | 0.0004 | 0.0033 | 0.0031 | 31.6 | 0.0028 |
| | 120 | 0.0395 | 0.4895 | 0.2530 | 0.0009 | 0.0068 | 0.0062 | 75.0 | 0.0036 |
| | 175 | 0.0565 | 0.8005 | 0.2201 | 0.0016 | 0.0084 | 0.0077 | 139 | 0.0051 |
| | 250 | 0.0587 | 0.3179 | 0.1898 | 0.0018 | 0.0062 | 0.0057 | 162 | 0.0053 |
| Sweepers/Scrubbers Composi | | 0.0410 | 0.4840 | 0.2255 | 0.0009 | 0.0061 | 0.0056 | 78.5 | 0.0037 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0045 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0316 | 0.2678 | 0.1895 | 0.0004 | 0.0037 | 0.0034 | 30.3 | 0.0029 |
| | 120 | 0.0281 | 0.3379 | 0.1761 | 0.0006 | 0.0055 | 0.0051 | 51.7 | 0.0025 |
| | 175 | 0.0420 | 0.5839 | 0.1613 | 0.0011 | 0.0072 | 0.0066 | 101 | 0.0038 |
| | 250 | 0.0633 | 0.3389 | 0.2157 | 0.0019 | 0.0073 | 0.0067 | 172 | 0.0057 |
| | 500 | 0.1263 | 0.6506 | 0.4127 | 0.0039 | 0.0144 | 0.0132 | 345 | 0.0114 |
| | 750 | 0.1896 | 0.9760 | 0.6256 | 0.0058 | 0.0216 | 0.0199 | 517 | 0.0171 |
| Tractors/Loaders/Backhoes Co | | 0.0336 | 0.3586 | 0.1857 | 0.0008 | 0.0059 | 0.0054 | 66.8 | 0.0030 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0687 | 0.3197 | 0.2467 | 0.0004 | 0.0140 | 0.0129 | 32.9 | 0.0062 |
| | 120 | 0.0625 | 0.4341 | 0.3863 | 0.0008 | 0.0259 | 0.0239 | 64.9 | 0.0056 |
| | 175 | 0.1009 | 0.8327 | 0.6152 | 0.0016 | 0.0338 | 0.0311 | 144 | 0.0091 |
| | 250 | 0.1247 | 0.4925 | 0.8480 | 0.0025 | 0.0309 | 0.0285 | 223 | 0.0112 |
| | 500 | 0.1661 | 0.7370 | 1.0663 | 0.0031 | 0.0400 | 0.0368 | 311 | 0.0150 |
| | 750 | 0.3147 | 1.3882 | 2.0666 | 0.0059 | 0.0766 | 0.0705 | 587 | 0.0284 |
| Trenchers Composite | | 0.0674 | 0.4085 | 0.3481 | 0.0007 | 0.0215 | 0.0198 | 58.7 | 0.0061 |
| Welders | 15 | 0.0075 | 0.0381 | 0.0468 | 0.0001 | 0.0020 | 0.0018 | 6.2 | 0.0007 |
| | 25 | 0.0141 | 0.0473 | 0.0876 | 0.0001 | 0.0035 | 0.0033 | 11.3 | 0.0013 |
| | 50 | 0.0280 | 0.2077 | 0.1684 | 0.0003 | 0.0053 | 0.0048 | 26.0 | 0.0025 |
| | 120 | 0.0223 | 0.2476 | 0.1601 | 0.0005 | 0.0073 | 0.0067 | 39.5 | 0.0020 |
| | 175 | 0.0430 | 0.5400 | 0.2396 | 0.0011 | 0.0111 | 0.0103 | 98.2 | 0.0039 |
| | 250 | 0.0423 | 0.2236 | 0.2294 | 0.0013 | 0.0069 | 0.0064 | 119 | 0.0038 |
| | 500 | 0.0585 | 0.3040 | 0.2969 | 0.0016 | 0.0095 | 0.0087 | 168 | 0.0053 |
| Welders Composite | | 0.0214 | 0.1745 | 0.1373 | 0.0003 | 0.0052 | 0.0048 | 25.6 | 0.0019 |

## Fugitive Dust Emission Calculation Methodology

### Fugitive Dust Source Emissions - Material Handling

**Truck Loading/Unloading (Removed debris/concrete materials)**

*Emission Factor [lb/ton] = k(0.0032) x (mean wind speed [mi/hr] / 5)* $^{1.3}$ / (moisture [%] / 2)$^{1.4}$ — *Reference: AP-42, Equation (1), Section 13.2.4, November 2006*

| | | | |
|---|---|---|---|
| *k = Aerodynamic Particle Size Multiplier, $PM_{10}$* | 0.35 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *k = Aerodynamic Particle Size Multiplier, $PM_{2.5}$* | 0.053 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *Mean Wind Speed* | 15 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *Moisture* | 4.8 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *PM10 Emission Factor* | 0.0014 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |
| *PM2.5 Emission Factor* | 0.0002 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |

**Demolition (Sq. Ft)**

| | | |
|---|---|---|
| PM10, uncontrolled | 0.00042 lbs/cubic ft[1] | http://www.urbemis.com/software/URBEMIS9%20Users%20Manual%20Appendices.pdf |
| PM2.5, uncontrolled | 0.00009 lbs/cubic ft[2] | PM2.5 fraction of PM10 = 0.208; SCAQMD Appendix A - Updated CEIDARS List with PM2.5 Fractions (www.aqmd.gov/ceqa/handbook/PM2_5/PM2_5.html |

**Bulldozing**

*Emission Factor [lb/hr] = [1.0 x (silt content [%])* $^{1.5}$ / (moisture)$^{1.4}$]*Scaling Factor

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Silt Content* | 6.9 | | AP-42 Chapter 11, Table 11.9-3 for overburden |
| *Moisture* | 16.8 | | AP-42 Chapter 11, Table 11.9-3 for overburden, upper end or range |
| *$PM_{10}$ Scaling Factor* | 0.75 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *$PM_{2.5}$ Scaling Factor* | 0.105 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *PM10 Emission Factor* | 0.26 | lb/hr | |
| *PM2.5 Emission Factor* | 0.04 | lb/hr | |

**Grading and Scraping**[d]

*Emission Factor [lb/VMT] = [0.051 (S)^2.0*Scaling Factor*

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Mean Vehicle Speed (S)*[a] *- Miles Per Hour (MPH)* | 2 | | Assumption based on project footprint |
| *$PM_{10}$ Scaling Factor* | 0.6 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *$PM_{2.5}$ Scaling Factor* | 0.031 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *PM10 Emission Factor (Uncontrolled)* | 0.12 | lb/VMT | |
| *PM2.5 Emission Factor (Uncontrolled)* | 0.00632 | lb/VMT | |

**Stock Pile Wind Erosion**

Emission Factor [lb/day-acre] = 0.85 x (silt content [%] / 1.5) x (365 / 235) x (percentage of time unobstructed wind exceeds 12 mph / 15)

Reference: SCAQMD CEQA Air Quality Handbook (1993), Table 9-9-E

| Parameter | Value | Basis |
|---|---|---|
| Silt Content | 7.5 | SCAQMD CEQA Handbook, (1993) Table A9-9-E-1 for overburden |
| Pct. time wind > 12 mph | 17.84 | Used 17.84% from AERMET Surface File used for dispersion modeling |

| | | |
|---|---|---|
| PM10 Emission Factor (Uncontrolled) | 7.9 | lb/day-acre |
| Reduction from Watering Twice/Day | 50% | |
| Controlled PM10 Emission Factor | 3.9 | lb/day-acre |
| Controlled PM2.5 Emission Factor[a] | 0.8 | lb/day-acre |

[a] PM2.5 emission factor [lb/hr] = PM10 emission factor [lb/hr] x PM2.5 fraction of PM10

PM2.5 Fraction of PM10 in Construction Dust = 0.208 — from Appendix A, Final–Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds, SCAQMD, October 2006

Emissions [pounds per day] = Controlled emission factor [pounds per acre-day] x Stock pile surface area [acres]

# Attachment I8 Alternative SB-2A Emissions

SB-2A - Low Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 4.59 | 33.32 | 25.16 | | 1.69 | 1.55 | 3,982 |
| Construction Off-Road Equipment | 13.43 | 122.22 | 56.60 | 0.17 | 11.05 | 5.27 | 16,883.99 | 0.67 | 6.21 | 2.74 | 0.01 | 0.83 | 0.50 | 780 |
| On-Road Motor Vehicles | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 | 0.01 | 0.30 | 0.09 | 0.00 | 0.01 | 0.01 | 62 |
| *Total On-Shore Emissions* | 13.97 | 137.61 | 59.73 | 0.20 | 11.49 | 5.56 | 20,025.62 | 0.68 | 6.51 | 2.83 | 0.01 | 0.84 | 0.51 | 4,824 |
| Amortized Construction | | | | | | | | | | | | | | 482 |

SB-2A - High Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 5.17 | 37.59 | 28.38 | | 1.90 | 1.75 | 4,491 |
| Construction Off-Road Equipment | 13.43 | 122.22 | 56.60 | 0.17 | 11.05 | 5.27 | 16883.99 | 0.74 | 6.82 | 3.00 | 0.01 | 0.91 | 0.55 | 857 |
| On-Road Motor Vehicles | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 | 0.01 | 0.30 | 0.09 | 0.00 | 0.01 | 0.01 | 64 |
| *Total On-Shore Emissions* | 13.97 | 137.61 | 59.73 | 0.20 | 11.49 | 5.56 | 20,025.62 | 0.75 | 7.12 | 3.09 | 0.01 | 0.92 | 0.56 | 5,411 |
| Amortized Construction | | | | | | | | | | | | | | 541 |

SB-2A - Low Sea Level

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 5.68 | 33.91 | 31.52 | 0.09 | 7.64 | 2.12 | 8,776.91 |
| On-Road Motor Vehicles | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |
| *Total On-Shore Emissions* | 6.06 | 37.56 | 33.62 | 0.12 | 7.81 | 2.33 | 11,589.68 |

SB-2A - High Sea Level

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 5.68 | 33.91 | 31.52 | 0.09 | 7.64 | 2.12 | 8,776.91 |
| On-Road Motor Vehicles | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |
| *Total On-Shore Emissions* | 6.06 | 37.56 | 33.62 | 0.12 | 7.81 | 2.33 | 11,589.68 |

## Alternative SB-2A - Construction - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.13 | 0.86 | 0.76 | 0.001 | 0.05 | 0.04 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.08 | 0.06 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-2A - Construction - Low Sea Level

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Emissions Summary | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| Concrete Trucks | 2 | 6 | 1.51 | 10.32 | 9.07 | 0.02 | 0.57 | 0.53 | - | - | 1,501 | 0.14 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.08 | 0.48 | 0.35 | 0.00 | 0.03 | 0.03 | - | - | 56 | 0.01 | lbs/day |
| | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | | | 16,883.99 | 1.21 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | 6.28 | 0.88 | 16,883.99 | 1.21 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **13.43** | **122.22** | **56.60** | **0.17** | | | **11.05** | **5.27** | **16,883.99** | **1.21** | **lbs/day** |

| Project Length | Work Days |
|---|---|
| | 107 |
| Notch Fill | 46 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 840,000 | 84 | 105 | 860,000 | 86 | 107 | ######## | 170 | 212 |
| HSL | 960,000 | 96 | 117 | 970,000 | 97 | 118 | ######## | 193 | 235 |

## Alternative SB-2A - Construction - Low Sea Level

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.22 | 2.59 | 0.89 | 0.00 | 0.08 | 0.07 | - | - | 403 | 0.0178 | tons |
| Loader | 1 | 12 | | 0.07 | 0.50 | 0.30 | 0.00 | 0.03 | 0.02 | - | - | 63 | 0.0055 | tons |
| Dozer | 2 | 12 | | 0.35 | 2.87 | 1.34 | 0.00 | 0.12 | 0.11 | - | - | 279 | 0.0287 | tons |
| Concrete Trucks | 2 | 6 | | 0.03 | 0.24 | 0.21 | 0.00 | 0.01 | 0.01 | - | - | 31 | 0.0028 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0002 | tons |
| | | | | 0.67 | 6.21 | 2.74 | 0.01 | 0.24 | 0.22 | | | 778.77 | 0.05 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.67 | 6.21 | 2.74 | 0.01 | 0.24 | 0.22 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.67** | **6.21** | **2.74** | **0.01** | **0.83** | **0.50** | **0.59** | **0.28** | **779** | **0.052** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **780** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative SB-2A - Construction - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| Construction Days Per Year | 86.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 4.59 | 33.32 | 25.16 | 1.69 | 1.55 | 3,982 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-2A - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 107 | 42,800 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.39 | 11.86 | 1.77 | 0.02 | 0.30 | 0.21 | 2,243 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 58 | 60 | 1,160 | 155 | 70,720 | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-2A - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 107 | 42,800 | 0.00 | 0.020 | 0.05 | 0.00 | 0.00 | 0.00 | 16 | 15 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.273 | 0.04 | 0.00 | 0.01 | 0.00 | 52 | 47 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 58 | 60 | 1,160 | 155 | 70,720 | 0.01 | 0.30 | 0.09 | 0.00 | 0.01 | 0.01 | 68.25 | 62.10 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative SB-2A - Operations - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.06 | 0.24 | 0.75 | 0.001 | 0.01 | 0.01 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-2A - Operations - Low S

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 2 | 12 | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| Concrete Trucks | 2 | 6 | 0.75 | 2.85 | 9.04 | 0.02 | 0.13 | 0.12 | - | - | 1,501 | 0.07 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.04 | 0.34 | 0.32 | 0.00 | 0.01 | 0.01 | - | - | 56 | 0.00 | lbs/day |
| | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | | | 8,776.91 | 0.51 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | 6.28 | 0.88 | 8,776.91 | 0.51 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **5.68** | **33.91** | **31.52** | **0.09** | | | **7.64** | **2.12** | **8,776.91** | **0.51** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 56 |
| Notch Fill | 46 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 720,000 | 72 | 93 | 350,000 | 35 | 56 | ######## | 107 | 149 |
| HSL | 880,000 | 88 | 109 | 500,000 | 50 | 71 | ######## | 138 | 180 |

## Alternative SB-2A - Operations - Low S

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 | - | - | 5 | 0.0005 | tons |
| Loader | 1 | 12 | | 0.02 | 0.10 | 0.14 | 0.00 | 0.00 | 0.00 | - | - | 33 | 0.0015 | tons |
| Dozer | 2 | 12 | | 0.11 | 0.73 | 0.44 | 0.00 | 0.03 | 0.03 | - | - | 146 | 0.0092 | tons |
| Concrete Trucks | 2 | 6 | | 0.02 | 0.07 | 0.21 | 0.00 | 0.00 | 0.00 | - | - | 31 | 0.0014 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0001 | tons |
| | | | | 0.16 | 0.93 | 0.84 | 0.00 | 0.04 | 0.03 | | | 216.55 | 0.01 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.16 | 0.93 | 0.84 | 0.00 | 0.04 | 0.03 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.16** | **0.93** | **0.84** | **0.00** | | | **0.21** | **0.06** | **217** | **0.013** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **217** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

## Alternative SB-2A - Operations - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Operating Days Per Year | 35.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.49 | 3.57 | 10.24 | 0.08 | 0.08 | 1,781 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-2A - Operations - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 56 | 22,400 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.29 | 2.72 | 1.33 | 0.02 | 0.10 | 0.14 | 2,035 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 |
| Total | 58 | 60 | 1,160 | 104 | 50,320 | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-2A - Operations - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 56 | 22,400 | 0.00 | 0.006 | 0.01 | 0.00 | 0.00 | 0.00 | 7 | 6 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.063 | 0.03 | 0.00 | 0.00 | 0.00 | 47 | 43 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 58 | 60 | 1,160 | 104 | 50,320 | 0.01 | 0.07 | 0.04 | 0.00 | 0.00 | 0.00 | 53.93 | 49.07 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

## Alternative SB-2A - Construction - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.13 | 0.86 | 0.76 | 0.001 | 0.05 | 0.04 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.08 | 0.06 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-2A - Construction - High Sea Leve

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| Concrete Trucks | 2 | 6 | 1.51 | 10.32 | 9.07 | 0.02 | 0.57 | 0.53 | - | - | 1,501 | 0.14 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.08 | 0.48 | 0.35 | 0.00 | 0.03 | 0.03 | - | - | 56 | 0.01 | lbs/day |
| | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | | | 16,883.99 | 1.21 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | 6.28 | 0.88 | 16,883.99 | 1.21 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **13.43** | **122.22** | **56.60** | **0.17** | | | **11.05** | **5.27** | **16,883.99** | **1.21** | **lbs/day** |

| **Project Length** | **Work Days** |
|---|---|
| | 118 |
| Notch Fill | 46 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 840,000 | 84 | 105 | 860,000 | 86 | 107 | ######## | 170 | 212 |
| HSL | 960,000 | 96 | 117 | 970,000 | 97 | 118 | ######## | 193 | 235 |

## Alternative SB-2A - Construction - High Sea Leve

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.24 | 2.86 | 0.98 | 0.00 | 0.09 | 0.08 | - | - | 445 | 0.0196 | tons |
| Loader | 1 | 12 | | 0.07 | 0.55 | 0.33 | 0.00 | 0.03 | 0.03 | - | - | 70 | 0.0061 | tons |
| Dozer | 2 | 12 | | 0.39 | 3.16 | 1.48 | 0.00 | 0.13 | 0.12 | - | - | 308 | 0.0316 | tons |
| Concrete Trucks | 2 | 6 | | 0.03 | 0.24 | 0.21 | 0.00 | 0.01 | 0.01 | - | - | 31 | 0.0028 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0002 | tons |
| | | | | 0.74 | 6.82 | 3.00 | 0.01 | 0.26 | 0.24 | | | 855.48 | 0.06 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.74 | 6.82 | 3.00 | 0.01 | 0.26 | 0.24 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.74** | **6.82** | **3.00** | **0.01** | **0.91** | **0.55** | **0.65** | **0.31** | **855** | **0.057** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **857** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative SB-2A - Construction - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 97.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 5.17 | 37.59 | 28.38 | 1.90 | 1.75 | 4,491 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-2A - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 118 | 47,200 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.39 | 11.86 | 1.77 | 0.02 | 0.30 | 0.21 | 2,243 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 58 | 60 | 1,160 | 166 | 75,120 | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-2A - Construction - High Sea Level Rise

**On-Road Construction Emissions**

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 118 | 47,200 | 0.00 | 0.022 | 0.05 | 0.00 | 0.00 | 0.00 | 18 | 16 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.273 | 0.04 | 0.00 | 0.01 | 0.00 | 52 | 47 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 58 | 60 | 1,160 | 166 | 75,120 | 0.01 | 0.30 | 0.09 | 0.00 | 0.01 | 0.01 | 69.90 | 63.61 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative SB-2A - Operations - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.06 | 0.24 | 0.75 | 0.001 | 0.01 | 0.01 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-2A - Operations - High

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 2 | 12 | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| Concrete Trucks | 2 | 6 | 0.75 | 2.85 | 9.04 | 0.02 | 0.13 | 0.12 | - | - | 1,501 | 0.07 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.04 | 0.34 | 0.32 | 0.00 | 0.01 | 0.01 | - | - | 56 | 0.00 | lbs/day |
| | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | | | 8,776.91 | 0.51 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | 6.28 | 0.88 | 8,776.91 | 0.51 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **5.68** | **33.91** | **31.52** | **0.09** | | | **7.64** | **2.12** | **8,776.91** | **0.51** | **lbs/day** |

Emissions Summary

| Project Length | Workdays |
|---|---|
| | 71 |
| Notch Fill | 46 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Construction Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 720,000 | 72 | 93 | 350,000 | 35 | 56 | ######## | 107 | 149 |
| HSL | 880,000 | 88 | 109 | 500,000 | 50 | 71 | ######## | 138 | 180 |

## Alternative SB-2A - Operations - High

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.05 | 0.04 | 0.00 | 0.00 | 0.00 | - | - | 6 | 0.0006 | tons |
| Loader | 1 | 12 | | 0.02 | 0.12 | 0.18 | 0.00 | 0.01 | 0.00 | - | - | 42 | 0.0020 | tons |
| Dozer | 2 | 12 | | 0.14 | 0.92 | 0.56 | 0.00 | 0.04 | 0.03 | - | - | 185 | 0.0117 | tons |
| Concrete Trucks | 2 | 6 | | 0.02 | 0.07 | 0.21 | 0.00 | 0.00 | 0.00 | - | - | 31 | 0.0014 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0001 | tons |
| | | | | 0.19 | 1.16 | 1.00 | 0.00 | 0.05 | 0.04 | | | 265.82 | 0.02 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.19 | 1.16 | 1.00 | 0.00 | 0.05 | 0.04 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.19** | **1.16** | **1.00** | **0.00** | | | **0.27** | **0.08** | **266** | **0.016** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **266** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

## Alternative SB-2A - Operations - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Operating Days Per Year | 50.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.70 | 5.10 | 14.63 | 0.12 | 0.11 | 2,544 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-2A - Operations - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 71 | 28,400 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.29 | 2.72 | 1.33 | 0.02 | 0.10 | 0.14 | 2,035 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 |
| Total | 58 | 60 | 1,160 | 119 | 56,320 | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-2A - Operations - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 71 | 28,400 | 0.00 | 0.007 | 0.01 | 0.00 | 0.00 | 0.00 | 8 | 8 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.063 | 0.03 | 0.00 | 0.00 | 0.00 | 47 | 43 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 58 | 60 | 1,160 | 119 | 56,320 | 0.01 | 0.07 | 0.05 | 0.00 | 0.00 | 0.00 | 55.69 | 50.68 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

**San Diego 2015 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,169,183 | 42,600,783.75 | 7,361,743.79 | 0.045 | 1.290 | 0.136 | 302.103 | 0.047 | 0.019 | 0.004 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,466 | 179,216.55 | 31,712.66 | 0.038 | 0.215 | 0.576 | 315.879 | 0.072 | 0.043 | 0.004 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 172,849 | 6,187,162.79 | 1,061,257.19 | 0.075 | 2.505 | 0.269 | 357.183 | 0.048 | 0.021 | 0.004 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 210 | 6,179.81 | 1,102.01 | 0.066 | 0.312 | 0.691 | 314.863 | 0.099 | 0.068 | 0.004 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 423,444 | 16,224,268.59 | 2,675,454.93 | 0.037 | 1.498 | 0.192 | 432.459 | 0.047 | 0.019 | 0.005 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 187 | 5,978.69 | 1,021.81 | 0.046 | 0.252 | 0.690 | 323.109 | 0.080 | 0.050 | 0.004 | | |
| Average | | | | | | | 0.051 | 1.012 | 0.426 | 340.933 | 0.066 | 0.037 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 2,454 | 392,614.49 | 0 | 0.296 | 1.343 | 8.984 | 1699.527 | 0.231 | 0.158 | 0.017 | | |

Source: EMFAC 2011

**San Diego 2020 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,261,438 | 46,436,329 | 7,971,039 | 0.03 | 0.10 | 0.83 | 244.16 | 0.05 | 0.02 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,897 | 203,726 | 36,279 | 0.02 | 0.39 | 0.13 | 265.72 | 0.06 | 0.03 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 186,176 | 6,674,684 | 1,134,440 | 0.04 | 0.17 | 1.56 | 297.84 | 0.05 | 0.02 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 226 | 8,187 | 1,308 | 0.03 | 0.45 | 0.17 | 259.42 | 0.07 | 0.04 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 450,141 | 17,355,693 | 2,832,803 | 0.02 | 0.11 | 0.93 | 364.76 | 0.05 | 0.02 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 199 | 7,528 | 1,228 | 0.02 | 0.47 | 0.14 | 280.32 | 0.06 | 0.03 | 0.00 | | |
| Average | | | | | | | 0.026 | 0.283 | 0.626 | 285.370 | 0.055 | 0.027 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,262 | 531,839 | - | 0.22 | 1.02 | 4.20 | 1553.04 | 0.18 | 0.11 | 0.02 | | |

Source: EMFAC 2011

**San Diego 2025 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,343,732.35 | ########### | 8,492,736.38 | 0.02 | 0.71 | 0.09 | 223.96 | 0.05 | 0.04 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 6,282.20 | 213,159.29 | 39,008.92 | 0.01 | 0.09 | 0.31 | 246.18 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 198,419.75 | 7,123,689.46 | 1,204,641.90 | 0.02 | 1.09 | 0.12 | 276.49 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 240.83 | 8,707.20 | 1,432.14 | 0.02 | 0.13 | 0.37 | 242.28 | 0.06 | 0.05 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 479,791.14 | ########### | 3,017,273.36 | 0.01 | 0.73 | 0.08 | 343.84 | 0.05 | 0.04 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 211.77 | 7,665.63 | 1,309.49 | 0.02 | 0.11 | 0.40 | 268.51 | 0.06 | 0.05 | 0.00 | | |
| Average | | | | | | | 0.019 | 0.478 | 0.227 | 266.878 | 0.052 | 0.042 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,476 | 582,978 | - | 0.22 | 1.01 | 2.06 | 1541.82 | 0.07 | 0.10 | 0.02 | | |

Source: EMFAC 2011

## 2015 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0155 | 0.0486 | 0.0902 | 0.0001 | 0.0046 | 0.0042 | 11.0 | 0.0014 |
| | 50 | 0.0480 | 0.1641 | 0.1699 | 0.0003 | 0.0129 | 0.0119 | 19.6 | 0.0043 |
| | 120 | 0.0460 | 0.2377 | 0.3272 | 0.0004 | 0.0246 | 0.0226 | 38.1 | 0.0042 |
| | 500 | 0.1026 | 0.4261 | 1.2422 | 0.0021 | 0.0368 | 0.0339 | 213 | 0.0093 |
| | 750 | 0.1912 | 0.7702 | 2.3263 | 0.0039 | 0.0680 | 0.0626 | 385 | 0.0173 |
| Aerial Lifts Composite | | 0.0439 | 0.1837 | 0.2670 | 0.0004 | 0.0167 | 0.0154 | 34.7 | 0.0040 |
| Air Compressors | 15 | 0.0108 | 0.0466 | 0.0664 | 0.0001 | 0.0040 | 0.0037 | 7.2 | 0.0010 |
| | 25 | 0.0229 | 0.0681 | 0.1247 | 0.0002 | 0.0069 | 0.0064 | 14.4 | 0.0021 |
| | 50 | 0.0747 | 0.2360 | 0.2056 | 0.0003 | 0.0183 | 0.0168 | 22.3 | 0.0067 |
| | 120 | 0.0691 | 0.3182 | 0.4334 | 0.0006 | 0.0375 | 0.0345 | 47.0 | 0.0062 |
| | 175 | 0.0903 | 0.5019 | 0.7101 | 0.0010 | 0.0388 | 0.0357 | 88.5 | 0.0082 |
| | 250 | 0.0892 | 0.2803 | 0.9294 | 0.0015 | 0.0286 | 0.0263 | 131 | 0.0080 |
| | 500 | 0.1463 | 0.4915 | 1.4297 | 0.0023 | 0.0470 | 0.0432 | 232 | 0.0132 |
| | 750 | 0.2285 | 0.7595 | 2.2932 | 0.0036 | 0.0743 | 0.0683 | 358 | 0.0206 |
| | 1000 | 0.3551 | 1.1843 | 4.4558 | 0.0049 | 0.1239 | 0.1140 | 486 | 0.0320 |
| Air Compressors Composite | | 0.0773 | 0.3257 | 0.5175 | 0.0007 | 0.0357 | 0.0329 | 63.6 | 0.0070 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1220 | 0.0002 | 0.0047 | 0.0043 | 16.0 | 0.0017 |
| | 50 | 0.0234 | 0.2235 | 0.2240 | 0.0004 | 0.0075 | 0.0069 | 31.0 | 0.0021 |
| | 120 | 0.0376 | 0.4676 | 0.3736 | 0.0009 | 0.0160 | 0.0148 | 77.1 | 0.0034 |
| | 175 | 0.0618 | 0.7540 | 0.5364 | 0.0016 | 0.0198 | 0.0182 | 141 | 0.0056 |
| | 250 | 0.0681 | 0.3425 | 0.4900 | 0.0021 | 0.0144 | 0.0132 | 188 | 0.0061 |
| | 500 | 0.1118 | 0.5511 | 0.7692 | 0.0031 | 0.0236 | 0.0217 | 311 | 0.0101 |
| | 750 | 0.2212 | 1.0888 | 1.5301 | 0.0062 | 0.0466 | 0.0429 | 615 | 0.0200 |
| | 1000 | 0.3562 | 1.6528 | 4.9704 | 0.0093 | 0.1194 | 0.1098 | 928 | 0.0321 |
| Bore/Drill Rigs Composite | | 0.0673 | 0.5022 | 0.6138 | 0.0017 | 0.0200 | 0.0184 | 165 | 0.0061 |
| Cement and Mortar Mixers | 15 | 0.0074 | 0.0386 | 0.0464 | 0.0001 | 0.0019 | 0.0018 | 6.3 | 0.0007 |
| | 25 | 0.0251 | 0.0782 | 0.1456 | 0.0002 | 0.0074 | 0.0068 | 17.6 | 0.0023 |
| Cement and Mortar Mixers Composite | | 0.0088 | 0.0419 | 0.0545 | 0.0001 | 0.0024 | 0.0022 | 7.2 | 0.0008 |
| Concrete/Industrial Saws | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0782 | 0.2745 | 0.2652 | 0.0004 | 0.0206 | 0.0189 | 30.2 | 0.0071 |
| | 120 | 0.0892 | 0.4759 | 0.6249 | 0.0009 | 0.0486 | 0.0448 | 74.1 | 0.0080 |
| | 175 | 0.1340 | 0.8674 | 1.1593 | 0.0018 | 0.0585 | 0.0538 | 160 | 0.0121 |
| Concrete/Industrial Saws Composite | | 0.0835 | 0.3982 | 0.4921 | 0.0007 | 0.0374 | 0.0345 | 58.5 | 0.0075 |
| Cranes | 50 | 0.0853 | 0.2729 | 0.2235 | 0.0003 | 0.0202 | 0.0186 | 23.2 | 0.0077 |
| | 120 | 0.0800 | 0.3559 | 0.4822 | 0.0006 | 0.0415 | 0.0382 | 50.1 | 0.0072 |
| | 175 | 0.0919 | 0.4794 | 0.6684 | 0.0009 | 0.0378 | 0.0348 | 80.3 | 0.0083 |
| | 250 | 0.0925 | 0.2713 | 0.8284 | 0.0013 | 0.0286 | 0.0263 | 112 | 0.0083 |
| | 500 | 0.1393 | 0.4663 | 1.1812 | 0.0018 | 0.0426 | 0.0392 | 180 | 0.0126 |
| | 750 | 0.2358 | 0.7835 | 2.0490 | 0.0030 | 0.0729 | 0.0671 | 303 | 0.0213 |
| | 9999 | 0.8682 | 2.8913 | 9.2743 | 0.0098 | 0.2775 | 0.2553 | 971 | 0.0783 |
| Cranes Composite | | 0.1204 | 0.4395 | 1.0200 | 0.0014 | 0.0426 | 0.0392 | 129 | 0.0109 |
| Crawler Tractors | 50 | 0.1017 | 0.3087 | 0.2464 | 0.0003 | 0.0232 | 0.0214 | 24.9 | 0.0092 |
| | 120 | 0.1143 | 0.4774 | 0.6815 | 0.0008 | 0.0579 | 0.0533 | 65.8 | 0.0103 |
| | 175 | 0.1509 | 0.7384 | 1.0951 | 0.0014 | 0.0614 | 0.0565 | 121 | 0.0136 |
| | 250 | 0.1582 | 0.4614 | 1.3531 | 0.0019 | 0.0514 | 0.0473 | 166 | 0.0143 |
| | 500 | 0.2300 | 0.8352 | 1.8987 | 0.0025 | 0.0732 | 0.0673 | 259 | 0.0207 |
| | 750 | 0.4140 | 1.4936 | 3.4863 | 0.0047 | 0.1327 | 0.1221 | 465 | 0.0374 |
| | 1000 | 0.6278 | 2.3640 | 6.6574 | 0.0066 | 0.2075 | 0.1909 | 658 | 0.0566 |
| Crawler Tractors Composite | | 0.1415 | 0.5650 | 1.0059 | 0.0013 | 0.0594 | 0.0546 | 114 | 0.0128 |
| Crushing/Proc. Equipment | 50 | 0.1392 | 0.4644 | 0.4024 | 0.0006 | 0.0346 | 0.0318 | 44.0 | 0.0126 |
| | 120 | 0.1167 | 0.5646 | 0.7374 | 0.0010 | 0.0629 | 0.0579 | 83.1 | 0.0105 |
| | 175 | 0.1654 | 0.9559 | 1.2783 | 0.0019 | 0.0700 | 0.0644 | 167 | 0.0149 |
| | 250 | 0.1646 | 0.5171 | 1.6355 | 0.0028 | 0.0506 | 0.0466 | 245 | 0.0149 |
| | 500 | 0.2358 | 0.7790 | 2.1722 | 0.0037 | 0.0722 | 0.0664 | 374 | 0.0213 |
| | 750 | 0.3723 | 1.2184 | 3.5561 | 0.0059 | 0.1154 | 0.1062 | 589 | 0.0336 |
| | 9999 | 0.9726 | 3.0901 | 11.5626 | 0.0131 | 0.3225 | 0.2967 | 1,308 | 0.0878 |
| Crushing/Proc. Equipment Composite | | 0.1465 | 0.6549 | 0.9893 | 0.0015 | 0.0607 | 0.0558 | 132 | 0.0132 |
| Dumpers/Tenders | 25 | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Dumpers/Tenders Composite | | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0650 | 0.2683 | 0.2256 | 0.0003 | 0.0167 | 0.0154 | 25.0 | 0.0059 |
| | 120 | 0.0912 | 0.5102 | 0.5787 | 0.0009 | 0.0455 | 0.0418 | 73.6 | 0.0082 |
| | 175 | 0.1052 | 0.6653 | 0.7408 | 0.0013 | 0.0405 | 0.0372 | 112 | 0.0095 |

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1117 | 0.3431 | 0.8935 | 0.0018 | 0.0297 | 0.0273 | 159 | 0.0101 |
| | 500 | 0.1577 | 0.4964 | 1.1619 | 0.0023 | 0.0413 | 0.0380 | 234 | 0.0142 |
| | 750 | 0.2630 | 0.8225 | 1.9926 | 0.0039 | 0.0698 | 0.0642 | 387 | 0.0237 |
| Excavators Composite | | 0.1064 | 0.5248 | 0.7416 | 0.0013 | 0.0379 | 0.0349 | 120 | 0.0096 |
| Forklifts | 50 | 0.0324 | 0.1522 | 0.1324 | 0.0002 | 0.0092 | 0.0084 | 14.7 | 0.0029 |
| | 120 | 0.0345 | 0.2143 | 0.2326 | 0.0004 | 0.0174 | 0.0160 | 31.2 | 0.0031 |
| | 175 | 0.0486 | 0.3316 | 0.3442 | 0.0006 | 0.0189 | 0.0174 | 56.1 | 0.0044 |
| | 250 | 0.0518 | 0.1582 | 0.4040 | 0.0009 | 0.0133 | 0.0122 | 77.1 | 0.0047 |
| | 500 | 0.0724 | 0.2164 | 0.5170 | 0.0011 | 0.0185 | 0.0171 | 111 | 0.0065 |
| Forklifts Composite | | 0.0459 | 0.2200 | 0.3163 | 0.0006 | 0.0156 | 0.0143 | 54.4 | 0.0041 |
| Generator Sets | 15 | 0.0135 | 0.0658 | 0.0929 | 0.0002 | 0.0051 | 0.0047 | 10.2 | 0.0012 |
| | 25 | 0.0247 | 0.0831 | 0.1522 | 0.0002 | 0.0080 | 0.0074 | 17.6 | 0.0022 |
| | 50 | 0.0706 | 0.2465 | 0.2628 | 0.0004 | 0.0193 | 0.0178 | 30.6 | 0.0064 |
| | 120 | 0.0910 | 0.4811 | 0.6607 | 0.0009 | 0.0484 | 0.0445 | 77.9 | 0.0082 |
| | 175 | 0.1120 | 0.7350 | 1.0463 | 0.0016 | 0.0485 | 0.0446 | 142 | 0.0101 |
| | 250 | 0.1090 | 0.4148 | 1.3776 | 0.0024 | 0.0381 | 0.0351 | 213 | 0.0098 |
| Generator Sets - 500 hp | 500 | 0.1556 | 0.6639 | 1.9429 | 0.0033 | 0.0567 | 0.0522 | 337 | 0.0140 |
| | 750 | 0.2599 | 1.0718 | 3.2483 | 0.0055 | 0.0934 | 0.0860 | 544 | 0.0234 |
| | 9999 | 0.6582 | 2.3655 | 8.9789 | 0.0105 | 0.2325 | 0.2139 | 1,049 | 0.0594 |
| Generator Sets Composite | | 0.0640 | 0.2913 | 0.4717 | 0.0007 | 0.0268 | 0.0246 | 61.0 | 0.0058 |
| Graders | 50 | 0.0897 | 0.3082 | 0.2569 | 0.0004 | 0.0217 | 0.0200 | 27.5 | 0.0081 |
| | 120 | 0.1081 | 0.5230 | 0.6726 | 0.0009 | 0.0555 | 0.0511 | 75.0 | 0.0098 |
| | 175 | 0.1299 | 0.7319 | 0.9534 | 0.0014 | 0.0526 | 0.0484 | 124 | 0.0117 |
| | 250 | 0.1326 | 0.4046 | 1.1596 | 0.0019 | 0.0400 | 0.0368 | 172 | 0.0120 |
| | 500 | 0.1666 | 0.5739 | 1.3760 | 0.0023 | 0.0496 | 0.0456 | 229 | 0.0150 |
| | 750 | 0.3549 | 1.2133 | 3.0011 | 0.0049 | 0.1066 | 0.0981 | 486 | 0.0320 |
| Graders Composite | | 0.1277 | 0.5931 | 0.9795 | 0.0015 | 0.0489 | 0.0450 | 133 | 0.0115 |
| Off-Highway Tractors | 120 | 0.1905 | 0.7051 | 1.1159 | 0.0011 | 0.0952 | 0.0876 | 93.7 | 0.0172 |
| | 175 | 0.1870 | 0.8216 | 1.3703 | 0.0015 | 0.0771 | 0.0709 | 130 | 0.0169 |
| | 250 | 0.1489 | 0.4320 | 1.2644 | 0.0015 | 0.0520 | 0.0478 | 130 | 0.0134 |
| | 750 | 0.5975 | 2.5165 | 5.0885 | 0.0057 | 0.2047 | 0.1884 | 568 | 0.0539 |
| | 1000 | 0.9006 | 3.9378 | 9.2072 | 0.0082 | 0.3063 | 0.2818 | 814 | 0.0813 |
| Off-Highway Tractors Composite | | 0.1893 | 0.7244 | 1.5085 | 0.0017 | 0.0717 | 0.0660 | 151 | 0.0171 |
| Off-Highway Trucks | 175 | 0.1259 | 0.7559 | 0.8596 | 0.0014 | 0.0477 | 0.0438 | 125 | 0.0114 |
| | 250 | 0.1252 | 0.3702 | 0.9818 | 0.0019 | 0.0328 | 0.0301 | 167 | 0.0113 |
| | 500 | 0.1960 | 0.5949 | 1.4165 | 0.0027 | 0.0505 | 0.0465 | 272 | 0.0177 |
| | 750 | 0.3198 | 0.9645 | 2.3779 | 0.0044 | 0.0835 | 0.0768 | 442 | 0.0289 |
| | 1000 | 0.4873 | 1.4801 | 5.2216 | 0.0063 | 0.1505 | 0.1385 | 625 | 0.0440 |
| Off-Highway Trucks Composite | | 0.1924 | 0.5974 | 1.4932 | 0.0027 | 0.0516 | 0.0475 | 260 | 0.0174 |
| Other Construction Equipment | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0039 | 0.0036 | 13.2 | 0.0014 |
| | 50 | 0.0597 | 0.2506 | 0.2369 | 0.0004 | 0.0162 | 0.0149 | 28.0 | 0.0054 |
| | 120 | 0.0827 | 0.5202 | 0.6012 | 0.0009 | 0.0441 | 0.0406 | 80.9 | 0.0075 |
| | 175 | 0.0796 | 0.5864 | 0.6636 | 0.0012 | 0.0331 | 0.0305 | 107 | 0.0072 |
| | 500 | 0.1310 | 0.4963 | 1.1867 | 0.0025 | 0.0394 | 0.0362 | 254 | 0.0118 |
| Other Construction Equipment Composite | | 0.0768 | 0.3645 | 0.6392 | 0.0013 | 0.0264 | 0.0243 | 123 | 0.0069 |
| Other General Industrial Equipmen | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0786 | 0.2532 | 0.2077 | 0.0003 | 0.0191 | 0.0175 | 21.7 | 0.0071 |
| | 120 | 0.0987 | 0.4387 | 0.5864 | 0.0007 | 0.0521 | 0.0480 | 62.0 | 0.0089 |
| | 175 | 0.1083 | 0.5684 | 0.7866 | 0.0011 | 0.0448 | 0.0412 | 95.9 | 0.0098 |
| | 250 | 0.1050 | 0.3015 | 0.9812 | 0.0015 | 0.0312 | 0.0287 | 136 | 0.0095 |
| | 500 | 0.1931 | 0.5811 | 1.6702 | 0.0026 | 0.0569 | 0.0524 | 265 | 0.0174 |
| | 750 | 0.3208 | 0.9578 | 2.8569 | 0.0044 | 0.0959 | 0.0883 | 437 | 0.0289 |
| | 1000 | 0.4546 | 1.4023 | 5.2482 | 0.0056 | 0.1513 | 0.1392 | 560 | 0.0410 |
| Other General Industrial Equipmen Composite | | 0.1355 | 0.4843 | 1.1215 | 0.0016 | 0.0475 | 0.0437 | 152 | 0.0122 |
| Other Material Handling Equipmen | 50 | 0.1090 | 0.3501 | 0.2887 | 0.0004 | 0.0265 | 0.0244 | 30.3 | 0.0098 |
| | 120 | 0.0959 | 0.4271 | 0.5727 | 0.0007 | 0.0509 | 0.0468 | 60.7 | 0.0087 |
| | 175 | 0.1365 | 0.7201 | 0.9997 | 0.0014 | 0.0567 | 0.0522 | 122 | 0.0123 |
| | 250 | 0.1109 | 0.3211 | 1.0483 | 0.0016 | 0.0332 | 0.0306 | 145 | 0.0100 |
| | 500 | 0.1376 | 0.4182 | 1.2042 | 0.0019 | 0.0409 | 0.0377 | 192 | 0.0124 |
| | 9999 | 0.6190 | 1.8527 | 6.9410 | 0.0073 | 0.1995 | 0.1835 | 741 | 0.0558 |
| Other Material Handling Equipment Composite | | 0.1289 | 0.4698 | 1.0967 | 0.0015 | 0.0460 | 0.0423 | 141 | 0.0116 |
| Pavers | 25 | 0.0234 | 0.0780 | 0.1458 | 0.0002 | 0.0066 | 0.0060 | 18.7 | 0.0021 |
| | 50 | 0.1198 | 0.3421 | 0.2775 | 0.0004 | 0.0271 | 0.0249 | 28.0 | 0.0108 |
| | 120 | 0.1235 | 0.4969 | 0.7477 | 0.0008 | 0.0636 | 0.0585 | 69.2 | 0.0111 |
| | 175 | 0.1608 | 0.7707 | 1.2155 | 0.0014 | 0.0673 | 0.0619 | 128 | 0.0145 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1858 | 0.5585 | 1.6747 | 0.0022 | 0.0640 | 0.0589 | 194 | 0.0168 |
| | 500 | 0.2059 | 0.8113 | 1.8097 | 0.0023 | 0.0697 | 0.0641 | 233 | 0.0186 |
| Pavers Composite | | 0.1347 | 0.5203 | 0.7607 | 0.0009 | 0.0526 | 0.0484 | 77.9 | 0.0122 |
| Paving Equipment | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0037 | 0.0034 | 12.6 | 0.0014 |
| | 50 | 0.1023 | 0.2901 | 0.2367 | 0.0003 | 0.0231 | 0.0213 | 23.9 | 0.0092 |
| | 120 | 0.0969 | 0.3891 | 0.5874 | 0.0006 | 0.0503 | 0.0462 | 54.5 | 0.0087 |
| | 175 | 0.1254 | 0.6025 | 0.9549 | 0.0011 | 0.0528 | 0.0486 | 101 | 0.0113 |
| | 250 | 0.1140 | 0.3441 | 1.0498 | 0.0014 | 0.0394 | 0.0362 | 122 | 0.0103 |
| Paving Equipment Composite | | 0.1023 | 0.4234 | 0.6842 | 0.0008 | 0.0469 | 0.0431 | 68.9 | 0.0092 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washers | 15 | 0.0065 | 0.0315 | 0.0445 | 0.0001 | 0.0024 | 0.0022 | 4.9 | 0.0006 |
| | 25 | 0.0100 | 0.0337 | 0.0617 | 0.0001 | 0.0033 | 0.0030 | 7.1 | 0.0009 |
| | 50 | 0.0251 | 0.0970 | 0.1183 | 0.0002 | 0.0077 | 0.0070 | 14.3 | 0.0023 |
| | 120 | 0.0245 | 0.1416 | 0.1947 | 0.0003 | 0.0128 | 0.0118 | 24.1 | 0.0022 |
| Pressure Washers Composite | | 0.0133 | 0.0590 | 0.0799 | 0.0001 | 0.0049 | 0.0045 | 9.4 | 0.0012 |
| | 15 | 0.0111 | 0.0479 | 0.0683 | 0.0001 | 0.0041 | 0.0038 | 7.4 | 0.0010 |
| | 25 | 0.0309 | 0.0919 | 0.1682 | 0.0002 | 0.0094 | 0.0086 | 19.5 | 0.0028 |
| | 50 | 0.0855 | 0.2910 | 0.2982 | 0.0004 | 0.0228 | 0.0210 | 34.3 | 0.0077 |
| | 120 | 0.0949 | 0.4887 | 0.6710 | 0.0009 | 0.0508 | 0.0467 | 77.9 | 0.0086 |
| | 175 | 0.1158 | 0.7365 | 1.0489 | 0.0016 | 0.0502 | 0.0462 | 140 | 0.0104 |
| | 250 | 0.1088 | 0.3998 | 1.3270 | 0.0023 | 0.0376 | 0.0346 | 201 | 0.0098 |
| Pumps | 500 | 0.1686 | 0.6929 | 2.0163 | 0.0034 | 0.0603 | 0.0555 | 345 | 0.0152 |
| | 750 | 0.2872 | 1.1454 | 3.4529 | 0.0057 | 0.1018 | 0.0937 | 571 | 0.0259 |
| | 9999 | 0.8773 | 3.1134 | 11.7387 | 0.0136 | 0.3072 | 0.2826 | 1,355 | 0.0792 |
| Pumps Composite | | 0.0621 | 0.2825 | 0.4121 | 0.0006 | 0.0267 | 0.0245 | 49.6 | 0.0056 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1018 | 0.0002 | 0.0039 | 0.0036 | 13.3 | 0.0015 |
| | 50 | 0.0871 | 0.2754 | 0.2405 | 0.0003 | 0.0209 | 0.0192 | 26.0 | 0.0079 |
| | 120 | 0.0857 | 0.4000 | 0.5498 | 0.0007 | 0.0454 | 0.0418 | 59.0 | 0.0077 |
| | 175 | 0.1104 | 0.6166 | 0.8731 | 0.0012 | 0.0470 | 0.0433 | 108 | 0.0100 |
| | 250 | 0.1107 | 0.3575 | 1.0948 | 0.0017 | 0.0368 | 0.0339 | 153 | 0.0100 |
| | 500 | 0.1468 | 0.5595 | 1.3956 | 0.0022 | 0.0487 | 0.0448 | 219 | 0.0132 |
| Rollers Composite | | 0.0851 | 0.3979 | 0.5706 | 0.0008 | 0.0386 | 0.0355 | 67.1 | 0.0077 |
| Rough Terrain Forklifts | 50 | 0.0942 | 0.3551 | 0.3066 | 0.0004 | 0.0243 | 0.0224 | 33.9 | 0.0085 |
| | 120 | 0.0801 | 0.4260 | 0.5164 | 0.0007 | 0.0420 | 0.0387 | 62.4 | 0.0072 |
| | 175 | 0.1171 | 0.7240 | 0.8746 | 0.0014 | 0.0477 | 0.0439 | 125 | 0.0106 |
| | 250 | 0.1168 | 0.3650 | 1.0385 | 0.0019 | 0.0338 | 0.0311 | 171 | 0.0105 |
| | 500 | 0.1668 | 0.5337 | 1.3642 | 0.0025 | 0.0477 | 0.0439 | 257 | 0.0150 |
| Rough Terrain Forklifts Composite | | 0.0850 | 0.4577 | 0.5588 | 0.0008 | 0.0423 | 0.0389 | 70.3 | 0.0077 |
| Rubber Tired Dozers | 175 | 0.1942 | 0.8333 | 1.3944 | 0.0015 | 0.0790 | 0.0727 | 129 | 0.0175 |
| | 250 | 0.2209 | 0.6304 | 1.8273 | 0.0021 | 0.0762 | 0.0701 | 183 | 0.0199 |
| | 500 | 0.2932 | 1.2456 | 2.3951 | 0.0026 | 0.0985 | 0.0906 | 265 | 0.0265 |
| | 750 | 0.4423 | 1.8685 | 3.6712 | 0.0040 | 0.1494 | 0.1374 | 399 | 0.0399 |
| | 1000 | 0.6883 | 3.0139 | 6.8297 | 0.0060 | 0.2311 | 0.2126 | 592 | 0.0621 |
| Rubber Tired Dozers Composite | | 0.2721 | 1.0420 | 2.2344 | 0.0025 | 0.0924 | 0.0850 | 239 | 0.0246 |
| Rubber Tired Loaders | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0049 | 0.0045 | 16.9 | 0.0018 |
| | 50 | 0.0993 | 0.3438 | 0.2888 | 0.0004 | 0.0242 | 0.0222 | 31.1 | 0.0090 |
| | 120 | 0.0835 | 0.4090 | 0.5226 | 0.0007 | 0.0431 | 0.0396 | 58.9 | 0.0075 |
| | 175 | 0.1094 | 0.6251 | 0.8077 | 0.0012 | 0.0445 | 0.0409 | 106 | 0.0099 |
| | 250 | 0.1118 | 0.3444 | 0.9890 | 0.0017 | 0.0337 | 0.0310 | 149 | 0.0101 |
| | 500 | 0.1678 | 0.5818 | 1.3980 | 0.0023 | 0.0499 | 0.0459 | 237 | 0.0151 |
| | 750 | 0.3459 | 1.1905 | 2.9534 | 0.0049 | 0.1040 | 0.0956 | 486 | 0.0312 |
| | 1000 | 0.4657 | 1.6412 | 5.2967 | 0.0060 | 0.1552 | 0.1428 | 594 | 0.0420 |
| Rubber Tired Loaders Composite | | 0.1050 | 0.4615 | 0.7838 | 0.0012 | 0.0416 | 0.0383 | 109 | 0.0095 |
| Scrapers | 120 | 0.1665 | 0.6826 | 0.9915 | 0.0011 | 0.0846 | 0.0778 | 93.9 | 0.0150 |
| | 175 | 0.1871 | 0.9030 | 1.3657 | 0.0017 | 0.0766 | 0.0704 | 148 | 0.0169 |
| | 250 | 0.2021 | 0.5906 | 1.7470 | 0.0024 | 0.0665 | 0.0612 | 209 | 0.0182 |
| | 500 | 0.2883 | 1.0688 | 2.4104 | 0.0032 | 0.0930 | 0.0855 | 321 | 0.0260 |
| | 750 | 0.5001 | 1.8419 | 4.2634 | 0.0056 | 0.1624 | 0.1494 | 555 | 0.0451 |
| Scrapers Composite | | 0.2513 | 0.9443 | 2.0647 | 0.0027 | 0.0854 | 0.0785 | 262 | 0.0227 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0931 | 0.3227 | 0.3148 | 0.0005 | 0.0243 | 0.0224 | 36.2 | 0.0084 |
| | 120 | 0.0970 | 0.5116 | 0.6762 | 0.0009 | 0.0525 | 0.0483 | 80.2 | 0.0088 |
| | 175 | 0.1290 | 0.8300 | 1.1249 | 0.0017 | 0.0559 | 0.0514 | 155 | 0.0116 |
| | 250 | 0.1416 | 0.5098 | 1.6229 | 0.0029 | 0.0474 | 0.0436 | 255 | 0.0128 |
| Signal Boards Composite | | 0.0171 | 0.0925 | 0.1250 | 0.0002 | 0.0066 | 0.0060 | 16.7 | 0.0015 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| Skid Steer Loaders | 25 | 0.0189 | 0.0601 | 0.1125 | 0.0002 | 0.0056 | 0.0052 | 13.8 | 0.0017 |
| | 50 | 0.0378 | 0.2138 | 0.2052 | 0.0003 | 0.0113 | 0.0104 | 25.5 | 0.0034 |
| | 120 | 0.0334 | 0.2710 | 0.2699 | 0.0005 | 0.0170 | 0.0156 | 42.8 | 0.0030 |
| Skid Steer Loaders Composite | | 0.0352 | 0.2220 | 0.2198 | 0.0004 | 0.0128 | 0.0118 | 30.3 | 0.0032 |
| Surfacing Equipment | 50 | 0.0408 | 0.1333 | 0.1263 | 0.0002 | 0.0101 | 0.0093 | 14.1 | 0.0037 |
| | 120 | 0.0840 | 0.4151 | 0.5756 | 0.0007 | 0.0439 | 0.0404 | 63.8 | 0.0076 |
| | 175 | 0.0787 | 0.4705 | 0.6706 | 0.0010 | 0.0335 | 0.0308 | 85.8 | 0.0071 |
| | 250 | 0.0891 | 0.3116 | 0.9338 | 0.0015 | 0.0309 | 0.0285 | 135 | 0.0080 |
| | 500 | 0.1342 | 0.5759 | 1.3809 | 0.0022 | 0.0468 | 0.0431 | 221 | 0.0121 |
| | 750 | 0.2139 | 0.9020 | 2.2264 | 0.0035 | 0.0745 | 0.0686 | 347 | 0.0193 |
| Surfacing Equipment Composite | | 0.1116 | 0.4705 | 1.0675 | 0.0017 | 0.0389 | 0.0357 | 166 | 0.0101 |
| Sweepers/Scrubbers | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0052 | 19.6 | 0.0021 |
| | 50 | 0.0782 | 0.3186 | 0.2828 | 0.0004 | 0.0211 | 0.0194 | 31.6 | 0.0071 |
| | 120 | 0.0880 | 0.5056 | 0.5893 | 0.0009 | 0.0466 | 0.0429 | 75.0 | 0.0079 |
| | 175 | 0.1193 | 0.7999 | 0.9051 | 0.0016 | 0.0488 | 0.0449 | 139 | 0.0108 |
| | 250 | 0.1029 | 0.3286 | 0.9094 | 0.0018 | 0.0289 | 0.0266 | 162 | 0.0093 |
| Sweepers/Scrubbers Composite | | 0.0913 | 0.5034 | 0.5746 | 0.0009 | 0.0387 | 0.0356 | 78.5 | 0.0082 |
| Tractors/Loaders/Backhoes | 25 | 0.0192 | 0.0653 | 0.1221 | 0.0002 | 0.0049 | 0.0045 | 15.9 | 0.0017 |
| | 50 | 0.0702 | 0.3020 | 0.2646 | 0.0004 | 0.0186 | 0.0171 | 30.3 | 0.0063 |
| | 120 | 0.0577 | 0.3480 | 0.3870 | 0.0006 | 0.0293 | 0.0270 | 51.7 | 0.0052 |
| | 175 | 0.0854 | 0.5853 | 0.6331 | 0.0011 | 0.0335 | 0.0308 | 101 | 0.0077 |
| | 250 | 0.1082 | 0.3566 | 0.9047 | 0.0019 | 0.0294 | 0.0270 | 172 | 0.0098 |
| | 500 | 0.2085 | 0.7089 | 1.6070 | 0.0039 | 0.0559 | 0.0514 | 345 | 0.0188 |
| | 750 | 0.3148 | 1.0631 | 2.4922 | 0.0058 | 0.0854 | 0.0786 | 517 | 0.0284 |
| Tractors/Loaders/Backhoes Composite | | 0.0666 | 0.3716 | 0.4501 | 0.0008 | 0.0298 | 0.0274 | 66.8 | 0.0060 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0087 | 32.9 | 0.0036 |
| | 50 | 0.1390 | 0.3900 | 0.3235 | 0.0004 | 0.0313 | 0.0288 | 32.9 | 0.0125 |
| | 120 | 0.1144 | 0.4600 | 0.7060 | 0.0008 | 0.0590 | 0.0542 | 64.9 | 0.0103 |
| | 175 | 0.1770 | 0.8534 | 1.3767 | 0.0016 | 0.0748 | 0.0688 | 144 | 0.0160 |
| | 250 | 0.2105 | 0.6510 | 1.9456 | 0.0025 | 0.0750 | 0.0690 | 223 | 0.0190 |
| | 500 | 0.2694 | 1.1349 | 2.4560 | 0.0031 | 0.0947 | 0.0871 | 311 | 0.0243 |
| | 750 | 0.5107 | 2.1334 | 4.7300 | 0.0059 | 0.1802 | 0.1658 | 587 | 0.0461 |
| Trenchers Composite | | 0.1274 | 0.4541 | 0.6043 | 0.0007 | 0.0485 | 0.0446 | 58.7 | 0.0115 |
| Welders | 15 | 0.0093 | 0.0400 | 0.0571 | 0.0001 | 0.0034 | 0.0032 | 6.2 | 0.0008 |
| | 25 | 0.0179 | 0.0532 | 0.0974 | 0.0001 | 0.0054 | 0.0050 | 11.3 | 0.0016 |
| | 50 | 0.0801 | 0.2564 | 0.2346 | 0.0003 | 0.0200 | 0.0184 | 26.0 | 0.0072 |
| | 120 | 0.0547 | 0.2606 | 0.3567 | 0.0005 | 0.0296 | 0.0273 | 39.5 | 0.0049 |
| | 175 | 0.0936 | 0.5424 | 0.7713 | 0.0011 | 0.0405 | 0.0373 | 98.2 | 0.0084 |
| | 250 | 0.0749 | 0.2483 | 0.8249 | 0.0013 | 0.0248 | 0.0228 | 119 | 0.0068 |
| | 500 | 0.0968 | 0.3491 | 1.0171 | 0.0016 | 0.0325 | 0.0299 | 168 | 0.0087 |
| Welders Composite | | 0.0534 | 0.1994 | 0.2301 | 0.0003 | 0.0187 | 0.0172 | 25.6 | 0.0048 |

## 2020 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0138 | 0.0459 | 0.0854 | 0.0001 | 0.0035 | 0.0032 | 11.0 | 0.0012 |
| | 50 | 0.0261 | 0.1436 | 0.1422 | 0.0003 | 0.0071 | 0.0065 | 19.6 | 0.0024 |
| | 120 | 0.0259 | 0.2292 | 0.2166 | 0.0004 | 0.0127 | 0.0117 | 38.1 | 0.0023 |
| | 500 | 0.0751 | 0.3804 | 0.6959 | 0.0021 | 0.0217 | 0.0199 | 213 | 0.0068 |
| | 750 | 0.1373 | 0.6877 | 1.2876 | 0.0039 | 0.0396 | 0.0365 | 385 | 0.0124 |
| Aerial Lifts Composite | | 0.0261 | 0.1696 | 0.1866 | 0.0004 | 0.0092 | 0.0084 | 34.7 | 0.0024 |
| Air Compressors | 15 | 0.0093 | 0.0451 | 0.0579 | 0.0001 | 0.0029 | 0.0027 | 7.2 | 0.0008 |
| | 25 | 0.0196 | 0.0630 | 0.1155 | 0.0002 | 0.0054 | 0.0050 | 14.4 | 0.0018 |
| | 50 | 0.0398 | 0.2030 | 0.1725 | 0.0003 | 0.0099 | 0.0091 | 22.3 | 0.0036 |
| | 120 | 0.0408 | 0.3058 | 0.2826 | 0.0006 | 0.0188 | 0.0173 | 47.0 | 0.0037 |
| | 175 | 0.0587 | 0.4989 | 0.4013 | 0.0010 | 0.0210 | 0.0193 | 88.5 | 0.0053 |
| | 250 | 0.0669 | 0.2592 | 0.5067 | 0.0015 | 0.0163 | 0.0150 | 131 | 0.0060 |
| | 500 | 0.1146 | 0.4395 | 0.7970 | 0.0023 | 0.0276 | 0.0254 | 232 | 0.0103 |
| | 750 | 0.1777 | 0.6792 | 1.2615 | 0.0036 | 0.0432 | 0.0398 | 358 | 0.0160 |
| | 1000 | 0.2641 | 0.9959 | 3.2946 | 0.0049 | 0.0804 | 0.0740 | 486 | 0.0238 |
| Air Compressors Composite | | 0.0483 | 0.3077 | 0.3255 | 0.0007 | 0.0185 | 0.0170 | 63.6 | 0.0044 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0196 | 0.2205 | 0.1756 | 0.0004 | 0.0020 | 0.0018 | 31.0 | 0.0018 |
| | 120 | 0.0280 | 0.4662 | 0.2329 | 0.0009 | 0.0040 | 0.0037 | 77.1 | 0.0025 |
| | 175 | 0.0402 | 0.7542 | 0.1862 | 0.0016 | 0.0051 | 0.0047 | 141 | 0.0036 |
| | 250 | 0.0474 | 0.3426 | 0.1617 | 0.0021 | 0.0044 | 0.0040 | 188 | 0.0043 |
| | 500 | 0.0784 | 0.5512 | 0.2622 | 0.0031 | 0.0072 | 0.0066 | 311 | 0.0071 |
| | 750 | 0.1549 | 1.0891 | 0.5202 | 0.0062 | 0.0143 | 0.0131 | 615 | 0.0140 |
| | 1000 | 0.2442 | 1.6437 | 3.9853 | 0.0093 | 0.0530 | 0.0488 | 928 | 0.0220 |
| Bore/Drill Rigs Composite | | 0.0480 | 0.5008 | 0.3439 | 0.0017 | 0.0062 | 0.0057 | 165 | 0.0043 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0223 | 0.0741 | 0.1372 | 0.0002 | 0.0058 | 0.0053 | 17.6 | 0.0020 |
| Cement and Mortar Mixers Co | | 0.0086 | 0.0415 | 0.0536 | 0.0001 | 0.0021 | 0.0020 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0424 | 0.2420 | 0.2231 | 0.0004 | 0.0113 | 0.0104 | 30.2 | 0.0038 |
| | 120 | 0.0524 | 0.4613 | 0.4128 | 0.0009 | 0.0249 | 0.0229 | 74.1 | 0.0047 |
| | 175 | 0.0865 | 0.8662 | 0.6554 | 0.0018 | 0.0323 | 0.0297 | 160 | 0.0078 |
| Concrete/Industrial Saws Com | | 0.0484 | 0.3783 | 0.3410 | 0.0007 | 0.0196 | 0.0180 | 58.5 | 0.0044 |
| Cranes | 50 | 0.0532 | 0.2423 | 0.1894 | 0.0003 | 0.0121 | 0.0111 | 23.2 | 0.0048 |
| | 120 | 0.0542 | 0.3446 | 0.3317 | 0.0006 | 0.0240 | 0.0221 | 50.1 | 0.0049 |
| | 175 | 0.0648 | 0.4754 | 0.4071 | 0.0009 | 0.0223 | 0.0206 | 80.3 | 0.0058 |
| | 250 | 0.0704 | 0.2440 | 0.4949 | 0.0013 | 0.0170 | 0.0157 | 112 | 0.0064 |
| | 500 | 0.1087 | 0.3839 | 0.7047 | 0.0018 | 0.0257 | 0.0236 | 180 | 0.0098 |
| | 750 | 0.1837 | 0.6455 | 1.2225 | 0.0030 | 0.0439 | 0.0404 | 303 | 0.0166 |
| | 9999 | 0.6702 | 2.1934 | 7.0436 | 0.0098 | 0.1797 | 0.1654 | 971 | 0.0605 |
| Cranes Composite | | 0.0898 | 0.3917 | 0.6610 | 0.0014 | 0.0256 | 0.0236 | 129 | 0.0081 |
| Crawler Tractors | 50 | 0.0699 | 0.2771 | 0.2107 | 0.0003 | 0.0150 | 0.0138 | 24.9 | 0.0063 |
| | 120 | 0.0831 | 0.4628 | 0.4896 | 0.0008 | 0.0371 | 0.0341 | 65.8 | 0.0075 |
| | 175 | 0.1123 | 0.7302 | 0.7150 | 0.0014 | 0.0398 | 0.0366 | 121 | 0.0101 |
| | 250 | 0.1188 | 0.3966 | 0.8681 | 0.0019 | 0.0315 | 0.0290 | 166 | 0.0107 |
| | 500 | 0.1759 | 0.6665 | 1.2170 | 0.0025 | 0.0455 | 0.0419 | 259 | 0.0159 |
| | 750 | 0.3168 | 1.1935 | 2.2429 | 0.0047 | 0.0828 | 0.0762 | 465 | 0.0286 |
| | 1000 | 0.4836 | 1.8458 | 5.2162 | 0.0066 | 0.1425 | 0.1311 | 658 | 0.0436 |
| Crawler Tractors Composite | | 0.1049 | 0.5260 | 0.6772 | 0.0013 | 0.0378 | 0.0348 | 114 | 0.0095 |
| Crushing/Proc. E | 50 | 0.0734 | 0.4036 | 0.3367 | 0.0006 | 0.0181 | 0.0166 | 44.0 | 0.0066 |
| | 120 | 0.0692 | 0.5446 | 0.4754 | 0.0010 | 0.0302 | 0.0278 | 83.1 | 0.0062 |
| | 175 | 0.1083 | 0.9519 | 0.7042 | 0.0019 | 0.0368 | 0.0338 | 167 | 0.0098 |
| | 250 | 0.1245 | 0.4844 | 0.8670 | 0.0028 | 0.0282 | 0.0259 | 245 | 0.0112 |
| | 500 | 0.1852 | 0.7092 | 1.1829 | 0.0037 | 0.0416 | 0.0383 | 374 | 0.0167 |
| | 750 | 0.2912 | 1.1167 | 1.9026 | 0.0059 | 0.0655 | 0.0603 | 589 | 0.0263 |
| | 9999 | 0.7584 | 2.6528 | 8.5119 | 0.0131 | 0.2049 | 0.1885 | 1,308 | 0.0684 |
| Crushing/Proc. Equipment Co | | 0.0934 | 0.6247 | 0.5983 | 0.0015 | 0.0310 | 0.0285 | 132 | 0.0084 |
| Dumpers/Tender | 25 | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0384 | 0.2446 | 0.1862 | 0.0003 | 0.0080 | 0.0074 | 25.0 | 0.0035 |
| | 120 | 0.0583 | 0.4979 | 0.3717 | 0.0009 | 0.0206 | 0.0189 | 73.6 | 0.0053 |
| | 175 | 0.0703 | 0.6637 | 0.3868 | 0.0013 | 0.0195 | 0.0179 | 112 | 0.0063 |
| | 250 | 0.0828 | 0.3276 | 0.4493 | 0.0018 | 0.0154 | 0.0141 | 159 | 0.0075 |
| | 500 | 0.1198 | 0.4591 | 0.6028 | 0.0023 | 0.0219 | 0.0202 | 234 | 0.0108 |
| | 750 | 0.1987 | 0.7606 | 1.0153 | 0.0039 | 0.0365 | 0.0336 | 387 | 0.0179 |
| Excavators Composite | | 0.0733 | 0.5124 | 0.4042 | 0.0013 | 0.0184 | 0.0169 | 120 | 0.0066 |
| Forklifts | 50 | 0.0191 | 0.1400 | 0.1084 | 0.0002 | 0.0039 | 0.0036 | 14.7 | 0.0017 |
| | 120 | 0.0225 | 0.2102 | 0.1443 | 0.0004 | 0.0074 | 0.0068 | 31.2 | 0.0020 |
| | 175 | 0.0336 | 0.3315 | 0.1772 | 0.0006 | 0.0087 | 0.0080 | 56.1 | 0.0030 |
| | 250 | 0.0385 | 0.1554 | 0.1887 | 0.0009 | 0.0062 | 0.0057 | 77.1 | 0.0035 |
| | 500 | 0.0548 | 0.2126 | 0.2528 | 0.0011 | 0.0088 | 0.0081 | 111 | 0.0049 |
| Forklifts Composite | | 0.0320 | 0.2160 | 0.1691 | 0.0006 | 0.0070 | 0.0065 | 54.4 | 0.0029 |
| Generator Sets | 15 | 0.0116 | 0.0638 | 0.0814 | 0.0002 | 0.0038 | 0.0035 | 10.2 | 0.0011 |
| | 25 | 0.0224 | 0.0769 | 0.1410 | 0.0002 | 0.0064 | 0.0059 | 17.6 | 0.0020 |
| | 50 | 0.0379 | 0.2161 | 0.2199 | 0.0004 | 0.0106 | 0.0098 | 30.6 | 0.0034 |
| | 120 | 0.0506 | 0.4641 | 0.4378 | 0.0009 | 0.0250 | 0.0230 | 77.9 | 0.0046 |
| | 175 | 0.0676 | 0.7323 | 0.5990 | 0.0016 | 0.0266 | 0.0245 | 142 | 0.0061 |
| | 250 | 0.0747 | 0.3844 | 0.7614 | 0.0024 | 0.0218 | 0.0200 | 213 | 0.0067 |
| | 500 | 0.1125 | 0.5968 | 1.0874 | 0.0033 | 0.0333 | 0.0307 | 337 | 0.0102 |
| | 750 | 0.1842 | 0.9634 | 1.7962 | 0.0055 | 0.0544 | 0.0500 | 544 | 0.0166 |
| | 9999 | 0.4502 | 2.0059 | 6.6947 | 0.0105 | 0.1476 | 0.1358 | 1,049 | 0.0406 |
| Generator Sets Composite | | 0.0395 | 0.2732 | 0.3232 | 0.0007 | 0.0150 | 0.0138 | 61.0 | 0.0036 |
| Graders | 50 | 0.0563 | 0.2762 | 0.2156 | 0.0004 | 0.0124 | 0.0114 | 27.5 | 0.0051 |
| | 120 | 0.0738 | 0.5090 | 0.4568 | 0.0009 | 0.0311 | 0.0286 | 75.0 | 0.0067 |
| | 175 | 0.0918 | 0.7282 | 0.5622 | 0.0014 | 0.0303 | 0.0279 | 124 | 0.0083 |
| | 250 | 0.0999 | 0.3683 | 0.6701 | 0.0019 | 0.0230 | 0.0211 | 172 | 0.0090 |
| | 500 | 0.1284 | 0.4966 | 0.7982 | 0.0023 | 0.0288 | 0.0265 | 229 | 0.0116 |
| | 750 | 0.2731 | 1.0508 | 1.7425 | 0.0049 | 0.0621 | 0.0571 | 486 | 0.0246 |
| Graders Composite | | 0.0919 | 0.5765 | 0.5823 | 0.0015 | 0.0280 | 0.0258 | 133 | 0.0083 |
| Off-Highway Trac | 120 | 0.1455 | 0.6789 | 0.8421 | 0.0011 | 0.0674 | 0.0621 | 93.7 | 0.0131 |
| | 175 | 0.1455 | 0.8025 | 0.9712 | 0.0015 | 0.0547 | 0.0503 | 130 | 0.0131 |
| | 250 | 0.1147 | 0.3614 | 0.8843 | 0.0015 | 0.0348 | 0.0321 | 130 | 0.0103 |
| | 750 | 0.4683 | 1.8825 | 3.5643 | 0.0057 | 0.1391 | 0.1280 | 568 | 0.0423 |
| | 1000 | 0.7129 | 2.9445 | 7.4279 | 0.0082 | 0.2214 | 0.2037 | 814 | 0.0643 |
| Off-Highway Tractors Compos | | 0.1470 | 0.6517 | 1.0657 | 0.0017 | 0.0497 | 0.0457 | 151 | 0.0133 |
| Off-Highway Truc | 175 | 0.0837 | 0.7538 | 0.4564 | 0.0014 | 0.0234 | 0.0215 | 125 | 0.0076 |
| | 250 | 0.0927 | 0.3514 | 0.5042 | 0.0019 | 0.0173 | 0.0159 | 167 | 0.0084 |
| | 500 | 0.1488 | 0.5446 | 0.7481 | 0.0027 | 0.0273 | 0.0251 | 272 | 0.0134 |
| | 750 | 0.2416 | 0.8831 | 1.2347 | 0.0044 | 0.0446 | 0.0411 | 442 | 0.0218 |
| | 1000 | 0.3613 | 1.2913 | 3.8920 | 0.0063 | 0.0903 | 0.0831 | 625 | 0.0326 |
| Off-Highway Trucks Composit | | 0.1443 | 0.5514 | 0.8306 | 0.0027 | 0.0280 | 0.0258 | 260 | 0.0130 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0328 | 0.2267 | 0.1956 | 0.0004 | 0.0078 | 0.0072 | 28.0 | 0.0030 |
| | 120 | 0.0501 | 0.5080 | 0.3835 | 0.0009 | 0.0199 | 0.0183 | 80.9 | 0.0045 |
| | 175 | 0.0524 | 0.5859 | 0.3414 | 0.0012 | 0.0164 | 0.0151 | 107 | 0.0047 |
| | 500 | 0.1012 | 0.4676 | 0.6065 | 0.0025 | 0.0212 | 0.0195 | 254 | 0.0091 |
| Other Construction Equipment | | 0.0563 | 0.3508 | 0.3519 | 0.0013 | 0.0139 | 0.0128 | 122 | 0.0051 |
| Other General In | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0431 | 0.2211 | 0.1744 | 0.0003 | 0.0101 | 0.0093 | 21.7 | 0.0039 |
| | 120 | 0.0602 | 0.4232 | 0.3810 | 0.0007 | 0.0256 | 0.0236 | 62.0 | 0.0054 |
| | 175 | 0.0721 | 0.5668 | 0.4439 | 0.0011 | 0.0237 | 0.0218 | 95.9 | 0.0065 |
| | 250 | 0.0791 | 0.2804 | 0.5318 | 0.0015 | 0.0173 | 0.0159 | 136 | 0.0071 |
| | 500 | 0.1506 | 0.5217 | 0.9276 | 0.0026 | 0.0326 | 0.0300 | 265 | 0.0136 |
| | 750 | 0.2490 | 0.8599 | 1.5657 | 0.0044 | 0.0543 | 0.0500 | 437 | 0.0225 |
| | 1000 | 0.3467 | 1.1855 | 3.8628 | 0.0056 | 0.0969 | 0.0892 | 560 | 0.0313 |
| Other General Industrial Equip | | 0.0983 | 0.4517 | 0.6661 | 0.0016 | 0.0262 | 0.0241 | 152 | 0.0089 |
| Other Material Ha | 50 | 0.0595 | 0.3049 | 0.2425 | 0.0004 | 0.0141 | 0.0130 | 30.3 | 0.0054 |
| | 120 | 0.0583 | 0.4117 | 0.3720 | 0.0007 | 0.0250 | 0.0230 | 60.7 | 0.0053 |
| | 175 | 0.0907 | 0.7176 | 0.5642 | 0.0014 | 0.0301 | 0.0277 | 122 | 0.0082 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0836 | 0.2984 | 0.5684 | 0.0016 | 0.0185 | 0.0170 | 145 | 0.0075 |
| | 500 | 0.1074 | 0.3752 | 0.6692 | 0.0019 | 0.0235 | 0.0216 | 192 | 0.0097 |
| | 9999 | 0.4910 | 1.5647 | 5.1082 | 0.0073 | 0.1280 | 0.1177 | 741 | 0.0443 |
| Other Material Handling Equip | | 0.0924 | 0.4429 | 0.6500 | 0.0015 | 0.0252 | 0.0232 | 141 | 0.0083 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1427 | 0.0002 | 0.0055 | 0.0051 | 18.7 | 0.0020 |
| | 50 | 0.0834 | 0.3055 | 0.2398 | 0.0004 | 0.0184 | 0.0169 | 28.0 | 0.0075 |
| | 120 | 0.0910 | 0.4805 | 0.5471 | 0.0008 | 0.0428 | 0.0394 | 69.2 | 0.0082 |
| | 175 | 0.1217 | 0.7599 | 0.8187 | 0.0014 | 0.0459 | 0.0422 | 128 | 0.0110 |
| | 250 | 0.1411 | 0.4713 | 1.1106 | 0.0022 | 0.0407 | 0.0375 | 194 | 0.0127 |
| | 500 | 0.1595 | 0.6305 | 1.1959 | 0.0023 | 0.0450 | 0.0414 | 233 | 0.0144 |
| Pavers Composite | | 0.0989 | 0.4920 | 0.5450 | 0.0009 | 0.0355 | 0.0326 | 77.9 | 0.0089 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0702 | 0.2577 | 0.2043 | 0.0003 | 0.0157 | 0.0144 | 23.9 | 0.0063 |
| | 120 | 0.0708 | 0.3762 | 0.4280 | 0.0006 | 0.0337 | 0.0310 | 54.5 | 0.0064 |
| | 175 | 0.0944 | 0.5945 | 0.6403 | 0.0011 | 0.0360 | 0.0331 | 101 | 0.0085 |
| | 250 | 0.0864 | 0.2894 | 0.6928 | 0.0014 | 0.0249 | 0.0229 | 122 | 0.0078 |
| Paving Equipment Composite | | 0.0757 | 0.4084 | 0.4807 | 0.0008 | 0.0315 | 0.0290 | 68.9 | 0.0068 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0056 | 0.0305 | 0.0390 | 0.0001 | 0.0018 | 0.0017 | 4.9 | 0.0005 |
| | 25 | 0.0091 | 0.0312 | 0.0572 | 0.0001 | 0.0026 | 0.0024 | 7.1 | 0.0008 |
| | 50 | 0.0128 | 0.0856 | 0.0986 | 0.0002 | 0.0041 | 0.0038 | 14.3 | 0.0012 |
| | 120 | 0.0128 | 0.1367 | 0.1293 | 0.0003 | 0.0065 | 0.0060 | 24.1 | 0.0012 |
| Pressure Washers Composite | | 0.0085 | 0.0549 | 0.0650 | 0.0001 | 0.0030 | 0.0027 | 9.4 | 0.0008 |
| Pumps | 15 | 0.0096 | 0.0464 | 0.0595 | 0.0001 | 0.0030 | 0.0028 | 7.4 | 0.0009 |
| | 25 | 0.0265 | 0.0850 | 0.1558 | 0.0002 | 0.0073 | 0.0067 | 19.5 | 0.0024 |
| | 50 | 0.0465 | 0.2546 | 0.2497 | 0.0004 | 0.0126 | 0.0116 | 34.3 | 0.0042 |
| | 120 | 0.0537 | 0.4713 | 0.4442 | 0.0009 | 0.0263 | 0.0242 | 77.9 | 0.0048 |
| | 175 | 0.0712 | 0.7336 | 0.6007 | 0.0016 | 0.0277 | 0.0255 | 140 | 0.0064 |
| | 250 | 0.0760 | 0.3700 | 0.7338 | 0.0023 | 0.0215 | 0.0198 | 201 | 0.0069 |
| | 500 | 0.1241 | 0.6189 | 1.1297 | 0.0034 | 0.0355 | 0.0327 | 345 | 0.0112 |
| | 750 | 0.2075 | 1.0232 | 1.9114 | 0.0057 | 0.0594 | 0.0547 | 571 | 0.0187 |
| | 9999 | 0.6127 | 2.6255 | 8.7489 | 0.0136 | 0.1961 | 0.1804 | 1,355 | 0.0553 |
| Pumps Composite | | 0.0376 | 0.2674 | 0.2854 | 0.0006 | 0.0147 | 0.0135 | 49.6 | 0.0034 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0543 | 0.2436 | 0.2039 | 0.0003 | 0.0128 | 0.0117 | 26.0 | 0.0049 |
| | 120 | 0.0576 | 0.3873 | 0.3799 | 0.0007 | 0.0270 | 0.0249 | 59.0 | 0.0052 |
| | 175 | 0.0774 | 0.6114 | 0.5331 | 0.0012 | 0.0286 | 0.0263 | 108 | 0.0070 |
| | 250 | 0.0842 | 0.3201 | 0.6581 | 0.0017 | 0.0223 | 0.0205 | 153 | 0.0076 |
| | 500 | 0.1151 | 0.4607 | 0.8354 | 0.0022 | 0.0299 | 0.0275 | 219 | 0.0104 |
| Rollers Composite | | 0.0584 | 0.3837 | 0.3793 | 0.0008 | 0.0232 | 0.0214 | 67.0 | 0.0053 |
| Rough Terrain Fo | 50 | 0.0520 | 0.3171 | 0.2556 | 0.0004 | 0.0122 | 0.0113 | 33.9 | 0.0047 |
| | 120 | 0.0495 | 0.4142 | 0.3326 | 0.0007 | 0.0197 | 0.0181 | 62.4 | 0.0045 |
| | 175 | 0.0788 | 0.7229 | 0.4710 | 0.0014 | 0.0245 | 0.0226 | 125 | 0.0071 |
| | 250 | 0.0881 | 0.3442 | 0.5378 | 0.0019 | 0.0182 | 0.0168 | 171 | 0.0079 |
| | 500 | 0.1296 | 0.4936 | 0.7287 | 0.0025 | 0.0265 | 0.0244 | 257 | 0.0117 |
| Rough Terrain Forklifts Compo | | 0.0533 | 0.4464 | 0.3494 | 0.0008 | 0.0201 | 0.0185 | 70.3 | 0.0048 |
| Rubber Tired Doz | 175 | 0.1509 | 0.8124 | 0.9962 | 0.0015 | 0.0561 | 0.0516 | 129 | 0.0136 |
| | 250 | 0.1701 | 0.5279 | 1.2898 | 0.0021 | 0.0516 | 0.0474 | 183 | 0.0153 |
| | 500 | 0.2291 | 0.9276 | 1.6868 | 0.0026 | 0.0673 | 0.0619 | 265 | 0.0207 |
| | 750 | 0.3461 | 1.3934 | 2.5948 | 0.0040 | 0.1024 | 0.0942 | 399 | 0.0312 |
| | 1000 | 0.5438 | 2.2500 | 5.5311 | 0.0060 | 0.1672 | 0.1539 | 592 | 0.0491 |
| Rubber Tired Dozers Compos | | 0.2118 | 0.8006 | 1.5773 | 0.0025 | 0.0630 | 0.0580 | 239 | 0.0191 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0615 | 0.3080 | 0.2424 | 0.0004 | 0.0137 | 0.0126 | 31.1 | 0.0055 |
| | 120 | 0.0563 | 0.3977 | 0.3529 | 0.0007 | 0.0237 | 0.0218 | 58.9 | 0.0051 |
| | 175 | 0.0767 | 0.6215 | 0.4713 | 0.0012 | 0.0253 | 0.0233 | 106 | 0.0069 |
| | 250 | 0.0848 | 0.3159 | 0.5655 | 0.0017 | 0.0194 | 0.0179 | 149 | 0.0077 |
| | 500 | 0.1302 | 0.5016 | 0.8032 | 0.0023 | 0.0291 | 0.0268 | 237 | 0.0118 |
| | 750 | 0.2680 | 1.0271 | 1.6958 | 0.0049 | 0.0606 | 0.0558 | 486 | 0.0242 |
| | 1000 | 0.3484 | 1.3166 | 4.0040 | 0.0060 | 0.0983 | 0.0904 | 594 | 0.0314 |
| Rubber Tired Loaders Compos | | 0.0753 | 0.4406 | 0.4747 | 0.0012 | 0.0235 | 0.0216 | 109 | 0.0068 |
| Scrapers | 120 | 0.1218 | 0.6612 | 0.7170 | 0.0011 | 0.0551 | 0.0507 | 93.9 | 0.0110 |

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|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1400 | 0.8921 | 0.9020 | 0.0017 | 0.0505 | 0.0464 | 148 | 0.0126 |
| | 250 | 0.1522 | 0.5044 | 1.1344 | 0.0024 | 0.0412 | 0.0379 | 209 | 0.0137 |
| | 500 | 0.2211 | 0.8455 | 1.5615 | 0.0032 | 0.0584 | 0.0537 | 321 | 0.0200 |
| | 750 | 0.3839 | 1.4588 | 2.7734 | 0.0056 | 0.1024 | 0.0942 | 555 | 0.0346 |
| Scrapers Composite | | 0.1914 | 0.7938 | 1.3434 | 0.0027 | 0.0541 | 0.0497 | 262 | 0.0173 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0502 | 0.2833 | 0.2631 | 0.0005 | 0.0131 | 0.0121 | 36.2 | 0.0045 |
| | 120 | 0.0558 | 0.4946 | 0.4424 | 0.0009 | 0.0264 | 0.0243 | 80.2 | 0.0050 |
| | 175 | 0.0811 | 0.8276 | 0.6279 | 0.0017 | 0.0302 | 0.0277 | 155 | 0.0073 |
| | 250 | 0.1022 | 0.4765 | 0.8737 | 0.0029 | 0.0266 | 0.0245 | 255 | 0.0092 |
| Signal Boards Composite | | 0.0129 | 0.0912 | 0.0912 | 0.0002 | 0.0042 | 0.0038 | 16.7 | 0.0012 |
| Skid Steer Loade | 25 | 0.0171 | 0.0575 | 0.1070 | 0.0002 | 0.0044 | 0.0040 | 13.8 | 0.0015 |
| | 50 | 0.0230 | 0.2006 | 0.1655 | 0.0003 | 0.0043 | 0.0040 | 25.5 | 0.0021 |
| | 120 | 0.0218 | 0.2673 | 0.1647 | 0.0005 | 0.0064 | 0.0059 | 42.8 | 0.0020 |
| Skid Steer Loaders Composite | | 0.0222 | 0.2125 | 0.1614 | 0.0004 | 0.0050 | 0.0046 | 30.3 | 0.0020 |
| Surfacing Equipm | 50 | 0.0265 | 0.1191 | 0.1069 | 0.0002 | 0.0063 | 0.0058 | 14.1 | 0.0024 |
| | 120 | 0.0570 | 0.4028 | 0.4035 | 0.0007 | 0.0271 | 0.0250 | 63.8 | 0.0051 |
| | 175 | 0.0550 | 0.4663 | 0.4168 | 0.0010 | 0.0210 | 0.0193 | 85.8 | 0.0050 |
| | 250 | 0.0652 | 0.2754 | 0.5719 | 0.0015 | 0.0188 | 0.0173 | 135 | 0.0059 |
| | 500 | 0.1008 | 0.4728 | 0.8400 | 0.0022 | 0.0288 | 0.0265 | 221 | 0.0091 |
| | 750 | 0.1599 | 0.7413 | 1.3593 | 0.0035 | 0.0459 | 0.0423 | 347 | 0.0144 |
| Surfacing Equipment Compos | | 0.0823 | 0.3953 | 0.6593 | 0.0017 | 0.0239 | 0.0220 | 166 | 0.0074 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0430 | 0.2898 | 0.2365 | 0.0004 | 0.0098 | 0.0090 | 31.6 | 0.0039 |
| | 120 | 0.0555 | 0.4959 | 0.3694 | 0.0009 | 0.0210 | 0.0193 | 75.0 | 0.0050 |
| | 175 | 0.0845 | 0.8043 | 0.4869 | 0.0016 | 0.0253 | 0.0233 | 139 | 0.0076 |
| | 250 | 0.0803 | 0.3198 | 0.4530 | 0.0018 | 0.0152 | 0.0140 | 162 | 0.0072 |
| Sweepers/Scrubbers Composi | | 0.0584 | 0.4916 | 0.3563 | 0.0009 | 0.0183 | 0.0169 | 78.5 | 0.0053 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0046 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0407 | 0.2760 | 0.2179 | 0.0004 | 0.0087 | 0.0080 | 30.3 | 0.0037 |
| | 120 | 0.0366 | 0.3402 | 0.2466 | 0.0006 | 0.0129 | 0.0119 | 51.7 | 0.0033 |
| | 175 | 0.0571 | 0.5841 | 0.3220 | 0.0011 | 0.0159 | 0.0146 | 101 | 0.0052 |
| | 250 | 0.0813 | 0.3445 | 0.4427 | 0.0019 | 0.0151 | 0.0139 | 172 | 0.0073 |
| | 500 | 0.1606 | 0.6642 | 0.8132 | 0.0039 | 0.0294 | 0.0270 | 345 | 0.0145 |
| | 750 | 0.2409 | 0.9959 | 1.2387 | 0.0058 | 0.0443 | 0.0408 | 517 | 0.0217 |
| Tractors/Loaders/Backhoes Co | | 0.0436 | 0.3616 | 0.2744 | 0.0008 | 0.0134 | 0.0124 | 66.8 | 0.0039 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0990 | 0.3495 | 0.2804 | 0.0004 | 0.0218 | 0.0201 | 32.9 | 0.0089 |
| | 120 | 0.0849 | 0.4443 | 0.5223 | 0.0008 | 0.0408 | 0.0375 | 64.9 | 0.0077 |
| | 175 | 0.1346 | 0.8393 | 0.9412 | 0.0016 | 0.0521 | 0.0479 | 144 | 0.0121 |
| | 250 | 0.1600 | 0.5472 | 1.3120 | 0.0025 | 0.0487 | 0.0448 | 223 | 0.0144 |
| | 500 | 0.2092 | 0.8710 | 1.6487 | 0.0031 | 0.0623 | 0.0573 | 311 | 0.0189 |
| | 750 | 0.3964 | 1.6395 | 3.1894 | 0.0059 | 0.1191 | 0.1095 | 587 | 0.0358 |
| Trenchers Composite | | 0.0933 | 0.4270 | 0.4575 | 0.0007 | 0.0336 | 0.0309 | 58.7 | 0.0084 |
| Welders | 15 | 0.0080 | 0.0388 | 0.0498 | 0.0001 | 0.0025 | 0.0023 | 6.2 | 0.0007 |
| | 25 | 0.0153 | 0.0492 | 0.0903 | 0.0001 | 0.0042 | 0.0039 | 11.3 | 0.0014 |
| | 50 | 0.0435 | 0.2219 | 0.1968 | 0.0003 | 0.0110 | 0.0102 | 26.0 | 0.0039 |
| | 120 | 0.0321 | 0.2508 | 0.2344 | 0.0005 | 0.0153 | 0.0140 | 39.5 | 0.0029 |
| | 175 | 0.0600 | 0.5396 | 0.4393 | 0.0011 | 0.0223 | 0.0205 | 98.2 | 0.0054 |
| | 250 | 0.0551 | 0.2294 | 0.4536 | 0.0013 | 0.0142 | 0.0130 | 119 | 0.0050 |
| | 500 | 0.0748 | 0.3117 | 0.5690 | 0.0016 | 0.0192 | 0.0176 | 168 | 0.0067 |
| Welders Composite | | 0.0310 | 0.1816 | 0.1735 | 0.0003 | 0.0102 | 0.0094 | 25.6 | 0.0028 |

## 2025 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0132 | 0.0451 | 0.0838 | 0.0001 | 0.0032 | 0.0030 | 11.0 | 0.0012 |
| | 50 | 0.0168 | 0.1351 | 0.1218 | 0.0003 | 0.0035 | 0.0032 | 19.6 | 0.0015 |
| | 120 | 0.0176 | 0.2265 | 0.1496 | 0.0004 | 0.0063 | 0.0058 | 38.1 | 0.0016 |
| | 500 | 0.0580 | 0.3710 | 0.3660 | 0.0021 | 0.0109 | 0.0100 | 213 | 0.0052 |
| | 750 | 0.1054 | 0.6706 | 0.6753 | 0.0039 | 0.0199 | 0.0183 | 385 | 0.0095 |
| Aerial Lifts Composite | | 0.0184 | 0.1646 | 0.1366 | 0.0004 | 0.0048 | 0.0044 | 34.7 | 0.0017 |
| Air Compressors | 15 | 0.0087 | 0.0444 | 0.0545 | 0.0001 | 0.0023 | 0.0022 | 7.2 | 0.0008 |
| | 25 | 0.0181 | 0.0605 | 0.1121 | 0.0002 | 0.0045 | 0.0042 | 14.4 | 0.0016 |
| | 50 | 0.0263 | 0.1911 | 0.1476 | 0.0003 | 0.0047 | 0.0043 | 22.3 | 0.0024 |
| | 120 | 0.0289 | 0.3023 | 0.1928 | 0.0006 | 0.0088 | 0.0081 | 47.0 | 0.0026 |
| | 175 | 0.0424 | 0.4998 | 0.2187 | 0.0010 | 0.0104 | 0.0095 | 88.5 | 0.0038 |
| | 250 | 0.0514 | 0.2531 | 0.2553 | 0.0015 | 0.0078 | 0.0072 | 131 | 0.0046 |
| | 500 | 0.0894 | 0.4292 | 0.4150 | 0.0023 | 0.0134 | 0.0123 | 232 | 0.0081 |
| | 750 | 0.1385 | 0.6633 | 0.6545 | 0.0036 | 0.0210 | 0.0193 | 358 | 0.0125 |
| | 1000 | 0.1999 | 0.9265 | 2.5439 | 0.0049 | 0.0483 | 0.0444 | 486 | 0.0180 |
| Air Compressors Composite | | 0.0349 | 0.3027 | 0.2104 | 0.0007 | 0.0088 | 0.0081 | 63.6 | 0.0031 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0190 | 0.2200 | 0.1662 | 0.0004 | 0.0009 | 0.0008 | 31.0 | 0.0017 |
| | 120 | 0.0252 | 0.4660 | 0.1955 | 0.0009 | 0.0020 | 0.0018 | 77.1 | 0.0023 |
| | 175 | 0.0324 | 0.7542 | 0.0787 | 0.0016 | 0.0030 | 0.0027 | 141 | 0.0029 |
| | 250 | 0.0427 | 0.3426 | 0.0981 | 0.0021 | 0.0035 | 0.0032 | 188 | 0.0039 |
| | 500 | 0.0706 | 0.5512 | 0.1622 | 0.0031 | 0.0058 | 0.0054 | 311 | 0.0064 |
| | 750 | 0.1396 | 1.0891 | 0.3204 | 0.0062 | 0.0115 | 0.0106 | 615 | 0.0126 |
| | 1000 | 0.2115 | 1.6437 | 3.8912 | 0.0093 | 0.0364 | 0.0335 | 928 | 0.0191 |
| Bore/Drill Rigs Composite | | 0.0428 | 0.5007 | 0.2864 | 0.0017 | 0.0042 | 0.0038 | 165 | 0.0039 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0213 | 0.0724 | 0.1346 | 0.0002 | 0.0052 | 0.0048 | 17.6 | 0.0019 |
| Cement and Mortar Mixers Co | | 0.0085 | 0.0414 | 0.0534 | 0.0001 | 0.0021 | 0.0019 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0279 | 0.2284 | 0.1910 | 0.0004 | 0.0053 | 0.0049 | 30.2 | 0.0025 |
| | 120 | 0.0370 | 0.4561 | 0.2840 | 0.0009 | 0.0117 | 0.0108 | 74.1 | 0.0033 |
| | 175 | 0.0623 | 0.8663 | 0.3523 | 0.0018 | 0.0160 | 0.0147 | 160 | 0.0056 |
| Concrete/Industrial Saws Com | | 0.0337 | 0.3706 | 0.2471 | 0.0007 | 0.0093 | 0.0086 | 58.5 | 0.0030 |
| Cranes | 50 | 0.0350 | 0.2256 | 0.1644 | 0.0003 | 0.0062 | 0.0057 | 23.2 | 0.0032 |
| | 120 | 0.0376 | 0.3384 | 0.2298 | 0.0006 | 0.0120 | 0.0111 | 50.1 | 0.0034 |
| | 175 | 0.0462 | 0.4744 | 0.2300 | 0.0009 | 0.0120 | 0.0110 | 80.3 | 0.0042 |
| | 250 | 0.0544 | 0.2316 | 0.2705 | 0.0013 | 0.0094 | 0.0087 | 112 | 0.0049 |
| | 500 | 0.0858 | 0.3535 | 0.3977 | 0.0018 | 0.0146 | 0.0134 | 180 | 0.0077 |
| | 750 | 0.1446 | 0.5947 | 0.6821 | 0.0030 | 0.0248 | 0.0228 | 303 | 0.0130 |
| | 9999 | 0.5219 | 1.9715 | 5.5760 | 0.0098 | 0.1146 | 0.1055 | 971 | 0.0471 |
| Cranes Composite | | 0.0681 | 0.3738 | 0.4223 | 0.0014 | 0.0143 | 0.0132 | 129 | 0.0061 |
| Crawler Tractors | 50 | 0.0487 | 0.2566 | 0.1842 | 0.0003 | 0.0090 | 0.0083 | 24.9 | 0.0044 |
| | 120 | 0.0609 | 0.4537 | 0.3562 | 0.0008 | 0.0221 | 0.0203 | 65.8 | 0.0055 |
| | 175 | 0.0823 | 0.7265 | 0.4447 | 0.0014 | 0.0241 | 0.0222 | 121 | 0.0074 |
| | 250 | 0.0924 | 0.3662 | 0.5348 | 0.0019 | 0.0192 | 0.0177 | 166 | 0.0083 |
| | 500 | 0.1392 | 0.5877 | 0.7527 | 0.0025 | 0.0280 | 0.0258 | 259 | 0.0126 |
| | 750 | 0.2506 | 1.0528 | 1.3878 | 0.0047 | 0.0510 | 0.0469 | 465 | 0.0226 |
| | 1000 | 0.3749 | 1.5618 | 4.2168 | 0.0066 | 0.0958 | 0.0881 | 658 | 0.0338 |
| Crawler Tractors Composite | | 0.0789 | 0.5065 | 0.4492 | 0.0013 | 0.0227 | 0.0209 | 114 | 0.0071 |
| Crushing/Proc. E | 50 | 0.0508 | 0.3859 | 0.2899 | 0.0006 | 0.0083 | 0.0077 | 44.0 | 0.0046 |
| | 120 | 0.0506 | 0.5406 | 0.3289 | 0.0010 | 0.0140 | 0.0129 | 83.1 | 0.0046 |
| | 175 | 0.0795 | 0.9556 | 0.3830 | 0.0019 | 0.0177 | 0.0163 | 167 | 0.0072 |
| | 250 | 0.0967 | 0.4768 | 0.4357 | 0.0028 | 0.0134 | 0.0123 | 245 | 0.0087 |
| | 500 | 0.1459 | 0.6977 | 0.6163 | 0.0037 | 0.0200 | 0.0184 | 374 | 0.0132 |
| | 750 | 0.2307 | 1.1003 | 0.9907 | 0.0059 | 0.0316 | 0.0291 | 589 | 0.0208 |
| | 9999 | 0.6019 | 2.5014 | 6.6977 | 0.0131 | 0.1238 | 0.1139 | 1,308 | 0.0543 |
| Crushing/Proc. Equipment Co | | 0.0693 | 0.6187 | 0.3763 | 0.0015 | 0.0146 | 0.0134 | 132 | 0.0062 |
| Dumpers/Tenders | 25 | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0297 | 0.2365 | 0.1616 | 0.0003 | 0.0035 | 0.0032 | 25.0 | 0.0027 |
| | 120 | 0.0448 | 0.4942 | 0.2638 | 0.0009 | 0.0092 | 0.0085 | 73.6 | 0.0040 |
| | 175 | 0.0518 | 0.6636 | 0.1982 | 0.0013 | 0.0091 | 0.0084 | 112 | 0.0047 |
| | 250 | 0.0647 | 0.3210 | 0.2222 | 0.0018 | 0.0074 | 0.0068 | 159 | 0.0058 |
| | 500 | 0.0946 | 0.4495 | 0.3091 | 0.0023 | 0.0107 | 0.0098 | 234 | 0.0085 |
| | 750 | 0.1569 | 0.7451 | 0.5194 | 0.0039 | 0.0178 | 0.0164 | 387 | 0.0142 |
| Excavators Composite | | 0.0559 | 0.5086 | 0.2269 | 0.0013 | 0.0086 | 0.0079 | 120 | 0.0050 |
| Forklifts | 50 | 0.0150 | 0.1361 | 0.0904 | 0.0002 | 0.0013 | 0.0012 | 14.7 | 0.0014 |
| | 120 | 0.0168 | 0.2086 | 0.0997 | 0.0004 | 0.0023 | 0.0021 | 31.2 | 0.0015 |
| | 175 | 0.0228 | 0.3310 | 0.0732 | 0.0006 | 0.0029 | 0.0026 | 56.1 | 0.0021 |
| | 250 | 0.0289 | 0.1551 | 0.0746 | 0.0009 | 0.0027 | 0.0024 | 77.1 | 0.0026 |
| | 500 | 0.0416 | 0.2123 | 0.1038 | 0.0011 | 0.0038 | 0.0035 | 111 | 0.0038 |
| Forklifts Composite | | 0.0236 | 0.2148 | 0.0860 | 0.0006 | 0.0025 | 0.0023 | 54.4 | 0.0021 |
| Generator Sets | 15 | 0.0109 | 0.0627 | 0.0768 | 0.0002 | 0.0032 | 0.0030 | 10.2 | 0.0010 |
| | 25 | 0.0216 | 0.0738 | 0.1368 | 0.0002 | 0.0055 | 0.0050 | 17.6 | 0.0019 |
| | 50 | 0.0242 | 0.2034 | 0.1881 | 0.0004 | 0.0051 | 0.0047 | 30.6 | 0.0022 |
| | 120 | 0.0340 | 0.4585 | 0.3022 | 0.0009 | 0.0122 | 0.0112 | 77.9 | 0.0031 |
| | 175 | 0.0469 | 0.7328 | 0.3291 | 0.0016 | 0.0136 | 0.0125 | 142 | 0.0042 |
| | 250 | 0.0558 | 0.3746 | 0.3885 | 0.0024 | 0.0108 | 0.0099 | 213 | 0.0050 |
| | 500 | 0.0862 | 0.5820 | 0.5697 | 0.0033 | 0.0167 | 0.0153 | 337 | 0.0078 |
| | 750 | 0.1401 | 0.9395 | 0.9382 | 0.0055 | 0.0272 | 0.0250 | 544 | 0.0126 |
| | 9999 | 0.3235 | 1.8648 | 5.2188 | 0.0105 | 0.0888 | 0.0817 | 1,049 | 0.0292 |
| Generator Sets Composite | | 0.0288 | 0.2667 | 0.2329 | 0.0007 | 0.0081 | 0.0074 | 61.0 | 0.0026 |
| Graders | 50 | 0.0382 | 0.2599 | 0.1877 | 0.0004 | 0.0063 | 0.0058 | 27.5 | 0.0034 |
| | 120 | 0.0521 | 0.5009 | 0.3219 | 0.0009 | 0.0153 | 0.0141 | 75.0 | 0.0047 |
| | 175 | 0.0652 | 0.7261 | 0.3117 | 0.0014 | 0.0157 | 0.0144 | 124 | 0.0059 |
| | 250 | 0.0781 | 0.3549 | 0.3652 | 0.0019 | 0.0129 | 0.0119 | 172 | 0.0071 |
| | 500 | 0.1023 | 0.4610 | 0.4468 | 0.0023 | 0.0165 | 0.0152 | 229 | 0.0092 |
| | 750 | 0.2167 | 0.9755 | 0.9628 | 0.0049 | 0.0353 | 0.0324 | 486 | 0.0196 |
| Graders Composite | | 0.0676 | 0.5696 | 0.3314 | 0.0015 | 0.0147 | 0.0135 | 133 | 0.0061 |
| Off-Highway Trac | 120 | 0.1108 | 0.6619 | 0.6362 | 0.0011 | 0.0455 | 0.0419 | 93.7 | 0.0100 |
| | 175 | 0.1110 | 0.7932 | 0.6639 | 0.0015 | 0.0370 | 0.0341 | 130 | 0.0100 |
| | 250 | 0.0890 | 0.3179 | 0.5983 | 0.0015 | 0.0227 | 0.0208 | 130 | 0.0080 |
| | 750 | 0.3692 | 1.5358 | 2.4157 | 0.0057 | 0.0918 | 0.0844 | 568 | 0.0333 |
| | 1000 | 0.5623 | 2.3619 | 6.0896 | 0.0082 | 0.1577 | 0.1451 | 814 | 0.0507 |
| Off-Highway Tractors Compos | | 0.1134 | 0.6101 | 0.7291 | 0.0017 | 0.0331 | 0.0305 | 151 | 0.0102 |
| Off-Highway Truc | 175 | 0.0622 | 0.7536 | 0.2376 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0056 |
| | 250 | 0.0730 | 0.3435 | 0.2521 | 0.0019 | 0.0085 | 0.0078 | 167 | 0.0066 |
| | 500 | 0.1183 | 0.5319 | 0.3878 | 0.0027 | 0.0135 | 0.0124 | 272 | 0.0107 |
| | 750 | 0.1921 | 0.8627 | 0.6384 | 0.0044 | 0.0221 | 0.0203 | 442 | 0.0173 |
| | 1000 | 0.2823 | 1.2403 | 3.1782 | 0.0063 | 0.0546 | 0.0502 | 625 | 0.0255 |
| Off-Highway Trucks Composit | | 0.1140 | 0.5385 | 0.4769 | 0.0027 | 0.0142 | 0.0131 | 260 | 0.0103 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0244 | 0.2188 | 0.1693 | 0.0004 | 0.0034 | 0.0031 | 28.0 | 0.0022 |
| | 120 | 0.0379 | 0.5045 | 0.2730 | 0.0009 | 0.0087 | 0.0080 | 80.9 | 0.0034 |
| | 175 | 0.0384 | 0.5858 | 0.1729 | 0.0012 | 0.0075 | 0.0069 | 107 | 0.0035 |
| | 500 | 0.0792 | 0.4606 | 0.3034 | 0.0025 | 0.0099 | 0.0091 | 254 | 0.0071 |
| Other Construction Equipment | | 0.0442 | 0.3474 | 0.2021 | 0.0013 | 0.0069 | 0.0063 | 123 | 0.0040 |
| Other General Inc | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0298 | 0.2099 | 0.1491 | 0.0003 | 0.0047 | 0.0043 | 21.7 | 0.0027 |
| | 120 | 0.0436 | 0.4189 | 0.2603 | 0.0007 | 0.0120 | 0.0111 | 62.0 | 0.0039 |
| | 175 | 0.0519 | 0.5684 | 0.2412 | 0.0011 | 0.0115 | 0.0106 | 95.9 | 0.0047 |
| | 250 | 0.0608 | 0.2743 | 0.2679 | 0.0015 | 0.0083 | 0.0076 | 136 | 0.0055 |
| | 500 | 0.1174 | 0.5103 | 0.4826 | 0.0026 | 0.0157 | 0.0145 | 265 | 0.0106 |
| | 750 | 0.1939 | 0.8411 | 0.8117 | 0.0044 | 0.0262 | 0.0241 | 437 | 0.0175 |
| | 1000 | 0.2627 | 1.1060 | 2.9924 | 0.0056 | 0.0579 | 0.0533 | 560 | 0.0237 |
| Other General Industrial Equip | | 0.0747 | 0.4438 | 0.3947 | 0.0016 | 0.0130 | 0.0120 | 152 | 0.0067 |
| Other Material Ha | 50 | 0.0410 | 0.2893 | 0.2073 | 0.0004 | 0.0065 | 0.0060 | 30.3 | 0.0037 |
| | 120 | 0.0421 | 0.4076 | 0.2541 | 0.0007 | 0.0117 | 0.0108 | 60.7 | 0.0038 |
| | 175 | 0.0653 | 0.7197 | 0.3067 | 0.0014 | 0.0146 | 0.0134 | 122 | 0.0059 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0642 | 0.2920 | 0.2863 | 0.0016 | 0.0088 | 0.0081 | 145 | 0.0058 |
| | 500 | 0.0837 | 0.3670 | 0.3482 | 0.0019 | 0.0113 | 0.0104 | 192 | 0.0075 |
| | 9999 | 0.3781 | 1.4596 | 3.9555 | 0.0073 | 0.0764 | 0.0703 | 741 | 0.0341 |
| Other Material Handling Equip | | 0.0696 | 0.4355 | 0.3844 | 0.0015 | 0.0124 | 0.0114 | 141 | 0.0063 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1422 | 0.0002 | 0.0053 | 0.0049 | 18.7 | 0.0020 |
| | 50 | 0.0574 | 0.2803 | 0.2102 | 0.0004 | 0.0114 | 0.0105 | 28.0 | 0.0052 |
| | 120 | 0.0662 | 0.4696 | 0.4003 | 0.0008 | 0.0263 | 0.0242 | 69.2 | 0.0060 |
| | 175 | 0.0899 | 0.7543 | 0.5238 | 0.0014 | 0.0286 | 0.0263 | 128 | 0.0081 |
| | 250 | 0.1097 | 0.4287 | 0.7020 | 0.0022 | 0.0254 | 0.0234 | 194 | 0.0099 |
| | 500 | 0.1263 | 0.5374 | 0.7572 | 0.0023 | 0.0284 | 0.0261 | 233 | 0.0114 |
| Pavers Composite | | 0.0717 | 0.4745 | 0.3858 | 0.0009 | 0.0220 | 0.0202 | 77.9 | 0.0065 |
| Paving Equipmer | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0469 | 0.2355 | 0.1789 | 0.0003 | 0.0095 | 0.0088 | 23.9 | 0.0042 |
| | 120 | 0.0503 | 0.3671 | 0.3092 | 0.0006 | 0.0200 | 0.0184 | 54.5 | 0.0045 |
| | 175 | 0.0687 | 0.5900 | 0.4021 | 0.0011 | 0.0219 | 0.0201 | 101 | 0.0062 |
| | 250 | 0.0672 | 0.2648 | 0.4289 | 0.0014 | 0.0154 | 0.0141 | 122 | 0.0061 |
| Paving Equipment Composite | | 0.0548 | 0.3993 | 0.3281 | 0.0008 | 0.0190 | 0.0175 | 68.9 | 0.0049 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0052 | 0.0301 | 0.0368 | 0.0001 | 0.0015 | 0.0014 | 4.9 | 0.0005 |
| | 25 | 0.0087 | 0.0299 | 0.0555 | 0.0001 | 0.0022 | 0.0020 | 7.1 | 0.0008 |
| | 50 | 0.0079 | 0.0810 | 0.0843 | 0.0002 | 0.0019 | 0.0018 | 14.3 | 0.0007 |
| | 120 | 0.0082 | 0.1351 | 0.0897 | 0.0003 | 0.0031 | 0.0029 | 24.1 | 0.0007 |
| Pressure Washers Composite | | 0.0066 | 0.0531 | 0.0561 | 0.0001 | 0.0019 | 0.0017 | 9.4 | 0.0006 |
| Pumps | 15 | 0.0089 | 0.0456 | 0.0560 | 0.0001 | 0.0024 | 0.0022 | 7.4 | 0.0008 |
| | 25 | 0.0244 | 0.0816 | 0.1512 | 0.0002 | 0.0061 | 0.0056 | 19.5 | 0.0022 |
| | 50 | 0.0299 | 0.2394 | 0.2138 | 0.0004 | 0.0061 | 0.0056 | 34.3 | 0.0027 |
| | 120 | 0.0365 | 0.4656 | 0.3062 | 0.0009 | 0.0129 | 0.0119 | 77.9 | 0.0033 |
| | 175 | 0.0499 | 0.7342 | 0.3301 | 0.0016 | 0.0142 | 0.0130 | 140 | 0.0045 |
| | 250 | 0.0572 | 0.3604 | 0.3745 | 0.0023 | 0.0107 | 0.0098 | 201 | 0.0052 |
| | 500 | 0.0959 | 0.6034 | 0.5922 | 0.0034 | 0.0178 | 0.0163 | 345 | 0.0087 |
| | 750 | 0.1593 | 0.9975 | 0.9991 | 0.0057 | 0.0297 | 0.0274 | 571 | 0.0144 |
| | 9999 | 0.4488 | 2.4388 | 6.8114 | 0.0136 | 0.1186 | 0.1091 | 1,355 | 0.0405 |
| Pumps Composite | | 0.0270 | 0.2617 | 0.2079 | 0.0006 | 0.0078 | 0.0072 | 49.6 | 0.0024 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0345 | 0.2258 | 0.1776 | 0.0003 | 0.0068 | 0.0062 | 26.0 | 0.0031 |
| | 120 | 0.0392 | 0.3801 | 0.2647 | 0.0007 | 0.0137 | 0.0126 | 59.0 | 0.0035 |
| | 175 | 0.0553 | 0.6096 | 0.3030 | 0.0012 | 0.0156 | 0.0143 | 108 | 0.0050 |
| | 250 | 0.0656 | 0.3037 | 0.3629 | 0.0017 | 0.0127 | 0.0116 | 153 | 0.0059 |
| | 500 | 0.0920 | 0.4189 | 0.4752 | 0.0022 | 0.0174 | 0.0160 | 219 | 0.0083 |
| Rollers Composite | | 0.0410 | 0.3763 | 0.2501 | 0.0008 | 0.0122 | 0.0113 | 67.0 | 0.0037 |
| Rough Terrain Fo | 50 | 0.0381 | 0.3041 | 0.2193 | 0.0004 | 0.0054 | 0.0049 | 33.9 | 0.0034 |
| | 120 | 0.0369 | 0.4106 | 0.2316 | 0.0007 | 0.0087 | 0.0080 | 62.4 | 0.0033 |
| | 175 | 0.0569 | 0.7229 | 0.2450 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0051 |
| | 250 | 0.0671 | 0.3372 | 0.2625 | 0.0019 | 0.0084 | 0.0077 | 171 | 0.0061 |
| | 500 | 0.0999 | 0.4838 | 0.3682 | 0.0025 | 0.0123 | 0.0113 | 257 | 0.0090 |
| Rough Terrain Forklifts Compo | | 0.0396 | 0.4430 | 0.2336 | 0.0008 | 0.0090 | 0.0083 | 70.3 | 0.0036 |
| Rubber Tired Doz | 175 | 0.1163 | 0.8019 | 0.6895 | 0.0015 | 0.0386 | 0.0355 | 129 | 0.0105 |
| | 250 | 0.1329 | 0.4624 | 0.8841 | 0.0021 | 0.0340 | 0.0312 | 183 | 0.0120 |
| | 500 | 0.1817 | 0.7490 | 1.1543 | 0.0026 | 0.0448 | 0.0412 | 265 | 0.0164 |
| | 750 | 0.2747 | 1.1262 | 1.7818 | 0.0040 | 0.0684 | 0.0629 | 399 | 0.0248 |
| | 1000 | 0.4321 | 1.7954 | 4.5523 | 0.0060 | 0.1202 | 0.1106 | 592 | 0.0390 |
| Rubber Tired Dozers Compos | | 0.1672 | 0.6620 | 1.0824 | 0.0025 | 0.0419 | 0.0385 | 239 | 0.0151 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0418 | 0.2904 | 0.2109 | 0.0004 | 0.0069 | 0.0063 | 31.1 | 0.0038 |
| | 120 | 0.0397 | 0.3916 | 0.2476 | 0.0007 | 0.0115 | 0.0105 | 58.9 | 0.0036 |
| | 175 | 0.0546 | 0.6199 | 0.2592 | 0.0012 | 0.0130 | 0.0119 | 106 | 0.0049 |
| | 250 | 0.0661 | 0.3041 | 0.3040 | 0.0017 | 0.0107 | 0.0099 | 149 | 0.0060 |
| | 500 | 0.1034 | 0.4654 | 0.4455 | 0.0023 | 0.0164 | 0.0151 | 237 | 0.0093 |
| | 750 | 0.2119 | 0.9532 | 0.9273 | 0.0049 | 0.0338 | 0.0311 | 486 | 0.0191 |
| | 1000 | 0.2701 | 1.1927 | 3.2272 | 0.0060 | 0.0615 | 0.0566 | 594 | 0.0244 |
| Rubber Tired Loaders Compos | | 0.0559 | 0.4311 | 0.2835 | 0.0012 | 0.0121 | 0.0111 | 109 | 0.0050 |
| Scrapers | 120 | 0.0887 | 0.6472 | 0.5218 | 0.0011 | 0.0330 | 0.0303 | 93.9 | 0.0080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1025 | 0.8864 | 0.5654 | 0.0017 | 0.0307 | 0.0282 | 148 | 0.0092 |
| | 250 | 0.1187 | 0.4642 | 0.7040 | 0.0024 | 0.0254 | 0.0234 | 209 | 0.0107 |
| | 500 | 0.1755 | 0.7332 | 0.9727 | 0.0032 | 0.0364 | 0.0335 | 321 | 0.0158 |
| | 750 | 0.3043 | 1.2657 | 1.7266 | 0.0056 | 0.0638 | 0.0587 | 555 | 0.0275 |
| Scrapers Composite | | 0.1495 | 0.7187 | 0.8387 | 0.0027 | 0.0335 | 0.0308 | 262 | 0.0135 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0332 | 0.2686 | 0.2268 | 0.0005 | 0.0063 | 0.0058 | 36.2 | 0.0030 |
| | 120 | 0.0394 | 0.4898 | 0.3076 | 0.0009 | 0.0127 | 0.0116 | 80.2 | 0.0036 |
| | 175 | 0.0587 | 0.8292 | 0.3433 | 0.0017 | 0.0152 | 0.0139 | 155 | 0.0053 |
| | 250 | 0.0794 | 0.4676 | 0.4435 | 0.0029 | 0.0132 | 0.0121 | 255 | 0.0072 |
| Signal Boards Composite | | 0.0111 | 0.0909 | 0.0718 | 0.0002 | 0.0029 | 0.0026 | 16.7 | 0.0010 |
| Skid Steer Loade | 25 | 0.0167 | 0.0568 | 0.1055 | 0.0002 | 0.0040 | 0.0037 | 13.8 | 0.0015 |
| | 50 | 0.0194 | 0.1977 | 0.1446 | 0.0003 | 0.0015 | 0.0014 | 25.5 | 0.0017 |
| | 120 | 0.0175 | 0.2665 | 0.1240 | 0.0005 | 0.0022 | 0.0020 | 42.8 | 0.0016 |
| Skid Steer Loaders Composite | | 0.0186 | 0.2104 | 0.1354 | 0.0004 | 0.0019 | 0.0018 | 30.3 | 0.0017 |
| Surfacing Equipm | 50 | 0.0171 | 0.1105 | 0.0934 | 0.0002 | 0.0035 | 0.0033 | 14.1 | 0.0015 |
| | 120 | 0.0385 | 0.3950 | 0.2869 | 0.0007 | 0.0146 | 0.0134 | 63.8 | 0.0035 |
| | 175 | 0.0386 | 0.4642 | 0.2429 | 0.0010 | 0.0119 | 0.0109 | 85.8 | 0.0035 |
| | 250 | 0.0504 | 0.2604 | 0.3275 | 0.0015 | 0.0111 | 0.0103 | 135 | 0.0045 |
| | 500 | 0.0800 | 0.4236 | 0.4893 | 0.0022 | 0.0174 | 0.0160 | 221 | 0.0072 |
| | 750 | 0.1260 | 0.6643 | 0.7833 | 0.0035 | 0.0275 | 0.0253 | 347 | 0.0114 |
| Surfacing Equipment Compos | | 0.0638 | 0.3590 | 0.3924 | 0.0017 | 0.0142 | 0.0131 | 166 | 0.0058 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0308 | 0.2762 | 0.1942 | 0.0004 | 0.0033 | 0.0031 | 31.6 | 0.0028 |
| | 120 | 0.0395 | 0.4895 | 0.2530 | 0.0009 | 0.0068 | 0.0062 | 75.0 | 0.0036 |
| | 175 | 0.0565 | 0.8005 | 0.2201 | 0.0016 | 0.0084 | 0.0077 | 139 | 0.0051 |
| | 250 | 0.0587 | 0.3179 | 0.1898 | 0.0018 | 0.0062 | 0.0057 | 162 | 0.0053 |
| Sweepers/Scrubbers Composi | | 0.0410 | 0.4840 | 0.2255 | 0.0009 | 0.0061 | 0.0056 | 78.5 | 0.0037 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0045 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0316 | 0.2678 | 0.1895 | 0.0004 | 0.0037 | 0.0034 | 30.3 | 0.0029 |
| | 120 | 0.0281 | 0.3379 | 0.1761 | 0.0006 | 0.0055 | 0.0051 | 51.7 | 0.0025 |
| | 175 | 0.0420 | 0.5839 | 0.1613 | 0.0011 | 0.0072 | 0.0066 | 101 | 0.0038 |
| | 250 | 0.0633 | 0.3389 | 0.2157 | 0.0019 | 0.0073 | 0.0067 | 172 | 0.0057 |
| | 500 | 0.1263 | 0.6506 | 0.4127 | 0.0039 | 0.0144 | 0.0132 | 345 | 0.0114 |
| | 750 | 0.1896 | 0.9760 | 0.6256 | 0.0058 | 0.0216 | 0.0199 | 517 | 0.0171 |
| Tractors/Loaders/Backhoes C | | 0.0336 | 0.3586 | 0.1857 | 0.0008 | 0.0059 | 0.0054 | 66.8 | 0.0030 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0687 | 0.3197 | 0.2467 | 0.0004 | 0.0140 | 0.0129 | 32.9 | 0.0062 |
| | 120 | 0.0625 | 0.4341 | 0.3863 | 0.0008 | 0.0259 | 0.0239 | 64.9 | 0.0056 |
| | 175 | 0.1009 | 0.8327 | 0.6152 | 0.0016 | 0.0338 | 0.0311 | 144 | 0.0091 |
| | 250 | 0.1247 | 0.4925 | 0.8480 | 0.0025 | 0.0309 | 0.0285 | 223 | 0.0112 |
| | 500 | 0.1661 | 0.7370 | 1.0663 | 0.0031 | 0.0400 | 0.0368 | 311 | 0.0150 |
| | 750 | 0.3147 | 1.3882 | 2.0666 | 0.0059 | 0.0766 | 0.0705 | 587 | 0.0284 |
| Trenchers Composite | | 0.0674 | 0.4085 | 0.3481 | 0.0007 | 0.0215 | 0.0198 | 58.7 | 0.0061 |
| Welders | 15 | 0.0075 | 0.0381 | 0.0468 | 0.0001 | 0.0020 | 0.0018 | 6.2 | 0.0007 |
| | 25 | 0.0141 | 0.0473 | 0.0876 | 0.0001 | 0.0035 | 0.0033 | 11.3 | 0.0013 |
| | 50 | 0.0280 | 0.2077 | 0.1684 | 0.0003 | 0.0053 | 0.0048 | 26.0 | 0.0025 |
| | 120 | 0.0223 | 0.2476 | 0.1601 | 0.0005 | 0.0073 | 0.0067 | 39.5 | 0.0020 |
| | 175 | 0.0430 | 0.5400 | 0.2396 | 0.0011 | 0.0111 | 0.0103 | 98.2 | 0.0039 |
| | 250 | 0.0423 | 0.2236 | 0.2294 | 0.0013 | 0.0069 | 0.0064 | 119 | 0.0038 |
| | 500 | 0.0585 | 0.3040 | 0.2969 | 0.0016 | 0.0095 | 0.0087 | 168 | 0.0053 |
| Welders Composite | | 0.0214 | 0.1745 | 0.1373 | 0.0003 | 0.0052 | 0.0048 | 25.6 | 0.0019 |

## Fugitive Dust Emission Calculation Methodology

### Fugitive Dust Source Emissions - Material Handling

**Truck Loading/Unloading (Removed debris/concrete materials)**

*Emission Factor [lb/ton] = k(0.0032) x (mean wind speed [mi/hr] / 5)* $^{1.3}$ / (moisture [%] / 2)$^{1.4}$

*Reference: AP-42, Equation (1), Section 13.2.4, November 2006*

| | | | |
|---|---|---|---|
| *k = Aerodynamic Particle Size Multiplier, $PM_{10}$* | 0.35 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *k = Aerodynamic Particle Size Multiplier, $PM_{2.5}$* | 0.053 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *Mean Wind Speed* | 15 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *Moisture* | 4.8 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *PM10 Emission Factor* | 0.0014 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |
| *PM2.5 Emission Factor* | 0.0002 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |

**Demolition (Sq. Ft)**

| | | | |
|---|---|---|---|
| PM10, uncontrolled | 0.00042 | lbs/cubic ft[1] | http://www.urbemis.com/software/URBEMIS9%20Users%20Manual%20Appendices.pdf |
| PM2.5, uncontrolled | 0.00009 | lbs/cubic ft[2] | PM2.5 fraction of PM10 = 0.208; SCAQMD Appendix A - Updated CEIDARS List with PM2.5 Fractions (www.aqmd.gov/ceqa/handbook/PM2_5/PM2_5.html |

**Bulldozing**

*Emission Factor [lb/hr] = [1.0 x (silt content [%])* $^{1.5}$ / (moisture)$^{1.4}$]*Scaling Factor

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Silt Content* | 6.9 | | AP-42 Chapter 11, Table 11.9-3 for overburden |
| *Moisture* | 16.8 | | AP-42 Chapter 11, Table 11.9-3 for overburden, upper end or range |
| *$PM_{10}$ Scaling Factor* | 0.75 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *$PM_{2.5}$ Scaling Factor* | 0.105 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *PM10 Emission Factor* | 0.26 | lb/hr | |
| *PM2.5 Emission Factor* | 0.04 | lb/hr | |

**Grading and Scraping**[d]

*Emission Factor [lb/VMT] = [0.051 (S)^2.0*Scaling Factor*

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Mean Vehicle Speed (S)[a] - Miles Per Hour (MPH)* | 2 | | Assumption based on project footprint |
| *$PM_{10}$ Scaling Factor* | 0.6 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *$PM_{2.5}$ Scaling Factor* | 0.031 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *PM10 Emission Factor (Uncontrolled)* | 0.12 | lb/VMT | |
| *PM2.5 Emission Factor (Uncontrolled)* | 0.00632 | lb/VMT | |

**Stock Pile Wind Erosion**

Emission Factor [lb/day-acre] = 0.85 x (silt content [%] / 1.5) x (365 / 235) x (percentage of time unobstructed wind exceeds 12 mph / 15)
Reference: SCAQMD CEQA Air Quality Handbook (1993), Table 9-9-E

| Parameter | Value | Basis |
|---|---|---|
| Silt Content | 7.5 | SCAQMD CEQA Handbook, (1993) Table A9-9-E-1 for overburden |
| Pct. time wind > 12 mph | 17.84 | Used 17.84% from AERMET Surface File used for dispersion modeling |

| | | |
|---|---|---|
| PM10 Emission Factor (Uncontrolled) | 7.9 | lb/day-acre |
| Reduction from Watering Twice/Day | 50% | |
| Controlled PM10 Emission Factor | 3.9 | lb/day-acre |
| Controlled PM2.5 Emission Factor[a] | 0.8 | lb/day-acre |

[a] PM2.5 emission factor [lb/hr] = PM10 emission factor [lb/hr] x PM2.5 fraction of PM10

PM2.5 Fraction of PM10 in Construction Dust = 0.208 from Appendix A, Final–Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds, SCAQMD, October 2006

Emissions [pounds per day] = Controlled emission factor [pounds per acre-day] x Stock pile surface area [acres]

# Attachment I9 Alternative SB-2B Emissions

SB-2B - Low Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 2.93 | 21.31 | 16.09 | | 1.08 | 0.99 | 2,546 |
| Construction Off-Road Equipment | 13.43 | 122.22 | 56.60 | 0.17 | 11.05 | 5.27 | 16,883.99 | 0.49 | 4.48 | 2.01 | 0.01 | 0.59 | 0.36 | 564 |
| On-Road Motor Vehicles | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 | 0.01 | 0.29 | 0.08 | 0.00 | 0.01 | 0.01 | 58 |
| *Total On-Shore Emissions* | 13.97 | 137.61 | 59.73 | 0.20 | 11.49 | 5.56 | 20,025.62 | 0.50 | 4.77 | 2.08 | 0.01 | 0.60 | 0.36 | 3,168 |
| Amortized Construction | | | | | | | | | | | | | | 317 |

SB-2B - High Sea Level

| | Daily Emissions (pounds/day) | | | | | | | Annual Emissions (tons/year) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
| *Off-Shore Equipment (Dredge/Pumps)* | 106.68 | 774.99 | 585.17 | | 39.22 | 36.08 | 101,752.98 | 3.52 | 25.57 | 19.31 | | 1.29 | 1.19 | 3,056 |
| Construction Off-Road Equipment | 13.43 | 122.22 | 56.60 | 0.17 | 11.05 | 5.27 | 16883.99 | 0.55 | 5.10 | 2.27 | 0.01 | 0.68 | 0.41 | 640 |
| On-Road Motor Vehicles | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 | 0.01 | 0.29 | 0.08 | 0.00 | 0.01 | 0.01 | 59 |
| *Total On-Shore Emissions* | 13.97 | 137.61 | 59.73 | 0.20 | 11.49 | 5.56 | 20,025.62 | 0.56 | 5.39 | 2.35 | 0.01 | 0.69 | 0.41 | 3,755 |
| Amortized Construction | | | | | | | | | | | | | | 376 |

SB-2B - Low Sea Level

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 5.68 | 33.91 | 31.52 | 0.09 | 7.64 | 2.12 | 8,776.91 |
| On-Road Motor Vehicles | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |
| *Total On-Shore Emissions* | 6.06 | 37.56 | 33.62 | 0.12 | 7.81 | 2.33 | 11,589.68 |

SB-2B - High Sea Level

Daily Emissions (pounds/day)

| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| *Off-Shore Equipment (Dredge/Pumps)* | 27.81 | 203.95 | 585.17 | | 4.71 | 4.33 | 101,752.98 |
| Construction Off-Road Equipment | 5.68 | 33.91 | 31.52 | 0.09 | 7.64 | 2.12 | 8,776.91 |
| On-Road Motor Vehicles | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |
| *Total On-Shore Emissions* | 6.06 | 37.56 | 33.62 | 0.12 | 7.81 | 2.33 | 11,589.68 |

## Alternative SB-2B - Construction - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.13 | 0.86 | 0.76 | 0.001 | 0.05 | 0.04 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.08 | 0.06 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-2B - Construction - Low Sea Level

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Emissions Summary | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| Concrete Trucks | 2 | 6 | 1.51 | 10.32 | 9.07 | 0.02 | 0.57 | 0.53 | - | - | 1,501 | 0.14 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.08 | 0.48 | 0.35 | 0.00 | 0.03 | 0.03 | - | - | 56 | 0.01 | lbs/day |
| | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | | | 16,883.99 | 1.21 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | 6.28 | 0.88 | 16,883.99 | 1.21 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **13.43** | **122.22** | **56.60** | **0.17** | | | **11.05** | **5.27** | **16,883.99** | **1.21** | **lbs/day** |

| Project Length | Work Days |
|---|---|
| | 76 |
| Notch Fill | 46 |

| | Encinitas Volume | Encinitas Dredging Days | Encinitas Construction Days | Solana Beach Volume | Solana Beach Dredging Days | Solana Beach Construction Days | Total Volume | Total Dredging Days | Total Constructi on Days |
|---|---|---|---|---|---|---|---|---|---|
| LSL | 410,000 | 41 | 62 | 550,000 | 55 | 76 | 960,000 | 96 | 138 |
| HSL | 470,000 | 47 | 68 | 660,000 | 66 | 87 | ######## | 113 | 155 |

## Alternative SB-2B - Construction - Low Sea Level

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.15 | 1.84 | 0.63 | 0.00 | 0.06 | 0.05 | - | - | 286 | 0.0126 | tons |
| Loader | 1 | 12 | | 0.05 | 0.36 | 0.21 | 0.00 | 0.02 | 0.02 | - | - | 45 | 0.0039 | tons |
| Dozer | 2 | 12 | | 0.25 | 2.04 | 0.95 | 0.00 | 0.08 | 0.08 | - | - | 198 | 0.0204 | tons |
| Concrete Trucks | 2 | 6 | | 0.03 | 0.24 | 0.21 | 0.00 | 0.01 | 0.01 | - | - | 31 | 0.0028 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0002 | tons |
| | | | | 0.49 | 4.48 | 2.01 | 0.01 | 0.17 | 0.16 | | | 562.59 | 0.04 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.49 | 4.48 | 2.01 | 0.01 | 0.17 | 0.16 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.49** | **4.48** | **2.01** | **0.01** | **0.59** | **0.36** | **0.42** | **0.20** | **563** | **0.037** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **564** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

## Alternative SB-2B - Construction - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Construction Days Per Year | 55.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 2.93 | 21.31 | 16.09 | 1.08 | 0.99 | 2,546 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

# Alternative SB-2B - Construction - Low Sea Level Rise

## On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 76 | 30,400 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.39 | 11.86 | 1.77 | 0.02 | 0.30 | 0.21 | 2,243 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 58 | 60 | 1,160 | 124 | 58,320 | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-2B - Construction - Low Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 76 | 30,400 | 0.00 | 0.014 | 0.03 | 0.00 | 0.00 | 0.00 | 11 | 10 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.273 | 0.04 | 0.00 | 0.01 | 0.00 | 52 | 47 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 58 | 60 | 1,160 | 124 | 58,320 | 0.01 | 0.29 | 0.08 | 0.00 | 0.01 | 0.01 | 63.60 | 57.87 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

# Alternative SB-2B - Operations - Low Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.06 | 0.24 | 0.75 | 0.001 | 0.01 | 0.01 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-2B - Operations - Low

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 2 | 12 | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| Concrete Trucks | 2 | 6 | 0.75 | 2.85 | 9.04 | 0.02 | 0.13 | 0.12 | - | - | 1,501 | 0.07 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.04 | 0.34 | 0.32 | 0.00 | 0.01 | 0.01 | - | - | 56 | 0.00 | lbs/day |
| | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | | | 8,776.91 | 0.51 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | 6.28 | 0.88 | 8,776.91 | 0.51 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **5.68** | **33.91** | **31.52** | **0.09** | | | **7.64** | **2.12** | **8,776.91** | **0.51** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 52 |
| Notch Fill | 46 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 260,000 | 26 | 47 | 310,000 | 31 | 52 | 570,000 | 57 | 99 |
| HSL | 330,000 | 33 | 54 | 460,000 | 46 | 67 | 790,000 | 79 | 121 |

# Alternative SB-2B - Operations - Low S

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | - | - | 4 | 0.0005 | tons |
| Loader | 1 | 12 | | 0.02 | 0.09 | 0.13 | 0.00 | 0.00 | 0.00 | - | - | 31 | 0.0014 | tons |
| Dozer | 2 | 12 | | 0.10 | 0.68 | 0.41 | 0.00 | 0.03 | 0.02 | - | - | 136 | 0.0086 | tons |
| Concrete Trucks | 2 | 6 | | 0.02 | 0.07 | 0.21 | 0.00 | 0.00 | 0.00 | - | - | 31 | 0.0014 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0001 | tons |
| | | | | 0.15 | 0.87 | 0.79 | 0.00 | 0.03 | 0.03 | | | 203.41 | 0.01 | tons |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.15 | 0.87 | 0.79 | 0.00 | 0.03 | 0.03 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.15** | **0.87** | **0.79** | **0.00** | | | **0.20** | **0.06** | **203** | **0.012** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **204** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

# Alternative SB-2B - Operations - Low Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| | | |
| Operating Days Per Year | 31.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.43 | 3.16 | 9.07 | 0.07 | 0.07 | 1,577 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2020 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-2B - Operations - Low Sea Level Rise

**On-Road Construction Emissions**

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 52 | 20,800 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.29 | 2.72 | 1.33 | 0.02 | 0.10 | 0.14 | 2,035 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 |
| Total | 58 | 60 | 1,160 | 100 | 48,720 | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-2B - Operations - Low Sea Level Rise

**On-Road Construction Emissions**

| | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Total Trips** | **Distance** | **Average Daily Mileage** | **Project Length (days)** | **Total Mileage** | **ROG** | **$NO_x$** | **CO** | **SOx** | **PM10** | **PM25** | **$CO_2$** | **Total GHG Emissions (Metric Tons)** |
| Worker Trips | 20 | 20 | 400 | 52 | 20,800 | 0.00 | 0.005 | 0.01 | 0.00 | 0.00 | 0.00 | 6 | 6 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.063 | 0.03 | 0.00 | 0.00 | 0.00 | 47 | 43 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 58 | 60 | 1,160 | 100 | 48,720 | 0.01 | 0.07 | 0.04 | 0.00 | 0.00 | 0.00 | 53.46 | 48.65 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

# Alternative SB-2B - Construction - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.17 | 2.02 | 0.69 | 0.003 | 0.06 | 0.06 | - | - | 345.20 | 0.02 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.27 | 2.23 | 1.04 | 0.002 | 0.09 | 0.09 | - | - | 239.09 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.13 | 0.86 | 0.76 | 0.001 | 0.05 | 0.04 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.08 | 0.06 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-2B - Construction - High Sea Leve

| Source Description | Number | Usage Factor | Emissions Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | PM10 | PM2.5 | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 4.05 | 48.39 | 16.63 | 0.08 | 1.45 | 1.33 | - | - | 8,285 | 0.37 | lbs/day |
| Loader | 1 | 12 | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | - | - | 1,303 | 0.11 | lbs/day |
| Dozer | 2 | 12 | 6.53 | 53.63 | 25.01 | 0.06 | 2.22 | 2.04 | - | - | 5,738 | 0.59 | lbs/day |
| Concrete Trucks | 2 | 6 | 1.51 | 10.32 | 9.07 | 0.02 | 0.57 | 0.53 | - | - | 1,501 | 0.14 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.08 | 0.48 | 0.35 | 0.00 | 0.03 | 0.03 | - | - | 56 | 0.01 | lbs/day |
| | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | | | 16,883.99 | 1.21 | lbs/day |
| | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 13.43 | 122.22 | 56.60 | 0.17 | 4.77 | 4.39 | 6.28 | 0.88 | 16,883.99 | 1.21 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **13.43** | **122.22** | **56.60** | **0.17** | | | **11.05** | **5.27** | **16,883.99** | **1.21** | **lbs/day** |

| Project Length | Work Days |
|---|---|
| | 87 |
| Notch Fill | 46 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Constructi on Days |
| LSL | 410,000 | 41 | 62 | 550,000 | 55 | 76 | 960,000 | 96 | 138 |
| HSL | 470,000 | 47 | 68 | 660,000 | 66 | 87 | ######## | 113 | 155 |

## Alternative SB-2B - Construction - High Sea Leve

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.18 | 2.10 | 0.72 | 0.00 | 0.06 | 0.06 | - | - | 328 | 0.0145 | tons |
| Loader | 1 | 12 | | 0.05 | 0.41 | 0.24 | 0.00 | 0.02 | 0.02 | - | - | 52 | 0.0045 | tons |
| Dozer | 2 | 12 | | 0.28 | 2.33 | 1.09 | 0.00 | 0.10 | 0.09 | - | - | 227 | 0.0233 | tons |
| Concrete Trucks | 2 | 6 | | 0.03 | 0.24 | 0.21 | 0.00 | 0.01 | 0.01 | - | - | 31 | 0.0028 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0002 | tons |
| | | | | 0.55 | 5.10 | 2.27 | 0.01 | 0.20 | 0.18 | | | 639.30 | 0.04 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.55 | 5.10 | 2.27 | 0.01 | 0.20 | 0.18 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.55** | **5.10** | **2.27** | **0.01** | **0.68** | **0.41** | **0.48** | **0.23** | **639** | **0.042** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **640** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: | 50000 | 7390 |
| PFC: | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The P

# Alternative SB-2B - Construction - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| Construction Days Per Year | 66.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 106.68 | 774.99 | 585.17 | 39.22 | 36.08 | 101,752.98 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 3.52 | 25.57 | 19.31 | 1.29 | 1.19 | 3,056 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |
| | |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-2B - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Daily Emissions (lbs) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | CO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 87 | 34,800 | 0.05 | 0.37 | 0.89 | 0.00 | 0.06 | 0.03 | 300 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.39 | 11.86 | 1.77 | 0.02 | 0.30 | 0.21 | 2,243 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.10 | 3.16 | 0.47 | 0.01 | 0.08 | 0.06 | 598 |
| Total | 58 | 60 | 1,160 | 135 | 62,720 | 0.54 | 15.40 | 3.14 | 0.03 | 0.44 | 0.30 | 3,141.63 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-2B - Construction - High Sea Level Rise

### On-Road Construction Emissions

| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | Total Emission (tons) ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker Trips | 20 | 20 | 400 | 87 | 34,800 | 0.00 | 0.016 | 0.04 | 0.00 | 0.00 | 0.00 | 13 | 12 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.273 | 0.04 | 0.00 | 0.01 | 0.00 | 52 | 47 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.003 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 1 |
| Total | 58 | 60 | 1,160 | 135 | 62,720 | 0.01 | 0.29 | 0.08 | 0.00 | 0.01 | 0.01 | 65.25 | 59.37 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Four

## Alternative SB-2B - Operations - High Sea Level Rise

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust | | CO2 | CH4 | Unit |
| | | | | | | | | | | PM10 | PM2.5 | | | |
| | | | | | | | | | | | | | | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 7.42 | 0.00 | lbs/hr |
| Loader | 1 | 12 | hrs/day | 0.06 | 0.28 | 0.43 | 0.001 | 0.01 | 0.01 | - | - | 108.61 | 0.01 | lbs/hr |
| Dozer | 2 | 12 | hrs/day | 0.17 | 1.08 | 0.66 | 0.002 | 0.04 | 0.04 | - | - | 239.08 | 0.02 | lbs/hr |
| Concrete Trucks | 2 | 6 | hrs/day | 0.06 | 0.24 | 0.75 | 0.001 | 0.01 | 0.01 | - | - | 125.09 | 0.01 | lbs/hr |
| Trailer Mounted Pressure Nozzle | 1 | 6 | hrs/day | 0.01 | 0.06 | 0.05 | 0.000 | 0.00 | 0.00 | - | - | 9.41 | 0.00 | lbs/hr |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | hrs/day | - | - | - | - | - | - | 0.26 | 0.04 | - | | lb/hr |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | | | | | | | | | | | |
| **Peak Daily Emissions Summary, Controlled =** | | | | | | | | | | | | | | |

## Alternative SB-2B - Operations - High

| Source Description | Number | Usage Factor | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Emissions Summary | |
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | |
| Pump | 1 | 24 | 0.21 | 1.34 | 1.09 | 0.00 | 0.06 | 0.05 | - | - | 178 | 0.02 | lbs/day |
| Loader | 1 | 12 | 0.67 | 3.40 | 5.17 | 0.01 | 0.14 | 0.13 | - | - | 1,303 | 0.06 | lbs/day |
| Dozer | 2 | 12 | 4.01 | 25.98 | 15.89 | 0.06 | 1.01 | 0.92 | - | - | 5,738 | 0.36 | lbs/day |
| Concrete Trucks | 2 | 6 | 0.75 | 2.85 | 9.04 | 0.02 | 0.13 | 0.12 | - | - | 1,501 | 0.07 | lbs/day |
| Trailer Mounted Pressure Nozzle | 1 | 6 | 0.04 | 0.34 | 0.32 | 0.00 | 0.01 | 0.01 | - | - | 56 | 0.00 | lbs/day |
| | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | | | 8,776.91 | 0.51 | lbs/day |
| ***Fugitive Dust*** | | | | | | | | | | | | | |
| Bulldozing | - | 24 | - | - | - | - | - | - | 6.28 | 0.88 | - | | lbs/day |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | 5.68 | 33.91 | 31.52 | 0.09 | 1.35 | 1.25 | 6.28 | 0.88 | 8,776.91 | 0.51 | lbs/day |
| **Peak Daily Emissions Summary, Controlled =** | | | **5.68** | **33.91** | **31.52** | **0.09** | | | **7.64** | **2.12** | **8,776.91** | **0.51** | **lbs/day** |

| Project Length | Workdays |
|---|---|
| | 67 |
| Notch Fill | 46 |

| | Encinitas | | | Solana Beach | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days | Volume | Dredging Days | Construction Days |
| LSL | 260,000 | 26 | 47 | 310,000 | 31 | 52 | 570,000 | 57 | 99 |
| HSL | 330,000 | 33 | 54 | 460,000 | 46 | 67 | 790,000 | 79 | 121 |

## Alternative SB-2B - Operations - High

| Source Description | Number | Usage Factor | | ROG | NOX | CO | SOX | PM10 | PM2.5 | Fugitive Dust PM10 | Fugitive Dust PM2.5 | CO2 | CH4 | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Off-road Mobile Sources*** | | | | | | | | | | | | | | |
| Pump | 1 | 24 | | 0.01 | 0.05 | 0.04 | 0.00 | 0.00 | 0.00 | - | - | 5 | 0.0006 | tons |
| Loader | 1 | 12 | | 0.02 | 0.11 | 0.17 | 0.00 | 0.00 | 0.00 | - | - | 40 | 0.0018 | tons |
| Dozer | 2 | 12 | | 0.13 | 0.87 | 0.53 | 0.00 | 0.03 | 0.03 | - | - | 175 | 0.0110 | tons |
| Concrete Trucks | 2 | 6 | | 0.02 | 0.07 | 0.21 | 0.00 | 0.00 | 0.00 | - | - | 31 | 0.0014 | tons |
| Trailer Mounted Pressure Nozzle | 1 | 6 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | - | - | 1 | 0.0001 | tons |
| | | | | 0.18 | 1.10 | 0.96 | 0.00 | 0.04 | 0.04 | | | 252.68 | 0.01 | tons |
| ***Fugitive Dust*** | | | | | | | | | | | | | | |
| Bulldozing | - | 24 | | - | - | - | - | - | - | | | | | |
| **Peak Daily Emissions Summary, Uncontrolled =** | | | | 0.18 | 1.10 | 0.96 | 0.00 | 0.04 | 0.04 | | | | | tons |
| **Peak Daily Emissions Summary, Controlled =** | | | | **0.18** | **1.10** | **0.96** | **0.00** | | | **0.26** | **0.07** | **253** | **0.015** | tons |
| | | | | | | | | | | | | **Total GHG Emissions** | **253** | tons |

**Global Warming Potential**

| Gas | Atmospheric Lifetime | Global Warming |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

# Alternative SB-2B - Operations - High Sea Level Rise

**Assumptions**

| | | |
|---|---|---|
| Main Generator Engine | 5000 | bhp |
| | 3728.5 | kW |
| Aux Generator Engine | 1500 | bhp |
| | 1118.5 | kW |
| Operating Days Per Year | 46.0 | |

**Emissions (pounds per day)**

| Activity | Time (hours per day) | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | 24 | 27.81 | 203.95 | 585.17 | 4.71 | 4.33 | 101,753 |

**Emissions (tons per year)**

| Activity | | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Barge | | 0.64 | 4.69 | 13.46 | 0.11 | 0.10 | 2,340 |

**Emission Factors (g/bhp-hr)**

| | ROG | NOx | CO | PM10 | PM2.5 | CO2 | Fuel |
|---|---|---|---|---|---|---|---|
| 2015 | 0.68 | 4.94 | 3.73 | 0.25 | 0.23 | 648.6 | 184.15 |
| 2025 | 0.18 | 1.30 | 3.73 | 0.03 | 0.03 | 648.6 | 184.15 |

Source: ARB Harborcraft Emission Inventory Database

**Load Factor**

| Engine | Load factor |
|---|---|
| Propulsion | 0.5 |
| Auxiliary | 0.31 |

***Source: Carl Moyer Table B-19 > > >**
**http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf**

## Alternative SB-2B - Operations - High Sea Level Rise

### On-Road Construction Emissions

| | | | | | | Total Daily Emissions (lbs) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Total Trips** | **Distance** | **Average Daily Mileage** | **Project Length (days)** | **Total Mileage** | **ROG** | **$NO_x$** | **CO** | **SOx** | **PM10** | **PM25** | **CO2** |
| Worker Trips | 20 | 20 | 400 | 67 | 26,800 | 0.02 | 0.20 | 0.42 | 0.00 | 0.05 | 0.04 | 235 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.29 | 2.72 | 1.33 | 0.02 | 0.10 | 0.14 | 2,035 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.08 | 0.73 | 0.35 | 0.01 | 0.03 | 0.04 | 543 |
| Total | 58 | 60 | 1,160 | 115 | 54,720 | 0.38 | 3.65 | 2.11 | 0.03 | 0.17 | 0.21 | 2,812.77 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

## Alternative SB-2B - Operations - High Sea Level Rise

### On-Road Construction Emissions

| | | | | | | Total Emission (tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Trips | Distance | Average Daily Mileage | Project Length (days) | Total Mileage | ROG | $NO_x$ | CO | SOx | PM10 | PM25 | $CO_2$ | Total GHG Emissions (Metric Tons) |
| Worker Trips | 20 | 20 | 400 | 67 | 26,800 | 0.00 | 0.007 | 0.01 | 0.00 | 0.00 | 0.00 | 8 | 7 |
| Concrete Trucks | 30 | 20 | 600 | 46 | 27,600 | 0.01 | 0.063 | 0.03 | 0.00 | 0.00 | 0.00 | 47 | 43 |
| Equipment Delivery | 8 | 20 | 160 | 2 | 320 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 0 |
| Total | 58 | 60 | 1,160 | 115 | 54,720 | 0.01 | 0.07 | 0.05 | 0.00 | 0.00 | 0.00 | 55.22 | 50.25 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth

**San Diego 2015 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | GAS | AllMYr | AllSpeeds | 1,169,183 | 42,600,783.75 | 7,361,743.79 | 0.045 | 1.290 | 0.136 | 302.103 | 0.047 | 0.019 | 0.004 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,466 | 179,216.55 | 31,712.66 | 0.038 | 0.215 | 0.576 | 315.879 | 0.072 | 0.043 | 0.004 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 172,849 | 6,187,162.79 | 1,061,257.19 | 0.075 | 2.505 | 0.269 | 357.183 | 0.048 | 0.021 | 0.004 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 210 | 6,179.81 | 1,102.01 | 0.066 | 0.312 | 0.691 | 314.863 | 0.099 | 0.068 | 0.004 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 423,444 | 16,224,268.59 | 2,675,454.93 | 0.037 | 1.498 | 0.192 | 432.459 | 0.047 | 0.019 | 0.005 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 187 | 5,978.69 | 1,021.81 | 0.046 | 0.252 | 0.690 | 323.109 | 0.080 | 0.050 | 0.004 | | |
| Average | | | | | | | 0.051 | 1.012 | 0.426 | 340.933 | 0.066 | 0.037 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED (Miles/hr) | POP (Vehicles) | VMT (Miles/day) | TRIPS (Trips/day) | ROG_RUNEX (gms/mile) | CO_RUNEX (gms/mile) | NOX_RUNEX (gms/mile) | CO2_RUNEX (gms/mile) | PM10_Total (gms/mile) | PM2_5_Total (gms/mile) | SOX_RUNEX (gms/mile) | CH4 (gms/mile) | N2O (gms/mile) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T7 tractor | DSL | AllMYr | AllSpeeds | 2,454 | 392,614.49 | 0 | 0.296 | 1.343 | 8.984 | 1699.527 | 0.231 | 0.158 | 0.017 | | |

Source: EMFAC 2011

**San Diego 2020 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED | POP | VMT | TRIPS | ROG_RUNEX | CO_RUNEX | NOX_RUNEX | CO2_RUNEX | PM10_Total | PM2_5_Total | SOX_RUNEX | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (Miles/hr) | (Vehicles) | (Miles/day) | (Trips/day) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) |
| LDA | GAS | AllMYr | AllSpeeds | 1,261,438 | 46,436,329 | 7,971,039 | 0.03 | 0.10 | 0.83 | 244.16 | 0.05 | 0.02 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 5,897 | 203,726 | 36,279 | 0.02 | 0.39 | 0.13 | 265.72 | 0.06 | 0.03 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 186,176 | 6,674,684 | 1,134,440 | 0.04 | 0.17 | 1.56 | 297.84 | 0.05 | 0.02 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 226 | 8,187 | 1,308 | 0.03 | 0.45 | 0.17 | 259.42 | 0.07 | 0.04 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 450,141 | 17,355,693 | 2,832,803 | 0.02 | 0.11 | 0.93 | 364.76 | 0.05 | 0.02 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 199 | 7,528 | 1,228 | 0.02 | 0.47 | 0.14 | 280.32 | 0.06 | 0.03 | 0.00 | | |
| Average | | | | | | | 0.026 | 0.283 | 0.626 | 285.370 | 0.055 | 0.027 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED | POP | VMT | TRIPS | ROG_RUNEX | CO_RUNEX | NOX_RUNEX | CO2_RUNEX | PM10_Total | PM2_5_Total | SOX_RUNEX | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (Miles/hr) | (Vehicles) | (Miles/day) | (Trips/day) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) |
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,262 | 531,839 | - | 0.22 | 1.02 | 4.20 | 1553.04 | 0.18 | 0.11 | 0.02 | | |

Source: EMFAC 2011

**San Diego 2025 On-Road Emission Factors**

| VEH | FUEL | MDLYR | SPEED | POP | VMT | TRIPS | ROG_RUNEX | CO_RUNEX | NOX_RUNEX | CO2_RUNEX | PM10_Total | PM2_5_Total | SOX_RUNEX | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (Miles/hr) | (Vehicles) | (Miles/day) | (Trips/day) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) |
| LDA | GAS | AllMYr | AllSpeeds | 1,343,732.35 | 49,534,906.21 | 8,492,736.38 | 0.02 | 0.71 | 0.09 | 223.96 | 0.05 | 0.04 | 0.00 | | |
| LDA | DSL | AllMYr | AllSpeeds | 6,282.20 | 213,159.29 | 39,008.92 | 0.01 | 0.09 | 0.31 | 246.18 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | GAS | AllMYr | AllSpeeds | 198,419.75 | 7,123,689.46 | 1,204,641.90 | 0.02 | 1.09 | 0.12 | 276.49 | 0.05 | 0.04 | 0.00 | | |
| LDT1 | DSL | AllMYr | AllSpeeds | 240.83 | 8,707.20 | 1,432.14 | 0.02 | 0.13 | 0.37 | 242.28 | 0.06 | 0.05 | 0.00 | | |
| LDT2 | GAS | AllMYr | AllSpeeds | 479,791.14 | 18,608,664.04 | 3,017,273.36 | 0.01 | 0.73 | 0.08 | 343.84 | 0.05 | 0.04 | 0.00 | | |
| LDT2 | DSL | AllMYr | AllSpeeds | 211.77 | 7,665.63 | 1,309.49 | 0.02 | 0.11 | 0.40 | 268.51 | 0.06 | 0.05 | 0.00 | | |
| Average | | | | | | | 0.019 | 0.478 | 0.227 | 266.878 | 0.052 | 0.042 | 0.004 | | |

Source: EMFAC 2011

| VEH | FUEL | MDLYR | SPEED | POP | VMT | TRIPS | ROG_RUNEX | CO_RUNEX | NOX_RUNEX | CO2_RUNEX | PM10_Total | PM2_5_Total | SOX_RUNEX | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (Miles/hr) | (Vehicles) | (Miles/day) | (Trips/day) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) | (gms/mile) |
| T7 tractor | DSL | AllMYr | AllSpeeds | 3,476 | 582,978 | - | 0.22 | 1.01 | 2.06 | 1541.82 | 0.07 | 0.10 | 0.02 | | |

Source: EMFAC 2011

## 2015 Fleet Average Emission Factors (Diesel)

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0155 | 0.0486 | 0.0902 | 0.0001 | 0.0046 | 0.0042 | 11.0 | 0.0014 |
| | 50 | 0.0480 | 0.1641 | 0.1699 | 0.0003 | 0.0129 | 0.0119 | 19.6 | 0.0043 |
| | 120 | 0.0460 | 0.2377 | 0.3272 | 0.0004 | 0.0246 | 0.0226 | 38.1 | 0.0042 |
| | 500 | 0.1026 | 0.4261 | 1.2422 | 0.0021 | 0.0368 | 0.0339 | 213 | 0.0093 |
| | 750 | 0.1912 | 0.7702 | 2.3263 | 0.0039 | 0.0680 | 0.0626 | 385 | 0.0173 |
| Aerial Lifts Composite | | 0.0439 | 0.1837 | 0.2670 | 0.0004 | 0.0167 | 0.0154 | 34.7 | 0.0040 |
| Air Compressors | 15 | 0.0108 | 0.0466 | 0.0664 | 0.0001 | 0.0040 | 0.0037 | 7.2 | 0.0010 |
| | 25 | 0.0229 | 0.0681 | 0.1247 | 0.0002 | 0.0069 | 0.0064 | 14.4 | 0.0021 |
| | 50 | 0.0747 | 0.2360 | 0.2056 | 0.0003 | 0.0183 | 0.0168 | 22.3 | 0.0067 |
| | 120 | 0.0691 | 0.3182 | 0.4334 | 0.0006 | 0.0375 | 0.0345 | 47.0 | 0.0062 |
| | 175 | 0.0903 | 0.5019 | 0.7101 | 0.0010 | 0.0388 | 0.0357 | 88.5 | 0.0082 |
| | 250 | 0.0892 | 0.2803 | 0.9294 | 0.0015 | 0.0286 | 0.0263 | 131 | 0.0080 |
| | 500 | 0.1463 | 0.4915 | 1.4297 | 0.0023 | 0.0470 | 0.0432 | 232 | 0.0132 |
| | 750 | 0.2285 | 0.7595 | 2.2932 | 0.0036 | 0.0743 | 0.0683 | 358 | 0.0206 |
| | 1000 | 0.3551 | 1.1843 | 4.4558 | 0.0049 | 0.1239 | 0.1140 | 486 | 0.0320 |
| Air Compressors Composite | | 0.0773 | 0.3257 | 0.5175 | 0.0007 | 0.0357 | 0.0329 | 63.6 | 0.0070 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1220 | 0.0002 | 0.0047 | 0.0043 | 16.0 | 0.0017 |
| | 50 | 0.0234 | 0.2235 | 0.2240 | 0.0004 | 0.0075 | 0.0069 | 31.0 | 0.0021 |
| | 120 | 0.0376 | 0.4676 | 0.3736 | 0.0009 | 0.0160 | 0.0148 | 77.1 | 0.0034 |
| | 175 | 0.0618 | 0.7540 | 0.5364 | 0.0016 | 0.0198 | 0.0182 | 141 | 0.0056 |
| | 250 | 0.0681 | 0.3425 | 0.4900 | 0.0021 | 0.0144 | 0.0132 | 188 | 0.0061 |
| | 500 | 0.1118 | 0.5511 | 0.7692 | 0.0031 | 0.0236 | 0.0217 | 311 | 0.0101 |
| | 750 | 0.2212 | 1.0888 | 1.5301 | 0.0062 | 0.0466 | 0.0429 | 615 | 0.0200 |
| | 1000 | 0.3562 | 1.6528 | 4.9704 | 0.0093 | 0.1194 | 0.1098 | 928 | 0.0321 |
| Bore/Drill Rigs Composite | | 0.0673 | 0.5022 | 0.6138 | 0.0017 | 0.0200 | 0.0184 | 165 | 0.0061 |
| Cement and Mortar Mixers | 15 | 0.0074 | 0.0386 | 0.0464 | 0.0001 | 0.0019 | 0.0018 | 6.3 | 0.0007 |
| | 25 | 0.0251 | 0.0782 | 0.1456 | 0.0002 | 0.0074 | 0.0068 | 17.6 | 0.0023 |
| Cement and Mortar Mixers Composite | | 0.0088 | 0.0419 | 0.0545 | 0.0001 | 0.0024 | 0.0022 | 7.2 | 0.0008 |
| Concrete/Industrial Saws | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0782 | 0.2745 | 0.2652 | 0.0004 | 0.0206 | 0.0189 | 30.2 | 0.0071 |
| | 120 | 0.0892 | 0.4759 | 0.6249 | 0.0009 | 0.0486 | 0.0448 | 74.1 | 0.0080 |
| | 175 | 0.1340 | 0.8674 | 1.1593 | 0.0018 | 0.0585 | 0.0538 | 160 | 0.0121 |
| Concrete/Industrial Saws Composite | | 0.0835 | 0.3982 | 0.4921 | 0.0007 | 0.0374 | 0.0345 | 58.5 | 0.0075 |
| Cranes | 50 | 0.0853 | 0.2729 | 0.2235 | 0.0003 | 0.0202 | 0.0186 | 23.2 | 0.0077 |
| | 120 | 0.0800 | 0.3559 | 0.4822 | 0.0006 | 0.0415 | 0.0382 | 50.1 | 0.0072 |
| | 175 | 0.0919 | 0.4794 | 0.6684 | 0.0009 | 0.0378 | 0.0348 | 80.3 | 0.0083 |
| | 250 | 0.0925 | 0.2713 | 0.8284 | 0.0013 | 0.0286 | 0.0263 | 112 | 0.0083 |
| | 500 | 0.1393 | 0.4663 | 1.1812 | 0.0018 | 0.0426 | 0.0392 | 180 | 0.0126 |
| | 750 | 0.2358 | 0.7835 | 2.0490 | 0.0030 | 0.0729 | 0.0671 | 303 | 0.0213 |
| | 9999 | 0.8682 | 2.8913 | 9.2743 | 0.0098 | 0.2775 | 0.2553 | 971 | 0.0783 |
| Cranes Composite | | 0.1204 | 0.4395 | 1.0200 | 0.0014 | 0.0426 | 0.0392 | 129 | 0.0109 |
| Crawler Tractors | 50 | 0.1017 | 0.3087 | 0.2464 | 0.0003 | 0.0232 | 0.0214 | 24.9 | 0.0092 |
| | 120 | 0.1143 | 0.4774 | 0.6815 | 0.0008 | 0.0579 | 0.0533 | 65.8 | 0.0103 |
| | 175 | 0.1509 | 0.7384 | 1.0951 | 0.0014 | 0.0614 | 0.0565 | 121 | 0.0136 |
| | 250 | 0.1582 | 0.4614 | 1.3531 | 0.0019 | 0.0514 | 0.0473 | 166 | 0.0143 |
| | 500 | 0.2300 | 0.8352 | 1.8987 | 0.0025 | 0.0732 | 0.0673 | 259 | 0.0207 |
| | 750 | 0.4140 | 1.4936 | 3.4863 | 0.0047 | 0.1327 | 0.1221 | 465 | 0.0374 |
| | 1000 | 0.6278 | 2.3640 | 6.6574 | 0.0066 | 0.2075 | 0.1909 | 658 | 0.0566 |
| Crawler Tractors Composite | | 0.1415 | 0.5650 | 1.0059 | 0.0013 | 0.0594 | 0.0546 | 114 | 0.0128 |
| Crushing/Proc. Equipment | 50 | 0.1392 | 0.4644 | 0.4024 | 0.0006 | 0.0346 | 0.0318 | 44.0 | 0.0126 |
| | 120 | 0.1167 | 0.5646 | 0.7374 | 0.0010 | 0.0629 | 0.0579 | 83.1 | 0.0105 |
| | 175 | 0.1654 | 0.9559 | 1.2783 | 0.0019 | 0.0700 | 0.0644 | 167 | 0.0149 |
| | 250 | 0.1646 | 0.5171 | 1.6355 | 0.0028 | 0.0506 | 0.0466 | 245 | 0.0149 |
| | 500 | 0.2358 | 0.7790 | 2.1722 | 0.0037 | 0.0722 | 0.0664 | 374 | 0.0213 |
| | 750 | 0.3723 | 1.2184 | 3.5561 | 0.0059 | 0.1154 | 0.1062 | 589 | 0.0336 |
| | 9999 | 0.9726 | 3.0901 | 11.5626 | 0.0131 | 0.3225 | 0.2967 | 1,308 | 0.0878 |
| Crushing/Proc. Equipment Composite | | 0.1465 | 0.6549 | 0.9893 | 0.0015 | 0.0607 | 0.0558 | 132 | 0.0132 |
| Dumpers/Tenders | 25 | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Dumpers/Tenders Composite | | 0.0093 | 0.0315 | 0.0591 | 0.0001 | 0.0025 | 0.0023 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0650 | 0.2683 | 0.2256 | 0.0003 | 0.0167 | 0.0154 | 25.0 | 0.0059 |
| | 120 | 0.0912 | 0.5102 | 0.5787 | 0.0009 | 0.0455 | 0.0418 | 73.6 | 0.0082 |
| | 175 | 0.1052 | 0.6653 | 0.7408 | 0.0013 | 0.0405 | 0.0372 | 112 | 0.0095 |

| Equipment | MaxHP | ROG (lb/hr) | CO (lb/hr) | NOX (lb/hr) | SOX (lb/hr) | PM (lb/hr) | PM2.5 (lb/hr) | CO2 (lb/hr) | CH4 (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1117 | 0.3431 | 0.8935 | 0.0018 | 0.0297 | 0.0273 | 159 | 0.0101 |
| | 500 | 0.1577 | 0.4964 | 1.1619 | 0.0023 | 0.0413 | 0.0380 | 234 | 0.0142 |
| | 750 | 0.2630 | 0.8225 | 1.9926 | 0.0039 | 0.0698 | 0.0642 | 387 | 0.0237 |
| Excavators Composite | | 0.1064 | 0.5248 | 0.7416 | 0.0013 | 0.0379 | 0.0349 | 120 | 0.0096 |
| Forklifts | 50 | 0.0324 | 0.1522 | 0.1324 | 0.0002 | 0.0092 | 0.0084 | 14.7 | 0.0029 |
| | 120 | 0.0345 | 0.2143 | 0.2326 | 0.0004 | 0.0174 | 0.0160 | 31.2 | 0.0031 |
| | 175 | 0.0486 | 0.3316 | 0.3442 | 0.0006 | 0.0189 | 0.0174 | 56.1 | 0.0044 |
| | 250 | 0.0518 | 0.1582 | 0.4040 | 0.0009 | 0.0133 | 0.0122 | 77.1 | 0.0047 |
| | 500 | 0.0724 | 0.2164 | 0.5170 | 0.0011 | 0.0185 | 0.0171 | 111 | 0.0065 |
| Forklifts Composite | | 0.0459 | 0.2200 | 0.3163 | 0.0006 | 0.0156 | 0.0143 | 54.4 | 0.0041 |
| Generator Sets | 15 | 0.0135 | 0.0658 | 0.0929 | 0.0002 | 0.0051 | 0.0047 | 10.2 | 0.0012 |
| | 25 | 0.0247 | 0.0831 | 0.1522 | 0.0002 | 0.0080 | 0.0074 | 17.6 | 0.0022 |
| | 50 | 0.0706 | 0.2465 | 0.2628 | 0.0004 | 0.0193 | 0.0178 | 30.6 | 0.0064 |
| | 120 | 0.0910 | 0.4811 | 0.6607 | 0.0009 | 0.0484 | 0.0445 | 77.9 | 0.0082 |
| | 175 | 0.1120 | 0.7350 | 1.0463 | 0.0016 | 0.0485 | 0.0446 | 142 | 0.0101 |
| | 250 | 0.1090 | 0.4148 | 1.3776 | 0.0024 | 0.0381 | 0.0351 | 213 | 0.0098 |
| Generator Sets - 500 hp | 500 | 0.1556 | 0.6639 | 1.9429 | 0.0033 | 0.0567 | 0.0522 | 337 | 0.0140 |
| | 750 | 0.2599 | 1.0718 | 3.2483 | 0.0055 | 0.0934 | 0.0860 | 544 | 0.0234 |
| | 9999 | 0.6582 | 2.3655 | 8.9789 | 0.0105 | 0.2325 | 0.2139 | 1,049 | 0.0594 |
| Generator Sets Composite | | 0.0640 | 0.2913 | 0.4717 | 0.0007 | 0.0268 | 0.0246 | 61.0 | 0.0058 |
| Graders | 50 | 0.0897 | 0.3082 | 0.2569 | 0.0004 | 0.0217 | 0.0200 | 27.5 | 0.0081 |
| | 120 | 0.1081 | 0.5230 | 0.6726 | 0.0009 | 0.0555 | 0.0511 | 75.0 | 0.0098 |
| | 175 | 0.1299 | 0.7319 | 0.9534 | 0.0014 | 0.0526 | 0.0484 | 124 | 0.0117 |
| | 250 | 0.1326 | 0.4046 | 1.1596 | 0.0019 | 0.0400 | 0.0368 | 172 | 0.0120 |
| | 500 | 0.1666 | 0.5739 | 1.3760 | 0.0023 | 0.0496 | 0.0456 | 229 | 0.0150 |
| | 750 | 0.3549 | 1.2133 | 3.0011 | 0.0049 | 0.1066 | 0.0981 | 486 | 0.0320 |
| Graders Composite | | 0.1277 | 0.5931 | 0.9795 | 0.0015 | 0.0489 | 0.0450 | 133 | 0.0115 |
| Off-Highway Tractors | 120 | 0.1905 | 0.7051 | 1.1159 | 0.0011 | 0.0952 | 0.0876 | 93.7 | 0.0172 |
| | 175 | 0.1870 | 0.8216 | 1.3703 | 0.0015 | 0.0771 | 0.0709 | 130 | 0.0169 |
| | 250 | 0.1489 | 0.4320 | 1.2644 | 0.0015 | 0.0520 | 0.0478 | 130 | 0.0134 |
| | 750 | 0.5975 | 2.5165 | 5.0885 | 0.0057 | 0.2047 | 0.1884 | 568 | 0.0539 |
| | 1000 | 0.9006 | 3.9378 | 9.2072 | 0.0082 | 0.3063 | 0.2818 | 814 | 0.0813 |
| Off-Highway Tractors Composite | | 0.1893 | 0.7244 | 1.5085 | 0.0017 | 0.0717 | 0.0660 | 151 | 0.0171 |
| Off-Highway Trucks | 175 | 0.1259 | 0.7559 | 0.8596 | 0.0014 | 0.0477 | 0.0438 | 125 | 0.0114 |
| | 250 | 0.1252 | 0.3702 | 0.9818 | 0.0019 | 0.0328 | 0.0301 | 167 | 0.0113 |
| | 500 | 0.1960 | 0.5949 | 1.4165 | 0.0027 | 0.0505 | 0.0465 | 272 | 0.0177 |
| | 750 | 0.3198 | 0.9645 | 2.3779 | 0.0044 | 0.0835 | 0.0768 | 442 | 0.0289 |
| | 1000 | 0.4873 | 1.4801 | 5.2216 | 0.0063 | 0.1505 | 0.1385 | 625 | 0.0440 |
| Off-Highway Trucks Composite | | 0.1924 | 0.5974 | 1.4932 | 0.0027 | 0.0516 | 0.0475 | 260 | 0.0174 |
| Other Construction Equipment | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0039 | 0.0036 | 13.2 | 0.0014 |
| | 50 | 0.0597 | 0.2506 | 0.2369 | 0.0004 | 0.0162 | 0.0149 | 28.0 | 0.0054 |
| | 120 | 0.0827 | 0.5202 | 0.6012 | 0.0009 | 0.0441 | 0.0406 | 80.9 | 0.0075 |
| | 175 | 0.0796 | 0.5864 | 0.6636 | 0.0012 | 0.0331 | 0.0305 | 107 | 0.0072 |
| | 500 | 0.1310 | 0.4963 | 1.1867 | 0.0025 | 0.0394 | 0.0362 | 254 | 0.0118 |
| Other Construction Equipment Composite | | 0.0768 | 0.3645 | 0.6392 | 0.0013 | 0.0264 | 0.0243 | 123 | 0.0069 |
| Other General Industrial Equipmen | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0786 | 0.2532 | 0.2077 | 0.0003 | 0.0191 | 0.0175 | 21.7 | 0.0071 |
| | 120 | 0.0987 | 0.4387 | 0.5864 | 0.0007 | 0.0521 | 0.0480 | 62.0 | 0.0089 |
| | 175 | 0.1083 | 0.5684 | 0.7866 | 0.0011 | 0.0448 | 0.0412 | 95.9 | 0.0098 |
| | 250 | 0.1050 | 0.3015 | 0.9812 | 0.0015 | 0.0312 | 0.0287 | 136 | 0.0095 |
| | 500 | 0.1931 | 0.5811 | 1.6702 | 0.0026 | 0.0569 | 0.0524 | 265 | 0.0174 |
| | 750 | 0.3208 | 0.9578 | 2.8569 | 0.0044 | 0.0959 | 0.0883 | 437 | 0.0289 |
| | 1000 | 0.4546 | 1.4023 | 5.2482 | 0.0056 | 0.1513 | 0.1392 | 560 | 0.0410 |
| Other General Industrial Equipmen Composite | | 0.1355 | 0.4843 | 1.1215 | 0.0016 | 0.0475 | 0.0437 | 152 | 0.0122 |
| Other Material Handling Equipmen | 50 | 0.1090 | 0.3501 | 0.2887 | 0.0004 | 0.0265 | 0.0244 | 30.3 | 0.0098 |
| | 120 | 0.0959 | 0.4271 | 0.5727 | 0.0007 | 0.0509 | 0.0468 | 60.7 | 0.0087 |
| | 175 | 0.1365 | 0.7201 | 0.9997 | 0.0014 | 0.0567 | 0.0522 | 122 | 0.0123 |
| | 250 | 0.1109 | 0.3211 | 1.0483 | 0.0016 | 0.0332 | 0.0306 | 145 | 0.0100 |
| | 500 | 0.1376 | 0.4182 | 1.2042 | 0.0019 | 0.0409 | 0.0377 | 192 | 0.0124 |
| | 9999 | 0.6190 | 1.8527 | 6.9410 | 0.0073 | 0.1995 | 0.1835 | 741 | 0.0558 |
| Other Material Handling Equipment Composite | | 0.1289 | 0.4698 | 1.0967 | 0.0015 | 0.0460 | 0.0423 | 141 | 0.0116 |
| Pavers | 25 | 0.0234 | 0.0780 | 0.1458 | 0.0002 | 0.0066 | 0.0060 | 18.7 | 0.0021 |
| | 50 | 0.1198 | 0.3421 | 0.2775 | 0.0004 | 0.0271 | 0.0249 | 28.0 | 0.0108 |
| | 120 | 0.1235 | 0.4969 | 0.7477 | 0.0008 | 0.0636 | 0.0585 | 69.2 | 0.0111 |
| | 175 | 0.1608 | 0.7707 | 1.2155 | 0.0014 | 0.0673 | 0.0619 | 128 | 0.0145 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.1858 | 0.5585 | 1.6747 | 0.0022 | 0.0640 | 0.0589 | 194 | 0.0168 |
| | 500 | 0.2059 | 0.8113 | 1.8097 | 0.0023 | 0.0697 | 0.0641 | 233 | 0.0186 |
| Pavers Composite | | 0.1347 | 0.5203 | 0.7607 | 0.0009 | 0.0526 | 0.0484 | 77.9 | 0.0122 |
| Paving Equipment | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0037 | 0.0034 | 12.6 | 0.0014 |
| | 50 | 0.1023 | 0.2901 | 0.2367 | 0.0003 | 0.0231 | 0.0213 | 23.9 | 0.0092 |
| | 120 | 0.0969 | 0.3891 | 0.5874 | 0.0006 | 0.0503 | 0.0462 | 54.5 | 0.0087 |
| | 175 | 0.1254 | 0.6025 | 0.9549 | 0.0011 | 0.0528 | 0.0486 | 101 | 0.0113 |
| | 250 | 0.1140 | 0.3441 | 1.0498 | 0.0014 | 0.0394 | 0.0362 | 122 | 0.0103 |
| Paving Equipment Composite | | 0.1023 | 0.4234 | 0.6842 | 0.0008 | 0.0469 | 0.0431 | 68.9 | 0.0092 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washers | 15 | 0.0065 | 0.0315 | 0.0445 | 0.0001 | 0.0024 | 0.0022 | 4.9 | 0.0006 |
| | 25 | 0.0100 | 0.0337 | 0.0617 | 0.0001 | 0.0033 | 0.0030 | 7.1 | 0.0009 |
| | 50 | 0.0251 | 0.0970 | 0.1183 | 0.0002 | 0.0077 | 0.0070 | 14.3 | 0.0023 |
| | 120 | 0.0245 | 0.1416 | 0.1947 | 0.0003 | 0.0128 | 0.0118 | 24.1 | 0.0022 |
| Pressure Washers Composite | | 0.0133 | 0.0590 | 0.0799 | 0.0001 | 0.0049 | 0.0045 | 9.4 | 0.0012 |
| | 15 | 0.0111 | 0.0479 | 0.0683 | 0.0001 | 0.0041 | 0.0038 | 7.4 | 0.0010 |
| | 25 | 0.0309 | 0.0919 | 0.1682 | 0.0002 | 0.0094 | 0.0086 | 19.5 | 0.0028 |
| | 50 | 0.0855 | 0.2910 | 0.2982 | 0.0004 | 0.0228 | 0.0210 | 34.3 | 0.0077 |
| | 120 | 0.0949 | 0.4887 | 0.6710 | 0.0009 | 0.0508 | 0.0467 | 77.9 | 0.0086 |
| | 175 | 0.1158 | 0.7365 | 1.0489 | 0.0016 | 0.0502 | 0.0462 | 140 | 0.0104 |
| | 250 | 0.1088 | 0.3998 | 1.3270 | 0.0023 | 0.0376 | 0.0346 | 201 | 0.0098 |
| Pumps | 500 | 0.1686 | 0.6929 | 2.0163 | 0.0034 | 0.0603 | 0.0555 | 345 | 0.0152 |
| | 750 | 0.2872 | 1.1454 | 3.4529 | 0.0057 | 0.1018 | 0.0937 | 571 | 0.0259 |
| | 9999 | 0.8773 | 3.1134 | 11.7387 | 0.0136 | 0.3072 | 0.2826 | 1,355 | 0.0792 |
| Pumps Composite | | 0.0621 | 0.2825 | 0.4121 | 0.0006 | 0.0267 | 0.0245 | 49.6 | 0.0056 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1018 | 0.0002 | 0.0039 | 0.0036 | 13.3 | 0.0015 |
| | 50 | 0.0871 | 0.2754 | 0.2405 | 0.0003 | 0.0209 | 0.0192 | 26.0 | 0.0079 |
| | 120 | 0.0857 | 0.4000 | 0.5498 | 0.0007 | 0.0454 | 0.0418 | 59.0 | 0.0077 |
| | 175 | 0.1104 | 0.6166 | 0.8731 | 0.0012 | 0.0470 | 0.0433 | 108 | 0.0100 |
| | 250 | 0.1107 | 0.3575 | 1.0948 | 0.0017 | 0.0368 | 0.0339 | 153 | 0.0100 |
| | 500 | 0.1468 | 0.5595 | 1.3956 | 0.0022 | 0.0487 | 0.0448 | 219 | 0.0132 |
| Rollers Composite | | 0.0851 | 0.3979 | 0.5706 | 0.0008 | 0.0386 | 0.0355 | 67.1 | 0.0077 |
| Rough Terrain Forklifts | 50 | 0.0942 | 0.3551 | 0.3066 | 0.0004 | 0.0243 | 0.0224 | 33.9 | 0.0085 |
| | 120 | 0.0801 | 0.4260 | 0.5164 | 0.0007 | 0.0420 | 0.0387 | 62.4 | 0.0072 |
| | 175 | 0.1171 | 0.7240 | 0.8746 | 0.0014 | 0.0477 | 0.0439 | 125 | 0.0106 |
| | 250 | 0.1168 | 0.3650 | 1.0385 | 0.0019 | 0.0338 | 0.0311 | 171 | 0.0105 |
| | 500 | 0.1668 | 0.5337 | 1.3642 | 0.0025 | 0.0477 | 0.0439 | 257 | 0.0150 |
| Rough Terrain Forklifts Composite | | 0.0850 | 0.4577 | 0.5588 | 0.0008 | 0.0423 | 0.0389 | 70.3 | 0.0077 |
| Rubber Tired Dozers | 175 | 0.1942 | 0.8333 | 1.3944 | 0.0015 | 0.0790 | 0.0727 | 129 | 0.0175 |
| | 250 | 0.2209 | 0.6304 | 1.8273 | 0.0021 | 0.0762 | 0.0701 | 183 | 0.0199 |
| | 500 | 0.2932 | 1.2456 | 2.3951 | 0.0026 | 0.0985 | 0.0906 | 265 | 0.0265 |
| | 750 | 0.4423 | 1.8685 | 3.6712 | 0.0040 | 0.1494 | 0.1374 | 399 | 0.0399 |
| | 1000 | 0.6883 | 3.0139 | 6.8297 | 0.0060 | 0.2311 | 0.2126 | 592 | 0.0621 |
| Rubber Tired Dozers Composite | | 0.2721 | 1.0420 | 2.2344 | 0.0025 | 0.0924 | 0.0850 | 239 | 0.0246 |
| Rubber Tired Loaders | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0049 | 0.0045 | 16.9 | 0.0018 |
| | 50 | 0.0993 | 0.3438 | 0.2888 | 0.0004 | 0.0242 | 0.0222 | 31.1 | 0.0090 |
| | 120 | 0.0835 | 0.4090 | 0.5226 | 0.0007 | 0.0431 | 0.0396 | 58.9 | 0.0075 |
| | 175 | 0.1094 | 0.6251 | 0.8077 | 0.0012 | 0.0445 | 0.0409 | 106 | 0.0099 |
| | 250 | 0.1118 | 0.3444 | 0.9890 | 0.0017 | 0.0337 | 0.0310 | 149 | 0.0101 |
| | 500 | 0.1678 | 0.5818 | 1.3980 | 0.0023 | 0.0499 | 0.0459 | 237 | 0.0151 |
| | 750 | 0.3459 | 1.1905 | 2.9534 | 0.0049 | 0.1040 | 0.0956 | 486 | 0.0312 |
| | 1000 | 0.4657 | 1.6412 | 5.2967 | 0.0060 | 0.1552 | 0.1428 | 594 | 0.0420 |
| Rubber Tired Loaders Composite | | 0.1050 | 0.4615 | 0.7838 | 0.0012 | 0.0416 | 0.0383 | 109 | 0.0095 |
| Scrapers | 120 | 0.1665 | 0.6826 | 0.9915 | 0.0011 | 0.0846 | 0.0778 | 93.9 | 0.0150 |
| | 175 | 0.1871 | 0.9030 | 1.3657 | 0.0017 | 0.0766 | 0.0704 | 148 | 0.0169 |
| | 250 | 0.2021 | 0.5906 | 1.7470 | 0.0024 | 0.0665 | 0.0612 | 209 | 0.0182 |
| | 500 | 0.2883 | 1.0688 | 2.4104 | 0.0032 | 0.0930 | 0.0855 | 321 | 0.0260 |
| | 750 | 0.5001 | 1.8419 | 4.2634 | 0.0056 | 0.1624 | 0.1494 | 555 | 0.0451 |
| Scrapers Composite | | 0.2513 | 0.9443 | 2.0647 | 0.0027 | 0.0854 | 0.0785 | 262 | 0.0227 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0931 | 0.3227 | 0.3148 | 0.0005 | 0.0243 | 0.0224 | 36.2 | 0.0084 |
| | 120 | 0.0970 | 0.5116 | 0.6762 | 0.0009 | 0.0525 | 0.0483 | 80.2 | 0.0088 |
| | 175 | 0.1290 | 0.8300 | 1.1249 | 0.0017 | 0.0559 | 0.0514 | 155 | 0.0116 |
| | 250 | 0.1416 | 0.5098 | 1.6229 | 0.0029 | 0.0474 | 0.0436 | 255 | 0.0128 |
| Signal Boards Composite | | 0.0171 | 0.0925 | 0.1250 | 0.0002 | 0.0066 | 0.0060 | 16.7 | 0.0015 |

| Equipment | MaxHP | (lb/hr) ROG | (lb/hr) CO | (lb/hr) NOX | (lb/hr) SOX | (lb/hr) PM | (lb/hr) PM2.5 | (lb/hr) CO2 | (lb/hr) CH4 |
|---|---|---|---|---|---|---|---|---|---|
| Skid Steer Loaders | 25 | 0.0189 | 0.0601 | 0.1125 | 0.0002 | 0.0056 | 0.0052 | 13.8 | 0.0017 |
| | 50 | 0.0378 | 0.2138 | 0.2052 | 0.0003 | 0.0113 | 0.0104 | 25.5 | 0.0034 |
| | 120 | 0.0334 | 0.2710 | 0.2699 | 0.0005 | 0.0170 | 0.0156 | 42.8 | 0.0030 |
| Skid Steer Loaders Composite | | 0.0352 | 0.2220 | 0.2198 | 0.0004 | 0.0128 | 0.0118 | 30.3 | 0.0032 |
| Surfacing Equipment | 50 | 0.0408 | 0.1333 | 0.1263 | 0.0002 | 0.0101 | 0.0093 | 14.1 | 0.0037 |
| | 120 | 0.0840 | 0.4151 | 0.5756 | 0.0007 | 0.0439 | 0.0404 | 63.8 | 0.0076 |
| | 175 | 0.0787 | 0.4705 | 0.6706 | 0.0010 | 0.0335 | 0.0308 | 85.8 | 0.0071 |
| | 250 | 0.0891 | 0.3116 | 0.9338 | 0.0015 | 0.0309 | 0.0285 | 135 | 0.0080 |
| | 500 | 0.1342 | 0.5759 | 1.3809 | 0.0022 | 0.0468 | 0.0431 | 221 | 0.0121 |
| | 750 | 0.2139 | 0.9020 | 2.2264 | 0.0035 | 0.0745 | 0.0686 | 347 | 0.0193 |
| Surfacing Equipment Composite | | 0.1116 | 0.4705 | 1.0675 | 0.0017 | 0.0389 | 0.0357 | 166 | 0.0101 |
| Sweepers/Scrubbers | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0052 | 19.6 | 0.0021 |
| | 50 | 0.0782 | 0.3186 | 0.2828 | 0.0004 | 0.0211 | 0.0194 | 31.6 | 0.0071 |
| | 120 | 0.0880 | 0.5056 | 0.5893 | 0.0009 | 0.0466 | 0.0429 | 75.0 | 0.0079 |
| | 175 | 0.1193 | 0.7999 | 0.9051 | 0.0016 | 0.0488 | 0.0449 | 139 | 0.0108 |
| | 250 | 0.1029 | 0.3286 | 0.9094 | 0.0018 | 0.0289 | 0.0266 | 162 | 0.0093 |
| Sweepers/Scrubbers Composite | | 0.0913 | 0.5034 | 0.5746 | 0.0009 | 0.0387 | 0.0356 | 78.5 | 0.0082 |
| Tractors/Loaders/Backhoes | 25 | 0.0192 | 0.0653 | 0.1221 | 0.0002 | 0.0049 | 0.0045 | 15.9 | 0.0017 |
| | 50 | 0.0702 | 0.3020 | 0.2646 | 0.0004 | 0.0186 | 0.0171 | 30.3 | 0.0063 |
| | 120 | 0.0577 | 0.3480 | 0.3870 | 0.0006 | 0.0293 | 0.0270 | 51.7 | 0.0052 |
| | 175 | 0.0854 | 0.5853 | 0.6331 | 0.0011 | 0.0335 | 0.0308 | 101 | 0.0077 |
| | 250 | 0.1082 | 0.3566 | 0.9047 | 0.0019 | 0.0294 | 0.0270 | 172 | 0.0098 |
| | 500 | 0.2085 | 0.7089 | 1.6070 | 0.0039 | 0.0559 | 0.0514 | 345 | 0.0188 |
| | 750 | 0.3148 | 1.0631 | 2.4922 | 0.0058 | 0.0854 | 0.0786 | 517 | 0.0284 |
| Tractors/Loaders/Backhoes Composite | | 0.0666 | 0.3716 | 0.4501 | 0.0008 | 0.0298 | 0.0274 | 66.8 | 0.0060 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0087 | 32.9 | 0.0036 |
| | 50 | 0.1390 | 0.3900 | 0.3235 | 0.0004 | 0.0313 | 0.0288 | 32.9 | 0.0125 |
| | 120 | 0.1144 | 0.4600 | 0.7060 | 0.0008 | 0.0590 | 0.0542 | 64.9 | 0.0103 |
| | 175 | 0.1770 | 0.8534 | 1.3767 | 0.0016 | 0.0748 | 0.0688 | 144 | 0.0160 |
| | 250 | 0.2105 | 0.6510 | 1.9456 | 0.0025 | 0.0750 | 0.0690 | 223 | 0.0190 |
| | 500 | 0.2694 | 1.1349 | 2.4560 | 0.0031 | 0.0947 | 0.0871 | 311 | 0.0243 |
| | 750 | 0.5107 | 2.1334 | 4.7300 | 0.0059 | 0.1802 | 0.1658 | 587 | 0.0461 |
| Trenchers Composite | | 0.1274 | 0.4541 | 0.6043 | 0.0007 | 0.0485 | 0.0446 | 58.7 | 0.0115 |
| Welders | 15 | 0.0093 | 0.0400 | 0.0571 | 0.0001 | 0.0034 | 0.0032 | 6.2 | 0.0008 |
| | 25 | 0.0179 | 0.0532 | 0.0974 | 0.0001 | 0.0054 | 0.0050 | 11.3 | 0.0016 |
| | 50 | 0.0801 | 0.2564 | 0.2346 | 0.0003 | 0.0200 | 0.0184 | 26.0 | 0.0072 |
| | 120 | 0.0547 | 0.2606 | 0.3567 | 0.0005 | 0.0296 | 0.0273 | 39.5 | 0.0049 |
| | 175 | 0.0936 | 0.5424 | 0.7713 | 0.0011 | 0.0405 | 0.0373 | 98.2 | 0.0084 |
| | 250 | 0.0749 | 0.2483 | 0.8249 | 0.0013 | 0.0248 | 0.0228 | 119 | 0.0068 |
| | 500 | 0.0968 | 0.3491 | 1.0171 | 0.0016 | 0.0325 | 0.0299 | 168 | 0.0087 |
| Welders Composite | | 0.0534 | 0.1994 | 0.2301 | 0.0003 | 0.0187 | 0.0172 | 25.6 | 0.0048 |

**2020 Fleet Average Emission Factors (Diesel)**

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0138 | 0.0459 | 0.0854 | 0.0001 | 0.0035 | 0.0032 | 11.0 | 0.0012 |
| | 50 | 0.0261 | 0.1436 | 0.1422 | 0.0003 | 0.0071 | 0.0065 | 19.6 | 0.0024 |
| | 120 | 0.0259 | 0.2292 | 0.2166 | 0.0004 | 0.0127 | 0.0117 | 38.1 | 0.0023 |
| | 500 | 0.0751 | 0.3804 | 0.6959 | 0.0021 | 0.0217 | 0.0199 | 213 | 0.0068 |
| | 750 | 0.1373 | 0.6877 | 1.2876 | 0.0039 | 0.0396 | 0.0365 | 385 | 0.0124 |
| Aerial Lifts Composite | | 0.0261 | 0.1696 | 0.1866 | 0.0004 | 0.0092 | 0.0084 | 34.7 | 0.0024 |
| Air Compressors | 15 | 0.0093 | 0.0451 | 0.0579 | 0.0001 | 0.0029 | 0.0027 | 7.2 | 0.0008 |
| | 25 | 0.0196 | 0.0630 | 0.1155 | 0.0002 | 0.0054 | 0.0050 | 14.4 | 0.0018 |
| | 50 | 0.0398 | 0.2030 | 0.1725 | 0.0003 | 0.0099 | 0.0091 | 22.3 | 0.0036 |
| | 120 | 0.0408 | 0.3058 | 0.2826 | 0.0006 | 0.0188 | 0.0173 | 47.0 | 0.0037 |
| | 175 | 0.0587 | 0.4989 | 0.4013 | 0.0010 | 0.0210 | 0.0193 | 88.5 | 0.0053 |
| | 250 | 0.0669 | 0.2592 | 0.5067 | 0.0015 | 0.0163 | 0.0150 | 131 | 0.0060 |
| | 500 | 0.1146 | 0.4395 | 0.7970 | 0.0023 | 0.0276 | 0.0254 | 232 | 0.0103 |
| | 750 | 0.1777 | 0.6792 | 1.2615 | 0.0036 | 0.0432 | 0.0398 | 358 | 0.0160 |
| | 1000 | 0.2641 | 0.9959 | 3.2946 | 0.0049 | 0.0804 | 0.0740 | 486 | 0.0238 |
| Air Compressors Composite | | 0.0483 | 0.3077 | 0.3255 | 0.0007 | 0.0185 | 0.0170 | 63.6 | 0.0044 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0196 | 0.2205 | 0.1756 | 0.0004 | 0.0020 | 0.0018 | 31.0 | 0.0018 |
| | 120 | 0.0280 | 0.4662 | 0.2329 | 0.0009 | 0.0040 | 0.0037 | 77.1 | 0.0025 |
| | 175 | 0.0402 | 0.7542 | 0.1862 | 0.0016 | 0.0051 | 0.0047 | 141 | 0.0036 |
| | 250 | 0.0474 | 0.3426 | 0.1617 | 0.0021 | 0.0044 | 0.0040 | 188 | 0.0043 |
| | 500 | 0.0784 | 0.5512 | 0.2622 | 0.0031 | 0.0072 | 0.0066 | 311 | 0.0071 |
| | 750 | 0.1549 | 1.0891 | 0.5202 | 0.0062 | 0.0143 | 0.0131 | 615 | 0.0140 |
| | 1000 | 0.2442 | 1.6437 | 3.9853 | 0.0093 | 0.0530 | 0.0488 | 928 | 0.0220 |
| Bore/Drill Rigs Composite | | 0.0480 | 0.5008 | 0.3439 | 0.0017 | 0.0062 | 0.0057 | 165 | 0.0043 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0223 | 0.0741 | 0.1372 | 0.0002 | 0.0058 | 0.0053 | 17.6 | 0.0020 |
| Cement and Mortar Mixers Co | | 0.0086 | 0.0415 | 0.0536 | 0.0001 | 0.0021 | 0.0020 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0424 | 0.2420 | 0.2231 | 0.0004 | 0.0113 | 0.0104 | 30.2 | 0.0038 |
| | 120 | 0.0524 | 0.4613 | 0.4128 | 0.0009 | 0.0249 | 0.0229 | 74.1 | 0.0047 |
| | 175 | 0.0865 | 0.8662 | 0.6554 | 0.0018 | 0.0323 | 0.0297 | 160 | 0.0078 |
| Concrete/Industrial Saws Com | | 0.0484 | 0.3783 | 0.3410 | 0.0007 | 0.0196 | 0.0180 | 58.5 | 0.0044 |
| Cranes | 50 | 0.0532 | 0.2423 | 0.1894 | 0.0003 | 0.0121 | 0.0111 | 23.2 | 0.0048 |
| | 120 | 0.0542 | 0.3446 | 0.3317 | 0.0006 | 0.0240 | 0.0221 | 50.1 | 0.0049 |
| | 175 | 0.0648 | 0.4754 | 0.4071 | 0.0009 | 0.0223 | 0.0206 | 80.3 | 0.0058 |
| | 250 | 0.0704 | 0.2440 | 0.4949 | 0.0013 | 0.0170 | 0.0157 | 112 | 0.0064 |
| | 500 | 0.1087 | 0.3839 | 0.7047 | 0.0018 | 0.0257 | 0.0236 | 180 | 0.0098 |
| | 750 | 0.1837 | 0.6455 | 1.2225 | 0.0030 | 0.0439 | 0.0404 | 303 | 0.0166 |
| | 9999 | 0.6702 | 2.1934 | 7.0436 | 0.0098 | 0.1797 | 0.1654 | 971 | 0.0605 |
| Cranes Composite | | 0.0898 | 0.3917 | 0.6610 | 0.0014 | 0.0256 | 0.0236 | 129 | 0.0081 |
| Crawler Tractors | 50 | 0.0699 | 0.2771 | 0.2107 | 0.0003 | 0.0150 | 0.0138 | 24.9 | 0.0063 |
| | 120 | 0.0831 | 0.4628 | 0.4896 | 0.0008 | 0.0371 | 0.0341 | 65.8 | 0.0075 |
| | 175 | 0.1123 | 0.7302 | 0.7150 | 0.0014 | 0.0398 | 0.0366 | 121 | 0.0101 |
| | 250 | 0.1188 | 0.3966 | 0.8681 | 0.0019 | 0.0315 | 0.0290 | 166 | 0.0107 |
| | 500 | 0.1759 | 0.6665 | 1.2170 | 0.0025 | 0.0455 | 0.0419 | 259 | 0.0159 |
| | 750 | 0.3168 | 1.1935 | 2.2429 | 0.0047 | 0.0828 | 0.0762 | 465 | 0.0286 |
| | 1000 | 0.4836 | 1.8458 | 5.2162 | 0.0066 | 0.1425 | 0.1311 | 658 | 0.0436 |
| Crawler Tractors Composite | | 0.1049 | 0.5260 | 0.6772 | 0.0013 | 0.0378 | 0.0348 | 114 | 0.0095 |
| Crushing/Proc. E | 50 | 0.0734 | 0.4036 | 0.3367 | 0.0006 | 0.0181 | 0.0166 | 44.0 | 0.0066 |
| | 120 | 0.0692 | 0.5446 | 0.4754 | 0.0010 | 0.0302 | 0.0278 | 83.1 | 0.0062 |
| | 175 | 0.1083 | 0.9519 | 0.7042 | 0.0019 | 0.0368 | 0.0338 | 167 | 0.0098 |
| | 250 | 0.1245 | 0.4844 | 0.8670 | 0.0028 | 0.0282 | 0.0259 | 245 | 0.0112 |
| | 500 | 0.1852 | 0.7092 | 1.1829 | 0.0037 | 0.0416 | 0.0383 | 374 | 0.0167 |
| | 750 | 0.2912 | 1.1167 | 1.9026 | 0.0059 | 0.0655 | 0.0603 | 589 | 0.0263 |
| | 9999 | 0.7584 | 2.6528 | 8.5119 | 0.0131 | 0.2049 | 0.1885 | 1,308 | 0.0684 |
| Crushing/Proc. Equipment Co | | 0.0934 | 0.6247 | 0.5983 | 0.0015 | 0.0310 | 0.0285 | 132 | 0.0084 |
| Dumpers/Tender | 25 | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0582 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0384 | 0.2446 | 0.1862 | 0.0003 | 0.0080 | 0.0074 | 25.0 | 0.0035 |
| | 120 | 0.0583 | 0.4979 | 0.3717 | 0.0009 | 0.0206 | 0.0189 | 73.6 | 0.0053 |
| | 175 | 0.0703 | 0.6637 | 0.3868 | 0.0013 | 0.0195 | 0.0179 | 112 | 0.0063 |
| | 250 | 0.0828 | 0.3276 | 0.4493 | 0.0018 | 0.0154 | 0.0141 | 159 | 0.0075 |
| | 500 | 0.1198 | 0.4591 | 0.6028 | 0.0023 | 0.0219 | 0.0202 | 234 | 0.0108 |
| | 750 | 0.1987 | 0.7606 | 1.0153 | 0.0039 | 0.0365 | 0.0336 | 387 | 0.0179 |
| Excavators Composite | | 0.0733 | 0.5124 | 0.4042 | 0.0013 | 0.0184 | 0.0169 | 120 | 0.0066 |
| Forklifts | 50 | 0.0191 | 0.1400 | 0.1084 | 0.0002 | 0.0039 | 0.0036 | 14.7 | 0.0017 |
| | 120 | 0.0225 | 0.2102 | 0.1443 | 0.0004 | 0.0074 | 0.0068 | 31.2 | 0.0020 |
| | 175 | 0.0336 | 0.3315 | 0.1772 | 0.0006 | 0.0087 | 0.0080 | 56.1 | 0.0030 |
| | 250 | 0.0385 | 0.1554 | 0.1887 | 0.0009 | 0.0062 | 0.0057 | 77.1 | 0.0035 |
| | 500 | 0.0548 | 0.2126 | 0.2528 | 0.0011 | 0.0088 | 0.0081 | 111 | 0.0049 |
| Forklifts Composite | | 0.0320 | 0.2160 | 0.1691 | 0.0006 | 0.0070 | 0.0065 | 54.4 | 0.0029 |
| Generator Sets | 15 | 0.0116 | 0.0638 | 0.0814 | 0.0002 | 0.0038 | 0.0035 | 10.2 | 0.0011 |
| | 25 | 0.0224 | 0.0769 | 0.1410 | 0.0002 | 0.0064 | 0.0059 | 17.6 | 0.0020 |
| | 50 | 0.0379 | 0.2161 | 0.2199 | 0.0004 | 0.0106 | 0.0098 | 30.6 | 0.0034 |
| | 120 | 0.0506 | 0.4641 | 0.4378 | 0.0009 | 0.0250 | 0.0230 | 77.9 | 0.0046 |
| | 175 | 0.0676 | 0.7323 | 0.5990 | 0.0016 | 0.0266 | 0.0245 | 142 | 0.0061 |
| | 250 | 0.0747 | 0.3844 | 0.7614 | 0.0024 | 0.0218 | 0.0200 | 213 | 0.0067 |
| | 500 | 0.1125 | 0.5968 | 1.0874 | 0.0033 | 0.0333 | 0.0307 | 337 | 0.0102 |
| | 750 | 0.1842 | 0.9634 | 1.7962 | 0.0055 | 0.0544 | 0.0500 | 544 | 0.0166 |
| | 9999 | 0.4502 | 2.0059 | 6.6947 | 0.0105 | 0.1476 | 0.1358 | 1,049 | 0.0406 |
| Generator Sets Composite | | 0.0395 | 0.2732 | 0.3232 | 0.0007 | 0.0150 | 0.0138 | 61.0 | 0.0036 |
| Graders | 50 | 0.0563 | 0.2762 | 0.2156 | 0.0004 | 0.0124 | 0.0114 | 27.5 | 0.0051 |
| | 120 | 0.0738 | 0.5090 | 0.4568 | 0.0009 | 0.0311 | 0.0286 | 75.0 | 0.0067 |
| | 175 | 0.0918 | 0.7282 | 0.5622 | 0.0014 | 0.0303 | 0.0279 | 124 | 0.0083 |
| | 250 | 0.0999 | 0.3683 | 0.6701 | 0.0019 | 0.0230 | 0.0211 | 172 | 0.0090 |
| | 500 | 0.1284 | 0.4966 | 0.7982 | 0.0023 | 0.0288 | 0.0265 | 229 | 0.0116 |
| | 750 | 0.2731 | 1.0508 | 1.7425 | 0.0049 | 0.0621 | 0.0571 | 486 | 0.0246 |
| Graders Composite | | 0.0919 | 0.5765 | 0.5823 | 0.0015 | 0.0280 | 0.0258 | 133 | 0.0083 |
| Off-Highway Trac | 120 | 0.1455 | 0.6789 | 0.8421 | 0.0011 | 0.0674 | 0.0621 | 93.7 | 0.0131 |
| | 175 | 0.1455 | 0.8025 | 0.9712 | 0.0015 | 0.0547 | 0.0503 | 130 | 0.0131 |
| | 250 | 0.1147 | 0.3614 | 0.8843 | 0.0015 | 0.0348 | 0.0321 | 130 | 0.0103 |
| | 750 | 0.4683 | 1.8825 | 3.5643 | 0.0057 | 0.1391 | 0.1280 | 568 | 0.0423 |
| | 1000 | 0.7129 | 2.9445 | 7.4279 | 0.0082 | 0.2214 | 0.2037 | 814 | 0.0643 |
| Off-Highway Tractors Compos | | 0.1470 | 0.6517 | 1.0657 | 0.0017 | 0.0497 | 0.0457 | 151 | 0.0133 |
| Off-Highway Truc | 175 | 0.0837 | 0.7538 | 0.4564 | 0.0014 | 0.0234 | 0.0215 | 125 | 0.0076 |
| | 250 | 0.0927 | 0.3514 | 0.5042 | 0.0019 | 0.0173 | 0.0159 | 167 | 0.0084 |
| | 500 | 0.1488 | 0.5446 | 0.7481 | 0.0027 | 0.0273 | 0.0251 | 272 | 0.0134 |
| | 750 | 0.2416 | 0.8831 | 1.2347 | 0.0044 | 0.0446 | 0.0411 | 442 | 0.0218 |
| | 1000 | 0.3613 | 1.2913 | 3.8920 | 0.0063 | 0.0903 | 0.0831 | 625 | 0.0326 |
| Off-Highway Trucks Composit | | 0.1443 | 0.5514 | 0.8306 | 0.0027 | 0.0280 | 0.0258 | 260 | 0.0130 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0328 | 0.2267 | 0.1956 | 0.0004 | 0.0078 | 0.0072 | 28.0 | 0.0030 |
| | 120 | 0.0501 | 0.5080 | 0.3835 | 0.0009 | 0.0199 | 0.0183 | 80.9 | 0.0045 |
| | 175 | 0.0524 | 0.5859 | 0.3414 | 0.0012 | 0.0164 | 0.0151 | 107 | 0.0047 |
| | 500 | 0.1012 | 0.4676 | 0.6065 | 0.0025 | 0.0212 | 0.0195 | 254 | 0.0091 |
| Other Construction Equipment | | 0.0563 | 0.3508 | 0.3519 | 0.0013 | 0.0139 | 0.0128 | 122 | 0.0051 |
| Other General In | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0431 | 0.2211 | 0.1744 | 0.0003 | 0.0101 | 0.0093 | 21.7 | 0.0039 |
| | 120 | 0.0602 | 0.4232 | 0.3810 | 0.0007 | 0.0256 | 0.0236 | 62.0 | 0.0054 |
| | 175 | 0.0721 | 0.5668 | 0.4439 | 0.0011 | 0.0237 | 0.0218 | 95.9 | 0.0065 |
| | 250 | 0.0791 | 0.2804 | 0.5318 | 0.0015 | 0.0173 | 0.0159 | 136 | 0.0071 |
| | 500 | 0.1506 | 0.5217 | 0.9276 | 0.0026 | 0.0326 | 0.0300 | 265 | 0.0136 |
| | 750 | 0.2490 | 0.8599 | 1.5657 | 0.0044 | 0.0543 | 0.0500 | 437 | 0.0225 |
| | 1000 | 0.3467 | 1.1855 | 3.8628 | 0.0056 | 0.0969 | 0.0892 | 560 | 0.0313 |
| Other General Industrial Equip | | 0.0983 | 0.4517 | 0.6661 | 0.0016 | 0.0262 | 0.0241 | 152 | 0.0089 |
| Other Material Ha | 50 | 0.0595 | 0.3049 | 0.2425 | 0.0004 | 0.0141 | 0.0130 | 30.3 | 0.0054 |
| | 120 | 0.0583 | 0.4117 | 0.3720 | 0.0007 | 0.0250 | 0.0230 | 60.7 | 0.0053 |
| | 175 | 0.0907 | 0.7176 | 0.5642 | 0.0014 | 0.0301 | 0.0277 | 122 | 0.0082 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0836 | 0.2984 | 0.5684 | 0.0016 | 0.0185 | 0.0170 | 145 | 0.0075 |
| | 500 | 0.1074 | 0.3752 | 0.6692 | 0.0019 | 0.0235 | 0.0216 | 192 | 0.0097 |
| | 9999 | 0.4910 | 1.5647 | 5.1082 | 0.0073 | 0.1280 | 0.1177 | 741 | 0.0443 |
| Other Material Handling Equip | | 0.0924 | 0.4429 | 0.6500 | 0.0015 | 0.0252 | 0.0232 | 141 | 0.0083 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1427 | 0.0002 | 0.0055 | 0.0051 | 18.7 | 0.0020 |
| | 50 | 0.0834 | 0.3055 | 0.2398 | 0.0004 | 0.0184 | 0.0169 | 28.0 | 0.0075 |
| | 120 | 0.0910 | 0.4805 | 0.5471 | 0.0008 | 0.0428 | 0.0394 | 69.2 | 0.0082 |
| | 175 | 0.1217 | 0.7599 | 0.8187 | 0.0014 | 0.0459 | 0.0422 | 128 | 0.0110 |
| | 250 | 0.1411 | 0.4713 | 1.1106 | 0.0022 | 0.0407 | 0.0375 | 194 | 0.0127 |
| | 500 | 0.1595 | 0.6305 | 1.1959 | 0.0023 | 0.0450 | 0.0414 | 233 | 0.0144 |
| Pavers Composite | | 0.0989 | 0.4920 | 0.5450 | 0.0009 | 0.0355 | 0.0326 | 77.9 | 0.0089 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0702 | 0.2577 | 0.2043 | 0.0003 | 0.0157 | 0.0144 | 23.9 | 0.0063 |
| | 120 | 0.0708 | 0.3762 | 0.4280 | 0.0006 | 0.0337 | 0.0310 | 54.5 | 0.0064 |
| | 175 | 0.0944 | 0.5945 | 0.6403 | 0.0011 | 0.0360 | 0.0331 | 101 | 0.0085 |
| | 250 | 0.0864 | 0.2894 | 0.6928 | 0.0014 | 0.0249 | 0.0229 | 122 | 0.0078 |
| Paving Equipment Composite | | 0.0757 | 0.4084 | 0.4807 | 0.0008 | 0.0315 | 0.0290 | 68.9 | 0.0068 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0056 | 0.0305 | 0.0390 | 0.0001 | 0.0018 | 0.0017 | 4.9 | 0.0005 |
| | 25 | 0.0091 | 0.0312 | 0.0572 | 0.0001 | 0.0026 | 0.0024 | 7.1 | 0.0008 |
| | 50 | 0.0128 | 0.0856 | 0.0986 | 0.0002 | 0.0041 | 0.0038 | 14.3 | 0.0012 |
| | 120 | 0.0128 | 0.1367 | 0.1293 | 0.0003 | 0.0065 | 0.0060 | 24.1 | 0.0012 |
| Pressure Washers Composite | | 0.0085 | 0.0549 | 0.0650 | 0.0001 | 0.0030 | 0.0027 | 9.4 | 0.0008 |
| Pumps | 15 | 0.0096 | 0.0464 | 0.0595 | 0.0001 | 0.0030 | 0.0028 | 7.4 | 0.0009 |
| | 25 | 0.0265 | 0.0850 | 0.1558 | 0.0002 | 0.0073 | 0.0067 | 19.5 | 0.0024 |
| | 50 | 0.0465 | 0.2546 | 0.2497 | 0.0004 | 0.0126 | 0.0116 | 34.3 | 0.0042 |
| | 120 | 0.0537 | 0.4713 | 0.4442 | 0.0009 | 0.0263 | 0.0242 | 77.9 | 0.0048 |
| | 175 | 0.0712 | 0.7336 | 0.6007 | 0.0016 | 0.0277 | 0.0255 | 140 | 0.0064 |
| | 250 | 0.0760 | 0.3700 | 0.7338 | 0.0023 | 0.0215 | 0.0198 | 201 | 0.0069 |
| | 500 | 0.1241 | 0.6189 | 1.1297 | 0.0034 | 0.0355 | 0.0327 | 345 | 0.0112 |
| | 750 | 0.2075 | 1.0232 | 1.9114 | 0.0057 | 0.0594 | 0.0547 | 571 | 0.0187 |
| | 9999 | 0.6127 | 2.6255 | 8.7489 | 0.0136 | 0.1961 | 0.1804 | 1,355 | 0.0553 |
| Pumps Composite | | 0.0376 | 0.2674 | 0.2854 | 0.0006 | 0.0147 | 0.0135 | 49.6 | 0.0034 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0543 | 0.2436 | 0.2039 | 0.0003 | 0.0128 | 0.0117 | 26.0 | 0.0049 |
| | 120 | 0.0576 | 0.3873 | 0.3799 | 0.0007 | 0.0270 | 0.0249 | 59.0 | 0.0052 |
| | 175 | 0.0774 | 0.6114 | 0.5331 | 0.0012 | 0.0286 | 0.0263 | 108 | 0.0070 |
| | 250 | 0.0842 | 0.3201 | 0.6581 | 0.0017 | 0.0223 | 0.0205 | 153 | 0.0076 |
| | 500 | 0.1151 | 0.4607 | 0.8354 | 0.0022 | 0.0299 | 0.0275 | 219 | 0.0104 |
| Rollers Composite | | 0.0584 | 0.3837 | 0.3793 | 0.0008 | 0.0232 | 0.0214 | 67.0 | 0.0053 |
| Rough Terrain Fo | 50 | 0.0520 | 0.3171 | 0.2556 | 0.0004 | 0.0122 | 0.0113 | 33.9 | 0.0047 |
| | 120 | 0.0495 | 0.4142 | 0.3326 | 0.0007 | 0.0197 | 0.0181 | 62.4 | 0.0045 |
| | 175 | 0.0788 | 0.7229 | 0.4710 | 0.0014 | 0.0245 | 0.0226 | 125 | 0.0071 |
| | 250 | 0.0881 | 0.3442 | 0.5378 | 0.0019 | 0.0182 | 0.0168 | 171 | 0.0079 |
| | 500 | 0.1296 | 0.4936 | 0.7287 | 0.0025 | 0.0265 | 0.0244 | 257 | 0.0117 |
| Rough Terrain Forklifts Compo | | 0.0533 | 0.4464 | 0.3494 | 0.0008 | 0.0201 | 0.0185 | 70.3 | 0.0048 |
| Rubber Tired Doz | 175 | 0.1509 | 0.8124 | 0.9962 | 0.0015 | 0.0561 | 0.0516 | 129 | 0.0136 |
| | 250 | 0.1701 | 0.5279 | 1.2898 | 0.0021 | 0.0516 | 0.0474 | 183 | 0.0153 |
| | 500 | 0.2291 | 0.9276 | 1.6868 | 0.0026 | 0.0673 | 0.0619 | 265 | 0.0207 |
| | 750 | 0.3461 | 1.3934 | 2.5948 | 0.0040 | 0.1024 | 0.0942 | 399 | 0.0312 |
| | 1000 | 0.5438 | 2.2500 | 5.5311 | 0.0060 | 0.1672 | 0.1539 | 592 | 0.0491 |
| Rubber Tired Dozers Compos | | 0.2118 | 0.8006 | 1.5773 | 0.0025 | 0.0630 | 0.0580 | 239 | 0.0191 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0615 | 0.3080 | 0.2424 | 0.0004 | 0.0137 | 0.0126 | 31.1 | 0.0055 |
| | 120 | 0.0563 | 0.3977 | 0.3529 | 0.0007 | 0.0237 | 0.0218 | 58.9 | 0.0051 |
| | 175 | 0.0767 | 0.6215 | 0.4713 | 0.0012 | 0.0253 | 0.0233 | 106 | 0.0069 |
| | 250 | 0.0848 | 0.3159 | 0.5655 | 0.0017 | 0.0194 | 0.0179 | 149 | 0.0077 |
| | 500 | 0.1302 | 0.5016 | 0.8032 | 0.0023 | 0.0291 | 0.0268 | 237 | 0.0118 |
| | 750 | 0.2680 | 1.0271 | 1.6958 | 0.0049 | 0.0606 | 0.0558 | 486 | 0.0242 |
| | 1000 | 0.3484 | 1.3166 | 4.0040 | 0.0060 | 0.0983 | 0.0904 | 594 | 0.0314 |
| Rubber Tired Loaders Compos | | 0.0753 | 0.4406 | 0.4747 | 0.0012 | 0.0235 | 0.0216 | 109 | 0.0068 |
| Scrapers | 120 | 0.1218 | 0.6612 | 0.7170 | 0.0011 | 0.0551 | 0.0507 | 93.9 | 0.0110 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1400 | 0.8921 | 0.9020 | 0.0017 | 0.0505 | 0.0464 | 148 | 0.0126 |
| | 250 | 0.1522 | 0.5044 | 1.1344 | 0.0024 | 0.0412 | 0.0379 | 209 | 0.0137 |
| | 500 | 0.2211 | 0.8455 | 1.5615 | 0.0032 | 0.0584 | 0.0537 | 321 | 0.0200 |
| | 750 | 0.3839 | 1.4588 | 2.7734 | 0.0056 | 0.1024 | 0.0942 | 555 | 0.0346 |
| Scrapers Composite | | 0.1914 | 0.7938 | 1.3434 | 0.0027 | 0.0541 | 0.0497 | 262 | 0.0173 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0502 | 0.2833 | 0.2631 | 0.0005 | 0.0131 | 0.0121 | 36.2 | 0.0045 |
| | 120 | 0.0558 | 0.4946 | 0.4424 | 0.0009 | 0.0264 | 0.0243 | 80.2 | 0.0050 |
| | 175 | 0.0811 | 0.8276 | 0.6279 | 0.0017 | 0.0302 | 0.0277 | 155 | 0.0073 |
| | 250 | 0.1022 | 0.4765 | 0.8737 | 0.0029 | 0.0266 | 0.0245 | 255 | 0.0092 |
| Signal Boards Composite | | 0.0129 | 0.0912 | 0.0912 | 0.0002 | 0.0042 | 0.0038 | 16.7 | 0.0012 |
| Skid Steer Loade | 25 | 0.0171 | 0.0575 | 0.1070 | 0.0002 | 0.0044 | 0.0040 | 13.8 | 0.0015 |
| | 50 | 0.0230 | 0.2006 | 0.1655 | 0.0003 | 0.0043 | 0.0040 | 25.5 | 0.0021 |
| | 120 | 0.0218 | 0.2673 | 0.1647 | 0.0005 | 0.0064 | 0.0059 | 42.8 | 0.0020 |
| Skid Steer Loaders Composite | | 0.0222 | 0.2125 | 0.1614 | 0.0004 | 0.0050 | 0.0046 | 30.3 | 0.0020 |
| Surfacing Equipm | 50 | 0.0265 | 0.1191 | 0.1069 | 0.0002 | 0.0063 | 0.0058 | 14.1 | 0.0024 |
| | 120 | 0.0570 | 0.4028 | 0.4035 | 0.0007 | 0.0271 | 0.0250 | 63.8 | 0.0051 |
| | 175 | 0.0550 | 0.4663 | 0.4168 | 0.0010 | 0.0210 | 0.0193 | 85.8 | 0.0050 |
| | 250 | 0.0652 | 0.2754 | 0.5719 | 0.0015 | 0.0188 | 0.0173 | 135 | 0.0059 |
| | 500 | 0.1008 | 0.4728 | 0.8400 | 0.0022 | 0.0288 | 0.0265 | 221 | 0.0091 |
| | 750 | 0.1599 | 0.7413 | 1.3593 | 0.0035 | 0.0459 | 0.0423 | 347 | 0.0144 |
| Surfacing Equipment Compos | | 0.0823 | 0.3953 | 0.6593 | 0.0017 | 0.0239 | 0.0220 | 166 | 0.0074 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0430 | 0.2898 | 0.2365 | 0.0004 | 0.0098 | 0.0090 | 31.6 | 0.0039 |
| | 120 | 0.0555 | 0.4959 | 0.3694 | 0.0009 | 0.0210 | 0.0193 | 75.0 | 0.0050 |
| | 175 | 0.0845 | 0.8043 | 0.4869 | 0.0016 | 0.0253 | 0.0233 | 139 | 0.0076 |
| | 250 | 0.0803 | 0.3198 | 0.4530 | 0.0018 | 0.0152 | 0.0140 | 162 | 0.0072 |
| Sweepers/Scrubbers Composi | | 0.0584 | 0.4916 | 0.3563 | 0.0009 | 0.0183 | 0.0169 | 78.5 | 0.0053 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0046 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0407 | 0.2760 | 0.2179 | 0.0004 | 0.0087 | 0.0080 | 30.3 | 0.0037 |
| | 120 | 0.0366 | 0.3402 | 0.2466 | 0.0006 | 0.0129 | 0.0119 | 51.7 | 0.0033 |
| | 175 | 0.0571 | 0.5841 | 0.3220 | 0.0011 | 0.0159 | 0.0146 | 101 | 0.0052 |
| | 250 | 0.0813 | 0.3445 | 0.4427 | 0.0019 | 0.0151 | 0.0139 | 172 | 0.0073 |
| | 500 | 0.1606 | 0.6642 | 0.8132 | 0.0039 | 0.0294 | 0.0270 | 345 | 0.0145 |
| | 750 | 0.2409 | 0.9959 | 1.2387 | 0.0058 | 0.0443 | 0.0408 | 517 | 0.0217 |
| Tractors/Loaders/Backhoes C | | 0.0436 | 0.3616 | 0.2744 | 0.0008 | 0.0134 | 0.0124 | 66.8 | 0.0039 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0990 | 0.3495 | 0.2804 | 0.0004 | 0.0218 | 0.0201 | 32.9 | 0.0089 |
| | 120 | 0.0849 | 0.4443 | 0.5223 | 0.0008 | 0.0408 | 0.0375 | 64.9 | 0.0077 |
| | 175 | 0.1346 | 0.8393 | 0.9412 | 0.0016 | 0.0521 | 0.0479 | 144 | 0.0121 |
| | 250 | 0.1600 | 0.5472 | 1.3120 | 0.0025 | 0.0487 | 0.0448 | 223 | 0.0144 |
| | 500 | 0.2092 | 0.8710 | 1.6487 | 0.0031 | 0.0623 | 0.0573 | 311 | 0.0189 |
| | 750 | 0.3964 | 1.6395 | 3.1894 | 0.0059 | 0.1191 | 0.1095 | 587 | 0.0358 |
| Trenchers Composite | | 0.0933 | 0.4270 | 0.4575 | 0.0007 | 0.0336 | 0.0309 | 58.7 | 0.0084 |
| Welders | 15 | 0.0080 | 0.0388 | 0.0498 | 0.0001 | 0.0025 | 0.0023 | 6.2 | 0.0007 |
| | 25 | 0.0153 | 0.0492 | 0.0903 | 0.0001 | 0.0042 | 0.0039 | 11.3 | 0.0014 |
| | 50 | 0.0435 | 0.2219 | 0.1968 | 0.0003 | 0.0110 | 0.0102 | 26.0 | 0.0039 |
| | 120 | 0.0321 | 0.2508 | 0.2344 | 0.0005 | 0.0153 | 0.0140 | 39.5 | 0.0029 |
| | 175 | 0.0600 | 0.5396 | 0.4393 | 0.0011 | 0.0223 | 0.0205 | 98.2 | 0.0054 |
| | 250 | 0.0551 | 0.2294 | 0.4536 | 0.0013 | 0.0142 | 0.0130 | 119 | 0.0050 |
| | 500 | 0.0748 | 0.3117 | 0.5690 | 0.0016 | 0.0192 | 0.0176 | 168 | 0.0067 |
| Welders Composite | | 0.0310 | 0.1816 | 0.1735 | 0.0003 | 0.0102 | 0.0094 | 25.6 | 0.0028 |

## 2025 Fleet Average Emission Factors (Diesel)

| | | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) | (lb/hr) |
|---|---|---|---|---|---|---|---|---|---|
| **Equipment** | **MaxHP** | **ROG** | **CO** | **NOX** | **SOX** | **PM** | **PM2.5** | **CO2** | **CH4** |
| Aerial Lifts | 15 | 0.0101 | 0.0528 | 0.0631 | 0.0001 | 0.0025 | 0.0023 | 8.7 | 0.0009 |
| | 25 | 0.0132 | 0.0451 | 0.0838 | 0.0001 | 0.0032 | 0.0030 | 11.0 | 0.0012 |
| | 50 | 0.0168 | 0.1351 | 0.1218 | 0.0003 | 0.0035 | 0.0032 | 19.6 | 0.0015 |
| | 120 | 0.0176 | 0.2265 | 0.1496 | 0.0004 | 0.0063 | 0.0058 | 38.1 | 0.0016 |
| | 500 | 0.0580 | 0.3710 | 0.3660 | 0.0021 | 0.0109 | 0.0100 | 213 | 0.0052 |
| | 750 | 0.1054 | 0.6706 | 0.6753 | 0.0039 | 0.0199 | 0.0183 | 385 | 0.0095 |
| Aerial Lifts Composite | | 0.0184 | 0.1646 | 0.1366 | 0.0004 | 0.0048 | 0.0044 | 34.7 | 0.0017 |
| Air Compressors | 15 | 0.0087 | 0.0444 | 0.0545 | 0.0001 | 0.0023 | 0.0022 | 7.2 | 0.0008 |
| | 25 | 0.0181 | 0.0605 | 0.1121 | 0.0002 | 0.0045 | 0.0042 | 14.4 | 0.0016 |
| | 50 | 0.0263 | 0.1911 | 0.1476 | 0.0003 | 0.0047 | 0.0043 | 22.3 | 0.0024 |
| | 120 | 0.0289 | 0.3023 | 0.1928 | 0.0006 | 0.0088 | 0.0081 | 47.0 | 0.0026 |
| | 175 | 0.0424 | 0.4998 | 0.2187 | 0.0010 | 0.0104 | 0.0095 | 88.5 | 0.0038 |
| | 250 | 0.0514 | 0.2531 | 0.2553 | 0.0015 | 0.0078 | 0.0072 | 131 | 0.0046 |
| | 500 | 0.0894 | 0.4292 | 0.4150 | 0.0023 | 0.0134 | 0.0123 | 232 | 0.0081 |
| | 750 | 0.1385 | 0.6633 | 0.6545 | 0.0036 | 0.0210 | 0.0193 | 358 | 0.0125 |
| | 1000 | 0.1999 | 0.9265 | 2.5439 | 0.0049 | 0.0483 | 0.0444 | 486 | 0.0180 |
| Air Compressors Composite | | 0.0349 | 0.3027 | 0.2104 | 0.0007 | 0.0088 | 0.0081 | 63.6 | 0.0031 |
| Bore/Drill Rigs | 15 | 0.0120 | 0.0632 | 0.0754 | 0.0002 | 0.0029 | 0.0027 | 10.3 | 0.0011 |
| | 25 | 0.0193 | 0.0658 | 0.1219 | 0.0002 | 0.0046 | 0.0042 | 16.0 | 0.0017 |
| | 50 | 0.0190 | 0.2200 | 0.1662 | 0.0004 | 0.0009 | 0.0008 | 31.0 | 0.0017 |
| | 120 | 0.0252 | 0.4660 | 0.1955 | 0.0009 | 0.0020 | 0.0018 | 77.1 | 0.0023 |
| | 175 | 0.0324 | 0.7542 | 0.0787 | 0.0016 | 0.0030 | 0.0027 | 141 | 0.0029 |
| | 250 | 0.0427 | 0.3426 | 0.0981 | 0.0021 | 0.0035 | 0.0032 | 188 | 0.0039 |
| | 500 | 0.0706 | 0.5512 | 0.1622 | 0.0031 | 0.0058 | 0.0054 | 311 | 0.0064 |
| | 750 | 0.1396 | 1.0891 | 0.3204 | 0.0062 | 0.0115 | 0.0106 | 615 | 0.0126 |
| | 1000 | 0.2115 | 1.6437 | 3.8912 | 0.0093 | 0.0364 | 0.0335 | 928 | 0.0191 |
| Bore/Drill Rigs Composite | | 0.0428 | 0.5007 | 0.2864 | 0.0017 | 0.0042 | 0.0038 | 165 | 0.0039 |
| Cement and Mort | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0213 | 0.0724 | 0.1346 | 0.0002 | 0.0052 | 0.0048 | 17.6 | 0.0019 |
| Cement and Mortar Mixers Co | | 0.0085 | 0.0414 | 0.0534 | 0.0001 | 0.0021 | 0.0019 | 7.2 | 0.0008 |
| Concrete/Industri | 25 | 0.0199 | 0.0678 | 0.1256 | 0.0002 | 0.0047 | 0.0043 | 16.5 | 0.0018 |
| | 50 | 0.0279 | 0.2284 | 0.1910 | 0.0004 | 0.0053 | 0.0049 | 30.2 | 0.0025 |
| | 120 | 0.0370 | 0.4561 | 0.2840 | 0.0009 | 0.0117 | 0.0108 | 74.1 | 0.0033 |
| | 175 | 0.0623 | 0.8663 | 0.3523 | 0.0018 | 0.0160 | 0.0147 | 160 | 0.0056 |
| Concrete/Industrial Saws Com | | 0.0337 | 0.3706 | 0.2471 | 0.0007 | 0.0093 | 0.0086 | 58.5 | 0.0030 |
| Cranes | 50 | 0.0350 | 0.2256 | 0.1644 | 0.0003 | 0.0062 | 0.0057 | 23.2 | 0.0032 |
| | 120 | 0.0376 | 0.3384 | 0.2298 | 0.0006 | 0.0120 | 0.0111 | 50.1 | 0.0034 |
| | 175 | 0.0462 | 0.4744 | 0.2300 | 0.0009 | 0.0120 | 0.0110 | 80.3 | 0.0042 |
| | 250 | 0.0544 | 0.2316 | 0.2705 | 0.0013 | 0.0094 | 0.0087 | 112 | 0.0049 |
| | 500 | 0.0858 | 0.3535 | 0.3977 | 0.0018 | 0.0146 | 0.0134 | 180 | 0.0077 |
| | 750 | 0.1446 | 0.5947 | 0.6821 | 0.0030 | 0.0248 | 0.0228 | 303 | 0.0130 |
| | 9999 | 0.5219 | 1.9715 | 5.5760 | 0.0098 | 0.1146 | 0.1055 | 971 | 0.0471 |
| Cranes Composite | | 0.0681 | 0.3738 | 0.4223 | 0.0014 | 0.0143 | 0.0132 | 129 | 0.0061 |
| Crawler Tractors | 50 | 0.0487 | 0.2566 | 0.1842 | 0.0003 | 0.0090 | 0.0083 | 24.9 | 0.0044 |
| | 120 | 0.0609 | 0.4537 | 0.3562 | 0.0008 | 0.0221 | 0.0203 | 65.8 | 0.0055 |
| | 175 | 0.0823 | 0.7265 | 0.4447 | 0.0014 | 0.0241 | 0.0222 | 121 | 0.0074 |
| | 250 | 0.0924 | 0.3662 | 0.5348 | 0.0019 | 0.0192 | 0.0177 | 166 | 0.0083 |
| | 500 | 0.1392 | 0.5877 | 0.7527 | 0.0025 | 0.0280 | 0.0258 | 259 | 0.0126 |
| | 750 | 0.2506 | 1.0528 | 1.3878 | 0.0047 | 0.0510 | 0.0469 | 465 | 0.0226 |
| | 1000 | 0.3749 | 1.5618 | 4.2168 | 0.0066 | 0.0958 | 0.0881 | 658 | 0.0338 |
| Crawler Tractors Composite | | 0.0789 | 0.5065 | 0.4492 | 0.0013 | 0.0227 | 0.0209 | 114 | 0.0071 |
| Crushing/Proc. E | 50 | 0.0508 | 0.3859 | 0.2899 | 0.0006 | 0.0083 | 0.0077 | 44.0 | 0.0046 |
| | 120 | 0.0506 | 0.5406 | 0.3289 | 0.0010 | 0.0140 | 0.0129 | 83.1 | 0.0046 |
| | 175 | 0.0795 | 0.9556 | 0.3830 | 0.0019 | 0.0177 | 0.0163 | 167 | 0.0072 |
| | 250 | 0.0967 | 0.4768 | 0.4357 | 0.0028 | 0.0134 | 0.0123 | 245 | 0.0087 |
| | 500 | 0.1459 | 0.6977 | 0.6163 | 0.0037 | 0.0200 | 0.0184 | 374 | 0.0132 |
| | 750 | 0.2307 | 1.1003 | 0.9907 | 0.0059 | 0.0316 | 0.0291 | 589 | 0.0208 |
| | 9999 | 0.6019 | 2.5014 | 6.6977 | 0.0131 | 0.1238 | 0.1139 | 1,308 | 0.0543 |
| Crushing/Proc. Equipment Co | | 0.0693 | 0.6187 | 0.3763 | 0.0015 | 0.0146 | 0.0134 | 132 | 0.0062 |
| Dumpers/Tender | 25 | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dumpers/Tenders Composite | | 0.0092 | 0.0314 | 0.0581 | 0.0001 | 0.0022 | 0.0020 | 7.6 | 0.0008 |
| Excavators | 25 | 0.0198 | 0.0677 | 0.1253 | 0.0002 | 0.0047 | 0.0043 | 16.4 | 0.0018 |
| | 50 | 0.0297 | 0.2365 | 0.1616 | 0.0003 | 0.0035 | 0.0032 | 25.0 | 0.0027 |
| | 120 | 0.0448 | 0.4942 | 0.2638 | 0.0009 | 0.0092 | 0.0085 | 73.6 | 0.0040 |
| | 175 | 0.0518 | 0.6636 | 0.1982 | 0.0013 | 0.0091 | 0.0084 | 112 | 0.0047 |
| | 250 | 0.0647 | 0.3210 | 0.2222 | 0.0018 | 0.0074 | 0.0068 | 159 | 0.0058 |
| | 500 | 0.0946 | 0.4495 | 0.3091 | 0.0023 | 0.0107 | 0.0098 | 234 | 0.0085 |
| | 750 | 0.1569 | 0.7451 | 0.5194 | 0.0039 | 0.0178 | 0.0164 | 387 | 0.0142 |
| Excavators Composite | | 0.0559 | 0.5086 | 0.2269 | 0.0013 | 0.0086 | 0.0079 | 120 | 0.0050 |
| Forklifts | 50 | 0.0150 | 0.1361 | 0.0904 | 0.0002 | 0.0013 | 0.0012 | 14.7 | 0.0014 |
| | 120 | 0.0168 | 0.2086 | 0.0997 | 0.0004 | 0.0023 | 0.0021 | 31.2 | 0.0015 |
| | 175 | 0.0228 | 0.3310 | 0.0732 | 0.0006 | 0.0029 | 0.0026 | 56.1 | 0.0021 |
| | 250 | 0.0289 | 0.1551 | 0.0746 | 0.0009 | 0.0027 | 0.0024 | 77.1 | 0.0026 |
| | 500 | 0.0416 | 0.2123 | 0.1038 | 0.0011 | 0.0038 | 0.0035 | 111 | 0.0038 |
| Forklifts Composite | | 0.0236 | 0.2148 | 0.0860 | 0.0006 | 0.0025 | 0.0023 | 54.4 | 0.0021 |
| Generator Sets | 15 | 0.0109 | 0.0627 | 0.0768 | 0.0002 | 0.0032 | 0.0030 | 10.2 | 0.0010 |
| | 25 | 0.0216 | 0.0738 | 0.1368 | 0.0002 | 0.0055 | 0.0050 | 17.6 | 0.0019 |
| | 50 | 0.0242 | 0.2034 | 0.1881 | 0.0004 | 0.0051 | 0.0047 | 30.6 | 0.0022 |
| | 120 | 0.0340 | 0.4585 | 0.3022 | 0.0009 | 0.0122 | 0.0112 | 77.9 | 0.0031 |
| | 175 | 0.0469 | 0.7328 | 0.3291 | 0.0016 | 0.0136 | 0.0125 | 142 | 0.0042 |
| | 250 | 0.0558 | 0.3746 | 0.3885 | 0.0024 | 0.0108 | 0.0099 | 213 | 0.0050 |
| | 500 | 0.0862 | 0.5820 | 0.5697 | 0.0033 | 0.0167 | 0.0153 | 337 | 0.0078 |
| | 750 | 0.1401 | 0.9395 | 0.9382 | 0.0055 | 0.0272 | 0.0250 | 544 | 0.0126 |
| | 9999 | 0.3235 | 1.8648 | 5.2188 | 0.0105 | 0.0888 | 0.0817 | 1,049 | 0.0292 |
| Generator Sets Composite | | 0.0288 | 0.2667 | 0.2329 | 0.0007 | 0.0081 | 0.0074 | 61.0 | 0.0026 |
| Graders | 50 | 0.0382 | 0.2599 | 0.1877 | 0.0004 | 0.0063 | 0.0058 | 27.5 | 0.0034 |
| | 120 | 0.0521 | 0.5009 | 0.3219 | 0.0009 | 0.0153 | 0.0141 | 75.0 | 0.0047 |
| | 175 | 0.0652 | 0.7261 | 0.3117 | 0.0014 | 0.0157 | 0.0144 | 124 | 0.0059 |
| | 250 | 0.0781 | 0.3549 | 0.3652 | 0.0019 | 0.0129 | 0.0119 | 172 | 0.0071 |
| | 500 | 0.1023 | 0.4610 | 0.4468 | 0.0023 | 0.0165 | 0.0152 | 229 | 0.0092 |
| | 750 | 0.2167 | 0.9755 | 0.9628 | 0.0049 | 0.0353 | 0.0324 | 486 | 0.0196 |
| Graders Composite | | 0.0676 | 0.5696 | 0.3314 | 0.0015 | 0.0147 | 0.0135 | 133 | 0.0061 |
| Off-Highway Trac | 120 | 0.1108 | 0.6619 | 0.6362 | 0.0011 | 0.0455 | 0.0419 | 93.7 | 0.0100 |
| | 175 | 0.1110 | 0.7932 | 0.6639 | 0.0015 | 0.0370 | 0.0341 | 130 | 0.0100 |
| | 250 | 0.0890 | 0.3179 | 0.5983 | 0.0015 | 0.0227 | 0.0208 | 130 | 0.0080 |
| | 750 | 0.3692 | 1.5358 | 2.4157 | 0.0057 | 0.0918 | 0.0844 | 568 | 0.0333 |
| | 1000 | 0.5623 | 2.3619 | 6.0896 | 0.0082 | 0.1577 | 0.1451 | 814 | 0.0507 |
| Off-Highway Tractors Compos | | 0.1134 | 0.6101 | 0.7291 | 0.0017 | 0.0331 | 0.0305 | 151 | 0.0102 |
| Off-Highway Truc | 175 | 0.0622 | 0.7536 | 0.2376 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0056 |
| | 250 | 0.0730 | 0.3435 | 0.2521 | 0.0019 | 0.0085 | 0.0078 | 167 | 0.0066 |
| | 500 | 0.1183 | 0.5319 | 0.3878 | 0.0027 | 0.0135 | 0.0124 | 272 | 0.0107 |
| | 750 | 0.1921 | 0.8627 | 0.6384 | 0.0044 | 0.0221 | 0.0203 | 442 | 0.0173 |
| | 1000 | 0.2823 | 1.2403 | 3.1782 | 0.0063 | 0.0546 | 0.0502 | 625 | 0.0255 |
| Off-Highway Trucks Composit | | 0.1140 | 0.5385 | 0.4769 | 0.0027 | 0.0142 | 0.0131 | 260 | 0.0103 |
| Other Constructio | 15 | 0.0118 | 0.0617 | 0.0737 | 0.0002 | 0.0029 | 0.0026 | 10.1 | 0.0011 |
| | 25 | 0.0159 | 0.0544 | 0.1008 | 0.0002 | 0.0038 | 0.0035 | 13.2 | 0.0014 |
| | 50 | 0.0244 | 0.2188 | 0.1693 | 0.0004 | 0.0034 | 0.0031 | 28.0 | 0.0022 |
| | 120 | 0.0379 | 0.5045 | 0.2730 | 0.0009 | 0.0087 | 0.0080 | 80.9 | 0.0034 |
| | 175 | 0.0384 | 0.5858 | 0.1729 | 0.0012 | 0.0075 | 0.0069 | 107 | 0.0035 |
| | 500 | 0.0792 | 0.4606 | 0.3034 | 0.0025 | 0.0099 | 0.0091 | 254 | 0.0071 |
| Other Construction Equipment | | 0.0442 | 0.3474 | 0.2021 | 0.0013 | 0.0069 | 0.0063 | 123 | 0.0040 |
| Other General Ind | 15 | 0.0066 | 0.0391 | 0.0466 | 0.0001 | 0.0018 | 0.0017 | 6.4 | 0.0006 |
| | 25 | 0.0185 | 0.0632 | 0.1170 | 0.0002 | 0.0044 | 0.0040 | 15.3 | 0.0017 |
| | 50 | 0.0298 | 0.2099 | 0.1491 | 0.0003 | 0.0047 | 0.0043 | 21.7 | 0.0027 |
| | 120 | 0.0436 | 0.4189 | 0.2603 | 0.0007 | 0.0120 | 0.0111 | 62.0 | 0.0039 |
| | 175 | 0.0519 | 0.5684 | 0.2412 | 0.0011 | 0.0115 | 0.0106 | 95.9 | 0.0047 |
| | 250 | 0.0608 | 0.2743 | 0.2679 | 0.0015 | 0.0083 | 0.0076 | 136 | 0.0055 |
| | 500 | 0.1174 | 0.5103 | 0.4826 | 0.0026 | 0.0157 | 0.0145 | 265 | 0.0106 |
| | 750 | 0.1939 | 0.8411 | 0.8117 | 0.0044 | 0.0262 | 0.0241 | 437 | 0.0175 |
| | 1000 | 0.2627 | 1.1060 | 2.9924 | 0.0056 | 0.0579 | 0.0533 | 560 | 0.0237 |
| Other General Industrial Equip | | 0.0747 | 0.4438 | 0.3947 | 0.0016 | 0.0130 | 0.0120 | 152 | 0.0067 |
| Other Material Ha | 50 | 0.0410 | 0.2893 | 0.2073 | 0.0004 | 0.0065 | 0.0060 | 30.3 | 0.0037 |
| | 120 | 0.0421 | 0.4076 | 0.2541 | 0.0007 | 0.0117 | 0.0108 | 60.7 | 0.0038 |
| | 175 | 0.0653 | 0.7197 | 0.3067 | 0.0014 | 0.0146 | 0.0134 | 122 | 0.0059 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 250 | 0.0642 | 0.2920 | 0.2863 | 0.0016 | 0.0088 | 0.0081 | 145 | 0.0058 |
| | 500 | 0.0837 | 0.3670 | 0.3482 | 0.0019 | 0.0113 | 0.0104 | 192 | 0.0075 |
| | 9999 | 0.3781 | 1.4596 | 3.9555 | 0.0073 | 0.0764 | 0.0703 | 741 | 0.0341 |
| Other Material Handling Equip | | 0.0696 | 0.4355 | 0.3844 | 0.0015 | 0.0124 | 0.0114 | 141 | 0.0063 |
| Pavers | 25 | 0.0225 | 0.0768 | 0.1422 | 0.0002 | 0.0053 | 0.0049 | 18.7 | 0.0020 |
| | 50 | 0.0574 | 0.2803 | 0.2102 | 0.0004 | 0.0114 | 0.0105 | 28.0 | 0.0052 |
| | 120 | 0.0662 | 0.4696 | 0.4003 | 0.0008 | 0.0263 | 0.0242 | 69.2 | 0.0060 |
| | 175 | 0.0899 | 0.7543 | 0.5238 | 0.0014 | 0.0286 | 0.0263 | 128 | 0.0081 |
| | 250 | 0.1097 | 0.4287 | 0.7020 | 0.0022 | 0.0254 | 0.0234 | 194 | 0.0099 |
| | 500 | 0.1263 | 0.5374 | 0.7572 | 0.0023 | 0.0284 | 0.0261 | 233 | 0.0114 |
| Pavers Composite | | 0.0717 | 0.4745 | 0.3858 | 0.0009 | 0.0220 | 0.0202 | 77.9 | 0.0065 |
| Paving Equipmen | 25 | 0.0152 | 0.0520 | 0.0963 | 0.0002 | 0.0036 | 0.0033 | 12.6 | 0.0014 |
| | 50 | 0.0469 | 0.2355 | 0.1789 | 0.0003 | 0.0095 | 0.0088 | 23.9 | 0.0042 |
| | 120 | 0.0503 | 0.3671 | 0.3092 | 0.0006 | 0.0200 | 0.0184 | 54.5 | 0.0045 |
| | 175 | 0.0687 | 0.5900 | 0.4021 | 0.0011 | 0.0219 | 0.0201 | 101 | 0.0062 |
| | 250 | 0.0672 | 0.2648 | 0.4289 | 0.0014 | 0.0154 | 0.0141 | 122 | 0.0061 |
| Paving Equipment Composite | | 0.0548 | 0.3993 | 0.3281 | 0.0008 | 0.0190 | 0.0175 | 68.9 | 0.0049 |
| Plate Compactors | 15 | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Plate Compactors Composite | | 0.0050 | 0.0263 | 0.0314 | 0.0001 | 0.0012 | 0.0011 | 4.3 | 0.0005 |
| Pressure Washer | 15 | 0.0052 | 0.0301 | 0.0368 | 0.0001 | 0.0015 | 0.0014 | 4.9 | 0.0005 |
| | 25 | 0.0087 | 0.0299 | 0.0555 | 0.0001 | 0.0022 | 0.0020 | 7.1 | 0.0008 |
| | 50 | 0.0079 | 0.0810 | 0.0843 | 0.0002 | 0.0019 | 0.0018 | 14.3 | 0.0007 |
| | 120 | 0.0082 | 0.1351 | 0.0897 | 0.0003 | 0.0031 | 0.0029 | 24.1 | 0.0007 |
| Pressure Washers Composite | | 0.0066 | 0.0531 | 0.0561 | 0.0001 | 0.0019 | 0.0017 | 9.4 | 0.0006 |
| Pumps | 15 | 0.0089 | 0.0456 | 0.0560 | 0.0001 | 0.0024 | 0.0022 | 7.4 | 0.0008 |
| | 25 | 0.0244 | 0.0816 | 0.1512 | 0.0002 | 0.0061 | 0.0056 | 19.5 | 0.0022 |
| | 50 | 0.0299 | 0.2394 | 0.2138 | 0.0004 | 0.0061 | 0.0056 | 34.3 | 0.0027 |
| | 120 | 0.0365 | 0.4656 | 0.3062 | 0.0009 | 0.0129 | 0.0119 | 77.9 | 0.0033 |
| | 175 | 0.0499 | 0.7342 | 0.3301 | 0.0016 | 0.0142 | 0.0130 | 140 | 0.0045 |
| | 250 | 0.0572 | 0.3604 | 0.3745 | 0.0023 | 0.0107 | 0.0098 | 201 | 0.0052 |
| | 500 | 0.0959 | 0.6034 | 0.5922 | 0.0034 | 0.0178 | 0.0163 | 345 | 0.0087 |
| | 750 | 0.1593 | 0.9975 | 0.9991 | 0.0057 | 0.0297 | 0.0274 | 571 | 0.0144 |
| | 9999 | 0.4488 | 2.4388 | 6.8114 | 0.0136 | 0.1186 | 0.1091 | 1,355 | 0.0405 |
| Pumps Composite | | 0.0270 | 0.2617 | 0.2079 | 0.0006 | 0.0078 | 0.0072 | 49.6 | 0.0024 |
| Rollers | 15 | 0.0074 | 0.0386 | 0.0461 | 0.0001 | 0.0018 | 0.0017 | 6.3 | 0.0007 |
| | 25 | 0.0161 | 0.0549 | 0.1017 | 0.0002 | 0.0038 | 0.0035 | 13.3 | 0.0015 |
| | 50 | 0.0345 | 0.2258 | 0.1776 | 0.0003 | 0.0068 | 0.0062 | 26.0 | 0.0031 |
| | 120 | 0.0392 | 0.3801 | 0.2647 | 0.0007 | 0.0137 | 0.0126 | 59.0 | 0.0035 |
| | 175 | 0.0553 | 0.6096 | 0.3030 | 0.0012 | 0.0156 | 0.0143 | 108 | 0.0050 |
| | 250 | 0.0656 | 0.3037 | 0.3629 | 0.0017 | 0.0127 | 0.0116 | 153 | 0.0059 |
| | 500 | 0.0920 | 0.4189 | 0.4752 | 0.0022 | 0.0174 | 0.0160 | 219 | 0.0083 |
| Rollers Composite | | 0.0410 | 0.3763 | 0.2501 | 0.0008 | 0.0122 | 0.0113 | 67.0 | 0.0037 |
| Rough Terrain Fo | 50 | 0.0381 | 0.3041 | 0.2193 | 0.0004 | 0.0054 | 0.0049 | 33.9 | 0.0034 |
| | 120 | 0.0369 | 0.4106 | 0.2316 | 0.0007 | 0.0087 | 0.0080 | 62.4 | 0.0033 |
| | 175 | 0.0569 | 0.7229 | 0.2450 | 0.0014 | 0.0112 | 0.0103 | 125 | 0.0051 |
| | 250 | 0.0671 | 0.3372 | 0.2625 | 0.0019 | 0.0084 | 0.0077 | 171 | 0.0061 |
| | 500 | 0.0999 | 0.4838 | 0.3682 | 0.0025 | 0.0123 | 0.0113 | 257 | 0.0090 |
| Rough Terrain Forklifts Compo | | 0.0396 | 0.4430 | 0.2336 | 0.0008 | 0.0090 | 0.0083 | 70.3 | 0.0036 |
| Rubber Tired Doz | 175 | 0.1163 | 0.8019 | 0.6895 | 0.0015 | 0.0386 | 0.0355 | 129 | 0.0105 |
| | 250 | 0.1329 | 0.4624 | 0.8841 | 0.0021 | 0.0340 | 0.0312 | 183 | 0.0120 |
| | 500 | 0.1817 | 0.7490 | 1.1543 | 0.0026 | 0.0448 | 0.0412 | 265 | 0.0164 |
| | 750 | 0.2747 | 1.1262 | 1.7818 | 0.0040 | 0.0684 | 0.0629 | 399 | 0.0248 |
| | 1000 | 0.4321 | 1.7954 | 4.5523 | 0.0060 | 0.1202 | 0.1106 | 592 | 0.0390 |
| Rubber Tired Dozers Compos | | 0.1672 | 0.6620 | 1.0824 | 0.0025 | 0.0419 | 0.0385 | 239 | 0.0151 |
| Rubber Tired Loa | 25 | 0.0204 | 0.0697 | 0.1291 | 0.0002 | 0.0048 | 0.0044 | 16.9 | 0.0018 |
| | 50 | 0.0418 | 0.2904 | 0.2109 | 0.0004 | 0.0069 | 0.0063 | 31.1 | 0.0038 |
| | 120 | 0.0397 | 0.3916 | 0.2476 | 0.0007 | 0.0115 | 0.0105 | 58.9 | 0.0036 |
| | 175 | 0.0546 | 0.6199 | 0.2592 | 0.0012 | 0.0130 | 0.0119 | 106 | 0.0049 |
| | 250 | 0.0661 | 0.3041 | 0.3040 | 0.0017 | 0.0107 | 0.0099 | 149 | 0.0060 |
| | 500 | 0.1034 | 0.4654 | 0.4455 | 0.0023 | 0.0164 | 0.0151 | 237 | 0.0093 |
| | 750 | 0.2119 | 0.9532 | 0.9273 | 0.0049 | 0.0338 | 0.0311 | 486 | 0.0191 |
| | 1000 | 0.2701 | 1.1927 | 3.2272 | 0.0060 | 0.0615 | 0.0566 | 594 | 0.0244 |
| Rubber Tired Loaders Compos | | 0.0559 | 0.4311 | 0.2835 | 0.0012 | 0.0121 | 0.0111 | 109 | 0.0050 |
| Scrapers | 120 | 0.0887 | 0.6472 | 0.5218 | 0.0011 | 0.0330 | 0.0303 | 93.9 | 0.0080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 175 | 0.1025 | 0.8864 | 0.5654 | 0.0017 | 0.0307 | 0.0282 | 148 | 0.0092 |
| | 250 | 0.1187 | 0.4642 | 0.7040 | 0.0024 | 0.0254 | 0.0234 | 209 | 0.0107 |
| | 500 | 0.1755 | 0.7332 | 0.9727 | 0.0032 | 0.0364 | 0.0335 | 321 | 0.0158 |
| | 750 | 0.3043 | 1.2657 | 1.7266 | 0.0056 | 0.0638 | 0.0587 | 555 | 0.0275 |
| Scrapers Composite | | 0.1495 | 0.7187 | 0.8387 | 0.0027 | 0.0335 | 0.0308 | 262 | 0.0135 |
| Signal Boards | 15 | 0.0072 | 0.0377 | 0.0450 | 0.0001 | 0.0018 | 0.0016 | 6.2 | 0.0006 |
| | 50 | 0.0332 | 0.2686 | 0.2268 | 0.0005 | 0.0063 | 0.0058 | 36.2 | 0.0030 |
| | 120 | 0.0394 | 0.4898 | 0.3076 | 0.0009 | 0.0127 | 0.0116 | 80.2 | 0.0036 |
| | 175 | 0.0587 | 0.8292 | 0.3433 | 0.0017 | 0.0152 | 0.0139 | 155 | 0.0053 |
| | 250 | 0.0794 | 0.4676 | 0.4435 | 0.0029 | 0.0132 | 0.0121 | 255 | 0.0072 |
| Signal Boards Composite | | 0.0111 | 0.0909 | 0.0718 | 0.0002 | 0.0029 | 0.0026 | 16.7 | 0.0010 |
| Skid Steer Loade | 25 | 0.0167 | 0.0568 | 0.1055 | 0.0002 | 0.0040 | 0.0037 | 13.8 | 0.0015 |
| | 50 | 0.0194 | 0.1977 | 0.1446 | 0.0003 | 0.0015 | 0.0014 | 25.5 | 0.0017 |
| | 120 | 0.0175 | 0.2665 | 0.1240 | 0.0005 | 0.0022 | 0.0020 | 42.8 | 0.0016 |
| Skid Steer Loaders Composite | | 0.0186 | 0.2104 | 0.1354 | 0.0004 | 0.0019 | 0.0018 | 30.3 | 0.0017 |
| Surfacing Equipm | 50 | 0.0171 | 0.1105 | 0.0934 | 0.0002 | 0.0035 | 0.0033 | 14.1 | 0.0015 |
| | 120 | 0.0385 | 0.3950 | 0.2869 | 0.0007 | 0.0146 | 0.0134 | 63.8 | 0.0035 |
| | 175 | 0.0386 | 0.4642 | 0.2429 | 0.0010 | 0.0119 | 0.0109 | 85.8 | 0.0035 |
| | 250 | 0.0504 | 0.2604 | 0.3275 | 0.0015 | 0.0111 | 0.0103 | 135 | 0.0045 |
| | 500 | 0.0800 | 0.4236 | 0.4893 | 0.0022 | 0.0174 | 0.0160 | 221 | 0.0072 |
| | 750 | 0.1260 | 0.6643 | 0.7833 | 0.0035 | 0.0275 | 0.0253 | 347 | 0.0114 |
| Surfacing Equipment Compos | | 0.0638 | 0.3590 | 0.3924 | 0.0017 | 0.0142 | 0.0131 | 166 | 0.0058 |
| Sweepers/Scrubb | 15 | 0.0124 | 0.0729 | 0.0870 | 0.0002 | 0.0034 | 0.0031 | 11.9 | 0.0011 |
| | 25 | 0.0237 | 0.0808 | 0.1495 | 0.0002 | 0.0056 | 0.0051 | 19.6 | 0.0021 |
| | 50 | 0.0308 | 0.2762 | 0.1942 | 0.0004 | 0.0033 | 0.0031 | 31.6 | 0.0028 |
| | 120 | 0.0395 | 0.4895 | 0.2530 | 0.0009 | 0.0068 | 0.0062 | 75.0 | 0.0036 |
| | 175 | 0.0565 | 0.8005 | 0.2201 | 0.0016 | 0.0084 | 0.0077 | 139 | 0.0051 |
| | 250 | 0.0587 | 0.3179 | 0.1898 | 0.0018 | 0.0062 | 0.0057 | 162 | 0.0053 |
| Sweepers/Scrubbers Composi | | 0.0410 | 0.4840 | 0.2255 | 0.0009 | 0.0061 | 0.0056 | 78.5 | 0.0037 |
| Tractors/Loaders/ | 25 | 0.0191 | 0.0653 | 0.1209 | 0.0002 | 0.0045 | 0.0042 | 15.9 | 0.0017 |
| | 50 | 0.0316 | 0.2678 | 0.1895 | 0.0004 | 0.0037 | 0.0034 | 30.3 | 0.0029 |
| | 120 | 0.0281 | 0.3379 | 0.1761 | 0.0006 | 0.0055 | 0.0051 | 51.7 | 0.0025 |
| | 175 | 0.0420 | 0.5839 | 0.1613 | 0.0011 | 0.0072 | 0.0066 | 101 | 0.0038 |
| | 250 | 0.0633 | 0.3389 | 0.2157 | 0.0019 | 0.0073 | 0.0067 | 172 | 0.0057 |
| | 500 | 0.1263 | 0.6506 | 0.4127 | 0.0039 | 0.0144 | 0.0132 | 345 | 0.0114 |
| | 750 | 0.1896 | 0.9760 | 0.6256 | 0.0058 | 0.0216 | 0.0199 | 517 | 0.0171 |
| Tractors/Loaders/Backhoes C | | 0.0336 | 0.3586 | 0.1857 | 0.0008 | 0.0059 | 0.0054 | 66.8 | 0.0030 |
| Trenchers | 15 | 0.0099 | 0.0517 | 0.0617 | 0.0001 | 0.0024 | 0.0022 | 8.5 | 0.0009 |
| | 25 | 0.0397 | 0.1355 | 0.2509 | 0.0004 | 0.0094 | 0.0086 | 32.9 | 0.0036 |
| | 50 | 0.0687 | 0.3197 | 0.2467 | 0.0004 | 0.0140 | 0.0129 | 32.9 | 0.0062 |
| | 120 | 0.0625 | 0.4341 | 0.3863 | 0.0008 | 0.0259 | 0.0239 | 64.9 | 0.0056 |
| | 175 | 0.1009 | 0.8327 | 0.6152 | 0.0016 | 0.0338 | 0.0311 | 144 | 0.0091 |
| | 250 | 0.1247 | 0.4925 | 0.8480 | 0.0025 | 0.0309 | 0.0285 | 223 | 0.0112 |
| | 500 | 0.1661 | 0.7370 | 1.0663 | 0.0031 | 0.0400 | 0.0368 | 311 | 0.0150 |
| | 750 | 0.3147 | 1.3882 | 2.0666 | 0.0059 | 0.0766 | 0.0705 | 587 | 0.0284 |
| Trenchers Composite | | 0.0674 | 0.4085 | 0.3481 | 0.0007 | 0.0215 | 0.0198 | 58.7 | 0.0061 |
| Welders | 15 | 0.0075 | 0.0381 | 0.0468 | 0.0001 | 0.0020 | 0.0018 | 6.2 | 0.0007 |
| | 25 | 0.0141 | 0.0473 | 0.0876 | 0.0001 | 0.0035 | 0.0033 | 11.3 | 0.0013 |
| | 50 | 0.0280 | 0.2077 | 0.1684 | 0.0003 | 0.0053 | 0.0048 | 26.0 | 0.0025 |
| | 120 | 0.0223 | 0.2476 | 0.1601 | 0.0005 | 0.0073 | 0.0067 | 39.5 | 0.0020 |
| | 175 | 0.0430 | 0.5400 | 0.2396 | 0.0011 | 0.0111 | 0.0103 | 98.2 | 0.0039 |
| | 250 | 0.0423 | 0.2236 | 0.2294 | 0.0013 | 0.0069 | 0.0064 | 119 | 0.0038 |
| | 500 | 0.0585 | 0.3040 | 0.2969 | 0.0016 | 0.0095 | 0.0087 | 168 | 0.0053 |
| Welders Composite | | 0.0214 | 0.1745 | 0.1373 | 0.0003 | 0.0052 | 0.0048 | 25.6 | 0.0019 |

## Fugitive Dust Emission Calculation Methodology

### Fugitive Dust Source Emissions - Material Handling

**Truck Loading/Unloading (Removed debris/concrete materials)**

*Emission Factor [lb/ton] = k(0.0032) x (mean wind speed [mi/hr] / 5)* $^{1.3}$ / (moisture [%] / 2)$^{1.4}$ — *Reference: AP-42, Equation (1), Section 13.2.4, November 2006*

| | | | |
|---|---|---|---|
| *k = Aerodynamic Particle Size Multiplier, $PM_{10}$* | 0.35 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *k = Aerodynamic Particle Size Multiplier, $PM_{2.5}$* | 0.053 | | USEPA AP-42, Chapter 13.2.4, Equation 1 |
| *Mean Wind Speed* | 15 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *Moisture* | 4.8 | | USEPA AP-42, Chapter 13.2.4, Equation 1, upper end of provided range |
| *PM10 Emission Factor* | 0.0014 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |
| *PM2.5 Emission Factor* | 0.0002 | lb/ton | *AP-42 11/06 Table 13.2.4-1, truck unloading (per Chapter 13.2.3 Heavy Construction Operations) |

**Demolition (Sq. Ft)**

| | | | |
|---|---|---|---|
| PM10, uncontrolled | 0.00042 | lbs/cubic ft[1] | http://www.urbemis.com/software/URBEMIS9%20Users%20Manual%20Appendices.pdf |
| PM2.5, uncontrolled | 0.00009 | lbs/cubic ft[2] | PM2.5 fraction of PM10 = 0.208; SCAQMD Appendix A - Updated CEIDARS List with PM2.5 Fractions (www.aqmd.gov/ceqa/handbook/PM2_5/PM2_5.html |

**Bulldozing**

*Emission Factor [lb/hr] = [1.0 x (silt content [%])* $^{1.5}$ / (moisture)$^{1.4}$]*Scaling Factor

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Silt Content* | 6.9 | | AP-42 Chapter 11, Table 11.9-3 for overburden |
| *Moisture* | 16.8 | | AP-42 Chapter 11, Table 11.9-3 for overburden, upper end or range |
| *$PM_{10}$ Scaling Factor* | 0.75 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *$PM_{2.5}$ Scaling Factor* | 0.105 | | EPA AP-42 Chapter 11, Table 11.9-1, Bulldozing, Overburden |
| *PM10 Emission Factor* | 0.26 | lb/hr | |
| *PM2.5 Emission Factor* | 0.04 | lb/hr | |

**Grading and Scraping[d]**

*Emission Factor [lb/VMT] = [0.051 (S)^2.0*Scaling Factor*

*Reference: AP-42, Table 11.9-1, July 1998*

| | | | |
|---|---|---|---|
| *Mean Vehicle Speed (S)[a] - Miles Per Hour (MPH)* | 2 | | Assumption based on project footprint |
| *$PM_{10}$ Scaling Factor* | 0.6 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *$PM_{2.5}$ Scaling Factor* | 0.031 | | EPA AP-42 Chapter 11, Table 11.9-1, Grading |
| *PM10 Emission Factor (Uncontrolled)* | 0.12 | lb/VMT | |
| *PM2.5 Emission Factor (Uncontrolled)* | 0.00632 | lb/VMT | |

**Stock Pile Wind Erosion**

Emission Factor [lb/day-acre] = 0.85 x (silt content [%] / 1.5) x (365 / 235) x (percentage of time unobstructed wind exceeds 12 mph / 15)
Reference: SCAQMD CEQA Air Quality Handbook (1993), Table 9-9-E

| Parameter | Value | Basis |
|---|---|---|
| Silt Content | 7.5 | SCAQMD CEQA Handbook, (1993) Table A9-9-E-1 for overburden |
| Pct. time wind > 12 mph | 17.84 | Used 17.84% from AERMET Surface File used for dispersion modeling |

| | | |
|---|---|---|
| PM10 Emission Factor (Uncontrolled) | 7.9 | lb/day-acre |
| Reduction from Watering Twice/Day | 50% | |
| Controlled PM10 Emission Factor | 3.9 | lb/day-acre |
| Controlled PM2.5 Emission Factor[a] | 0.8 | lb/day-acre |

[a] PM2.5 emission factor [lb/hr] = PM10 emission factor [lb/hr] x PM2.5 fraction of PM10

PM2.5 Fraction of PM10 in Construction Dust = 0.208 from Appendix A, Final–Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds, SCAQMD, October 2006

Emissions [pounds per day] = Controlled emission factor [pounds per acre-day] x Stock pile surface area [acres]

# Attachment I0 Reef Construction Emission Estimates

**Emissions Summary**

| | ROG | NOX | CO | PM10 | PM2.5 | CO2 |
|---|---|---|---|---|---|---|
| **Pounds/Day** | | | | | | |
| Equipment | 1.74 | 9.42 | 6.37 | 0.57 | 0.53 | 1,309.94 |
| Tug/Barge | 102.97 | 748.06 | 564.83 | 37.86 | 34.83 | 98,217.16 |
| Total | 102.97 | 748.06 | 564.83 | 37.86 | 34.83 | 98,217.16 |
| | | | | | | |
| **Tons/Year** | | | | | | |
| Equipment | 0.03 | 0.16 | 0.11 | 0.01 | 0.01 | 20.26 |
| Tug/Barge | 1.75 | 12.72 | 9.60 | 0.64 | 0.59 | 1,519.42 |
| Total | 1.78 | 12.88 | 9.71 | 0.65 | 0.60 | 1,539.68 |

## Shoreline - Reef Construction

| Source Description | Number | Usage Factor | Unit | Emission Factor | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | CH4 |
| Loader | 1 | 12 | hrs/day | 0.11 | 0.78 | 0.46 | 0.001 | 0.04 | 0.04 | 108.61 | 0.01 |
| Crew Boat | 1 | 12 | hrs/day | 0.04 | 0.00 | 0.07 | 0.00 | 0.01 | 0.01 | 0.55 | 0.00 |
| | | | | | | | | | | | |

| Source Description | Emissions Summary (lbs/day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | CH4 |
| Loader | 1.26 | 9.41 | 5.54 | 0.01 | 0.50 | 0.46 | 1,303 | 0.11 |
| Crew Boat | 0.48 | 0.02 | 0.83 | 0.00 | 0.07 | 0.07 | 6.60 | 0.03 |
| | 1.74 | 9.42 | 6.37 | 0.01 | 0.57 | 0.53 | 1,309.94 | 0.14 |

| Source Description | Emissions Summary (tons/year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ROG | NOX | CO | SOX | PM10 | PM2.5 | CO2 | CH4 |
| Loader | 0.02 | 0.16 | 0.09 | 0.00 | 0.01 | 0.01 | 20 | 0.0018 |
| Crew Boat | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0 | 0.0005 |
| | 0.03 | 0.16 | 0.11 | 0.00 | 0.01 | 0.01 | 20.26 | 0.00 |

| Work Days |
|---|
| 34 |

**Global Warming Potential**

| Gas | Atmospheric Lifetime (years) | Global Warming Potential (100 year time horizon) |
|---|---|---|
| Carbon Dioxide | 50-200 | 1 |
| Methane | 12 ± 3 | 25 |
| Nitrous Oxide | 120 | 298 |
| HFC-23 | 264 | 14800 |
| HFC-134a | 14.6 | 1430 |
| HFC-152a | 1.5 | 124 |
| PFC: Tetrafluoromethane ($CF_4$) | 50000 | 7390 |
| PFC: Hexafluoromethane ($C_2F_6$) | 10000 | 12200 |
| Sulfur Hexafluoride ($SF_6$) | 3200 | 22800 |

Source: IPCC, 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

# Encinitas-Solana Beach Coastal Storm Damage Reduction Project

# San Diego County, California

# Appendix J

# Coordination Act Report (CAR)

**U.S. Army Corps of Engineers**
**Los Angeles District**

April 2015

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# FINAL
# FISH AND WILDLIFE
# COORDINATION ACT REPORT

*for the proposed*

Encinitas - Solana Beach Coastal Storm Damage Reduction Project
San Diego County, California

*Prepared for the*
U.S. Army Corps of Engineers
Los Angeles District
Los Angeles, California

*By the*
U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, California

09B0396-12CPA0127

February 2014

## EXECUTIVE SUMMARY

This is the U.S. Fish and Wildlife Service's (Service) Final Coordination Act Report for the U.S. Army Corps of Engineers' (Corps) proposed Encinitas-Solana Beach Coastal Storm Damage Reduction Project (Project). Pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (87 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Corps is consulting with the Service to ensure that there is equal consideration for fish and wildlife resources during the planning of the Corps' proposed Project.

Our Draft Coordination Act Report (November 2012) was developed under a former name for the Project, the proposed Encinitas-Solana Beach Shoreline Protection Project. The Corps published a Draft Environmental Impact Statement/Environmental Impact Report (2012 Draft EIS/EIR) for the proposed Project in December 2012. The Corps Los Angeles District is the Federal lead agency for the proposed Project under the National Environmental Policy Act (NEPA) of 1969. The cities of Encinitas and Solana Beach (Cities) are co-lead agencies under the California Environmental Quality Act (CEQA) of 1970. The Corps and Cities prepared the 2012 Draft EIS/EIR, jointly with a Feasibility Study, to examine the potential for replenishing beach sand and reducing bluff erosion, in response to concerns for protecting property, local recreation, and tourism along the coasts of Solana Beach and Encinitas, San Diego County, California. The 2012 Draft EIS/EIR describes the proposed Project's need, goals, objectives, and the potential environmental effects.

The Project's tentatively recommended plan in the 2012 Draft EIS/EIR for Encinitas was designated alternative "EN-1A" and for Solana Beach was alternative "SB-1A." This tentative plan of the 2012 Draft EIS/EIR was subsequently revised by the Corps and Cities in September 2013 with a recommended Project description consisting of smaller design beach widths and reduced sand nourishment volumes, and including revised monitoring provisions (City of Solana Beach 2013). The current proposed Project is defined as the combined "EN-1B" and "SB-1B" beach nourishment alternatives, summarized as:

- Encinitas: alternative "EN-1B" beach nourishment - 50-foot (ft) beach width increase; 5-year nourishment cycle
- Solana Beach: alternative "SB-1B" beach nourishment - 150-ft beach width increase; 10 year nourishment cycle

The primary source for sand on the beaches of the action area is sediment carried downstream to the ocean from regional inland areas by rivers and streams (California State Lands Commission 2001; CDBW & SCC 2002; SCE 2005). An artificially decreased supply of sediments delivered to the ocean by local rivers and streams over the last several decades continues to allow otherwise natural cyclically heavy storm wave action erosion to effectively narrow many beaches of northern San Diego County through non-cyclical erosion, resulting in the depletion of sand from these beaches in the long-term (Griggs and Savoy 1985; Patsch and Griggs 2006; Terra Costa 2005; SCE 2005). Wave-induced erosion of bluffs, bluff failure, and associated damage to structures (e.g., residences) have also reportedly increased significantly in the last couple decades from a combination of factors; most notably the reduced littoral[1] sand supply and subsequent narrowed beach widths, with the resultant increased access by ocean waves to the bases of these bluffs (USACE 1996). Additionally, the episodic recurrence of "El Niño" climatic conditions and associated heavy waves have also increased beach and bluff erosion during these periods.

Erosion to bluffs (with associated structure damage following bluff failure) in the region are projected to continue in the future, based on storm and wave studies, the current artificially reduced sediment supply conditions, and natural erosion (USACE 1991; California State Lands Comm. 2001; Terra Costa 2005; City of Solana Beach 2009). While bluff erosion and retreat is natural, the narrowed beaches of the Study Area have increased the vulnerability of the adjacent coastal bluffs to accelerated erosion (relative to natural conditions) from wave energy, including the formation of notches at the toe of bluffs in some locations (California State Lands Comm. 2001; SCE 2005). The presence of these notches has considerable potential to result in bluff failures, due to the weight of the overburden of the steep slope above the notch (USACE 1996; California State Lands Comm. 2001). In addition, upslope local water infiltration from landscaping irrigation and rainfall likely contributes to bluff-erosion, and has been a reported factor in bluff failures in localized areas. Bluff failures have resulted in damage to structures and loss of human life in the Study Area (USACE 2012e).

The proposed Project would, over a 50-year period (2015-2065), provide repeated stop-gap replenishment (nourishment) of beach sands that are subject to mid-term erosion in the Study Area. However, the Project as proposed would not include measures to restore natural sediment supplies or sand transport to the littoral system of the Project area. The artificial reduction in sand delivery to the ocean by regional streams and rivers, and the disruption of littoral sand transport down the coast, are the main causes of the mid-term net beach erosion in much of San Diego County, including the Study Area.

The Project could have direct, indirect, and cumulative impacts on biological resources during and following proposed dredging, transport, notch filling, and beach replenishment activities. These potential effects include physical disturbance from dredging and sand placement-related activities, direct or indirect impacts on terrestrial and marine biota from burial, and effects from increased noise and human activity, nighttime lighting, contaminant release from vehicles and equipment, and increased turbidity in nearshore and surf zone waters. Federally-threatened western snowy plovers (*Charadrius alexandrinus nivosusi*; snowy plover) could be affected by beach-related equipment, nighttime lighting, and/or human activities associated with beach replenishment and notch filling, including the potential for disturbance of plover foraging and loafing, degradation of beach forage resources, and injury/mortality. It should be noted that snowy plovers are currently known to occupy areas that would likely be indirectly affected by sand replenishment-related activities (e.g., project staging in Seaside parking lot and access routes on southern Cardiff State Beach; both are proposed to occur adjacent to snowy plover

[1] Littoral is defined as: of, relating to, or situated on or near a shore especially of the sea.

occupied areas). Additionally, past snowy plover surveys of the proposed sand receiver site areas are somewhat limited, and conditions are expected to change substantially over the 50-year life of the proposed Project, including potential increases in attractiveness and expansion of use of Project area beaches by snowy plovers. Project-associated turbidity from dredging and sand replenishment activities could reduce foraging success of the Federally- and State-endangered California least tern (*Sternula [Sterna] antillarum browni*; least tern), which nests in the Project region and has primary foraging areas (USFWS 2006) in the Project action area. The California grunion (*Leuresthes tenuis*; grunion), a unique resource, could also be adversely affected by Project-caused disruption of spawning and disturbance/smothering of eggs from sand replenishment-related activities onshore and nearshore.

Local beach habitats for snowy plovers and grunion would likely be temporarily improved by increased sand beach widths/depths from Project beach replenishment (SAIC 2006). Also, forage fish normally taken by least terns may be attracted to Project-associated turbidity plumes (e.g., if dredge material plumes contain substantial invertebrates); as such, foraging least terns may be attracted to the areas of such plumes.

## PREFACE

The FWCA directs that water use projects should be planned to improve fish and wildlife resources, where feasible, as well as to prevent damages to these resources (Hearing on the Coordination Act Amendments 1958; McBroom 1958). The purpose of the FWCA is to recognize the contribution of wildlife resources to the Nation, the increasing public interest and significance thereof due to expansion of our national economy and other factors, and to provide that wildlife conservation receives equal consideration and be coordinated with other features of water-resources development programs (16 U.S.C. 661).

This document constitutes the Final FWCA Report in fulfillment of a Military Interdepartmental Purchase Request between the Service and the Corps regarding the potential effects of the proposed Encinitas-Solana Beach Coastal Storm Damage Reduction Project (previously named the Encinitas and Solana Beach Shoreline Protection Project) in San Diego County, California, on fish and wildlife resources. We have prepared this Final FWCA Report on behalf of the Secretary of the Interior, pursuant to the requirements section 2(b) of the FWCA and in keeping with the intent of the NEPA. This Final FWCA Report supersedes our 2005 Draft FWCA Report for a proposed beach replenishment project described in the 2005 Draft EIS/EIR for the same location, and also supersedes our 2012 Draft FWCA Report for a similar proposed project described by the Corps to the Service in March - June 2012 (USACE 2012b, 2012c, & 2012d). Because this is a Final report, this report fulfills the requirements of Section 2(b) of the FWCA.

Our analysis of the proposed Project and the recommendations provided herein are based on information in: 1) the Scope of Work provided by the Corps, dated 28 July 2005; 2) the Corps' 2005 Draft EIS/EIR; 3) the Corps' August 2005 draft Feasibility Report; 4) the Corps' April 2012 Notice of Preparation of an EIS/EIR for the Project; 5) a March-April 2012 "functional assessment" series of meetings and discussions about the potential biological effects of the proposed Project and potential mitigation measures held among the Corps, California Coastal

Commission, National Marine Fisheries Service, California Department of Fish and Wildlife, and Service; 6) information and analysis provided by Corps' 2012 Draft EIS/EIR and associated response to comments; 7) a meeting on 12 September 2013 between the Corps, Cities and Service regarding potential Project impacts; 8) an email from the City of Solana Beach dated 24 September 2013 providing a revised Project description from the Corps and Cities; 9) revisions to the Project description and associated information provided in a letter from the Corps to the Coastal Commission and a subsequent Consistency Determination dated 30 September 2013; 10) revisions to the Project description and other information provided in an email from the Corps to the Coastal Commission on 30 October 2013; 11) other reports and data provided by the Corps; 12) an extensive review of the published and unpublished literature on the terrestrial and aquatic biota and ecosystems of the shore, lagoon, and nearshore areas of the region; 13) field and water visits by Service personnel; 14) discussions and meetings with professional biologists and representatives from other Federal, State and local agencies; and 15) our best collective professional judgment.

Our goals in this analysis are to: a) identify and evaluate the potential effects of the proposed Project on fish and wildlife resources and the ecosystems they depend upon within the action area; b) recommend measures for avoiding, minimizing, and offsetting any negative ecological effects of the proposed Project; c) recommend measures to improve or enhance fish and wildlife resources in the Project region; and d) suggest actions that the lead agencies can participate in associated with evaluating, planning, and implementing projects within their jurisdictions that would partially restore natural sediment transport from local drainages to the Oceanside littoral cell in northern San Diego County.

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## INTRODUCTION

Beach nourishment or replenishment is the placement of sand along the nearshore zone or the shoreline to widen a beach that is narrow or where the natural supply of sand and beach width has been significantly reduced through human activities (CDBW & SCC 2002). Artificially nourished shorelines provide a number of potential benefits including increased beach area for recreation, increased revenue from tourism, improvement of habitats for some sandy beach/shore dependent species, greater protection of coastline structures or bluffs from coastal storms, reduced need for bluff armoring, and increased public access to beaches (CDBW & SCC 2002).

Mid- (1 to 10 years) and long-term (10 years or more) beach erosion in the Project region are of concern, and beach sand replenishment efforts likely benefit (after impacts of Project activity ecological disturbances are abated and recovered from) certain marine-related organisms, such as many shorebirds and sand dwelling invertebrates. However, replenishment activities have potential negative impacts on a variety of organisms and natural community types. One of the main concerns with many beach replenishment projects (such as the proposed Project) is the repeated Project-caused deposition of substantial amounts sand, and the potential for mid-term or recurrent disturbance and/or burial of natural communities such as reefs (including those that normally support various kelp and surf grass natural communities). Recovery of affected natural communities following burial by sand can range from months to several years (e.g., see Newell et al 1998; Versar 2004).

Beaches are dynamic environments subject to substantial natural seasonal cyclical movement of sand offshore (erosion) during the winter and onshore (accretion) during the summer (USACE 2012e). Sand moves by wave energy within the littoral zone, including alongshore within the littoral zone, and sand naturally passes through the action area littoral zone to other beaches upcoast and downcoast. Sand is lost from the littoral zone by very large waves that carry sand offshore beyond the water depths of littoral transport, and it is also lost to sand transport north and south of the action area to sediment sinks of submarine canyons (USACE 2012e).

Sand that is seasonally lost from the littoral zone is naturally replenished by river-borne sand carried to the coastal zone during periodic high stream flow conditions (e.g., following heavy rains), and to a lesser extent by sediment added to the shore by erosion of coastal bluffs (USACE 2012e). Over the last century, development in San Diego County has greatly hindered natural sediment conveyance to the coastal zone. Rivers and streams have been altered, and in many cases channelized, constrained, and/or dammed, reducing the quantities of sand-sized material conveyed by the stream channels to the ocean. Dams slow stream flow velocities, capture sand, and reduce the capacity of streams to convey sand to the coastal zone (USACE2012e). Sand mining activities in floodplains and narrow-span bridge openings over streams also alter stream hydrology and typically reduce downstream movement of sand to the ocean and beaches. As sediment loads have become trapped within the watersheds upstream of the Project littoral zone, significant reductions in beach sediment supply have occurred (USACE 2012e). Additionally, groins and jetties associated with Oceanside Harbor have substantially disrupted littoral sand transport down the coast to the action area (USACE 1991; SANDAG 2009). While the shoreline in the action area was relatively stable between 1933 and 1988 (USACE 1990), a trend of net depletion of sand on most of the beaches in action area has occurred in the last couple decades, likely as a result of the above-noted disruption of natural sediment sources and transport processes (USACE 2012e).

The stated purpose of the proposed Project is to effectively reduce risks to public safety and economic damages associated with bluff erosion and to restore beach widths along the shorelines of the cities of Encinitas and Solana Beach (USACE 2012e). The Corps, Los Angeles District, is the Federal lead agency for the Project. The Corps has published a draft EIS/EIR pursuant to NEPA; the cities of Encinitas and Solana Beach are local sponsors and co-lead agencies for the Draft 2012 EIS/EIR, which was also developed pursuant to CEQA. The Corps and Cities published the 2012 Draft EIS/EIR, jointly with a Feasibility Study, to examine the potential for replenishing beach sand and reducing bluff erosion, in response to concerns for protecting property, local recreation, and tourism along the coasts of Solana Beach and Encinitas, San Diego County, California. The 2012 Draft EIS/EIR described the Project's need, goals, objectives, and the potential environmental effects of the various alternatives as analyzed by the Corps and Cities.

Besides the no-action alternative, the 2012 Draft EIS/EIR evaluated two main sets of alternatives: 1) beach nourishment, and 2) beach nourishment with notch fills. All of the fully evaluated alternatives involve various beach width replenishment scenarios at the Encinitas and Solana Beach segments (with sub-alternatives based on high and low sea level rise (SLR) conditions). These design-width scenarios ranged from 50 ft to 400 ft of additional beach width in 50-ft increments, either alone or combined with notchfills. The Corps and Cities will determine which alternatives qualify as the least environmentally damaging practicable alternative and the National Economic Development Plan alternative. Preliminary and secondary screening by the Corps and Cities in the 2012 Draft EIS/EIR eliminated the following Project alternatives: managed retreat, emergent breakwaters, submerged breakwaters/artificial reefs, groins, seawalls, notchfills (without beach nourishment), and revetments.

As outlined in the 2012 Draft EIS/EIR, the Corps and Cities' tentatively recommended plan was termed alternative "EN-1A" for Encinitas and alternative "SB-1A" for Solana Beach. This tentative plan would have involved beach nourishment to add 100 ft to the width of the beach in the City of Encinitas, with renourishment cycles approximately every 5 years to the same width. For the City of Solana Beach the tentatively plan was to add 200 ft to the initial width of the beach, with renourishment cycles about every 13 years to the same width (or 300 ft width if "high" sea level rise occurred). The tentatively recommended plan of the 2012 Draft EIS/EIR would have resulted in an initial placement of sand of about 680,000 $yd^3$ at Encinitas and about 960,000 $yd^3$ at Solana Beach.

In September 2013 a revised proposed Project description was developed with smaller beach widths and lower sand nourishment volumes than in the 2012 Draft EIS/EIR tentative plan, based in part on input from outside agencies (City of Solana Beach 2013). The Corps and the Cities revised the recommended Project to adopt a Locally Preferred Plan (involving smaller alternatives analyzed in the 2012 Draft EIS/EIR) and to include additional and revised monitoring provisions (City of Solana Beach 2013). As of the date of this document, this revised

Project description is the current proposed Project; it is defined as the combined "EN-1B" and "SB-1B" beach nourishment alternatives:

- Encinitas receiver site: Alternative EN-1B Beach Nourishment
  - 50-foot beach; 5-year nourishment cycle

- Solana Beach receiver site: Alternative SB-1B Beach Nourishment
  - 150-foot beach; 10 year nourishment cycle

Proposed alternative EN-1B (within the City of Encinitas) would have an initial placement volume of 340,000 cubic yards ($yd^3$) that would extend the base-year beach width at mean-sea level by approximately 50 feet. Subsequent sand renourishments for alternative EN-1B would occur every 5 years and require placement of about 220,000 $yd^3$ of material, to the same beach extension width. Proposed alternative SB-1B (within the City of Solana Beach) would have an initial placement volume of 700,000 $yd^3$ that would extend the base-year beach width at mean-sea level approximately 150 feet. Renourishments for SB-1B would occur every 10 years and require placement of 290,000 $yd^3$ of sand, to the same beach extension width. Sand for both replenishment/receiver sites would be dredged from offshore, in areas beyond the depth of closure,[2] using specific borrow sites designated as SO-5, MB-1, and SO-6. The dredged sand material would then transported and placed onto the two receiver sites within Encinitas and Solana Beach.

The 2012 Draft EIS/EIR determined that potential impacts associated with the various Encinitas alternatives would be less than significant for biological resources, whereas impacts from the range of Solana Beach alternatives were determined to be significant for biological resources. Mitigation for biological resources is proposed by the Corps and Cities in the 2012 Draft EIS/EIR for the predicted impacts identified under each Solana Beach alternative. The severity of these impacts are anticipated to increase with the size (and volumes) of the proposed additional sand replenishment/beach width extension and the associated period of construction.

Implementation of any substantial project in the Corps' Study Area[3] could indirectly affect biological resources beyond the geographic or jurisdictional boundaries used to delimit the Study Area chosen by the Corps. For example, most sand naturally or artificially deposited along the shore within the Study Area is transported naturally through the littoral system along the coast and ultimately moves beyond the Study Area limits (e.g., upcoast, downcoast, and offshore).

[2] Depth of closure is a term used to define the seaward water depth of active sediment movement of the seabed caused by waves (Schwartz 2006).

[3] Study Area – as defined by the Corps: the Study Area refers to the area that was studied in the 2012 Draft EIS/EIR to identify the need for and formulation of a coastal storm damage reduction plan. The Study Area was used by the Corps and Cities to evaluate potential need and opportunities to reduce storm damages caused by the erosion of coastal bluffs resulting from wave attack. As reported, the environmental analysis in the 2012 Draft EIS/EIS evaluated the Encinitas and Solana Beach Project segments and the surrounding areas for the purposes of evaluating the potential for impacts in the context of the location and setting as prudent for each topic and distinct from the Study Area.

Therefore, the analysis in this Final FWCA Report considers all potential ecological effects associated with the potential alternatives to be evaluated, not just those effects limited to the Study Area. We also considered in our analysis the potential effects to biological resources resulting from the potential interactions between the proposed Project and other known regional planning efforts.

## FISH AND WILDLIFE COORDINATION ACT

The FWCA conditions or supplements other Federal water project authorities. Section 1 of the FWCA requires for water resources development projects that fish and wildlife conservation receives equal consideration by Federal agencies with other project purposes, and that such conservation be coordinated with other project features, and it was the intent of Congress with the FWCA to establish fish and wildlife enhancement (beyond mitigation) as a potential coequal project purpose (Smalley and Mueller 2004). Sections 1 and 2 of the FWCA direct and authorize Federal agencies that they have an affirmative duty to conserve and improve wildlife resources in connection with water development projects (Metcalf 1958; Smalley and Mueller 2004). While the FWCA is somewhat permissive (i.e., acceptance of Service's conservation recommendations is not mandatory), it does provide clear, general authority for the Corps to fund and construct measures that will provide for fish and wildlife conservation and enhancement as part of their projects, and directs that fish and wildlife conservation, especially in terms of prevention of losses, is a goal of all Federal water projects (Smalley and Mueller 2004).

To help accomplish the above requirements, Section 2(a) of the FWCA establishes that preconstruction planning on project development shall be coordinated with the Service through consultation. Section 2(b) requires that the Service provide a report and recommendations that determine "the possible damage to wildlife resources" and provide "means and measures that should be adopted to prevent the loss of or damage to such wildlife resources, as well as to provide concurrently for the development and improvement of such resources." Section 2(b) also requires Federal agencies to give "full consideration to the report and recommendations" of the Service. It also directs Federal agencies that "the project plan shall include such justifiable means and measures for wildlife purposes as the reporting agency finds should be adopted to obtain maximum overall project benefits." The 2(b) report must be made available to the Congress or other authorizing agents when decisions are made to authorize (or not to authorize, or authorize with modifications) a project. Section 2(c) of the FWCA authorizes the Service to: conduct surveys and investigations to determine the possible damage of proposed developments on wildlife resources; to make recommendations for preventing their loss or damage; and to offer measures for developing and improving these wildlife resources.

The terms "wildlife" and "wildlife resources", as used in the FWCA, "include birds, fishes, mammals and all other classes of wild animals and all types of aquatic and land vegetation upon which wildlife is dependent" [Section 6(b)]. Thus, although the FWCA uses the term wildlife, it is representing all fish and wildlife and their habitats/ecosystems. Evaluations made under the FWCA can, therefore, take into consideration a wide spectrum of environmental factors, including a watershed or ecosystem approach (Smalley and Mueller 2004). No regulations for implementing the provisions of the FWCA currently exist.

## DESCRIPTION OF PROJECT ACTION AREA, STUDY AREA, REACHES, AND SEGMENTS

Action Area: The proposed Project action area[4] consists of the following areas near and along the shoreline of the Pacific Ocean in San Diego County, California: a) nearshore, lagoon mouth, barrier spit, beach, bluff/cliff areas, and environs from southern Carlsbad to northern Del Mar; b) three proposed borrow sites and environs; and c) the ocean vessel transit zones between the proposed borrow sites and the nearshore (receiver site) areas of Encinitas and Solana Beach. The proposed sand borrow sites are located off the coast of Solana Beach (SO-6), Del Mar (SO-5), and Mission Beach (MB-1) in the Pacific Ocean.

The shoreline portion of the action area is located along the Pacific Ocean within the Oceanside littoral cell. The Oceanside littoral cell spans the coast of southern Orange and northern San Diego counties of southern California, extending from Dana Point in the north to the Scripps-La Jolla submarine canyons in the south (Grandy and Griggs 2007). The shoreline of the action area is predominately southwest facing with beaches backed by coastal bluffs largely topped with residential development, with smaller areas backed by sand spits/lagoons.

The cities of Carlsbad, Encinitas, Solana Beach, and Del Mar (running north-south down the coast though the action area, respectively) are located along the western edge of the coastal plain of the Peninsular Ranges Geomorphic Province. This coastal plain consists of numerous marine and non-marine terraces dissected by stream valleys. The coastal plain of the action area is dissected by: a) Batiquitos Lagoon on the northern edge of Encinitas and southern edge of Carlsbad; b) Cottonwood Creek and Escondido Creek/San Elijo Lagoon in the middle of the action area along the boundary between Encinitas and Solana Beach; and c) the San Dieguito River/Del Mar Estuary along the southern edge of Solana Beach and northern edge of Del Mar. Solana Beach has about 1.7 mi of shoreline and is approximately 17 mi south of Oceanside Harbor, and 10 mi north of La Jolla. Encinitas has about 6 mi of shoreline and is approximately 10 mi south of Oceanside Harbor, and 17 mi north of La Jolla.

Within the action area, a bottom surface platform just offshore typically extends 500 to 900 ft seaward to a depth of approximately -12 ft Mean Lower Low Water (MLLW), followed by a slope to a depth greater than -60 ft MLLW where a broader shelf is located. On average, the beach face slope of the action area shoreline has a contour of approximate 45:1, extending from the base of the coastal bluffs (USACE 2012e). The nearshore slope of the action area is generally parallel to the shoreline, with a consistent slope with a contour of about 70:1. The beach face and nearshore slopes in the City of Encinitas are generally steeper than those to the south in Solana Beach (USACE 2012e). The overall shelf offshore of the action area is generally about 2.5 mi wide and rocky, supporting substantial kelp growth (City of Solana Beach 2009).

[4] Action area means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.

The coastal streams and rivers of the Oceanside littoral cell historically carried to the ocean approximately twice the sediment compared to what they are currently delivering (Scripps 2004; City of Solana Beach 2009). With uninterrupted (natural) sand supplies as occurred historically, the beaches of the action area would likely otherwise normally recover from the heavy wave action and beach erosion associated with winter storms (Terra Costa 2005).

Over the last couple decades, beaches of San Diego's North County have experienced long-term net erosion due to urban and road development, sand mining, flood damage reduction structures and dams, and harbor development disrupting sand delivery (California State Lands Comm. 2001; CDBW & SCC 2002; Terra Costa 2005; SCE 2005; Patsch and Griggs 2006; SANDAG 2009). Construction of Oceanside Harbor in the early 1960s added substantial sand to the littoral cell over the mid-term (delaying the effects of disrupted sand transport), but the Harbor's north jetty significantly interrupted sand delivery from the northern portion of the littoral cell to the Project area over the long-term (SANDAG 2009), resulting in a net sand loss from Encinitas and Solana Beach beaches (Terra Costa 2005; SCE 2005) and ultimately contributing to cliff and beach erosion (Patsch and Griggs 2006).

Fluvial delivery (the movement of sediments by stream flows) of sands and gravels to the ocean by local streams between Carlsbad and La Jolla is estimated to have decreased from 65,000 $yd^3$/year during historical periods to 5,000 $yd^3$/year at present, a 92 percent reduction (USACE 1991). To a lesser extent, naturally cyclical storminess and associated heavy wave action generated by El Niño Southern Oscillations (El Niño) between 1978 and the late 1990's is a secondary cause of beach erosion. These El Niño-driven storms (which occur every 2 to 7 years), often cause increased rain and stream sediment delivery to the ocean in the region, but also typically cause substantial erosion of the beach and shoreline bluffs through heavy wave action (University of Arizona 2010; Terra Costa 2005).

Historically, the beaches of the action area naturally maintained cyclical equilibrium following storm wave erosion, through the subsequent accretion of beach sands that normally occurred in the following summer season. Due to the artificially reduced littoral system sand supply, reduced natural recovery (deposition and accretion) of beach sand occurs in the periods following storms, culminating in substantial erosion and narrowing of the beaches in the action area. For example, Encinitas beaches are currently losing about 100,000 $yd^3$ of sand every year (Whitlock 2013).

Maintenance dredging regularly occurs at Oceanside Harbor, Agua Hedionda Lagoon, Batiquitos Lagoon, San Elijo Lagoon, and San Dieguito Lagoon. About 175,000 $yd^3$ of sand is annually dredged from Oceanside Harbor (from the navigation channel and sand trap) and placed on the adjacent beaches to the south (USACE 2012e). These maintenance projects contribute to wider beaches in the areas where the sand is placed, but add relatively small amounts of sand to the broader littoral cell sand transport system. Consequently, these maintenance projects likely have relatively small to moderate effects on the beaches within the action area down the coast. Batiquitos Lagoon, which is located at the north end of the action area, requires (by design) regular maintenance dredging since its restoration in 1995-1996. Approximately 118,000 $yd^3$ of sand was dredged from the lagoon and placed on South Ponto Beach, at the north end of the action area, in 2011-2012 (USACE 2012e). These volumes of sand have had a relatively small influence on the beaches of the action area to the south (USACE 2012e). Likewise, dredging of the entrance channel at San Elijo Lagoon typically places about 25,000 to 40,000 $yd^3$ per year onto the beaches south of the lagoon mouth, with relatively small effects on beach width. These projects do at least partially offset the effects of artificial reductions in sand supply to the action area that are noted above.

The Regional Beach Sand Project (RBSP) placed 2.1 million $yd^3$ of sand on 12 San Diego County beaches in 2001 by dredging sand from offshore and pumping it onto beaches in Oceanside, Carlsbad, Encinitas, Solana Beach, Del Mar, San Diego, and Imperial Beach (SANDAG 2012b). Of these, all but the San Diego and Imperial Beach sites are within Oceanside littoral Cell. Four of these replenishment beaches were located in the Study Area (three in Encinitas and one in Solana Beach) and received a total of 580,100 $yd^3$ of sand. SANDAG implemented an additional sand replenishment project in late 2012 on eight San Diego County beaches: Imperial Beach, Oceanside, Moonlight State Beach, Cardiff State Beach, Batiquitos, Solana Beach, North Carlsbad Beach, and South Carlsbad Beach (SANDAG 2012a) totaling 1.4 million $yd^3$ of sand. Three of these beaches are within the Study Area, and seven are within the Oceanside littoral cell.

The sea cliffs and bluffs in the action area are steep escarpments at the coastline. These features commonly form during times of rising sea level (such as the present), as the shoreline advances landward and erodes the elevated landmass (Hampton and Griggs 2004). The land above the sea cliffs and bluffs of the action area region has been heavily developed, and the natural instability and progressive retreat of the cliffs pose a threat to property. Global sea levels are predicted to rise through the 21st century (e.g., see Jevrejeva et al. 2008; Grinsted et al. 2009; Rahmstorf 2010) and will likely contribute to further beach and bluff erosion. Although the exact magnitude of future sea level rise is unknown, the main contributions will come from both ocean water thermal expansion and the meltwater from continental glaciers and the Antarctic ice sheet (Rahmstorf 2010; California Ocean Protection Council 2011).

Older estimates regarding future sea level rise within the action area are correlated to an approximate 0.4 to 0.8 ft potential future increase in mean sea level (MSL) elevations over the course of the 21st century (USACE 1991; Collins 1993). Current estimates of the range of sea level rise from 2000 to 2100, which now include estimated effects of ice dynamics, range from 2.6 and 6.6 ft (Pfeffer et al. 2008; Vermeer and Rahmstorf 2009; Rahmstorf 2010; California Ocean Protection Council 2011).

Within the action area are three proposed borrow sites. These sites are about 0.5 mi (SO-6), 0.5 mi (SO-5), and 0.1 mi (MB-1) from shore, well outside the depth of closure for littoral sediments. From the northern end of the proposed Encinitas beach replenishment area, borrow site MB-1 is about 21 mi away, borrow site SO-5 is about 8 mi away, and borrow site SO-6 is about 5 mi away. Borrow sites SO-5 and SO-6 are the primary borrow sites proposed for the Project, meaning they would be used first until exhausted. As proposed, Project-related vessels would be involved in substantial travel to and from the borrow sites, pipelines, home harbor, and beach replenishment areas.

Study Area: The Corps in the 2012 Draft EIS/EIR describes the Study Area for the Project as the shoreline extending from the northern limits of the City of Encinitas (bounded by the City of Carlsbad) to the southern limits of the City of Solana Beach (bounded by Del Mar (Figure 1). The Study Area also includes some terrestrial environments upslope of the intertidal zone, and it extends to the top of bluffs or the first parallel road, whichever is closer. The Study Area does not include all of the areas likely subject to appreciable upcoast and downcoast movement of sand (littoral transport zone) placed in the Project footprint.

Almost all of the shoreline in the Study Area consists of relatively narrow sand or sand/cobblestone beaches fronting coastal bluffs. The tops of the bluffs backing the beaches of the Study Area are largely built out with houses and condominiums (City of Solana Beach 2009). Approximately half of the shoreline in the study area has been modified with some type of bluff protection structure (e.g., seawalls, notch fills, etc.) (USACE 2012e, Battelle 2013). The Encinitas portion of the Study Area shoreline is about 6 mi long, and the Solana Beach portion is about 2 mi long. The beach widths of the Study Area are relatively narrow; the beach widths indicated by MSL shoreline locations along 95 percent of the Study Area from 1996 to 2009 ranged between 60 and 130 ft wide (USACE 2012e). At the southern end of the Study Area the beach at Fletcher Cove has lost approximately 20 ft in width since 1996 (USACE 2012e).

The stretch of beach west of the San Elijo Lagoon in the community of Cardiff (City of Encinitas) is the only portion of the beach in the Study Area not backed by coastal bluffs. This area is a 4,900-ft long low-lying barrier spit fronting the San Elijo tidal lagoon, forming a partial water passage barrier between the lagoon and the ocean; this spit is currently topped by the roadway of Coast Highway 101, parking lots, and several restaurants. Portions of this spit area formerly contained the dynamic main outlet channel of Escondido Creek/San Elijo Lagoon at various times during higher stream flows, before construction of the railroad and what is now Coast Highway 101 constrained such flows to the current northern mouth area.

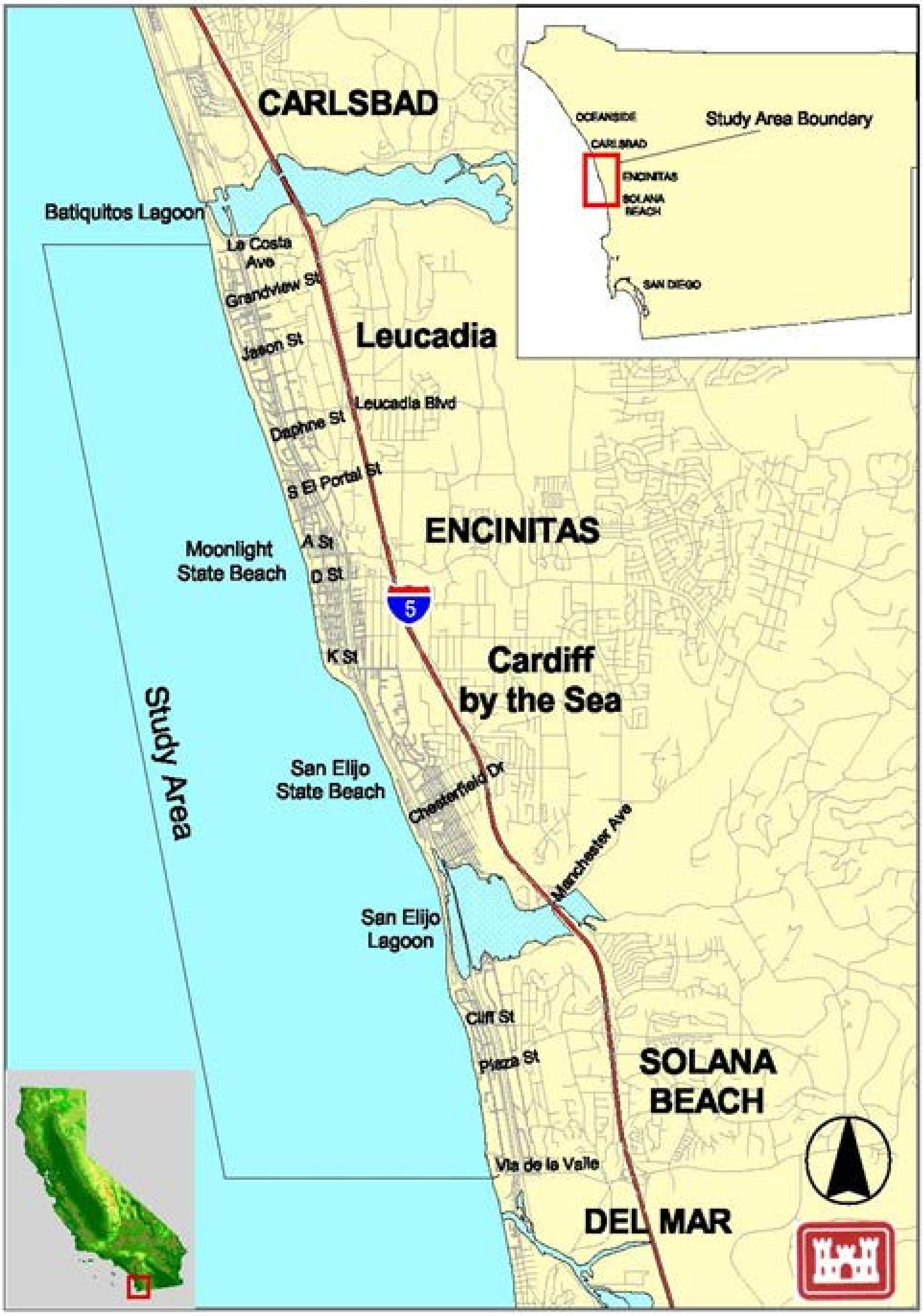


Figure 1. Project vicinity and study area.

Reaches: The coastal shoreline and offshore of portions of the Study Area are further divided into nine reaches for characterizing environmental conditions (Figure 2). The reach boundaries were selected based on differences in geology, shoreline morphology, and other physical differences along the shoreline. The 2012 Draft EIS/EIR contains additional biological information on each reach. The ranges of the nine reaches, from north to south, are described in Table 1 below. The indirect effects of proposed beach sand replenishment, outside of littoral sand movement up and down coast, would mostly occur within the Reaches identified.

**Table 1 – Project Reaches**

| Reach | Range | | Approx. length (mi) |
|---|---|---|---|
| | From | To | |
| 1 | Encinitas northern city limit | Beacon's (Leucadia State) Beach | 1.1 |
| 2 | Beacon's (Leucadia State) Beach | 700 Block, Neptune Avenue | 0.3 |
| 3 | 700 Block, Neptune Avenue | Stone Steps. | 0.5 |
| 4 | Stone Steps | Moonlight State Beach | 0.5 |
| 5 | Moonlight State Beach | Swami's. | 1.0 |
| 6 | Swami's | San Elijo Lagoon mouth (entrance) | 1.1 |
| 7 | San Elijo Lagoon mouth | Table Tops reef | 1.2 |
| 8 | Table Tops reef | Fletcher Cove | 0.8 |
| 9 | Fletcher Cove | Solana Beach southern city limit | 0.8 |

Segments: Within the Study Area are two segments that were identified in the 2012 Draft EIS/EIR as the areas in the Study Area with the greatest potential for storm damage protection value. All proposed Project beach direct replenishment (direct sand deposition) and notch filling would solely occur in these two segments (Figures 2, 3, and 4); some related activities would occur outside these segments. Some or all dredging, ocean transport/traffic, staging, beach access, and pipeline activities would (or could) occur outside these segments.

Segment 1 is a portion of the beach and bluffs within the city limits of Encinitas that extends along approximately 7,800 ft of shoreline, from the 700 block of Neptune Avenue south to West H Street. Segment 1 consists of Reaches 3, 4, and the northern 60 percent of Reach 5. Segment 2 involves most of the beach and bluffs within the city limits of Solana Beach; it is approximately 7,200 ft long and includes the southern 75 percent of Reach 8 and all of Reach 9. It should be noted that Project access related activities on beaches of the Study Area may occur outside these two Segments, as noted below regarding Project methods.

<u>Segment 1, Reach 3 – 700 Block, Neptune Avenue to Stone Steps</u>
This reach is between the 700 block of Neptune Ave. and Stone Steps Beach, and is approximately 0.5 mi in length. It consists of a narrow to medium-width beach backed by high,

steep sedimentary sandstone sea cliffs, similar to that of Reaches 1 and 2. The bluff top is fully developed with residential homes along the entire length of this reach. Throughout the reach, residences are at the immediate edge of the bluff. Within Reach 3 is Stone Steps Beach (a local park) with public access consisting of a concrete and wooden staircase surrounded by shotcrete. This reach includes Encinitas Beach Park (a County of San Diego park), and approximately 13 privately-owned staircases have been developed for private access to the beach from residences. The bluffs of the northern half of this reach are covered by many substantial sea walls and some areas of riprap and gabion baskets. The cliffs of the southern half of this reach are generally protected by long, low seawalls at the base of the bluff.

The bluffs in this reach are comprised of the slightly more erodible Santiago or Delmar Formations. Several bluff failure areas and a wave cut notches exist in this reach, ranging from 2 to 6 ft deep, extending along the entire reach where seawalls are absent. The upper bluff, comprised of weakly cemented sandstone, is steep along much of this reach where seawalls are present and where relatively heavy vegetation is present on the bluff face.

The beach in Reach 3 is narrower than in Reaches 1 and 2. Privately constructed seawalls have been installed to help protect the majority of the homes located along the bluff top. Along the northern section of the reach, a combination of seawalls and upper bluff retention structures has been built. Some of these upper bluff stabilization techniques include shotcrete walls, as well as vegetated terracing. Within the southern portion of this reach, several sections of 15-ft tall seawalls were constructed in the last couple decades.

Segment 1, Reach 4 – Stone Steps to Moonlight State Beach

This reach between Stone Steps Beach and Moonlight State Beach is approximately 0.5 mi in length. Reach 4 includes Seaside Gardens Park (a local park) and a parking area at the northern end of Moonlight State Beach. Five storm drains occur at Moonlight State Beach, three convey flows from Cottonwood Creek, and two are from residential neighborhoods. Throughout the reach residences are at the immediate edge of the bluff, and Rosetta Street, A Street, and C Street dead-end at the bluff edge. Two private stairways connect the top of the bluff to the beach. Small, scattered seawalls have been installed in the northern and central part of the reach, as well as substantial riprap placements at the toe of the bluff between Sylvia Street and Moonlight State Beach.

Similar in the physical characteristics and urban development to Reaches 1 through 3, the relatively narrow sandy beach along much of Reach 4 is backed entirely by the more erodible Torrey Sandstone. The bluff top ranges in height from approximately 30 ft tall in the southern portion of the reach, adjacent to Moonlight State Beach, and quickly transitions to approximately 80 to 100 ft. Along the entire reach, except for the southern portion of the reach immediately adjacent to Moonlight State Beach, an approximate 2- to 4-ft notch exists at the base of the bluff where measures such as seawalls have not been installed.

Within the northern section of the reach two small sections of bluff base are armored with seawalls that were constructed in the last couple decades (USACE 2012e). Notch fills are also present at some locations along the reach. Within the southern portion adjacent to Moonlight

State Beach, two patches of revetment have been installed at toe of the bluff. The sandy pocket beach that delineates Moonlight State Beach includes recreational facilities and structures. As a mitigation measure against potential flooding, the City of Encinitas annually constructs a protective temporary sand berm during the winter months to reduce potential flooding damage. This berm is built approximately 10 ft high and 600 ft long on the back beach area, reportedly to help protect the beach recreational facilities and structures from inundation during large wave/storm events.

Segment 1, Reach 5 – Moonlight State Beach to Swami's

The reach extending from Moonlight State Beach to Swami's is approximately 1.0 mi in length and contains a narrow beach with a thin sand lens backed by the predominantly high, steep coastal bluffs representative of the Encinitas shoreline. The development along the bluff top consists of high-density residential structures. The Self Realization Fellowship (SRF) property is located at the southern boundary of the reach and consists of two parks on the bluffs: H Street and I Street Viewpoint Parks, and provides public access and viewing areas on the bluffs. Several fences lie on the face of the bluff. Public access to D Street Beach consists of benches on the top of the bluff and a wooden staircase leading from the top of the bluff to the beach; two staircases for private access to the beach exist in this reach.

The bluffs in Reach 5 range in height from approximately 30 to 80 ft and are comprised of different formations. The northern one-third section is comprised of Torrey Sandstone, while the remaining section is comprised of the Del Mar formation, which is slightly more resistant to wave abrasion.

Historically, the beach within this reach was relatively narrow. Even after RBSP was completed, the beach was still relatively narrow (USACE 2012e). As a result, wave attack has substantially affected the base of the bluff in the last several decades. In specific locations these notches extend as deep as 8 ft or more and range in height from approximately 10 to 15 ft. Numerous bluff failures have been reported in the last few years (USACE 2012e).

No bluff toe protective devices have been constructed recently within this reach; however, a long revetment structure is present at the SRF property providing bluff slope protection. The bluff at the SRF has well-known history of slope stability problems, as the area is reportedly susceptible to landslides. Following the winter of 1941, the original SRF Temple, which had been built 30 ft from the edge of the cliff, collapsed onto the beach below as a result of a landslide (USACE 2012e).

Segment 2, Reach 8 – Table Tops to Fletcher Cove

Reach 8, between Table Tops and Fletcher Cove, is approximately 0.8 mi in length and represents the northernmost reach located in the City of Solana Beach. The bluff top is fully developed throughout the reach with large private residences. Reach 8 includes Tide Beach Park (a County of San Diego park) and Fletcher Cove Beach Park (a local park); these parks include recreational facilities and structures. Public access to the beach consists of a public staircase from Solana Vista Dr. in the northern half of the reach down to the beach and a public paved ramp at Fletcher Cove, near the end of Plaza St. at the southern end of the reach. The northern end of the reach is protected by a moderately sized seawall. A large seawall has been installed just north of Solana Vista Dr., and several very large seawalls are in place between Solana Vista Dr. and Estrella St.

The bluffs in this reach are about 70 to 80 ft high and are comprised of Torrey Sandstone as the lower 10 to 15 ft of the cliff face, with the remaining 60 ft comprised of silty sandstone. The shoreline presently consists of narrow to very narrow sandy beach backed by high coastal bluffs. In addition, small pockets of cobble exist in the back beach area at various locations. Fletcher Cove represents a 300-ft long recessed “pocket” beach. Substantial bluff toe erosion and bluff failures have been reported in the last couple decades in this reach (USACE 2012e). Presently, notches about 4 to 8 ft deep and sea caves are present in the lower bluffs along this reach.

Several bluff top residence owners have installed lower bluff stabilization measures to reduce bluff erosion from the impingement of waves and tides. These stabilization measures include concrete seawalls that range in height from about 3 to 15 ft. Concrete notch infills have been installed at several notch areas; erosion has since taken place in the lee of the infill in some locations, resulting in loss of some bluff sediments around the end of the infill.

Segment 2, Reach 9 – Fletcher Cove to Solana Beach Southern City Limit

Reach 9 is located between Fletcher Cove and the southern city limit boundary of Solana Beach and is approximately 0.8 mi in length. The bluff top, ranging in height from approximately 60 to 80 ft, is fully developed with private residences, townhomes, and condominiums. Reach 9 includes the southern end of Fletcher Cove Beach Park and North Seascape Surf Beach Park (also a local park), with one storm drain at each of the two parks. The bluffs at the southern end of the reach include large seawalls, reinforced earth walls, riprap placements, and concrete covered crib walls (USACE 2012e).

The coastal bluffs are comprised of exposures of Torrey Sandstone in the lower bluff overlain by another sandstone layer. The shoreline within this reach is presently narrow to very narrow sandy beach backed by high, steep bluffs. Various small pockets of natural cobble berm exist in the southern half of the reach that provide limited protection to the bluff face. The notches in this reach range in depth from approximately 2 to 8 ft. Evidence of several landslides exists within the reach. Sea caves, several of which extend as deep as 18 to 30 ft, are present in several areas at the southern portion of the reach.

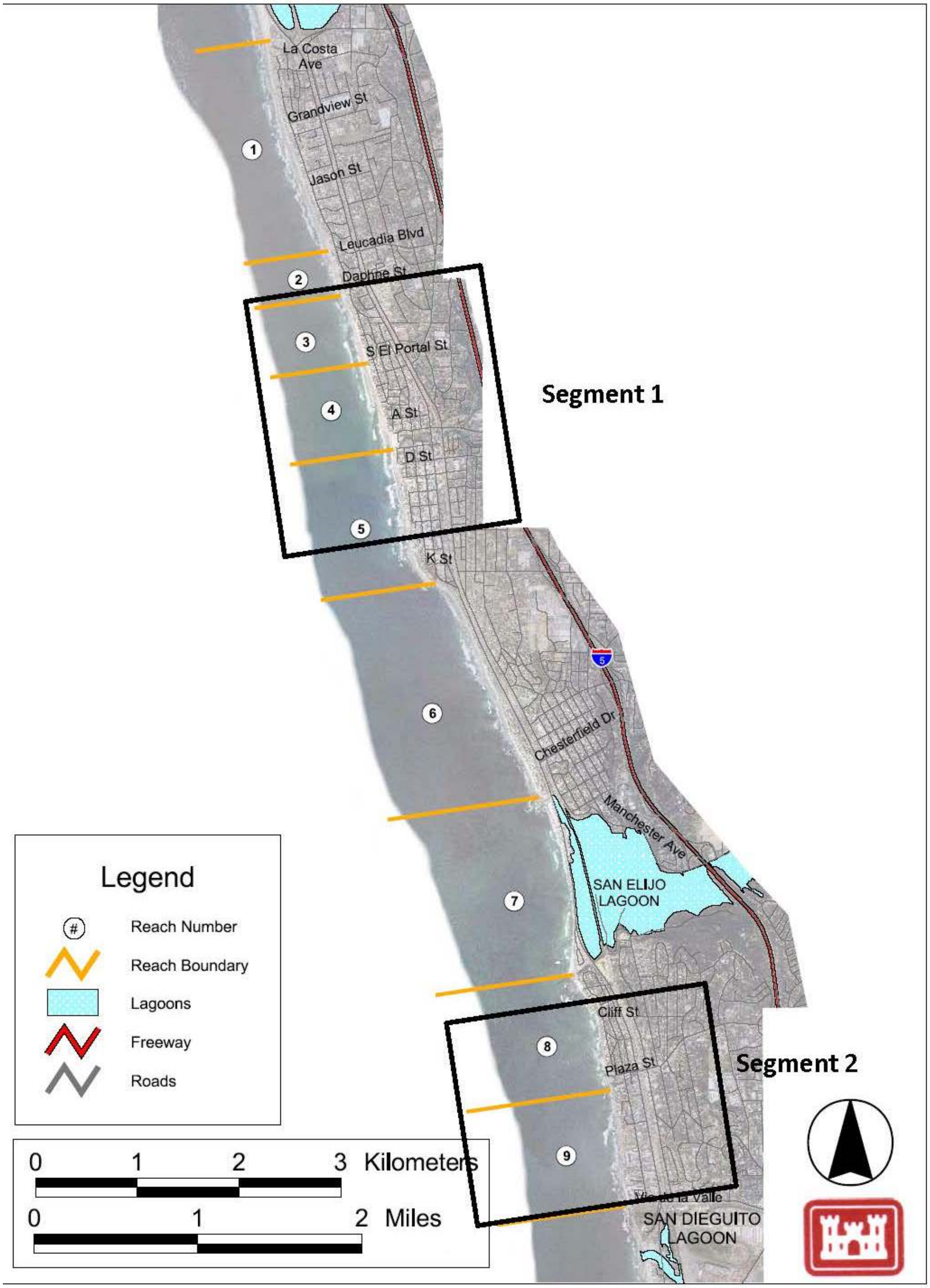


**Figure 2. Project Reaches and Segments**

## PROJECT HISTORY

An Encinitas/Solana Beach Shoreline Feasibility Study was authorized by a resolution of the U.S. House Public Works and Transportation Committee (now the U.S. House Committee on Transportation and Infrastructure) in May 1993. Planning for the proposed Project was initiated in March 2000 with the preparation of a Reconnaissance Study by the Corps, which determined that there was a Federal interest in the Project. In 2005, the Corps and the Cities issued a Draft EIS/EIR (2005 Draft EIS/EIR), and the Service issued a Draft FWCA report for a similar project described in the 2005 Draft EIS/EIR.

However, the project description and range of alternatives for this similar project have been modified substantially since 2005, and the 2005 Draft EIS/EIR was never finalized. Changes to that project, and the lapse of time since 2005, prompted the Corps and Cities to prepare a new Draft EIS/EIR, which was released for public review in late 2012. The Corps requested a new Draft FWCA Report from the Service based on a new Project description provided in March 2012.

The previously proposed similar project analyzed in the 2005 Draft EIS/EIR for both the Encinitas and Solana Beach sites would have placed approximately 1,226,900 $yd^3$ of sand dredged from two offshore borrow sites along 2.9 mi of shoreline with renourishment of about 527,750 $yd^3$ for each 5-year cycle. It would also have included the filling of notches in the beach bluffs. As originally proposed, initial sand placement described in that project would have required 821,400 $yd^3$ for Encinitas and 405,500 $yd^3$ for Solana Beach, with repeated renourishment requiring approximately 344,375 $yd^3$ and 183,375 $yd^3$ for these two areas, respectively.

After evaluating comments received on the 2005 Draft EIS/EIR, the lead agencies re-evaluated that project as it was then proposed and studied ways to better estimate potential impacts that would result from implementation of that action. As a result, the proposed Project alternatives analyzed herein have changed compared to those proposed in 2005. A Notice of Intent to prepare a new Draft EIS/EIR for the proposed Project analyzed herein was published in April 2012.

In November 2012 the Service provided the Corps a Draft Coordination Act Report for the Project as briefly described in a Corps Notice of Intent and Table 2 below (USACE 2012b; 2012d). In December 2012 the Corps and Cities published a joint Draft EIS/EIR to assess beach replenishment and shoreline protection options and associated potential effects along the coastlines of these two cities (USACE 2012e). The 2012 Draft EIR/EIS provided an analysis of potential impacts of the Proposed Project and a range of alternatives to the Project.

In July 2013 the California Coastal Commission provided a conditional concurrence on a Corps-submitted consistency determination for the proposed Project. The Commission adopted conditions which provided, in part, "…for modifications to the Project to ensure protection of sensitive habitat areas, adequate monitoring of Project implementation and impacts, mitigation of Project impacts, and phased review of future renourishment projects. If the Corps were to agree to implement these conditions, the proposed project could be found consistent with the marine resources, beach nourishment, and dredging and filling policies of the Coastal Act (Sections 30230, 30231, and 30233)."

In September 2013 a revised proposed Project description was developed with smaller beach widths and lower sand nourishment volumes than the 2012 Draft EIS/EIR tentative plan, based in part on input from outside agencies (City of Solana Beach 2013). The Corps and the Cities of Encinitas and Solana Beach revised the recommended Project to adopt a Locally Preferred Plan involving smaller alternatives than those chosen as the tentative recommended plan in the 2012 Draft EIS/EIR and revised monitoring and conservation provisions (City of Solana Beach 2013; USACE 2013c; USACE 2013d; USACE 2013e). In October 2013 the Corps again provided a revised Project description with modified conservation measures (USACE 2013f). As of the date of this document these revised Project descriptions are combined to form the current proposed Project, summarized as the "EN-1B" and "SB-1B" beach nourishment alternatives.

## PROJECT PURPOSE AND NEED

The purpose of the proposed Project is to effectively reduce risks to public safety and economic damages associated with bluff erosion and to restore beaches along the shorelines of the cities of Encinitas and Solana Beach (USACE 2012e). The need for the proposed action is that ongoing bluff erosion and storm surge along unprotected shorelines will result in structural damages and threats to public safety that include Coast Highway 101 closures and catastrophic damage to occupied buildings; and ongoing beach erosion will also result in reduced recreational use of beaches (USACE 2012e).

## DESCRIPTION OF PROPOSED ACTION ALTERNATIVES

An array of structural and non-structural measures was formulated by the Corps and Cities in the 2012 Draft EIS/EIR to address identified problems and opportunities. Alternatives analyzed included:

- No action
- Managed retreat (non-structural measure)
- Beach nourishment
- Emergent breakwaters
- Submerged breakwater/artificial reef
- Groins
- Revetments
- Seawalls
- Notchfills

Preliminary screening by the Corps and Cities eliminated the following alternatives from additional evaluation in the 2012 Draft EIS/EIS:

- Managed retreat
- Emergent breakwaters

- Submerged breakwater/artificial reef
- Groins
- Revetments

These alternatives were screened out because they would reportedly not meet Project needs and objectives and/or because the costs for implementation to meet the needs and objectives would be disproportionately high.

Secondary screening eliminated the notchfills (alone) and seawalls as alternatives. These two alternatives were determined by the Corps and Cities to have the potential to meet a basic Project need or objective at proportionally lower implementation costs than those alternatives screened out in the preliminary screening. However, these alternatives reportedly did not meet all the Project needs and objectives.

Numerous scenarios for potential beach widths at each segment and at high and low sea level rise (SLR) scenarios were explored in the 2012 Draft EIS/EIR to determine the most prudent and practicable design beach widths, from 50 ft to 400 ft of additional beach width, at 50-ft increments. Alternatives for Encinitas were analyzed independently of Solana Beach such that alternatives for Encinitas could be paired with any of the alternatives for Solana Beach (and vice versa). The final array of alternatives analyzed in the 2012 Draft EIS/EIR consisted of beach nourishment at various increments (as shown in Table 2), and hybrids of these same beach nourishment scenarios combined with bluff notchfills.

| Table 2 - Final Array of Proposed Alternatives | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Encinitas (EN)** | **Potential Sea Level Rise (SLR)** | **Alternative EN -1A: Beach Nourishment** | **Alternative EN -1B: Beach Nourishment** | | **Alternative EN-2A: Hybrid** | **Alternative EN-2B: Hybrid** | **Alternative EN -3: No Action** |
| Initial Placement Volume (cy)* | High SLR | 730,000 | 390,000 | | 800,000 | 390,000 | Assumes that the practice of emergency permitting for seawalls along the segment would continue. |
| | Low SLR | 680,000 | 340,000 | | 700,000 | 340,000 | |
| Re-Nourishment Cycle | High SLR | 5-yr | 5-yr | | 10-yr | 5-yr | |
| | Low SLR | 5-yr | 5-yr | | 10-yr | 5-yr | |
| Added Beach Width at Mean Sea Level (MSL) | High SLR | 100 ft | 50 ft | | 100 ft | 50 ft | |
| | Low SLR | 100 ft | 50 ft | | 100 ft | 50 ft | |
| **Solana Beach (SB)** | **Potential Sea Level Rise** | **Alternative SB -1A: Beach Nourishment** | **Alternative SB -1B: Beach Nourishment** | **Alternative SB-1C: Beach Nourishment** | **Alternative SB-2A: Hybrid** | **Alternative SB-2B:** | **Alternative SB-3: No Action** |
| Initial Placement Volume (cy) | High SLR | 1,620,000 | 790,000 | 540,000 | 790,000 | 540,000 | Assumes that the practice of emergency permitting for seawalls along the segment would continue. |
| | Low SLR | 960,000 | 700,000 | 440,000 | 700,000 | 440,000 | |
| Re-Nourishment Cycle | High SLR | 14-yr | 10-yr | 10-yr | 10-yr | 10-yr | |
| | Low LSR | 13-yr | 10-yr | 10-yr | 10-yr | 10-yr | |
| Added Beach MSL Width | High SLR | 300 ft | 150 ft | 100 ft | 150 ft | 100 ft | |
| | Low SLR | 200 ft | 150 ft | 100 ft | 150 ft | 100 ft | |

*The volumes noted do not include an estimated 10 percent loss during construction operations, with losses primarily occurring offshore and nearshore.

**Dredging and Beach Nourishment**

Outside of the No Action Alternative, the various proposed Project alternatives would involve the dredging of sand from offshore borrow sites (designated MB-1, SO-5, and SO-6; Figures 7, 8, 9, and 10) and placement onto the beach at the receiver sites (USACE 2012e). All of the proposed borrow sites have reportedly been subject to previous dredging activities by other projects (USACE 2012e). As proposed, detailed construction design specifications (yet to be developed) would control specifically where the sand would be dredged and placed, and the dredging contractor would select the exact methods and equipment to be utilized. Nevertheless, dredging for the proposed Project would not be directly repeated in the same location within any borrow site in subsequent Project dredging cycles (USACE 2013b). The discussion below includes all important equipment that we expect could be selected for the Project.

Per the various alternatives, a total of up to 2,420,000 $yd^3$ of sand would be placed for the initial total Project replenishment (Segments 1 and 2 combined; Figure 2, 3 and 4). In Segment 1 (in Encinitas), up to 800,000 $yd^3$ of sand would be initially placed along about 1.6 mi of beach in Reaches 3, 4, and 5 (Table 2). Under any of the various alternatives in Segment 1 the top of the beach fill berm created by deposited sand would be constructed to an elevation as high as +13 ft MLLW, and would be relatively flat and up to 100 ft wide. The created beach fill would then continue to extend seaward up to about 70 ft at a slope of 10:1 (horizontal distance to vertical distance), for a total maximum direct fill width of about 170 ft. The total maximum footprint area of direct beach fill in Segment 1 would be about 31 ac.

In Segment 2 (in Solana Beach), up to 1,620,000 $yd^3$ of sand would be placed along 1.4 mi of beach in Reaches 8 and 9 (Table 2). Under the various alternatives in Segment 2 the top of the beach fill berm created by dredged sand would be constructed to an elevation of up to +13 ft MLLW, and would be relatively flat and up to 300 ft wide. The beach fill would then continue to extend seaward up to about 130 ft at a slope of 10:1 (horizontal distance to vertical distance) for a total maximum fill width of about 430 ft. The total maximum footprint area of beach fill in Segment 2 would be about 73 ac.

Over the proposed 50-year life of the Project (from 2015 to 2065), subsequent replenishment events could occur every 5 to 10 years in Segment 1, and every 10 to 14 years for Segment 2, with sand volumes of as much as 700,000 $yd^3$ in Segment 1, and as much as 960,000 $yd^3$ in Segment 2. Therefore, these subsequent replenishment events could involve up to a total of 1,660,000 $yd^3$ with each cycle in both Segments. As proposed, each replenishment cycle would restore design beach widths to those of the initial replenishment to maintain protection of the shoreline (USACE 2012a).


**Figure 3. Encinitas/Segment 1 proposed receiver site approximate linear extent** (USACE 2012e)


**Figure 4. Solana Beach/Segment 2 proposed receiver site approximate linear extent** (USACE 2012e)

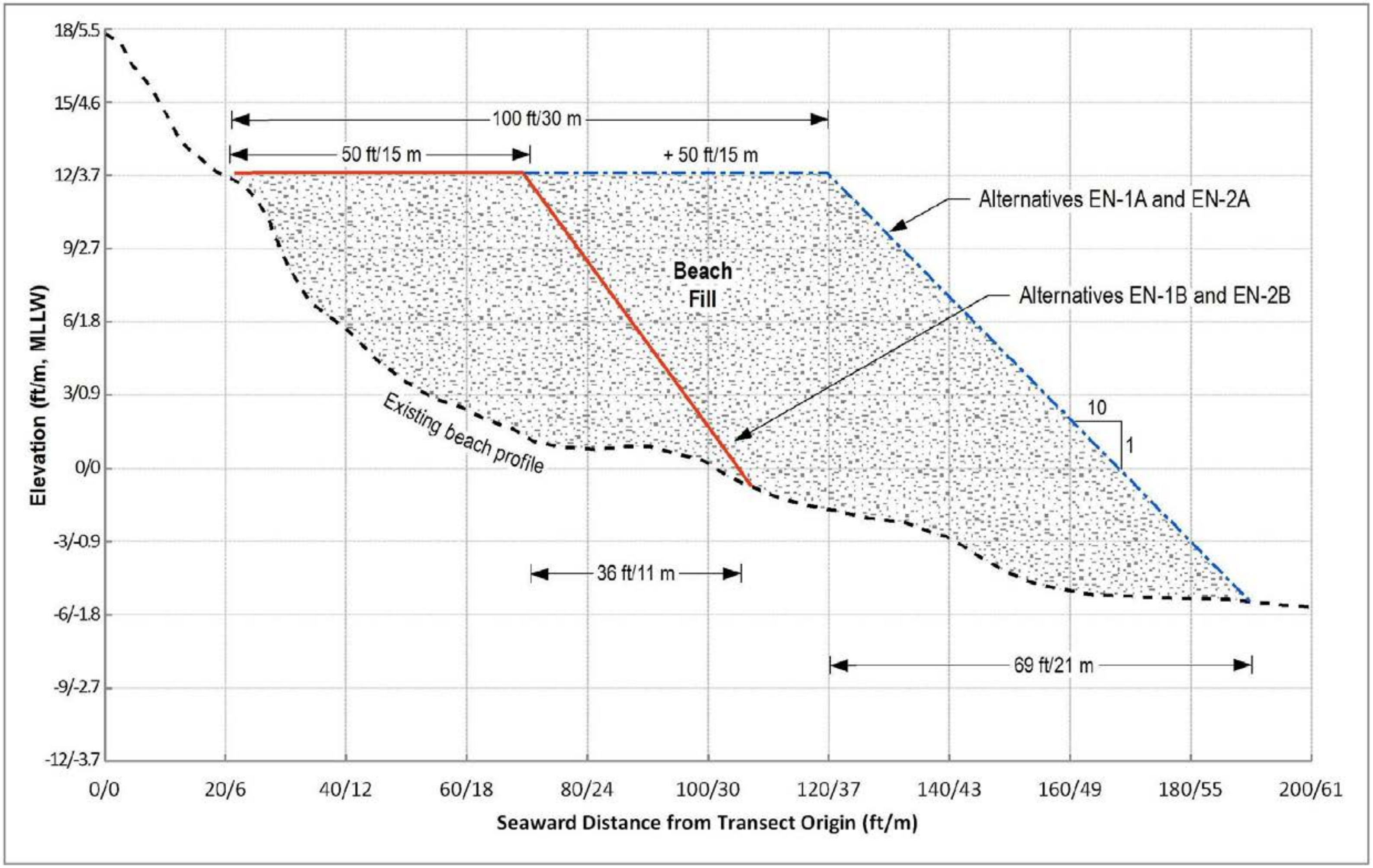


**Figure 5. Segment 1 Proposed Beach Fill Profile**

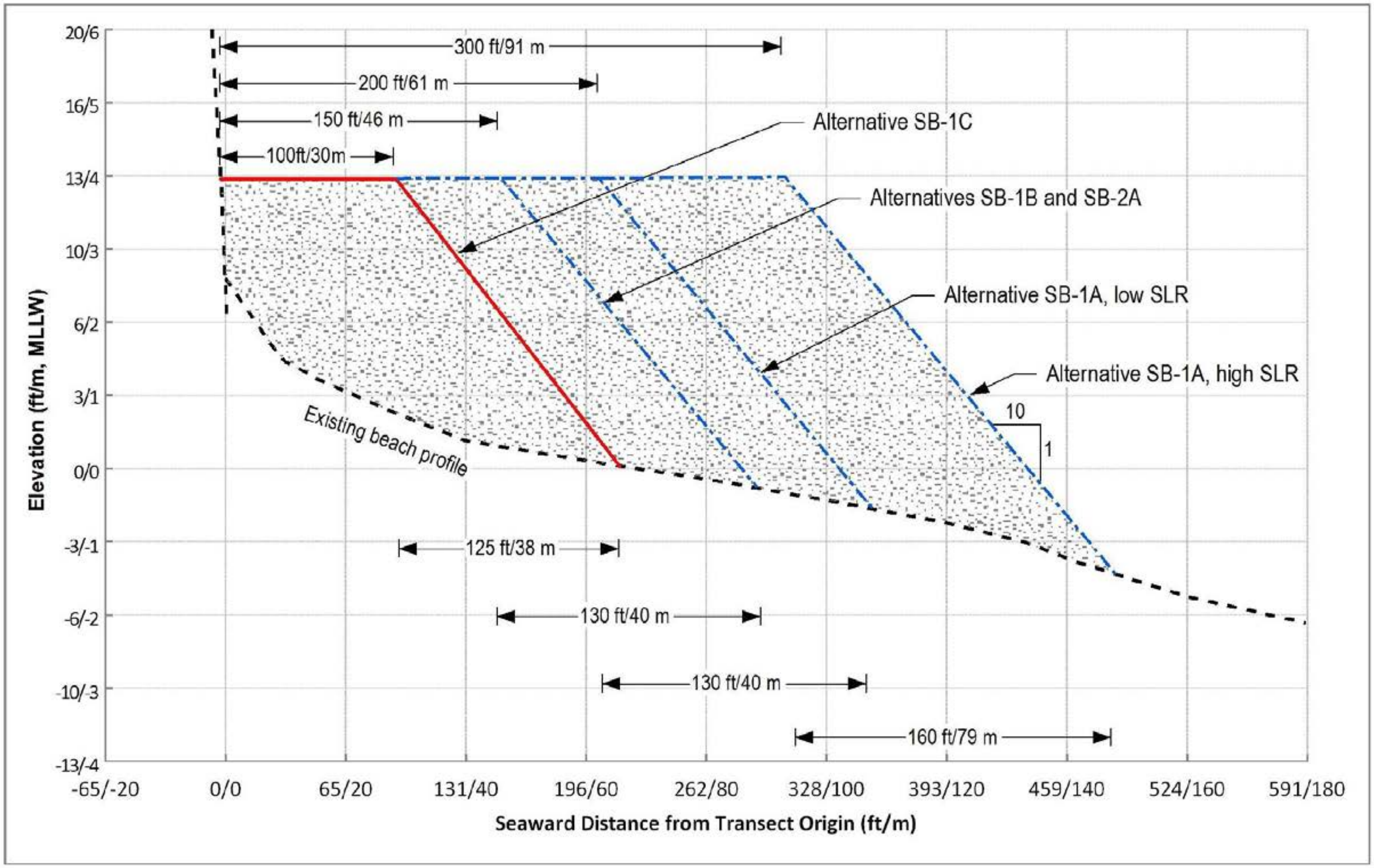


**Figure 6. Segment 2 Proposed Beach Fill Profile**

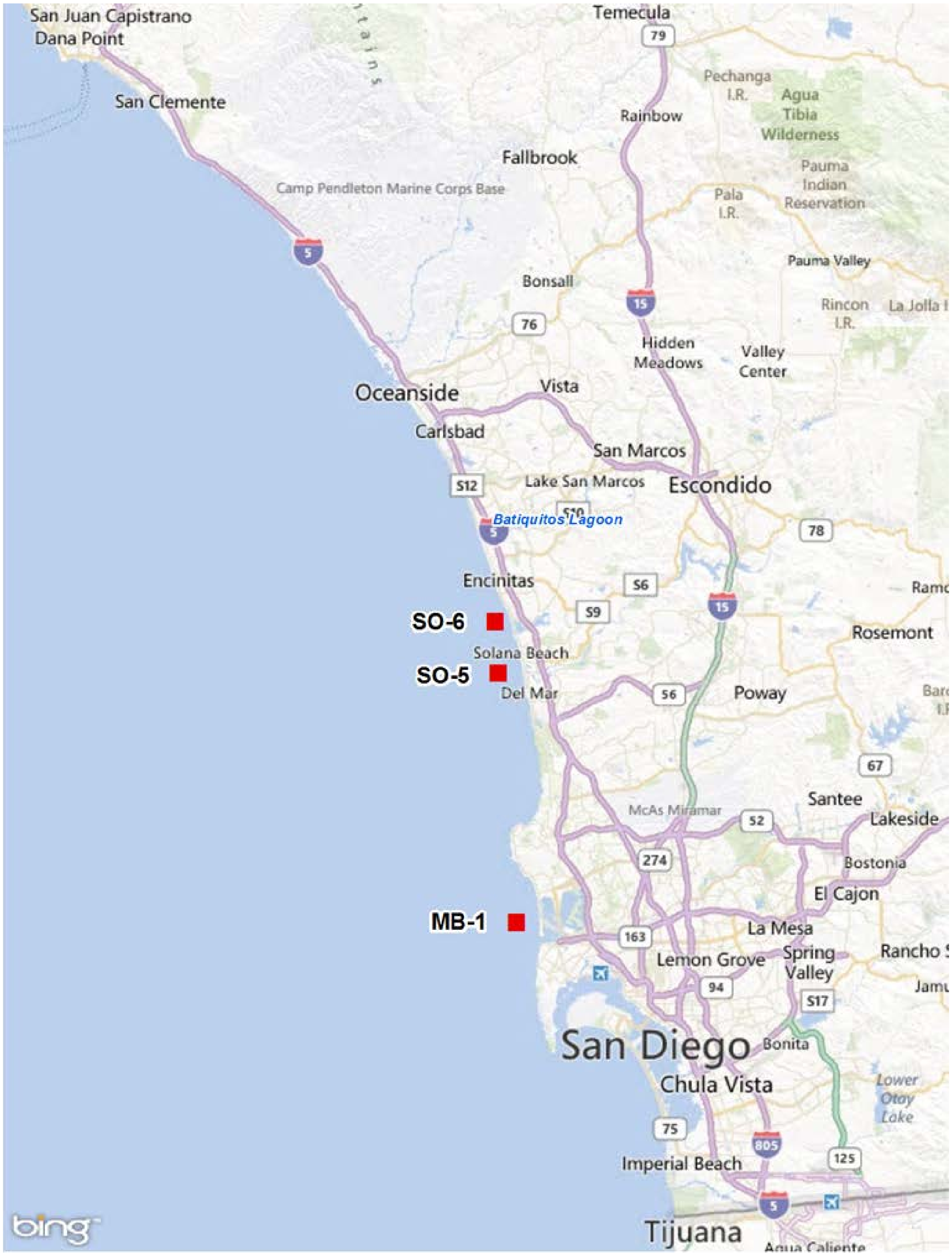

**Figure 7. Location of proposed borrow sites**

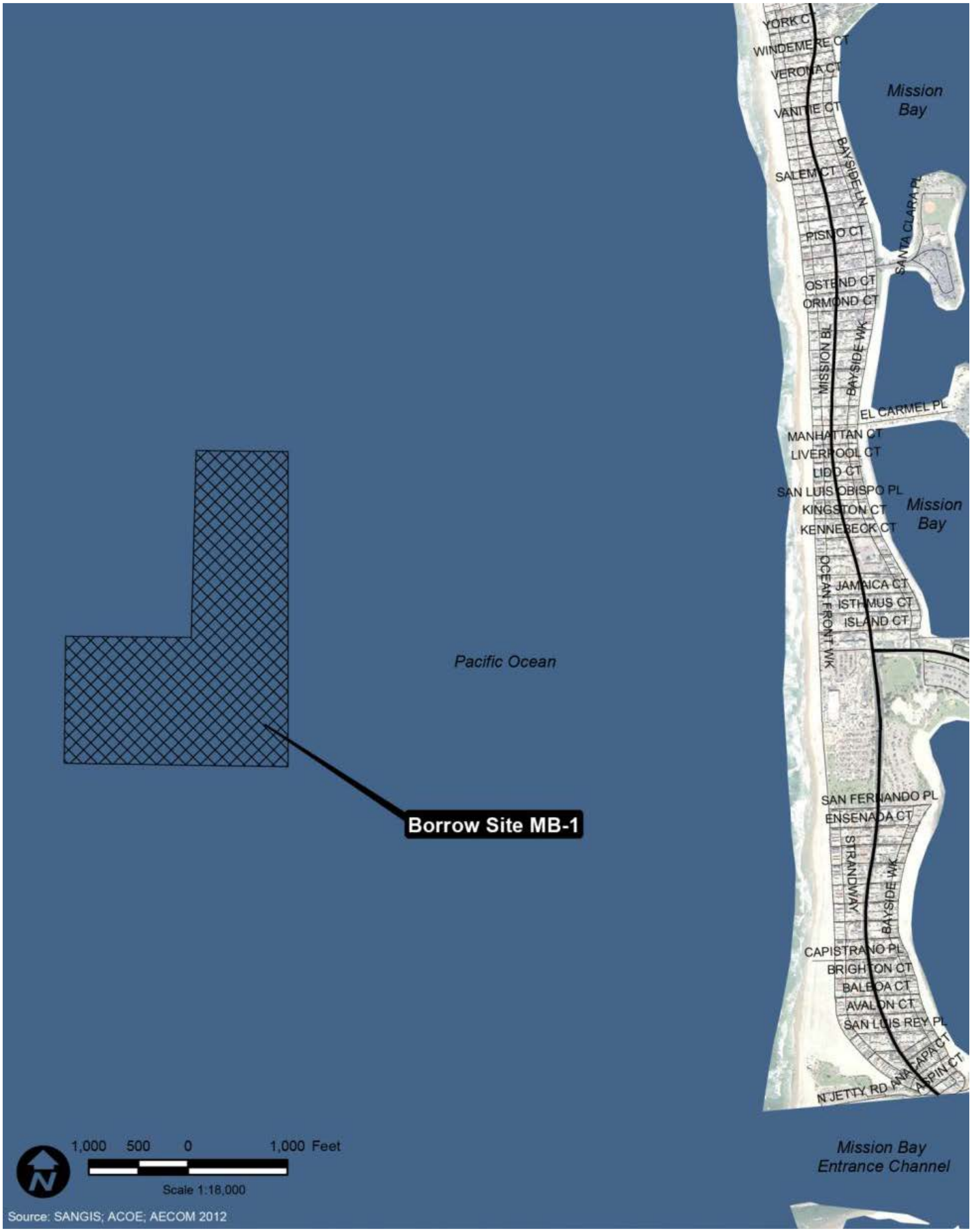


**Figure 8. Footprint of proposed borrow site MB-1**


**Figure 9. Footprint of proposed borrow site SO-6** (USACE 2012e)


**Figure 10. Footprint of proposed borrow site SO-5** (USACE 2012e)

Methods

The general process for proposed sand dredging, transport, and dispersal is very similar for the three borrow sites and for both sand receiver site segments. Potential methods proposed for dredging include both hopper and cutterhead dredges.

The hopper dredge is a self-propelled vessel that collects sand material from the ocean bottom and stores the material in the hoppers of the vessel. The hopper dredge then moves to a receiver site for sand placement. The hopper dredge contains two large arms that have the ability to drag along the ocean floor and collect sediment. The drag heads are about 10 $ft^2$. The hopper dredge moves along the ocean surface with its arms extended, passing back and forth in the designated borrow site until the hull is fully loaded with sediment. The hopper dredge can generally reach within approximately 0.5 mi of shore to offload to receiver sites. From this distance, the hopper dredge connects to a floating or submerged pipeline from shore. The vessel then discharges sediment onto the receiver site.

Typically, as material is loaded into the hoppers of the dredge, overflow water carrying fine sediments (carriage water) is allowed to run off the top of the hoppers and spill directly into the ocean, potentially generating a turbidity plume. While the Corps has noted that for this specific carriage water situation that the Project's dredge "[s]ediments are sand; overflow would be expected to consist of sandy sediments" (USACE 2013a), it should be noted that sediment particle size distributions for sediments to be dredged at a 2 ft depth (below the ocean floor) are reported to be about 18 percent and 6 percent silt/clay for sites S0-5 and SO-6, respectively (USACE 2012e). Sediments from samples from a depth of 20 ft at borrow sites SO-5 and SO-6 indicated a fine sediment content between 2 and 5 percent (USACE 2012e). As such, a considerable portion of the proposed Project sediments to be dredged, and thus any hopper dredge carriage water, would contain appreciable amounts of fine sediments.

If a hopper dredge is utilized for the proposed Project, it would be loaded with dredged material from the borrow sites and then transported to a monobuoy close to the beach area designated to receive the dredged material. A monobuoy is a floating pipeline connection platform that is moored to the seafloor, and is used to interconnect with a steel sinker pipeline that carries the slurry along the seafloor to the beach. The monobuoy is generally anchored to the seabed at an appropriate depth and location to serve the Project needs, depending on locations of sensitive resources and engineering considerations. For this Project the monobuoy would be anchored in at least 25 ft of water, between 2,500 ft and 5,000 ft from shore (USACE 2012e).

At this monobuoy, seawater would be mixed with the dredged material, creating a slurry, and would then be pumped through floating or submerged pipelines directly to the highest portions of the beach, utilizing booster pumps if necessary. Submerged pipelines would reportedly be sufficiently encased by large tractor tires to prevent abrasion of the ocean floor, reefs, or other seabed natural communities (USACE 2012e). One hopper dredge would be required for the proposed Project.

The other dredge type that may be employed for this Project is a cutterhead, which is essentially a floating barge with onboard pumping equipment. The cutterhead is equipped with a cutter apparatus surrounding the intake end of the suction pipe that rotates to loosen the seabed material and suction it up as the pipe swings across the ocean floor, excavating a swath about 300 ft wide and 3 to 5 ft deep. The dredge material would be mixed with seawater, creating a slurry, and then pumped onshore by a submerged or floating discharge pipeline. This dredge has the capability of pumping dredged material long distances to upland disposal areas. A cutterhead dredge would reportedly likely only be considered for Project dredging at SO-6 (USACE 2012e). The cutterhead dredge is usually equipped with two stern spud anchors used to hold the dredge in working position and to advance the dredge into the cut or excavating area. During operation, the cutterhead dredge swings from side to side alternately using the port and starboard spuds as a pivot. Cables attached to anchors on each side of the dredge control lateral movement. Forward movement is achieved by lowering the starboard spud after the port swing is made and then raising the port spud. The dredge is then swung back to the starboard side of the cut centerline, and the process is repeated for the port side. Floating pipeline is then connected from the barge to the beach. One cutterhead dredge would be required, with one anchor tender vessel to move the spuds as needed and a crew boat to ferry crew and supplies to and from the rig from the shoreside support facility, most probably located at Oceanside Harbor.

For the cutterhead/pipeline option for dredge and discharge, the pipe would be laid on the seafloor from SO-6 into shore. As described in the 2012 Draft EIS/EIR, this pipe would have been directed straight into shore to a booster pump located on Cardiff State Beach; this booster pump would have been required to pump the slurry up or down coast in a pipeline from that point. Pursuant to revisions to the proposed Project description (City of Solana Beach 2013), this booster pump and beach pipeline, if utilized, are currently proposed to be fully located within the Segment 2 (Solana Beach) replenishment area (and away from Cardiff State Beach).

For both cutterhead and hopper dredge/discharge operation options, existing sand at each receiver site would be moved to build an “L”-shaped berm to anchor the sand placement operations. The short side of the “L” would be perpendicular to the shoreline and approximately the same width as the flat portion of the beach-fill area for each segment. The long side would be parallel to the shore, at the seaward edge of the planned beach-fill footprint. The long side would initially be about 200 ft long.

The dredged slurry would be pumped into the angle of the “L” between the berm and the bluff toe. This berm would reduce ocean water turbidity by allowing most the dredge material to settle out inside the bermed area while the seawater is channeled just inside the long berm until it reaches the open end where it drains across the shore platform and into the ocean. As filling progresses the berm would be continuously extended to maintain at least 200 ft of length beyond where filling is occurring. In this way return water would have to flow approximately 200 ft, along the berm, and would drop most of its sand load, before returning to the ocean.

As the sand slurry material would be deposited behind the berm, the sand would likely be spread using two bulldozers and one front-end loader, to direct the flow of the sand slurry and to form a gradual slope to the existing beach elevation. A crew of up to 10 people would be required for the beach replenishment work. The construction sequence is described in further detail below.

For each receiver site, berm construction would be adjusted from the design requirements during fill placement depending on actual field conditions. The measurements indicated herein for the width of the berms are the initial placement widths. The berms would be subject to the forces of the waves and weather once constructed and would erode and settle over time to a natural grade for the beach segment.

Construction Sequence and Duration

Implementation of various alternatives would likely occur on a 24-hour, 7-day a week (24/7) basis, by operating three crew shifts per day. Approximately two days would be required to set up the pipeline leading from the dredge or monobuoy to the shoreline. The contractor would typically assemble two sets of pipelines, to avoid delays associated with moving and setting up the pipelines, as each section of sand placement is completed. Sand discharge and grading would therefore be continuous, as long as the dredge is operating.

Daily average production rate of dredge material would likely range from 10,000 $yd^3$ to 15,000 $yd^3$. To complete the initial beach replenishment in the two segments, dredging, placing, and dispersing of sand would require up to about 169 days of construction (the estimated duration for replenishment activity in Encinitas is about 62 days; for Solana Beach it is estimated to require 107 days) (USACE 2013c).

Access and Staging

Under each nourishment alternative, existing public beach access points would be used for the construction equipment and crew at Moonlight State Beach in Encinitas. Beach access for the construction equipment and crew at Solana Beach would be provided at Fletcher Cove and potentially Cardiff State Beach parking lot north of the City of Solana Beach. Because the construction equipment would be used on a 24/7 basis, there would reportedly be only occasional need for a staging area. Should equipment need to be temporarily moved off the beach, it would be stored in parking lots at the access points. Any fueling or maintenance activities would occur at the staging areas, and the contractor would be required to provide and comply with a Spill Prevention, Control, and Containment (SPCC) plan for hazardous spill prevention and containment.

The dredge crew would park at the port of operations for the dredge, and the shore crew (about 10 people) would be required to park in available public parking lots or street parking near the beach access points.

Borrow Sites

Under each proposed alternative, implementation would involve use of the same borrow sites for sand. These borrow site have apparently all been previously mined for prior beach replenishment activities including the RBSP I, and are identified as MB-1, SO-5 and SO-6 (Figures 7, 8, 9, 10, 21, 22, and 23).

Borrow site SO-6 is located approximately 2,400 to 4,500 ft (05. to 0.9 mi) offshore from the beach fronting the San Elijo Lagoon at the southern end of Encinitas, and SO-5 is located approximately 2,500 to 3,800 ft (0.5 to 0.7 mi) offshore of the beach fronting the San Dieguito lagoon, south of Solana Beach. The SO-6 borrow site is located in the southwest corner of the Swami's State Marine Conservation Area. Borrow site MB-1 is located approximately 5,000 to 7,400 ft (1.0 to 1.4 mi) offshore from Mission Beach. Table 3 provides a summary of proposed activities in the borrow sites, including volumes of sand available and surface areas for each of these borrow sites. The amount of material that would be dredged from these borrow sites varies, both for initial nourishment and for periodic renourishment activities, with each proposed alternative.

Borrow sites SO-5 and SO-6 are identified as the primary sites and would be used first under any of the proposed action alternatives. As proposed, sand material from borrow site SO-5 would be used for Segment 2 (Solana Beach), and material from borrow site SO-6 would be used for Segment 1 (Encinitas), until SO-6 is exhausted at which time SO-5 would then provide material for both Encinitas and Solana Beach receiver sites. The dredge volumes necessary for various combinations of Segment 1 and Segment 2 alternatives, under the high sea level rise scenario, exceed the total combined volumes of material available at borrow sites SO-5 and SO-6. As such, if and when SO-5 and SO-6 are exhausted, borrow site MB-1 would then be used as the sand source to provide to the required volumes of sand for alternatives under the high sea level rise scenarios.

**Table 3**

| **Proposed offshore borrow sites summary** | **MB-1** | **SO-5** | **SO-6** |
|---|---|---|---|
| Volume available (approximate) | 5,800,000 $yd^3$ | 7,800,000 $yd^3$ | 1,300,000 $yd^3$ |
| Surface area affected | 107 ac | 124 ac | 44 ac |
| Depth of the dredge (MLLW) | 20 ft | 20 ft | 20 ft |
| Water depth of borrow site (MLLW) | -60 to -74 ft | -34 to -95 ft | -42 to -56 ft |

**Notch Fill**

Per the noted proposed alternatives, the Project would include extensive beach bluff notch fills, utilizing erodible concrete at the bases of bluffs backing the Study Area beaches (Figure 11). These notch fills could occur prior to or after the placement of beach sand fill. This bluff protection would be limited to filling notches or small sea caves at the bases of the bluffs. The goal would be to help stabilize the lower portion of the bluff, and the proposed work would not include seawalls or upper bluff stabilization measures.

Methods

Filling of small sea caves and notches with engineered concrete has reportedly been proven to be an effective method of protecting the bluff toe of slope, when properly maintained. As indicated in the 1994 Corps Reconnaissance Report, notch fills effectively improve overall sea-cliff stability, preventing significant further wave erosion of the cliff base and providing vertical support of any bluff overhang (USACE 1994). The 1994 Reconnaissance Report discussed fill designs using reinforced concrete and constructing a 5.9 in thick shotcrete wall applied directly to the bluff face, extending up to an elevation of about 15.4 ft MLLW.

Shotcrete walls have already been implemented in some portions of Reaches 3 and 4. Notch fills differ from seawalls in that they are not designed to protect the entire bluff face from constant wave attack, but only to stabilize the lower bluff, reduce erosion, and to help prevent bluff collapse during occasional periods of wave exposure. As such, they are generally smaller and less conspicuous than seawalls.

Types of Notch Fill Equipment

The main construction equipment required for filling notches includes sand excavating equipment, a trailer-mounted high-pressure pump and nozzle for concrete fill, a minimum of two concrete trucks, and powered hand tools.

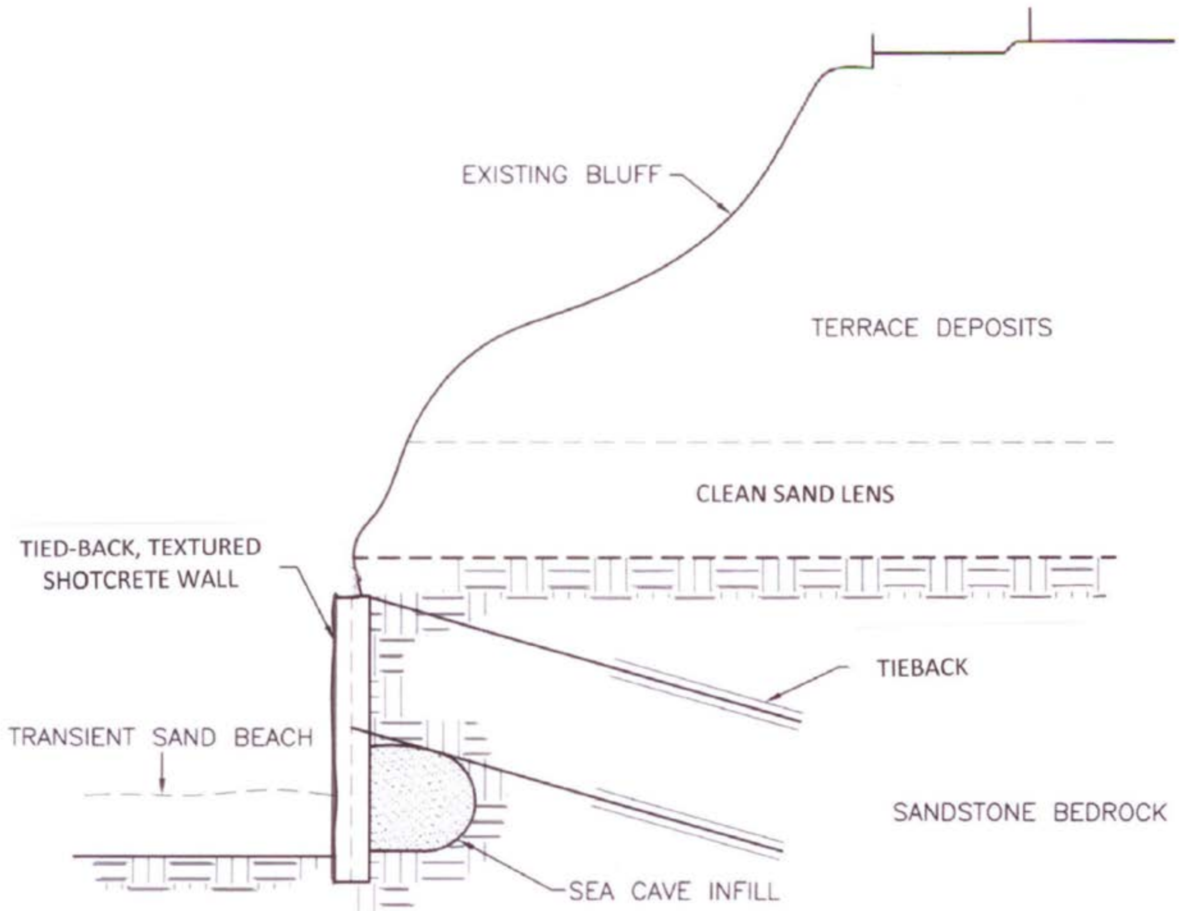


**Figure 11. Cross-section of typical notch fill**

Construction Sequence and Duration

If constructed prior to beachfill sand placement, notch fill activities would need to occur during low tides in most or all Project locations; it would be the contractor's option to schedule the notch fill work either before, during, or after the proposed beach fill. The area immediately in front of the notch would be cleared of sand by the contractor. If the work activities would occur post-beachfill, notch fill work would likely be able to proceed during any tide, due to the greater sand surface elevation above high tides that would be present. Should the contractor opt to do notch fill work before beachfill, smaller volumes of sand material would need to be removed, but the work would likely only be able to occur approximately 2 weeks per month and 6 hours per day, due to tides otherwise interrupting the activities. In either case, this work would likely be done concurrently, but not co-located, with beach replenishment.

Proposed notch fill activities in Segments 1 and 2 would require roughly 10 to 15 trucks of concrete per day. The total volume of concrete required to fill notches in the bluff base would be determined by the specific site conditions at the time of Project construction. However, based on an estimate of roughly 1.0 mi of bluff protection to be installed for the whole proposed Project, approximately 6,000 $yd^3$ of concrete would be needed, which would be provided by concrete trucks driven into the work area. Quick-drying erodible shotcrete gunite would be spread using a concrete pump and high-pressure hose, and approximately 100 ft horizontal length of bluff face per day would typically be covered, assuming about 8 $yd^3$ of shotcrete can be produced with each concrete truckload. At an estimated production rate of 100 ft per day, approximately 46 days would be required to complete the proposed notch fills.

Access and Staging

Proposed notch fill activities would involve about five people at the site at a time. Beach access for the construction equipment and crew in Segment 1 would be at Moonlight State Beach. Beach access for the construction equipment and crew in Segment 2 would be at Fletcher Cove. Should equipment need to be temporarily moved off the beach, it would be stored in parking lots at the access points. All fueling and equipment maintenance activities would occur at the staging areas, and the contractor would be required to prepare and implement a Spill Prevention, Control, and Containment plan for hazardous spill containment. The shore crew would park in available public parking lots or street parking near the beach access points.

Minimization and Mitigation

As described in the 2012 Draft EIS/EIR, mitigation would be implemented as part of the proposed Project for likely effects to biological resources from the burying or smothering of vegetated rock substrate communities within the nearshore environment. The predicted burying effects would result from implementation of the proposed beach sand replenishment in the Project's Solana Beach segment, with either direct or indirect burying of substrates. The proposed mitigation would consist of providing additional rocky substrate near shore (i.e., deposited rock) that would be expected to become passively vegetated over time. With the exception of the No Action Alternative, all the Project alternatives evaluated would result in impacts from burying by sand. Amongst the alternatives the degree or severity of the predicted impacts varied somewhat linearly with the width of beach that would be added. As such, for the predicted biological impacts the acreage of necessary mitigation area also varied amongst the alternatives (USACE 2013b).

Should spawning and/or grunion eggs be encountered during periods of construction of the proposed beach replenishment berms, a second perpendicular replenishment berm would be constructed to close off the cell ahead of the beach section where spawning occurred. That cell would then be filled, and the section of beach with grunion presence would be bypassed by Project activities. Filling of a new cell with sand would then commence down the coast with construction of a new transverse and berm. A boundary of at least 100 ft in both down-coast and up-coast directions around the grunion spawning area would be avoided for a minimum of one lunar month following the grunion spawning event.

Maintenance costs for Project-related sedimentation impacts to the lagoon mouths of Batiquitos, San Elijo, and San Dieguito lagoons are included in the Project costs as mitigation. See Appendix F - Cost Engineering in the 2012 Draft EIS/EIR for more detail. As proposed, the Corps would address dredging of these lagoon mouths through a contract (USACE 2013b).

The Corps has provided the following environmental commitments for the proposed Project (USACE 2012e):

**Table 4 – Project Environmental Commitments**

| Design Feature | Purpose | Timing | Implementation Responsibility |
|---|---|---|---|
| Construct "L"-shaped berms at all receiver sites | Anchor sand placement operations and reduce nearshore turbidity | During beach fill | Construction contractor |
| Maintenance for land-based vehicles would occur in staging area away from beach and sensitive areas | Minimize contamination from leaks, if any | During beach nourishment/ notch fill | Construction contractor |
| Water and Sediment Quality: If monitoring indicates that suspended particulate concentrations outside the zone of initial dilution exceeded permissible limits, dredge operations would be modified to reduce turbidity to permissible levels (see Table 5) | Avoid turbidity impacts to fish and aquatic species | During dredging operations and beach fill activities | (none stated) |
| Generate plan for hazardous spill prevention and containment | Ensure minimal contamination from fuel leaks, if any | During operation of equipment on the beach or in the water | Construction contractor |
| Design borrow sites to maintain adequate distance from artificial reefs, kelp, and other features | Avoid direct impacts to artificial reefs and kelp | Final engineering and during construction | Engineering contractor and construction contractor |

| Table 4 – Project Environmental Commitments (continued) | | | |
|---|---|---|---|
| **Design Feature** | **Purpose** | **Timing** | **Implementation Responsibility** |
| Construct second transverse berm to begin a new cell if grunion spawning or eggs are encountered during construction; establish buffer extending 100 ft shoreward of high tide line and 100 ft upcoast and downcoast (total 200 ft), until grunion eggs hatch (minimum of one lunar month) and surveys show no subsequent spawning (see Table 5) | Section of beach with grunion would be avoided and bypassed;<br>avoid grunion eggs and protect until hatched | If grunion spawning or eggs are encountered | Construction contractor, in coordination with Corps |
| No construction shall be performed within 1,400 ft of any sensitive bird species that have clear line of sight to the construction area during breeding and nesting season; no beach construction shall occur within 790 ft of any sensitive bird species regardless of visibility during the breeding and nesting season | Minimize impacts to sensitive wildlife from noise emissions | During beach nourishment and notch fill | Construction contractor |
| Post-project mitigation measure (if necessary):<br>Restore or create like habitat at a functional equivalent (assumed to be 2:1 for the purposes of evaluation) to be determined with the responsible resource agencies according to the long-term significant impacts, if any, to marine resources. | Mitigate for significant, long-term impacts, if any, to sensitive marine resources caused by sediment transport or placement | Subsequent to resource agency review of monitoring reports and determination that significant impact occurred | Qualified biologist |

Monitoring Program

The Corps would provide monitoring to record and report biological effects and to determine if any unexpected adverse effects occur.

Proposed construction activities would likely occur outside of the period of winter storms and during the period of April through September. To help ensure that no significant unpredicted biological impacts occur as a result of the proposed Project, some monitoring would occur during construction. Monitoring would include weekly grunion monitoring. Nearshore underwater surveys would be conducted prior to construction and after construction.

The Corps has provided the following monitoring commitments for the proposed Project (USACE 2012e):

**Table 5 – Monitoring Commitments**

| Design Feature | Purpose | Timing | Implementation Responsibility |
|---|---|---|---|
| Water and Sediment Quality: Monitor turbidity levels; monitor suspended particulate concentrations outside the zone of initial dilution to determine if permissible limits are exceeded | Avoid turbidity impacts to fish and aquatic species | During dredging operations and beach fill activities | (none stated) |
| Biology: Conduct nearshore underwater surveys. | Establish baseline data for comparison purposes and determine if any natural/biological resources/habitats have been adversely affected by the project | Prior to construction and after construction | Qualified biologist |
| Biology: Monitor weekly for grunion spawning in construction area; survey for spawning (see Table 4) | Avoid grunion eggs and protect until hatched | April through September and per the published annual schedule of Expected Grunion Runs (CDFW). | Qualified biologist |

Adaptive Management Program

Adaptive Management is a systematic approach for improving resource management by learning from post-project monitoring outcomes (City of Solana Beach 2013). Adaptive Management focuses on learning and adapting in order to create and maintain sustainable resource systems. The purpose of the proposed Adaptive Management Program is to the provide flexibility over the 50-year life of the Project to modify/adjust future renourishment events in terms of timing, location, volume, construction methods and other elements of the Project if post-construction monitoring data indicate that Project-related impacts are substantially different (e.g., greater or lesser) than those predicted by the Integrated Report. The key steps in the Adaptive Management process are the following: Design; Implement; Monitor; Evaluate; Assess; and Adjust.

Potential scenarios that could trigger an Adaptive Management action include no impacts, impacts are larger than expected, impacts are smaller than expected, higher erosion in the Project area, slower erosion in the project area, climate change and sea level rise beyond maximum predicted levels.

The key actions that the Corps would use in the implementation of the Adaptive Management Program include the following (USACE 2013c, City of Solana Beach 2013):

- Monitor biological resources and monitor beach widths;
- Coordinate with State and Federal regulatory agencies including California Coastal Commission (CCC), USFWS, and California Department of Fish and Wildlife (CDFW) to review monitoring data;
- Utilize the resulting data systematically for learning and improvement; and
- Adjust future renourishment events based on monitoring program findings.

## REVISED PROJECT DESCRIPTION

As noted above, in September and October 2013 a series of revised proposed Project descriptions were provided by the Corps and Cities for a Project alternative with smaller beach widths, lower sand nourishment volumes, and enhanced minimization and monitoring measures as compared to the 2012 Draft EIS/EIR tentative recommended Plan. The following is combined revision of these Project descriptions and represents the current proposed recommended Project:

The Corps and the Cities have revised the recommended Project to adopt a Locally Preferred Plan and include additional/revised survey, monitoring, and minimization provisions. The proposed Project is defined as the EN-1B and SB-1B beach nourishment alternatives described above, plus the following revisions (City of Solana Beach 2013; USACE 2013c, 2013d, 2013e, & 2013f):

Cardiff State Beach/Seaside Parking Lot Area: Project Staging, Access, and Booster Pump

The only circumstances in which the portion of Cardiff State Beach north of the Seaside parking lot would be used for proposed Project activities (such as for access or a staging area) is if sands dredged during restoration of San Elijo Lagoon would be used for the proposed Project for the initial beach fill or first renourishment event at Solana Beach/Segment 2 (USACE 2013d). This scenario is considered highly unlikely by the Corps given the timing of the proposed Project and a planned San Elijo restoration project, as well as the possible disparity in sand grain sizes between the lagoon and the beaches (USACE 2013d). While not thoroughly investigated as yet, the dredged sediments from the lagoon are considered unlikely to be compatible for beach replenishment (USACE 2013d). However, given the chance that the sediments could be utilized and that timing could work out, this option was retained in the Draft EIS/EIR. The Corps will further clarify this issue and provide for surveys, avoidance measures, and monitoring (in consultation with USFWS) should that remote possibility occur (USACE 2013d).

A booster pump on Cardiff State Beach was originally proposed as an option for the proposed Project in the 2012 Draft EIS/EIR. As currently proposed, any booster pump and associated piping utilized for the Project (if necessary, as noted in the 2012 Draft EIS/EIR regarding optional use of a cutterhead dredge) would be placed fully within the Solana Beach sand replenishment segment (Segment 2) and would not be located at the Seaside staging area or on Cardiff State Beach (USACE 2013d). The Corps will modify the Final EIS/EIR for the Project to incorporate standard avoidance measures for snowy plover if the Seaside parking lot area would be needed for staging or access (USACE 2013d). These avoidance measures would be coordinated with the USFWS (USACE 2013d).

The City of Solana Beach has indicated that the Fletcher Cove staging area identified in the 2012 Draft EIS/EIR is inadequate for allowing heavy construction equipment to stage and for providing access to the beach (due to potential damage from heavy construction vehicles to existing parking lot and beach access road pavement) (USACE 2013d), and the site may not have adequate space for staging (USACE 2013f). As such, the Seaside parking lot at the southern end of Cardiff State Beach may be required for Project purposes (USACE 2013d). The Corps proposes to retain the option to use the Seaside parking lot as a staging area for the initial fill and subsequent re-nourishment events in Segment 2 in Solana Beach (USACE 2013f). The Seaside staging area activities would be confined to the existing paved Seaside parking lot and dirt access route from the parking lot to the beach and then along the beach to the fill site (USACE 2013f). The parking lot would host a construction trailer, vehicle maintenance and refueling, pipeline storage, and parking for contractor and Corps employees working on Segment 2 beach fill segment (USACE 2013f). The staging area also would provide access to project equipment and crew for sand distribution (USACE 2013f).

Pursuant to proposed Project activities within the Seaside staging area the Corps would incorporate minimization of night lighting to the lowest illumination necessary for human safety that would be selectively placed, shielded, and directed away from natural habitats (USACE 2013f). Safety considerations reportedly do not allow the Corps to completely eliminate nighttime lighting from staging activities within the Seaside parking lot (USACE 2013f). The

Corps has proposed to require Project employees to strictly limit their activities, vehicles, equipment, and construction materials to the marked staging area within the parking lot (USACE 2013f). In consideration of potential effects to adjacent snowy plovers, the Corps has indicated that the level and extent of proposed Project activities within the Seaside staging area would be similar to current beach activities (USACE 2013f), albeit the parking lot is empty at night normally. Measures described below would be implemented in the event the Seaside staging area is utilized and monitoring indicates presence of snowy plovers at Cardiff State Beach (USACE 2013f).

The Corps would confer with the Service on specific avoidance measures and would share information (including relevant reports generated) during contract performance, as described below (USACE 2013f). Proposed avoidance and minimization measures would consist of the following (USACE 2013f):

- The Project impact limits, including the access route and paved staging area, would be temporarily marked with flagging or orange fencing. The final construction plans, including photographs of the marked project impact limits, would be provided to the Service prior to mobilization for their review. Temporary markers would be removed upon Project completion.
- A Project biologist that is appropriately qualified to monitor snowy plovers would be responsible for overseeing compliance with protective measures for the plover. The Project biologist's name, address, telephone number, and work schedule on the Project would be submitted to the Service prior to initiating Project impacts. The Project biologist would perform the following duties:
  - Monitor compliance with all avoidance and minimization measures.
  - Oversee installation of the temporary marking of Project limits.
  - Train all contractors and construction personnel on the biological resources associated with the Project. At a minimum, training would include:
    - the purpose for resource protection;
    - a description of the snowy plover and their habitat;
    - measures that would be implemented during Project construction to avoid impacts to the snowy plovers, including strictly limiting activities, vehicles, equipment, and construction materials to the marked Project footprint;
    - the protocol to resolve conflicts that may arise; and
    - the general provisions of the Endangered Species Act, the need to adhere to the provisions of the Act, and the penalties associated with violating the Act.
  - Halt work, if necessary, for any Project activities not in compliance with avoidance and minimization measures. The Project biologist would report any non-compliance issues to the Corps within 24 hours of its occurrence. The Corps would confer with the Service to ensure the proper implementation of species and habitat protection measures.
  - Submit a report to the Corps within 48 hours if an impact occurs outside of the approved Project limits. Copies would be forwarded to the Service as soon as possible.

- Submit weekly compliance reports, with photographs of impact areas, to the Corps to document whether the authorized impacts were exceeded and compliance with all avoidance and minimization measures was maintained. Copies of the compliance reports would be forwarded to the Service.
  - Submit a biological monitoring report to the Corps after Project completion that includes: as-built construction drawings with an overlay of areas that were affected and other relevant information documenting whether impacts exceeded authorized limits and general compliance with the avoidance and minimization measures was achieved.
- At all times while on Cardiff State Beach, a qualified snowy plover monitor would walk ahead of the vehicle(s) and equipment to assure that all snowy plovers are out of harm's way before the vehicle(s) or equipment can proceed.
- The number of vehicle trips on Cardiff State Beach would be minimized to the extent practicable during equipment and dredge pipeline mobilization, inspection and maintenance, and demobilization.
- Vehicle use on approved beach areas would be authorized only for activities associated with the various discharge operations.

Beach Nourishment (Fill) Segments

The Corps proposes to monitor the beach fill/nourishment Segments prior to Project mobilization (initiation) to determine if snowy plovers are present (USACE 2013f). If snowy plovers are not present, then no further measures would be taken. If snowy plovers are present, the same avoidance and minimization measures described above for the Seaside staging area would be applied to those beach segments with snowy plovers (USACE 2013f).

General Measures

The following general measures would be added Project to aid in avoiding impacts to snowy plovers, but would also reduce other potential biological impacts as well (USACE 2013f). These measures would be implemented independent of possible affects to snowy plovers; i.e., they would be implemented even if the Project does not utilize the Seaside staging area, and/or if no snowy plovers occur on the sand fill/nourishment Segments during any of the nourishment events (USACE 2013f):

- If night work is necessary, night lighting would only be used in the surf fence construction/ maintenance zone and would be of the lowest illumination necessary for human safety, selectively placed, shielded, and directed away from natural habitats.
- Employees would strictly limit their activities, vehicles, equipment, and construction materials to the marked impact limits.
- The Project site would be kept as clean of debris as possible. All food-related trash items would be enclosed in sealed containers and regularly removed from the site
- Pets of project personnel would not be allowed on the Project site.

- All equipment maintenance, staging, and dispensing of fuel, oil, coolant, or any other such activities would occur only in designated areas outside of waters of the U.S. within the fenced project impact limits. These designated areas, which would be shown on construction plans, would be located in previously compacted and disturbed areas to the maximum extent practicable in such a manner as to prevent any runoff from entering waters of the U.S. Contractor equipment would be checked for leaks prior to operation and repaired as necessary to avoid leaks on the Project site.

Pre-Construction, Construction, Post-Construction Monitoring Program

Implementation of the proposed Project would include a comprehensive monitoring program including the following elements (City of Solana Beach 2013):

- Turbidity and Water Quality Monitoring Plan
- Habitat Monitoring Plan
- Habitat Mitigation and Monitoring Plan - Pre- and Post-Construction Monitoring Program
- Borrow Site Monitoring Plan
- Grunion Monitoring and Avoidance Plan
- Cultural Resources Surveys and Monitoring Plan
- Snowy Plover Avoidance Plan
- Noise Monitoring Plan
- Beach Profile Monitoring Plan
- Surfing Monitoring Plan
- Stormwater Pollution Prevention Plan
- Oil Spill Prevention Plan
- Public Safety Plan
- Air Quality Monitoring Plan

Revised programs relevant to the FWCA are described in greater detail below (City of Solana Beach 2013):

Turbidity and Water Quality Monitoring Plan

The primary goal of the proposed Project is to keep the dredged sand on the beach. The proposed Project would accomplish sand retention/turbidity reduction by building sand berms parallel to shore that would allow the water to drain and leave the maximum amount of dredged material behind. This construction method would also reduce turbidity relative to standard discharge methods.

The Turbidity and Water Quality Monitoring Plan would include weekly monitoring at the dredge and beach receiver sites for salinity, pH, temperature, dissolved oxygen, and turbidity/light transmissivity; monthly water samples would be taken and analyzed for total suspended solids. Baseline conditions would be established by conducting monitoring events the week before construction starts and the week after construction ends.

Habitat Mitigation and Monitoring Plan - Pre- and Post-Construction Monitoring Program

Proposed Project sand fill alternatives were chosen that limit fill volume while achieving project objectives (USACE 2013c). A proposed beach fill width for Segment 1/Encinitas (alternative EN-1B) was selected that would avoid modeled sand burial of rocky and surf grass natural communities while still achieving Project objectives. Within Segment 2/Solana Beach a beach width alternative (SB-1B) was selected that would result in no modeled burial of surf grass natural community areas, but would result in some burial of reef resources. The replenishment sand fill footprints for both segments would avoid any direct burial of sensitive natural communities; all estimated impacts are the result of modeled indirect burial. As modeled, indirect covering of vegetated rocky substrate areas within the nearshore could result from Project implementation at the Solana Beach receiver site (Segment 2); mitigation is proposed for these predicted impacts consisting of creation of new rocky substrate in the nearshore that is expected to become vegetated passively over time (USACE 2013c).

In addition, Project monitoring to record effects from sand replenishment is proposed, including monitoring to determine whether any unexpected adverse effects occur. Sand introduced into the littoral system by the proposed Project is modeled to potentially indirectly impact up to 6.8 ac of marine biological resources (benthic natural communities) as a result of burial or degradation of sensitive natural communities/resources, under the low sea level rise Project alternative scenario (SB-1B). Mitigation in the form of creation of 13.6-ac of artificial reef would be required, as proposed. The requirement to construct 13.6 ac as suitable reef natural community was determined by the Corps in coordination with state and federal resource agencies using a Functional Assessment.

Per the Southern California Eelgrass Mitigation Policy (SCEMP; NMFS 1991) and the general approach for assessing sand replenishment impacts, the Project area and reference site(s) would be surveyed the year prior to construction (in spring and fall) and annually for two years following construction (again in spring and fall). As proposed, any Project-related losses of nearshore rocky reef or surf grass natural communities based on Year 2 monitoring results would require mitigation. Given the high degree of sediment transport that naturally occurs in the Project area nearshore zone, sampling at reference sites would provide a level of accounting for natural variability, and any change in the sediment cover would be put into a regional/local perspective. If natural variation was not measured, any increase in sediment cover in the Project area would likely be considered related to the Project. For example, the use of reference sites would be helpful if a reduction in surf grass occurs in the Project site that was the result of a natural decline (as measured at the reference area) and not an impact of the Project.

Prior to the implementation of construction of the proposed Project, the extent of reef and natural communities throughout and adjacent to the entire predicted sand replenishment equilibrium footprint would be mapped using remote sensing techniques such as multi-spectral aerial photography and/or interferometric side scan sonar. Multi-spectral aerial photography utilizes an airplane to capture multispectral reflectance characteristics that allow the identification and separation of various bottom substrates and vegetation, while interferometric side scan sonar is a type of technology used to interpret seabed features, material, and textures from acoustic backscatter response intensity as well as bathymetry. When the two techniques are combined, the resulting data sets created include bathymetry, bottom substrate type, and vegetation type information. The proposed mapping reportedly provides the most cost-effective approach for surveying the relatively large Project Study Area (USACE 2013c). This pre-construction monitoring would be utilized to establish baseline conditions to compare post-construction conditions against. All data would be geo-rectified, and natural community types would be digitized as a theme over an aerial image to calculate the coverage of various community types and show their distribution. Diver surveys would also be conducted to ground truth remote sensing data. The proposed diver surveys would be at a level appropriate to ensure that data were representative (e.g., 20 random locations for each substrate or natural community type). The proposed mapping would be repeated during post-construction years one and two in order to determine what long-term impacts have resulted from the Project that require mitigation. Based on the data collected, a decision by the Corps would be made as to whether, and to what extent, mitigation is necessary.

The final monitoring plan would be prepared during the pre-construction engineering design phase of the Project in consultation with resource and regulatory agencies. Impacts from the proposed reef construction (mitigation) would be temporary and short-term and would likely be completed in 28 days. The height of the constructed reef would vary, but is expected to be approximately 3 ft in height, on average. The proposed mitigation reef would be constructed offshore in waters of -30 to -40 ft MLLW. The reef would be constructed in a fashion similar to the Southern California Edison (SCE) Wheeler North Reef that was developed as mitigation for the impacts of the San Onofre Nuclear Generating Station. The described "push off" method utilized for fabrication of the Wheeler North Reef proved to be more than adequate in building the modules to meet design specifications for that project. For the subject Project, a flat-deck barge would be tethered to a derrick barge equipped with a GPS navigation system to guide the barges to the coordinates of the mitigation site. A front-end track loader would place quarry rock material at the edge of the flat-deck barge, with a calculated distance of separation between the boulders. Once in position, the front-end track loader operator would push the boulders into the water where they would sink into position on the surface of the ocean floor.

Grunion Monitoring and Avoidance Plan

The proposed Project would monitor and avoid potential impacts to grunion in the entire construction area, including any beach activity areas beyond the sand placement footprint (City of Solana Beach 2013). Most Project-related equipment would be located above the mean high tide line during Project activities. Pre-construction grunion surveys would be performed prior to all predicted grunion runs in construction years, including surveys conducted to assess the potential for suitable grunion spawning habitat (i.e., any beaches with a dry beach at spring high tide levels) within all Project activity footprints occurring in beach areas, including replenishment sand placement areas, beach access routes, construction staging areas, pipeline routes, and other equipment placements or construction activity, in order to minimize potential effects on grunion. Project staff would also review available literature to address flexibility over the 50-year life of the Project.

The season for grunion is identified as March 15 to September 1. Proposed beach fill sites would be surveyed for suitable grunion spawning habitat by March 1 to allow for agency coordination of results. Should Project beach fill activities occur during the grunion spawning season, those suitable habitats would be monitored during predicted runs for grunion spawning in construction areas. If grunion spawning is detected within beach fill activity areas, where practicable the Project would establish a Project activity buffer extending 100 ft upcoast and downcoast (total 200 ft) of the spawning area, until grunion eggs hatch (minimum of one lunar month) and surveys show no subsequent spawning.

Snowy Plover Avoidance Plan

Prior to each proposed sand renourishment event, all beach areas and environs to be used for construction activity shall be surveyed for the presence/absence of western snowy plovers (USACE 2013d). The proposed Project would avoid to the maximum extent feasible those areas occupied by snowy plovers. The Corps considers it likely that, at the time of proposed renourishment, the receiver beaches would not be suitable habitat for snowy plovers (City of Solana Beach 2013). However, absence of snowy plovers would be confirmed prior to any on-beach Project construction activities (including access or staging) for each renourishment event (USACE 2013c). The Corps would consult with the Service if adverse effects to plovers would likely be unavoidable (USACE 2013c & 2013d).

## DESCRIPTION OF BIOLOGICAL RESOURCES

### General Description

The proposed beach replenishment and notch fill footprint areas contain stretches of sand and cobble beaches with high and low profile reefs immediately offshore. Extensive marine resources exist directly offshore of some of the proposed Project sand replenishment receiver sites (Cumberland et al. 1997). The shoreline and reefs are home to or are utilized by a variety of macroalgae, invertebrate, and vertebrate resources. The reefs in northern San Diego County are important for commercial fisheries, especially lobster, crab, and urchin. Recreational activities dependent on these biological resources include diving, sport fishing, tide pooling, bird watching, and whale watching.

The notches proposed to be filled generally consist of unvegetated bluff faces, while the bluffs above the notch fill areas contain mostly non-native vegetation associated with bluff- top development interspersed with remnants of native vegetation.

San Elijo, Batiquitos, and San Dieguito lagoons are within the action area. These lagoons are integral components of the coastal ecosystem within the region, and contain many important biological resources. Batiquitos and San Dieguito lagoons have been subject to restoration projects which partially restored natural tidal flows and improved lagoon ecosystem functioning.

The three proposed sand borrow sites consist of open ocean with a sandy substrate at water depths of about -34 to -95 ft MLLW.

**Marine Environment**

The characterization herein of marine resources in the action area was based on the 2005 Draft EIS/EIR, the 2012 Draft EIS/EIR, resource mapping and assessments conducted for the RBSP (SANDAG 2000; MEC 2000; AMEC 2002a, b), marine resource evaluations and mapping by the U.S. Navy (1997a, b), kelp mapping by MBC (2001), and the Service's knowledge of the resources.

Marine Natural Communities

Three main types of vegetated natural communities typically occur in association with shoreline and reefs of the action area: surf grass beds, nearshore kelp and macroalgae, and offshore kelp beds. Bedrock intertidal reefs comprise 14 percent of the coastline of San Diego County, with the remaining 86 percent consisting of sand, gravel, or cobble beaches (Engle 2005); they are important features of portions of the Study Area. Most rocky intertidal shores in the county occur on the Point Loma and La Jolla peninsulas, with relatively few isolated reefs farther north (which includes the Study Area) (Engle 2005). Intertidal reefs typically contain diverse natural communities of plants and animals. Kelp forms some of the dominant nearshore and offshore natural communities in southern California and provides habitats for hundreds of species of fish, invertebrates, and algae (DeMartini and Roberts 1990).

Surf grass (*Phyllospadix* spp.) and kelp (e.g., *Macrocystis* sp.) beds are particularly important marine natural communities in the Project region, because they provide shelter and cover for many fishes and invertebrates, attachment sites for a variety of sessile invertebrates, and form the basis of many marine food chains. Surf grass and kelp beds occur in limited areas along the southern California coast, usually on hard bottom substrate, compared to much more common soft-bottom natural communities.

<u>Surf Grass Beds</u>
Surf grass (*Phyllospadix torreyi* and *P. scouleri*.) beds provide are highly productive and important habitats for a variety of algae, invertebrates, and fish (Stewart and Myers 1980). About 34 species of algae and 27 species of invertebrates have been associated with surf grass on San Diego County beaches (Stewart and Myers 1980). One notable invertebrate is the California spiny lobster (*Panuliris interruptus*), which uses surf grass as nursery habitat (Williams 1995).

Surf grass in the action area typically occurs in submerged active portions of the beach profile (Figures 12 through 19). Surf grass is considered stress-tolerant and morphologically adapted to withstand a moderate amount of shifting sand movement (O'Brien and Littler 1977; Taylor and Littler 1982; Littler et al. 1983), though the roots and rhizomes of *Phyllospadix* spp. attach to rocks are that are normally exposed (unburied) (Craig et al. 2008). Recovery can take several years if the rhizome mat is removed associated with disturbance (Stewart 1989; Turner 1985).

Surf grasses are likely to be adversely affected by actions that place sand either directly or indirectly onto surf grass beds (Craig et al. 2008). A laboratory study of *P. scouoleri* found that short term sand burial may result in shoot mortality, decreased shoot counts, and reduced growth of surf grass (Craig et al. 2008). The study found that shoot density decreased compared to controls for a sand burial depth of 0.8 ft, but not shallower burial depths, and mean shoot growth rate decreased in all sand burial treatments (Craig et al. 2008). Sand burial that reduces shoot density of surf grasses may influence population stability for several years (Craig et al. 2008).

<u>Nearshore Kelp and Macroalgae</u>

Feather boa kelp (*Egregia menziesii*) is a conspicuous and common annual species that ranges from low intertidal to shallow subtidal depths of the action area (Aleem 1973; Black 1974; Gunnill 1980) (Figures 12 through 19). It is an opportunistic colonizer characterized by high recruitment in spring and rapid growth (Black 1974). Feather boa kelp occurs on exposed hard substrates; impacts to feather boa kelp from sand burial would be expected to last as long as a reef was covered by sand through the following summer, assuming the holdfasts for the kelp were not killed (SANDAG 2012a). The plant sea palm (*Eisenia arborea*) may co-occur with feather boa kelp at subtidal depths. The shorter height of the sea palm, and occurrence on reefs without interspersed sand patches and/or high-relief (greater than 3 ft), suggests they may be less tolerant of sand sedimentation than surf grass and feather boa kelp (Ogden 1999). A variety of red (*Corallina* spp., *Erythroglossum californicum, Gigartina* spp., *Gracillari*a spp., *Jania* spp., *Lithothrix* spp. , *Rhodoymenia* spp.) and brown macroalgae (*Cystoseira osmundacea*, *Zonaria farlowi*) may co-occur with feather boa kelp and/or sea palms on nearshore reefs (MEC 1995; U.S. Navy 1995). Lobsters, marine snails, sea stars, sea urchins, and a variety of fish commonly occur within nearshore kelp and macroalgae in the action area.

<u>Offshore Kelp Beds</u>

Southern California kelp forests and beds are dominated by giant kelp (*Macrocystis pyrifera*), which grows at depths between -20 and -118 ft MLLW (Aleem 1973; Leet et al. 1992). Giant kelp, and its associated hard-bottom substrates, supports a diverse community of algae, invertebrates, and fish. Lobsters, marine snails, sea stars, sea urchins, and a variety of fish commonly occur within giant kelp beds. In addition, kelp beds provide or support substantial food resources for marine birds and mammals, including detritus that is distributed outside of kelp beds.

The density and distribution of the kelp canopy exhibits seasonal and interannual variability related to a variety of physical and chemical factors (e.g., nutrient concentrations, sedimentation, temperature, turbidity).

Southern California kelp beds generally deteriorate to some degree during summer and fall when temperatures are higher and water nutrient concentrations are lower (Foster and Schiel 1985; Tegner and Dayton 1987). Kelp beds also may show dramatic die-back during El Niño conditions, followed by recovery during La Niña conditions. Giant kelp is very sensitive to sand scour and burial and is one of the first species eliminated under wave or sand scour stress (Dayton et al. 1984; Foster and Schiel 1985). Sediment can affect giant kelp forests by scouring or burying established populations or by affecting the survivorship of its microscopic life history stages (SAIC 2007). Compared to seagrasses, kelp usually displays less tolerance to sand burial before critical thresholds (e.g., growth, mortality, etc.) are reached (SAIC 2007).

Marine Biota

Plankton

Plankton includes a diverse group of microscopic plants (phytoplankton), larval fish and eggs (ichthyoplankton), and other animals (zooplankton); they are the primary producers in the marine food web.

Zooplankton that would be expected within the action area include microscopic animals (e.g., radiolarians, ciliates, foraminifera), larval forms of macroinvertebrates (e.g., crabs, lobster, shrimps, mollusks), and animals that live within the plankton community (e.g., arrow worms, copepods, cladocerans, ctenophores, salps). Larger zooplankton (greater than 1.4 in) serve as a major food source for fish.

Ichthyoplankton includes larvae and eggs of resident fish that spawn near shore, migratory species, and subarctic and temperate/tropical species whose spawning ranges extend into the area (Loeb et al. 1983).

Invertebrates

Common invertebrates observed on San Diego County sandy beaches include beach hoppers (*Orchestodea* spp.), sand crabs (*Emerita analoga*), bean clams (*Donax gouldii*), olive snails (*Olivella biplicata*), and polychaete worms (e.g., *Euzonus* spp., *Lumbrineris* spp., *Nephtys californiensis*, *Scololepis* spp., *Scoloplos* spp.) (Straughan 1981). In a 12-year study of sandy beaches from Estero Bay (San Luis Obisbo County, California) to Coronado (San Diego County, California), Straughan (1981) found that higher abundance and species diversity were found on long, gently sloping, relatively fine-grained beaches with no periodically-exposed beach rock. Beaches that were short and steep, coarse-grained, and/or experienced more erosion had fewer organisms, and, in some cases, only sand crabs were detected.

The beaches within the Study Area vary between having no detected marine invertebrates, limited marine invertebrates (sand crabs, worms), or more abundant marine invertebrates (sand crabs, worms, and bean clams or amphipod crustaceans) (MEC 2000). None of the beaches within the Study Area that were surveyed in 1999 had a particularly diverse invertebrate fauna (i.e., with a variety of species of worms, mollusks, and crustaceans) prior to beach sand placement that occurred in 2001.

Pismo clams (*Tivela stultorum*), which live in sandy areas from the intertidal zone to approximately -80 ft MLLW, were not observed during surveys of beaches within the Study Area prior to sand placement in 2001 (Leet et al. 1992; MEC 2000).

Low-relief reefs within the Study Area ranged from being essentially devoid of detected animals to supporting low numbers of hermit crabs, aggregating sea anemones, chitons, and in some cases, newly recruited mussels (MEC 2000). Several of these species are known to be sand tolerant and/or to opportunistically settle newly exposed substrate (Taylor and Littler 1982; Littler et al. 1983). Chitons (e.g., *Mopalia muscosa*) can withstand sand burial over relatively long periods (several weeks). The aggregating sea anemone (*Anthopleura elegantissima*) can withstand sand burial for periods greater than 3 months and has the ability to quickly reoccupy exposed space through asexual reproduction. Opportunistic species such as the sand castle worm (*Phragmatopoma californica*) and mussels (*Mytilus* spp.) are rapid colonizers of bare substrate. Mobile species such as turban snails (*Tegula funebralis*) and hermit crabs (*Pagurus* spp.) may migrate to and from reef areas as they become exposed from or covered with sand.

Invertebrates on persistent, high-relief reefs exhibit a distinct zonation with tidal level in the region (Reish 1972). The upper intertidal or splash zone is characterized by acorn barnacles (*Cthamalus* spp.), limpets (*Collisella* spp., *Lottia* spp.), and periwinkles (*Littorina* spp.). California mussel (*Mytilus californianus*), gooseneck barnacle, aggregating sea anemones, chitons, hermit crabs, and a variety of marine snails (e.g., *Acanthina* spp., *Lithopoma undulosa*, *Kelletia kelletia*, *Ocenebra* spp., *Tegula* spp.) are commonly observed in the middle intertidal zone of rocky shores of the area (Stewart 1982; MEC 2000). The low to minus intertidal zone of persistent reefs are characterized by a greater diversity of animals, including aggregating and green sea anemones, purple sea urchin (*Strongylocentrotus purpuratus*), California sea hare (*Aplysia californica*), crabs (*Heterocrypta occidentalis, Portunis xantusii, Randallia ornata*), marine snails, brittlestars (e.g., *Ophithrix* spp.), and starfish (*Asterina miniata*, *Pisaster* spp.). Subtidal reefs support a variety of invertebrates including: ectoproct (*Bryozoan*), sea fan (*Muricea californica*), California spiny lobster, nudibranch (*Dendrodoris albopuncata*), seastar (*Pisaster gigantus*), tube anemone (*Pachycerianthus fimbriatus*), and urchin (*Strongylocentrotus franciscanus*).

In the absence of survey information for sites SO-6 and MB-1, we expect that the invertebrates observed at sites SO-5 and SO-7 are representative of what would likely also be found at SO-6 and MB-1. Invertebrates observed by divers and collected by otter trawl in 1999 at sand borrow sites used for the 2001 RBSP (SO-5, SO-7; located offshore of Batiquitos Lagoon and Del Mar at depths of -59 to -62 ft MLLW) included tube worms (*Diopatra ornata*), crabs, shrimp (*Crangon nigromaculata*), marine snails (*Kelletia kelletia*, *Nassarius perpinguis*), sand dollar (*Dendraster* sp.), sea star (*Astropecten verrilli*), and white urchin (*Lytechinus pictus*) (MEC 2000). Limited hard substrate was observed at borrow site SO-7, which had red algae turf and a few tunicates and sea anemones.

<u>Fish</u>

The California grunion (*Leuresthes tenuis*) is a regulated species that uses sandy beaches for spawning. The species ranges from south of Point Conception, California, to Magdalena Bay, Baja California Sur, in nearshore waters from the surf to a depth of approximately -60 ft MLLW (Miller and Lea 1972). To spawn, grunion travel from their nearshore water use-areas to specific sandy beaches, just after certain full and new moons (which correlate with the highest tides of the month). Spawning takes place during nighttime high tides between March and August. Eggs and sperm are deposited into the sand of the upper intertidal and then hatch 10 days later following exposure during the next high tide (Cross and Allen 1993; Middaugh et al. 1983). In her surveys of southern California sandy beaches, Straughan (1981) reported that grunion were found on relatively longer and gently sloping beaches with moderately fine grain size.

Beach sites in north Leucadia and at Moonlight State Beach (in Segment 1) are considered to have periodically suitable spawning habitat for grunion (MEC 2000). Grunion eggs were detected on Moonlight State Beach in 2004 and Leucadia in 2005 (SAIC 2006). Other RBSP receiver sites at Leucadia, Cardiff, and Solana Beach were considered to have unsuitable habitat for grunion spawning in 2000, either because they lacked sufficient sand or were too narrow (i.e., wave run-up covered the beach over higher tide cycles) (MEC 2000). Surveys in 2001 confirmed the presence of potentially suitable habitat for grunion at RBSP Batiquitos and Leucadia receiver sites; surveys in 2001 indicated habitat was then unsuitable for spawning at Moonlight State Beach, Cardiff, and Solana Beach (AMEC 2002a). Southern Cardiff State Beach (Seaside Beach) reportedly had seasonal grunion suitability in 2005 (SAIC 2006). The spawning habitat potential/suitability at north Leucadia was confirmed during the 2001 RBSP sand placement, when the footprint of that RBSP receiver site was altered to avoid impacts to grunion that had spawned on the beach.

Fish commonly found associated with sandy subtidal communities off San Diego County beaches include barred surfperch (*Amphistichus argenteus*), California corbina (*Menticirrhus undulatus*), California halibut (*Paralichthys californicus*), queenfish, round stingray (*Urolophus halleri*), shovelnose guitarfish (*Rhinobatos productus*), spotfin croaker (*Roncador stearnsii*), and white croaker (*Genyonemus lineatus* ) (USACE 1994; U.S. Navy 1997a). Speckled sanddabs (*Citharicthys stigmaeus*) and bat rays (*Myliobatis californica*) also have been observed in these waters at depths of -10 to -33 ft MLLW. Schooling water column fish, abundant just beyond the surf zone, include northern anchovy (*Engraulis mordax*), jack mackerel (*Trachurus symmetricus*), Pacific bonito (*Sarda chiliensis*), and topsmelt (*Atherinops affinis*) (Cross and Allen 1993; Garfield 1994).

Flatfish, including speckled sanddab, hornyhead turbot (*Pleuronichthys verticalis*), and fantail sole (*Xystreurys liolepis*), generally are more common at deeper inner shelf depths ranging from about -30 to -80 ft MLLW (Allen 1982; Love et al. 1986). Twenty species of fish were observed by divers and collected by otter trawl at sites SO-5 and SO-7 (MEC 2000); these sites are expected to be similar to sites SO-6 and MB-1. The most abundant fish included barred sand bass (*Paralabrax nebulifer*), California halibut, California lizardfish (*Synodus lucioceps*), English sole (*Pleuronichthys vetulus*), horneyhead turbot, queenfish, speckled sanddab, and white croaker.

Fish abundance on reefs is related to available vegetative cover, substrate complexity, and relief; however, increases in relief height greater than 3 ft reportedly have minimal effects on observed reef fish abundance (Cross and Allen 1993; Patton et al. 1985). Fish commonly found in surf grass communities off San Diego include barred sand bass, black perch (*Embiotoca jacksoni*), blacksmith (*Chromis punctipinnis*), garibaldi (*Hypsypops rubicundus*), opaleye (*Girella nigricans*), señorita (*Oxyjulis californica*), and topsmelt (DeMartini 1981; MEC 1995).

Fish associated with nearshore reef communities within the action area include kelp bass (*Paralabrax clathratus*) and barred sand bass; black, shiner, walleye, and dwarf surfperches (Embiotocidae); señorita; California sheephead (*Semicossyphus pulcher*); garibaldi; opaleye; white seabass (*Atractoscion nobilis*); sargo (*Anisotremus davidsoni*); salema (*Xenistius californiensis*); giant kelpfish (*Heterostichus rostratus*); painted greenlings (*Oxylebius pictus*); and halfmoon (*Medialuna californiensis*). Transient fish such as jack mackerel, Pacific bonito, Pacific barracuda (*Sphyraena argentea*), and silversides also commonly occur over reefs with kelp (Feder et al. 1974; Ebeling et al. 1980; Foster and Schiel 1985).

<u>Marine-Associated Birds</u>
Seabirds and shorebirds are very commonly observed along and near southern California beaches. Seabirds such as cormorants, pelicans, and terns forage for fish offshore. Gulls may feed on fish and invertebrates and are notable scavengers. Shorebirds probe for marine invertebrates in the damp sands of the intertidal zone and may feed on small fish and crustaceans in tide pools. Approximately 50 species of marine-associated birds have been reported to occur along the shoreline and adjacent nearshore ocean between Carlsbad and Del Mar (MEC 2000). A total of 12 species of birds was observed along the shoreline during the September 2002 reconnaissance survey.

The most commonly observed seabirds within the action area during the September 2002 survey included Heerman’s gull (*Larus heermanni*), ringed-billed gull (*Larus delawarensis*), and western gull (*Larus occidentalis*). Other commonly observed seabird species in the ocean waters offshore of northern San Diego County include the surf scoter (*Melinita perspicillata*); western grebe (*Aecmophorus occidentalis*); and double-crested (*Phalacrocorax auritus*), Brandt's (*P. pencillatus*), and pelagic (*P. pelagicus*) cormorants. Terns, including the elegant tern (*S. elegans*), Caspian tern (*S. caspia*), California least tern *(Sternula (Sterna) antillarum browni)*, and Forster's tern (*S. forsteri*), often forage in nearshore waters of the action area.

The most commonly observed shorebirds during the September 2002 survey were black turnstone (*Arenaria melanocephala*), marbled godwit (*Limosa fedoa*), sanderling (*Calidris alba*), whimbrel (*Numenius phaeopus*), and willet (*Caloptrophorus semipalmatus*). Marsh birds, including great blue heron (*Ardea herodias*), great egret (*Casmerodius albus*), and black-crowned night heron (*Nycticorax nycticorax*), were observed foraging on exposed reefs south of Swami’s during the May 2002 surf grass mapping survey. Other commonly observed and/or expected shorebirds in the action area include killdeer (*Charadrius vociferus*), black-bellied plover (*Pluvialis squatarola),* wandering tattler (*Heteroscelus incanus*), and spotted sandpiper (*Actitis macularia*).

> <u>Sensitive Marine-Associated Birds</u>: Two listed marine-associated bird species are found within the action area: the state and Federally-endangered California least tern and the Federally-threatened western snowy plover (*Charadrius alexandrinus nivosus*).
>
> **California least tern –** the least tern is known to forage within the action area (Fancher 1992; Powell and Collier 2000; R. Patton, consulting biologist, pers. comm. 2013). Least terns currently nest at Batiquitos and San Dieguito lagoons and Mariner’s Point (Mission

Bay) (Figures 20, 22, and 23). Nesting formerly occurred in San Elijo Lagoon until 2005 (Figure 21).

Between 1 to 15 pairs nested between 1998-2004 within San Elijo Lagoon (Patton 2002; CDFG 2004), with no known breeding activity detected at this location from 2005 to present (CDFG 2008; CDFG 2012). Batiquitos Lagoon has a relatively large least tern subpopulation with 205 nesting pairs observed in 2001, 416 in 2004, approximately 579 to 619 pairs in 2009, and about 519 to 522 pairs in 2011 (CDFG 2004; Squires and Wolf 2009; CDFG 2012). Mariner's Point in Mission Bay was in the past one of the more successful least tern breeding areas in California, with between 220 and 562 breeding pairs between 1998 and 2002 (CDFG 2003), and about 75 to 143 breeding pairs between 2007 and 2011 (CDFG 2008; CDFG 2012).

Least terns nested in 2013 in San Dieguito Lagoon in nest sites created in the lagoon around 2008 (Friends of the San Dieguito River Valley 2013) (Figure 22). San Dieguito Lagoon had five least tern nests recorded for two of the nesting sites (sites "NS-11" and "NS-12") in 2013, with two nests successfully producing chicks (Friends of San Dieguito River Valley 2013). These relatively new nesting sites are expected to be substantially more productive for least terns during the 50-year Project life.

Least terns sight-feed for small fish from the air within nearshore ocean waters and lagoons and dive into the water to capture prey items. For coastal least terns, preference for nearshore foraging habitats is apparently related to prey species selection, as northern anchovy, topsmelt, and jacksmelt (*Atherinopsis californiensis*) (all marine species) comprised 92 percent of captured fish considered to be suitable prey in one study (Atwood and Kelly 1984).

During the nesting season, least terns usually forage within 2 mi (what we consider the primary foraging range) of their colony (USFWS 2006); however, they have been observed foraging up to 5 mi from their colony (secondary foraging range). Atwood and Minsky (1983) found that 60 percent of foraging forays were limited to an area within 2 mi of nesting sites, although large numbers of least terns were occasionally observed at locations more than 2 mi from a nesting site. Steinbeck et al. (2005) also monitored least terns over the water during the breeding season and reported observing birds up to 5 mi from the nesting colony; however 91 percent of birds were observed within 3.5 mi of the colony.

Collins et al. (1979) found that least terns from the Santa Ana River area utilized specific areas in the ocean, and that use of the ocean for foraging varied at different times of the day. They found that least terns were concentrated in 3 main areas: 1) just beyond the surfline, 2) up to about 0.5 mi offshore, and 3) further offshore (Collins et al. 1979). Atwood and Minsky (1983) found that while 90 to 95 percent of foraging forays were within 1 mi of shore, least terns occasionally foraged 1 to 2 mi offshore. In the action area least terns are most often detected foraging within the surf zone (R. Patton, consulting biologist, pers. comm. 2013).

Breeding least terns usually begin arriving in the Project region in mid to late April. California least terns typically began departing some breeding areas in early July, but remain at others until late August/early September (CDFG 2012).

No critical habitat has been designated for the California least tern, thus none is in the Project region.

**Western snowy plover –** the snowy plover currently is known to occur on the action area beaches near San Elijo Lagoon (Cardiff State Beach) and north of Segment 1 at South Carlsbad State Beach. They are also known currently from the nearby Batiquitos Lagoon. Snowy plovers are not known to currently utilize Segments 1 and 2. Conversely, few or no surveys for plovers have recently occurred in Segments 1 and 2, likely due to low available survey resources and the current conditions of narrow beach widths. In recent years potential occupation by breeding and wintering/non-breeding snowy plovers in these segments has been at least partially hampered by human, pet, and predator disturbance, and very limited habitat in most years. Regular monitoring of snowy plovers in the action area only occurs at South Carlsbad State Beach and Cardiff State Beach (R. Patton, consulting biologist, pers. comm. 2013). As a result, little data on potential recent occupation or absence is available for Segments 1 and 2. Regardless, the conditions of Segments 1 and 2 are expected to at least periodically improve for snowy plovers during the 50-year life of the Project, including changes in human use and beach conditions, as well as the likelihood for some active protection of any wintering/non-breeding and breeding plovers in the future (e.g., control on unleashed dogs and plover exclosure areas). Additionally, the status of the species (e.g., numbers of plovers in southern California) is expected to improve over the substantial life of the Project potentially expanding the areas that are occupied. As such, some of the receiver/notch fill activity beaches and environs have the potential to be occupied by wintering/non-breeding and/or breeding snowy plovers during the life of the Project.

The majority of birds in the action area and environs, including the normal influx of overwintering birds, are found in beach and/or estuarine flat habitats where they forage on invertebrates. Breeding snowy plovers utilizing inland nesting sites would be expected to periodically forage on the beaches of the action area during the breeding season given the limited distance between these areas (R. Patton, consulting biologist, pers. comm. 2013).

Snowy plovers have been consistently documented on Cardiff State Beach approximately 0.5 to 0.8 mi south of the San Elijo Lagoon mouth (often near the Seaside parking lot) primarily during the fall and winter months, but typically with some occupation from mid-July to mid-April (R. Patton, consulting biologist, pers. comm. 2013). Wintering bird surveys for this area typically detected 0 to 28 birds before 2000, and surveys at this location documented 31 individuals in January 2005 and 28 individuals in September 2005 (USFWS 2007). A July 2013 survey for Cardiff State Beach detected 22 snowy plovers, and an August 2013 survey detected 79 snowy plovers (R. Patton, consulting biologist, pers. comm. 2013). This location is approximately 1,500 ft north of proposed sand placement in Segment 2. The occupied portion of southern Cardiff State Beach is adjacent to proposed Project staging activities in the Seaside parking lot and to proposed beach access for Project equipment from the Seaside parking lot.

It should be noted that occupied portions of Cardiff State Beach are somewhat similar to much of Segments 1 and 2 in that they have had little (if any in many locations) remaining beach at high tide (i.e., wave run-up covers the beach over higher tide cycles) during most of the last decade; it is expected that wintering snowy plovers will make considerable use of some beaches in the action area that do not remain at high tide, by flying to wider nearby beach areas periodically. In the last few years some important portions of southern Cardiff State Beach have had remaining beach or open areas at high tide.

Snowy plovers are now likely sporadic nesters at San Elijo Lagoon, the site of 12 nesting pairs in 1978 (Unitt 2004). Nesting by snowy plovers was observed at San Elijo Lagoon in 2000 when 3 adults were observed (S. Wolf, Avian Research Associates consulting biologist, pers. comm. 2005). Nesting has apparently not been reported in San Elijo Lagoon and adjacent beach areas since 2000, most likely due to degradation of suitable nesting habitat and increased predator pressure (K. Clark, Service biologist, pers. comm. 2005; R. Patton, consulting biologist, pers. comm. 2013). The expected future restoration efforts in the lagoon and environs will likely improve nesting potential and numbers in the future during the life of the proposed Project. The recovery plan for the western snowy plover states that the San Elijo Lagoon/beach area can contribute significantly to the conservation goal for the region, as it provides a management potential of about 20 breeding birds (USFWS 2007).

Wintering/non-breeding bird surveys south of the Batiquitos Lagoon mouth have consistently documented the presence of snowy plovers, particularly in the fall and winter months. Flocks of as many as 100 were documented in October 2004 (S. Wolf, Avian Research Associates consulting biologist, pers. comm. 2005). Wintering numbers for plovers reported for Batiquitos Lagoon typically ranged from 0 to 51 for the period 2000 to 2005 (USFWS 2007).

A substantial amount of nesting has occurred within Batiquitos Lagoon with nesting bird surveys documenting 13 nests in 2002, while surveys in 1996 documented 39 nests. Breeding bird numbers for the lagoon ranged from 5 to 26 for the period of 2000 to 2005 (USFWS 2007). The recovery plan for the western snowy plover states that the Batiquitos Lagoon/beach area can contribute significantly to the conservation goal for the region, as it provides a management potential of 70 breeding birds (USFWS 2007). Project sand placement activities are proposed less than 1.5 mi south of wintering/foraging habitats for these South Carlsbad Beach/Batiquitos area birds.

Snowy plovers typically breed in loose colonies. Sand spits, dune backed beaches, sparsely to unvegetated beach strands, open areas around estuaries, and beaches at river mouths are preferred nesting areas. Nest sites are typically flat, open areas with sandy substrates and little to no vegetation. Nesting western snowy plovers at coastal locations consist of both year-round residents and migrants (USFWS 2007). Snowy plovers have been shown to display breeding site fidelity.

The nesting season of the western snowy plover extends from early March through late September (USFWS 2007). The earliest snowy plover nests on the California coast occur during the first week of March in some years and by the third week of March in most years (USFWS 2007). Peak egg-laying is from mid-April to mid-June. Three eggs are laid in a shallow depression nest. Incubation lasts approximately 27 days, so hatching extends from early April through mid-August (USFWS 2007). Chicks are precocial and leave the nest almost immediately, but do not gain the ability to fly for about 31 days. Males attend their young for approximately 29 to 47 days (Warriner et al. 1986).

Critical habitat for the western snowy plover was designated in 2012, with no designated areas within the direct activity footprint area of the proposed Project. Critical habitat Subunits 51A and 51B, within San Elijo Lagoon and just east of Coast Highway 101, are close to (but not within) the Study Area, including Cardiff State Beach. Subunit 51C, located east of Interstate 5, is over 1 mi from proposed Project activity areas. Subunit 52A is located within San Dieguito Lagoon, about 1 mi southeast of the Project activity area. Critical habitat designation excluded all proposed subunits within Batiquitos Lagoon (subunits 50A–C), as they were addressed by the City of Carlsbad's Habitat Management Plan.

Marine Mammals

Numerous marine mammals are known to occur within the action area. All marine mammals are considered sensitive and protected by the Marine Mammal Protection Act (MMPA), which prohibits harassment and harm to these animals. Under the 1994 amendments to the MMPA, harassment includes disturbance that would cause injury or disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

California sea lions (*Zalophus californicanus*) and harbor seals (*Phoca vitulina*) are commonly seen in the water, and occasionally on beaches, in northern San Diego County (U.S. Navy 1997a,b), and are commonly seen in the offshore waters of the Project action area. Common dolphins (*Delphinus delphis*) and bottlenose dolphins (*Tursiops truncatus*) regularly occur in the surf zone and in offshore waters of the action area (Geraci and St. Aubin 1990). A coastal population of bottlenose dolphins often occurs within 0.6 mi of shore in the action area and environs (Bonnell and Dailey 1993). Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) and Risso's dolphins (*Grampus griseus*) also are known to occur in the action area seasonally.

California gray whales (*Eschrichtius robustus*) transit the action area. The southbound migration of these whales off the southern California coast occurs in December through February, and the return northbound migration is from February through May (Bonnell and Dailey 1993). The southbound migration begins in the Bering and Chukchi seas in the Artic and ends in the warm-water lagoons of Mexico's Baja California peninsula and the southern Gulf of California. Gray whales often migrate quite close to shore while passing through the Southern California Bight, often including the action area. No marine mammals are expected to regularly use the beach areas of the action area, either because of the continual human presence on these beaches during daylight hours or because beach use is not typical for the species.

Marine Resources by Reach (Figures 2, 12 through 17; additional data is available in the 2012 Draft EIS/EIR)

- Reach 1 – Encinitas Northern City Limit to Beacon's Beach

During the 1999 survey, the majority of the beach in Reach 1 was sand, and cobble formed an extensive band in the upper intertidal near the northern boundary of the reach; the cobble became sparse in occurrence towards the southern reach boundary. Sand depths averaged from 11 to 17 in across the intertidal zone at Batiquitos during the spring, and they averaged 19 to 27 in during the summer at Leucadia in 1999 (MEC 2000). Worms and sand crabs were present in the beach sand natural communities; no marine life was detected in cobble areas that were devoid of sand. These beaches were considered suitable for grunion spawning prior to the 2001 sand placement (MEC 2000; AMEC 2002a).

Hard substrate occurs from the low intertidal zone to greater than -66 ft MLLW off the northern and southern ends of Reach 1 and closer to shore (within -33 ft MLLW) in the middle portion of the reach. Most hard substrate consists of low-relief reef, and areas with high-relief occur in localized patches.

The occurrences of sensitive resources are patchy within this reach, both in the intertidal and nearshore zones. Small areas of surf grass were mapped in the lower intertidal between Grandview Beach and Beacon's Beach in 2000; the largest bed occurred off Grandview Street. Surf grass was mapped off Grandview Beach and Beacon's Beach, but it was not observed in the lower intertidal between these locations in 2002. The surf grass occurred in patches flush with the sand both in 2000 and 2002. Commercial fishermen have reported the presence of surf grass on nearshore reefs in this reach. Nearshore dive surveys noted that surf grass and feather boa kelp have scattered occurrences on the low- and high-relief reefs in this reach (U.S. Navy 1997a, b; MEC 2000).

SANDAG has three shallow subtidal monitoring stations (BL-SS-1, BL-SS-2, BL-SS-3) offshore of Batiquitos/Leucadia in Reach 1 that were being surveyed as part of a five-year study to document any post-construction impacts resulting from the RBSP. The monitoring stations are located primarily on low-relief substrate (less than 3 ft), with patchy high-relief substrate (greater than 3 ft) and sand (AMEC 2002b). The occurrence of indicator species was variable on these reefs during 2001 and 2002. Percent cover of surf grass differed among monitoring stations; the mean percent cover was lowest near Batiquitos Lagoon (0 to 1 percent at BL-SS-1), and low to moderate cover was reported at stations offshore of Leucadia (11 to 57 percent at BL-SS-2, 30 to 40 percent at BL-SS-3). Mean cover of feather boa kelp at all sites ranged from less than 2 percent to 4 percent. Similarly, mean density of sea palms at all sites ranged up to 0.2 per 10 $ft^2$. Sea fans were only observed in low densities at station BL-SS-1 (less than 0.1 individual per 10 $ft^2$); they were not observed at the other monitoring stations offshore of Leucadia.

Giant kelp beds occur offshore in the northern and southern areas of Reach 1 between the depths of -20 and -70 ft MLLW. Giant kelp offshore of Reach 1 is commonly referred to as the Leucadia kelp bed, which experienced substantial die back during the 1997-1998 El Niño. The bed reportedly looked healthy during the 2001 (MBC 2001) and 2002 reconnaissance survey.

SANDAG has three kelp survey stations (BL-K-1, BL-K-2, BL-K-3) offshore of Batiquitos/Leucadia in Reach 1 that were being surveyed as part the RBSP. The mean total number of stipes of giant kelp ranged from 0.1 to 2.0 per 10 $ft^2$ at these stations in 2001 and 2002 (AMEC 2002b). The understory kelp *Cystoseira osmundacea* had a mean density that ranged from 0.2 to 9.5 per 10 $ft^2$. Other understory kelp included feather boa kelp and sea palms, both of which had a mean density ranging from less than 1 to approximately 4 plants per 10 $ft^2$. Low-growing red algae (coralline, leafy, turf) ranged from a mean of 0.3 to 11 percent cover. Encrusting invertebrates (i.e., sponges, ectoprocts, and tunicates) ranged from 0 to 3 percent cover. Boring clams (*Chaceia ovoidea*, *Parapholas californica*) and ornate tube worms (*Diopatra ornata*) had a mean density of 0 to 2.2 and 1.4 to 3.3 individuals per 10 $ft^2$, respectively. Sea fans (*Muricea* spp.) and Kellet's whelk snails (*Kelletia kelletia*) had a mean density of less than 1 individual per 10 $ft^2$. Other indicator macroinvertebrates such as sea urchins (*Strongylocentrotus* spp.), starfish (*Pisaster* spp.), and trochiid snails (*Lithopoma* spp.) were not observed at these stations.

Shorebirds observed during the September 2002 survey included killdeer, sanderling, willet, marbled godwit, and whimbrel. Western gulls were common, and Heermann's gulls and double-crested cormorants also were observed.

- Reach 2 – Beacon's Beach to 700 Block, Neptune Avenue

The beach in Reach 2 consists of a mix of sand and hard substrate natural communities. Reach 2 corresponds to the northern portion of an alternative Leucadia receiver site evaluated for the RBSP. During a 1999 survey of the site, cobble formed an extensive band in the upper intertidal, and the mid to lower intertidal areas had a mix of sand and low-relief sandstone reefs (MEC 2000). Sand depths ranged from 6 to 20 in throughout the different tidal zones during early spring, but increased to 21 to 27 in in the summer of 1999. Worms, sand crabs, and bean clams were observed in the beach sand communities. The site was considered largely unsuitable for grunion due to exposed hard substrates and narrow beach width.

Hard substrates, in the form of low-relief reef (less than 3 ft), extends throughout the intertidal and nearshore zone. The intertidal low-relief reefs were subject to seasonal sedimentation impacts prior to the RBSP. Scattered occurrences of surf grass and feather boa kelp, coralline and filamentous red algae, small leafy brown algae, *Ulva* green algae, aggregated sea anemone, California mussel, wavy top turban snails (*Lithopoma undosa*), hermit crabs, and *Cancer* crabs were associated with the intertidal reefs during the 1999 winter season when sand depths were lower on the beach (MEC 2000). During the summer in 1999, most of the sandstone bench was covered with sand, with only a few exposed patches of surf grass, and hermit crabs were the only invertebrates observed.

Dive surveys by the U.S. Navy mapped scattered occurrences of surf grass and feather boa kelp on the nearshore reefs in this reach. No sea fans or sea palms were mapped on reefs within Reach 2.

Giant kelp in Reach 2 is part of the Leucadia kelp bed. Giant kelp occurs between depths of --20 and -70 ft MLLW near the northern reach boundary, but mainly occurs at deeper depths between -46 and -70 ft MLLW. Commercial fishermen have indicated that scattered rocks also occur offshore between depths of approximately -46 and -66 ft MLLW.

SANDAG has one kelp station (EN-K-1) offshore of Leucadia in Reach 2 that was surveyed as part the RBSP. The mean total number of stipes of giant kelp ranged between 0.7 to 3.0 stipes per 10 $ft^2$ in 2001 and 2002 (AMEC 2002b). Understory kelp included *Cystoseira osmundacea* (5.0 to 10.1 plants per 10 $ft^2$), feather boa kelp (1.5 to 4.7 per 10 $ft^2$), and sea palms (1.8 to 2.0 plants per 10 $ft^2$). Low growing red algae (coralline, leafy, turf) ranged from a mean of 16 to 27 percent cover. Encrusting invertebrates (i.e., sponges, ectoprocts, and tunicates) had a mean percent cover that ranged from 1 to 3 percent. Observed indicator macroinvertebrates (boring clams, Kellet's whelk, ornate tube worms, sea fans) each had an average density of about 1 individual per 10 $ft^2$. Sea urchin, starfish, and trochiid snail indicator macroinvertebrates were not observed.

Sanderling, marbled godwit, and spotted sandpipers were observed foraging along the shoreline during a September 2002 survey of Reach 2. Several western gulls, a few ring-billed gulls, and numerous California brown pelicans also were observed.

- Reach 3 –700 Block, Neptune Avenue to Stone Steps

Prior to the RBSP, the beach in this reach was similar to that described for Reach 2; however, hard substrate formed more extensive coverage. Reach 3 includes the southern portion of the alternative Leucadia receiver site evaluated for the RBSP. During 1999, cobble formed an extensive band in the upper intertidal, and the mid to lower intertidal was covered by a low-relief sandstone bench and cobbles during the spring (MEC 2000). The sandstone reef had few marine resources (coralline and filamentous red algae) and was covered with 1 to 3 ft of sand during summer. The site was considered unsuitable for grunion spawning due to extensive hard substrate in 2000 and likely is unsuitable currently.

Hard substrate has a scattered occurrence offshore in Reach 3. Low-relief reef extends throughout the nearshore zone and one localized patch of high-relief reef occurs in the northern half of the reach. Dive surveys by the U.S. Navy mapped scattered occurrences of surf grass and feather boa kelp on the low relief nearshore reefs; these species and sea palms were observed on the high-relief reef.

SANDAG has one shallow subtidal survey station (ML-SS-1) offshore of Encinitas in Reach 3, upcoast of the Moonlight State Beach receiver site, that was surveyed as part of the RBSP. The location had seasonally variable amounts of low-relief substrate (41 to 60 percent), high-relief substrate (5 to 36 percent), and sand (9 to 33 percent) in 2001 and 2002 (AMEC 2002b). The occurrences of indicator species were similar in 2001 and 2002. The mean percent cover of surf grass ranged from 35 to 41 percent, and the mean cover of feather boa kelp was about 3 percent. The number of sea palms ranged from 0.1 to 0.3 per 10 $ft^2$. No other indicator species (sea fans) were observed at this station in 2001 and 2002.

Giant kelp in Reach 3 is part of the Leucadia kelp bed, and occurs at depths of -20 to -56 ft MLLW. Commercial fishermen have indicated that scattered rocks also occur offshore, between depths of approximate -46 to -66 ft MLLW.

SANDAG has one kelp survey station (EN-K-2) offshore of Leucadia in Reach 3 that was surveyed as part the RBSP. The mean total number of stipes of giant kelp ranged between 3.3 and 5.1 per 10 $ft^2$ in 2001 and 2002 (AMEC 2002b). Understory kelp included sea palms (0.4 to 1.8 plants per 10 $ft^2$), a few feather boa kelp, and *Cystoseira osmundacea* (less than 1 plant per 10 $ft^2$). Low growing red algae (coralline, leafy, turf) ranged from a mean of 1 to 4 percent cover. Encrusting invertebrates (i.e., sponges, ectoprocts, and tunicates) ranged from a mean of 1 to 2 percent cover. The most abundant macroinvertebrates included boring clams (mean of 0 to 2.9 10 $ft^2$) and sea fans (mean of 0.7 to 1.7 per 10 $ft^2$). Other observed macroinvertebrates (Kellet's whelk, ornate tube worms, sea urchins, starfish) each had an average density of less than or 1 individual per 10 $ft^2$. Trochiid snail indicator macroinvertebrates were not observed.

Spotted sandpipers were observed on the beach during the September 2002 survey.

- Reach 4 – Stone Steps to Moonlight State Beach

Prior to the RBSP, the beach in this reach mainly consisted of sand; however, 30 to 100 percent cobble was present in the upper intertidal. The southern portion of Reach 4 includes the Moonlight State Beach receiver site evaluated for the RBSP. Sand depths within the Moonlight State Beach receiver site in the spring of 1999 ranged from 6 to 24 in, and supported worms and sand crabs. The Moonlight State Beach site was considered marginally suitable to unsuitable for grunion spawning (MEC 2000; AMEC 2002a).

Hard substrates were reported to be of scattered occurrence offshore in Reach 4. Reef areas mapped by side-scan sonar are small and of low relief. Only one patch of surf grass of about 0.04 acre (ac) was mapped on one small reef in 2000. Coralline and red turf algae were observed on most of the low-relief reefs, and feather boa kelp had scattered occurrences (MEC 2000). The Navy noted scattered occurrences of surf grass and feather boa kelp; no sea fans or sea palms were observed on reefs within this reach.

SANDAG has one kelp station (EN-K-3) offshore of Leucadia in Reach 4 that was surveyed as part the RBSP. The mean total number of stipes of giant kelp ranged from 1.4 to 2.9 per

10 $ft^2$ in 2001 and 2002 (AMEC 2002b). Feather boa kelp had a mean density that ranged between 1.0 and 2.0 per 10 $ft^2$. Other understory kelp species (sea palms, *Cystoseira osmundacea*, *Desmerestia ligulata*) each had a density of less than 1 plant per 10 $ft^2$. Low growing red algae (coralline, leafy, turf) ranged from a mean of 13 to 21 percent cover. Encrusting invertebrates (i.e., sponges, ectoprocts, and tunicates) ranged from a mean of 7 to 29 percent cover. The most abundant macroinvertebrates included sea fans (mean of 2.4 to 5.6 individuals per 10 $ft^2$) and Kellet's welk (mean of 0.4 to 2.5 individuals per 10 $ft^2$). Other observed macroinvertebrates (boring clams, ornate tube worms, starfish) each had an average density of less than or 1 individual per 10 $ft^2$. Trochiid snail and sea urchin indicator macroinvertebrates were not observed.

Giant kelp in Reach 4 is part of the Leucadia kelp bed, which ends offshore of the northern half of this reach. Prior to the 1997 to 1998 El Niño, kelp was mapped between -16 to -36 ft MLLW.

Marbled godwit, willet, and Heermann's and western gulls were observed on the shoreline in Reach 4 during the September 2002 survey.

- Reach 5 – Moonlight State Beach to Swami's

Prior to the RBSP, the northern half of this reach was similar to the southern end of Reach 4, in being mainly sand; however, 30 to 100 percent cobble was present in the upper intertidal (MEC 2000).

Scattered occurrences of hard substrate were observed offshore of the northern half of the reach, and likely remains more extensive in the southern portion of Reach 5. The hard substrate includes scattered low-relief reef and rocks in the northern half of the reach, and extensive low- to high-relief reefs south of H Street. Although substrates have not been fully mapped offshore of the southern portion of the reach, reef communities are known to extend offshore from the intertidal reefs (AMEC 2002b).

No surf grass or other sensitive resources were mapped on the low-relief reef offshore of the northern half of the site in 2000; whereas, sea fans, sea palms, feather boa kelp, and surf grass occurred on the nearshore reefs south of H Street and around Swami's Point (Ogden 1999; MEC 2000). One small area of surf grass was mapped in the lower intertidal zone near G Street, and extensive surf grass coverage extended from approximately I Street to the end of Swami's Point in both 2000 and 2002.

SANDAG has one shallow subtidal survey station (SW-SS-1) offshore of Swami's Point in Reach 5 that was surveyed as a control site for the RBSP. The location had a seasonally variable amount of low-relief substrate (5 to 80 percent), high-relief substrate (0 to 20 percent), and sand (0 to 95 percent) in 2001 and 2002 (AMEC 2002b). The occurrence of indicator species was similar in 2001 and 2002. The mean percent cover of surf grass ranged from 6 to 8 percent, and the mean percent cover of feather boa kelp ranged from 2 to 17 percent. The mean density of sea palms was relatively low. No other indicator species (sea fans) were observed at this station in 2001 and 2002.

Giant kelp occurs near the southern boundary of Reach 5 and represents the northern part of the Encinitas kelp bed. Prior to the 1997 to 1998 El Niño, kelp occurred between -33 to -49 ft MLLW.

SANDAG has one kelp survey station (SW-K-1) offshore of Swami's Point in Reach 5 that has been surveyed as a control site for the RBSP. The mean total number of stipes of giant kelp ranged from 1.4 to 2.9 per 10 $ft^2$ in 2001 and 2002 (AMEC 2002b). The mean density of understory kelp was relatively similar for sea palms (3.8 to 9.2 per 10 $ft^2$), *Cystoseira osmundacea* (2.0 to 6.7 plants per 10 $ft^2$), and feather boa kelp (1.5 to 4.1 per 10 $ft^2$). Low growing red algae (coralline, leafy, turf) ranged between a mean of 6 and 20 percent cover. Encrusting invertebrates (i.e., sponges, ectoprocts, and tunicates) averaged between 0 and 3 percent cover. Observed macroinvertebrates (boring clams, Kellet's whelk, ornate tube worms, sea fans, sea urchins) each had a mean density of less than 1 individual per 10 $ft^2$. Trochiid snail and starfish indicator macroinvertebrates were not observed

No shorebird or seabirds were observed along Reach 5 during the September 2002 survey.

- Reach 6 – Swami's to San Elijo Lagoon Entrance

The beach consists of sand in the upper to mid intertidal. Intertidal reefs with surf grass occur at Swami's Beach and from about mid reach to the southern reach boundary. The intertidal reefs support a variety of marine resources including several species of algae, feather boa kelp, and invertebrates. Marine and water birds, including black-crowned night heron, great blue heron, and great egret, were observed foraging on the reefs during the 2002 reconnaissance survey. Swami's State Marine Conservation Area occurs within this Reach (CDFW 2013).

Hard substrate is extensive offshore of the whole reach. However, no detailed mapping of substrate type, height, and marine resources has been reported to date.

SANDAG has two shallow subtidal control survey stations (SW-SS-2, SW-SS-3) offshore of Swami's Beach at the north end of Reach 6 that were being surveyed for the RBSP. These locations had seasonally variable amounts of low-relief substrate (22 to 87 percent), high-relief substrate (0 to 6 percent), and sand (9 to 78 percent) in 2001 and 2002 (AMEC 2002b). The occurrence of indicator species was similar in 2001 and 2002. The mean percent cover of surf grass was moderate at station SW-SS-2 (16 to 26 percent) and seasonally low at station SW-SS-3 (0.5 to 7 percent). Similarly, the mean percent cover of feather boa kelp was higher at station SW-SS-2 (9 to 17 percent) than at station SW-SS-3 (2 to 6 percent). The mean density of sea palms was relatively low (less than 0.1 plant per 10 $ft^2$) at each of these stations. No other indicator species (sea fans) were observed at these stations in 2001 and 2002.

The major portion of the Encinitas kelp bed occurs offshore at depths between -20 and -59 ft MLLW. SANDAG has two kelp survey control stations (SW-K-2, SW-K-3) offshore of Swami's Beach at the north end of Reach 6, and one station offshore of Cardiff (CF-K-1) at the south end of this reach, that were being surveyed for the RBSP. The mean total number of stipes of giant kelp ranged between 2.7 and 7.1 per 10 $ft^2$ at the stations offshore of Swami's and from 0.6 to 5.9 per 10 $ft^2$ offshore of Cardiff in 2001 and 2002 (AMEC 2002b). A variety of other indicator species occurred in the kelp beds offshore of Swami's, but at relatively low densities and percent cover. The mean density of sea palms ranged from 1.4 to 4.8 per 10 $ft^2$, and other species of understory kelp (*Cystoseira osmundacea*, *Desmerestia ligulata*, feather boa kelp, *Laminaria farlowii*) each had less than 2 plants per 10 $ft^2$ at stations SW-K-2 and SW-K-3. Low growing red algae (coralline, leafy, turf) averaged 1 to 8 percent cover. Encrusting invertebrates (i.e., sponges, ectoprocts, tunicates) had less than 5 percent cover, and observed macroinvertebrates (boring clams, Kellet's whelk, ornate tube worms, sea fans, sea urchins, starfish, trochiid snails) each had a mean density of less than 2 individuals per 10 $ft^2$. The density of indicator species was slightly higher at Cardiff station CF-K-1, but fewer indicator species were observed than offshore of Swami's Beach. Sea palms and *Cystoseira osmundacea* had mean densities that ranged from 5.5 to 9.2 plants per 10 $ft^2$ and 3.7 to 6.7 plants per 10 $ft^2$, respectively, at station CF-K-1. Feather boa kelp density was less than 2 plants per 10 $ft^2$. Low growing red algae (coralline, leafy, turf) had a moderate (20 to 40) percent cover. Encrusting invertebrates (i.e., sponges, ectoprocts, tunicates) averaged less than 5 percent cover, and observed macroinvertebrates (Kellet's whelk, ornate tube worms, trochiid snails) each had a mean density of less than 1 individual per 10 $ft^2$.

Several shorebirds were observed during the September 2002 survey, including black turnstone, marbled godwit, whimbrel, and willet. Heermann's, ring-billed, and western gulls also were observed. Great egret, great blue heron, and black-crowned night heron were observed on exposed reefs during a minus tide during the May 2002 survey.

- Reach 7 – San Elijo Lagoon Entrance to Table Tops Reef

In the several years prior to the RBSP, the mid to upper intertidal zone of this reach consisted of 80 to 100 percent cobble, and the low intertidal consisted of sand with moderate cobble coverage. No marine organisms were found on the cobble beach during surveys (MEC 2000). Swami's State Marine Conservation Area occurs within this Reach (CDFW 2013).

Riprap revetment/slope protection has been placed on the beach in front of three restaurants near the north end of the reach, west of Coast Highway 101. Few marine organisms were observed on the riprap prior to the RBSP. Acorn barnacle (*Cthamalus* spp.) was common in the splash zone; whereas, feather boa kelp (*Egregia menziesii*) and goose-neck barnacle (*Pollicipes polymerus*) had localized occurrence along the lower elevations of the riprap (MEC 2000).

Sand occurs offshore of most of the reach, and low- to high-relief reefs occur near the northern and southern boundaries of the reach.

Low- to high-relief reef, which corresponds to Cardiff reef, was mapped from the intertidal zone through the nearshore of the northern portion of the reach. Surf grass occurred on the intertidal portion of Cardiff reef in 2000 and 2002. Surf grass, feather boa kelp, sea palm, and sea fans were noted on offshore of portions of Cardiff reef in 2000.

High-relief substrate also was mapped mid reach; this substrate corresponds to the San Elijo outfall pipeline. Reef also occurs at the southern end of the reach, which transitions from patchy low-relief reef into high-relief reef at Table Tops. Surf grass was present offshore on the low-relief reef. Most of Table Tops reef occurs in Reach 8 and is described below under that subsection.

SANDAG has two shallow subtidal survey stations (CF-SS-1, CC-SS-1) offshore of Cardiff in Reach 7 that were surveyed for the RBSP. Station CF-SS-1 had a seasonally variable amount of low-relief substrate (18 to 60 percent), high-relief substrate (7 to 15 percent), and sand (30 to 76 percent) in 2001 and 2002 (AMEC 2002b). Station CC-SS-1 primarily had low-relief substrate (53 to 80 percent) with seasonally patchy high-relief substrate (17 to 46 percent) and sand (2 to 9 percent). The mean percent cover of surf grass was seasonally low to moderate at station CF-SS-1 (2 to 15 percent) and moderate at station CC-SS-1 (23 to 24 percent). The percent cover of other surveyed indicator species was low to moderate. At station CF-SS-1, the mean percent cover of feather boa kelp ranged from 7 to 16 percent, and the mean densities of sea palms and sea fans were less than 0.1 individual per 10 $ft^2$. At Station CC-SS-1, feather boa kelp had 6 to 9 percent cover, sea palms ranged from 0.2 to 0.3 individuals per 10 $ft^2$, and no sea fans were observed.

Giant kelp occurs offshore of the northern and southern portions of the reach. Giant kelp also has been found growing on the San Elijo outfall pipe, which discharges farther offshore with the outlet at a depth of -148 ft MLLW. Kelp in the northern part of the reach belongs to the Cardiff kelp bed, and kelp in the southern part of the reach belongs to the Solana Beach kelp bed, both of which have had substantial recovery since the 1997 to 1998 El Niño. Giant kelp is expected between depths of -20 and -49 ft MLLW offshore of Reach 7.

SANDAG has two kelp survey stations offshore of Cardiff (CF-K-2, CF-K-3) in Reach 7 that have been surveyed for the RBSP. The mean total number of stipes of giant kelp ranged between 0.4 and 3.9 per 10 $ft^2$ offshore of Cardiff in 2001 and 2002 (AMEC 2002b). The mean density of sea palms ranged from 4.8 to 7.1 plants per 10 $ft^2$, and other species of understory kelp (*Cystoseira osmundacea*, *Desmerestia ligulata*, feather boa kelp, *Laminaria farlowii*, *Pterygophora californica*) each averaged 4 or fewer plants per 10 $ft^2$. Low growing red algae (coralline, leafy, turf) averaged 10 to 31 percent cover. Encrusting invertebrates (i.e., sponges, ectoprocts, and tunicates) generally had less than 5 percent cover. The mean density of boring clams and Kellet's whelk ranged from approximately 0.1 to 3.7 individuals per 10 $ft^2$. Other observed macroinvertebrates (ornate tube worms, sea fans, sea urchins, starfish, trochiid snail) each had a mean density of less than 1 individual per 10 $ft^2$.

Shorebirds, including black turnstone, marbled godwit, and willet, were observed on the shoreline during the September 2002 survey. Heermann's gulls also were seen in this reach.

- Reach 8 – Table Tops Reef to Fletcher Cove

Prior to the RBSP, the northern portion of the reach consisted of sand in the upper intertidal with various densities of cobble cover (up to 60 percent) next to the cliff (MEC 2000). The southern half of the reach corresponds to the alternative Solana Beach receiver site evaluated for the RBSP. Sand depths were less during winter (average of 14 in) than summer (average of 28 in) (MEC 2000). No marine resources were associated with the cobble substrate. Sand crabs, worms, and amphipod crustaceans occupied the sand communities.

Low- and high-relief reefs occur in mid to low intertidal zones and extend offshore. Surf grass forms extensive beds in the northern part of the reach, which corresponds to Table Tops and Tide Park reefs. An intertidal to shallow subtidal reef, known as "Pill Box", occurs in the southern part of the reach, just north of Plaza Street. Seasonal sand sedimentation was observed to affect marine resource development at these reefs prior to the RBSP. The low- to high-relief reefs at Table Tops had surf grass, a variety of algae, aggregated sea anemones, California mussel, chitons, crabs, hermit crabs, limpets, sand castle worms, marine snails, sea hares, and sea stars during both winter and summer, although substantial sand sedimentation (up to 3 ft) buried some marine resources, including surf grass, on the lower portions of the reef in the summer of 1999 (MEC 2000).

The intertidal to shallow subtidal reef at Tide Park also exhibited considerable seasonal change in resource development in 1999. This low-relief reef supported feather boa kelp, coralline and filamentous red algae, *Ulva* green algae, *Colpomenia* and dictyotales brown algae, hermit crabs, aggregated sea anemones, and a variety of marine snails during the winter, but most of the low lying reef was covered with sand in the summer. Only feather boa kelp, filamentous red algae, and a few hermit crabs were observed (MEC 2000).

The higher relief portions of Pill Box reef had coralline and leafy red algae, *Ulva*, small leafy brown algae, feather boa kelp, surf grass, and aggregated sea anemones during both winter and summer. However, the lower portions of the reef exhibited a similar pattern of burial and reduction in marine resources between winter and summer as described above for the low-relief reef offshore of Tide Park (MEC 2000).

SANDAG has two shallow subtidal survey stations (CC-SS-2, CC-SS-3) offshore of Solana Beach in Reach 8 that are being surveyed for the RBSP. Station CC-SS-2 had seasonally variable amounts of low-relief substrate (27 to 51 percent), high-relief substrate (6 to 20 percent), and sand (40 to 67 percent) in 2001 and 2002 (AMEC 2002b). Station CC-SS-3 had seasonally variable amounts of low-relief substrate (36 to 82 percent) and high-relief substrate (18 to 64 percent), and very little sand (0 to 0.2 percent). The mean percent cover of surf grass was moderate at these stations (21 to 35 percent). The mean percent cover of feather boa kelp was low to moderate (2 to 14 percent). The mean density of sea palms ranged from 0.02 to 0.3 individuals per 10 $ft^2$ at station CF-SS-2. No other indicator macroinvertebrate species (sea fans) were observed at these stations.

Giant kelp in this reach belongs to the Solana Beach kelp bed, which has substantially recovered since the 1997-1998 El Niño. Kelp occurs offshore at depths of -20 to -66 ft MLLW.

SANDAG has one kelp station (SB-K-1) offshore of Solana Beach in Reach 8 that has been surveyed as part of the RBSP. The mean total number of stipes of giant kelp ranged between 1.7 and 3.5 per 10 $ft^2$ in 2001 and 2002 (AMEC 2002b). The mean density of understory kelp was less than 1 plant per 10 $ft^2$ for each observed species (*Cystoseira osmundacea*, feather boa kelp, *Laminaria farlowii*, *Pterygophora californica*). Low growing red algae (coralline, leafy, turf) ranged between a mean of 3 and 7 percent cover. Encrusting invertebrates (i.e., sponges, ectoprocts, and tunicates) averaged between 1 and 11 percent cover. Observed macroinvertebrates (boring clams, Kellet's whelk, ornate tube worms, sea fans, sea urchins, and starfish) each had a mean density of less than 1 individual per 10 $ft^2$. No other indicator macroinvertebrate species (i.e., trochiid snails) were observed at this station.

Black turnstone, marbled godwit, and sanderling were observed foraging along the shoreline during the September 2002 survey. Heermann's gull, ring-billed gull, and western gull also were commonly observed in this reach.

- Reach 9 - Fletcher Cove to Solana Beach Southern City Limit

Intertidal natural communities in this area are primarily sand with localized areas of low-relief reef. The northern half of the reach corresponds to the proposed Solana Beach receiver site evaluated for the RBSP. Sand depths ranged from 2 to 40 in with an overall average depth of 19 in during the winter and 25 in during the summer of 1999 (MEC 2000). Sand crabs, worms, and amphipod crustaceans occurred in the sand communities.

Four low relief reefs were observed in the low intertidal between 499 to 794 ft, 994 and 1142 ft, 2,684 and 2,762 ft, and 3,107 and 3,540 ft south of Fletcher Cove during 1999. Marine resources associated with these reef areas included coralline and filamentous red algae, feather boa kelp, small leafy brown and red algae, aggregated sea anemones, chitons, and hermit crabs during early spring 1999 (MEC 2000). During the summer of 1999, sand covered large portions of these low-lying reefs, and feather boa kelp was the only exposed marine resource. Surf grass was not observed during surveys of the intertidal of this reach in 2000 or 2002.

Sand natural communities occur in the nearshore subtidal zone directly offshore of Fletcher Cove and extend south approximately 1,100 ft from the southern edge of the cove. Patch and low-relief finger reefs occur near shore south of that point and continue to the end of the reach boundary. Surf grass, feather boa kelp, sea fans, and sea palms occur on reefs within this area.

SANDAG has one shallow subtidal survey station (SB-SS-1) offshore of Solana Beach in Reach 9. The location had seasonally variable amounts of low-relief substrate (36 to 58 percent), high-relief substrate (8 to 14 percent), and sand (28 to 52 percent) in 2001 and 2002 (AMEC 2002b). The occurrence of indicator species was similar in 2001 and 2002. The mean percent cover of surf grass ranged from 8 to 12 percent, and the mean percent cover of feather boa kelp was less than 1 percent. The mean density of sea palms was relatively low (less than 0.1 plant per 10 $ft^2$). No macroinvertebrate indicator species (sea fans) were observed at this station in 2001 and 2002.

Giant kelp in this reach belongs to the Solana Beach kelp bed. Kelp occurs offshore at depths of -20 to -59 ft MLLW. Kelp has undergone recovery in the northern, but not southern, portion of the reach since the 1997 to 1998 El Niño.

SANDAG has two kelp survey stations (SB-K-2, SB-K-3) offshore of Solana Beach in Reach 9. The number of stipes of giant kelp per area was higher at station SB-K-2 (mean total of stipes 2.6 to 5.2 per 10 $ft^2$) than at station SB-K-3 (mean total of stipes 0.7 to 1.6 per 10 $ft^2$) in 2001 and 2002 (AMEC 2002b). A relatively low mean density was reported for understory kelp (less than 1 plant per 10 $ft^2$), and low growing red algae (coralline, leafy, turf) ranged from 6 to 9 percent cover at station SB-K-2. Similarly, encrusting invertebrates had a relatively low mean (1 to 3) percent cover, and observed macroinvertebrates (boring clams, ornate tube worms, sea fans, sea urchins, starfish) each had a mean density of less than 1 individual per 10 $ft^2$ at station SB-K-2. Mean density and/or percent cover were slightly higher at station SB-K-3 for understory algae (1.5 to 8.3 plants per 10 $ft^2$), low growing red algae (3 to 13 percent cover), and encrusting invertebrates (3 to 12 percent cover). The mean density of sea fans ranged from 0.7 to 2.6 individuals per 10 $ft^2$, and other observed macroinvertebrate species (boring clams, ornate tube worms, sea urchin, starfish) each had a mean density of less than 2 individuals per 10 $ft^2$ at Station SB-K-3. No Kellet's whelk or trochiid snail indicator macroinvertebrate species were observed at stations SB-K-2, and SB-K-3 in 2001 to 2002.

Shorebirds observed during the September 2002 survey included willet and whimbrel. Ring-billed gulls were observed foraging along the shoreline.

**Terrestrial Environment**

Because potential ecological impacts from the proposed Project on the terrestrial environment would likely occur almost solely within the Study Area, this section focusses on the Study Area. The Study Area includes terrestrial environments upslope of the intertidal zone, and it extends to the top of adjacent bluffs or to the first parallel road. The characterization of terrestrial shoreline natural communities of the Study Area is based on a consultant biological survey completed in 2002, Service knowledge of the local environment, relevant studies, and applicable literature.

The terrestrial survey submitted for this Project occurred in the fall of 2002, which would result in an inclusive determination for the majority of flora and some fauna. The majority of botanical surveys within the coastal zone typically take place during the prime growing season (spring, early summer). Therefore, the survey effort for this Project was outside of the seasonal window deemed appropriate to make conclusive botanical identifications and determinations. However, proposed Project implementation activities (e.g., notch fill activities) would almost totally take place on the beach and water, with minimal encroachment on bluff natural communities. Proposed project activities occurring on bluffs would be limited to the bases of bluffs, within and immediately surrounding bluff notches. Therefore, additional surveys are not deemed necessary to assess the impacts to terrestrial plants in this case.

Plants and Vegetation Communities

The Study Area consists of a mixture of non-native and native vegetation along the coastal bluffs and shoreline beach communities adjacent to the bluffs. Fig marigold (*Carpobrotus* sp.), which is a non-native species, was the dominant plant in all reaches. Identifiable native plant communities do not occur along the immediate coastal bluff area; native species were sparse and occurred in localized areas. The lagoon communities, which occur nearby outside of the Study Area and were not surveyed, contain predominately native natural communities (e.g., coastal salt marsh).

Diegan coastal sage scrub species were found interspersed with a large amount of exotic vegetation occurring in a relatively small (remnant) somewhat natural area south of Batiquitos Lagoon near the northern boundary of Reach 1. The more commonly occurring native plant species included: coastal prickly pear (*Opuntia littoralis*), salt marsh fleabane (*Pluchea odorata*), and western marsh rosemary (*Limonium californicum*).

> Sensitive Plants: Numerous sensitive plants are known to occur in or near the Study Area. However, the majority of these species are located further upslope/inland from the actual proposed Project activity direct footprint in Segments 1 and 2. Additionally, these sensitive plants are not expected to occur within any areas that would be potentially affected by any other upland Project activities, such as equipment staging or access routes utilized outside of Segments 1 and 2. The following species are unlikely to occur within the Project activity direct footprint and are unlikely to be affected by the Project, mostly due to a lack of suitable habitats associated with existing development and continued human disturbance in that footprint: Nuttal's lotus (*Lotus nuttallianus*),[5] Del Mar sand aster (*Corethrogyne filaginifolia* var. *linifolia*), sea dahlia (*Coreopsis maritima*), coastal wooly-heads (*Nemacaulis denudata* var. *denudata*), Orcutt's spineflower (*Chorizanthe orcuttiana*), Blochman's dudleya (*Dudleya blochmaniae* ssp. *blochmaniae*), decumbent

[5] Nuttal's lotus occurs within the Study Area based on its habitat affinities, and historical or recent observations along the beaches at both Encinitas and Del Mar, at the southern ends of Cardiff and Carlsbad State Beaches, and south of the mouth of Batiquitos Lagoon (Reiser 1994). Recent observations have been recorded from Reach 7 at Cardiff State Beach, in a vacant lot area adjacent to the north side of the Seaside parking lot (R. Patton, consulting biologist, pers. comm. 2013); this is just outside the footprint of a proposed staging area for the Project within the Seaside parking lot.

goldenbush (*Isocoma menziesii* var. *decumbens*), Orcutt's pincushion (*Chaenactis glabriuscula* var. *orcuttiana*), cliff spurge (*Euphorbia misera*), and Lewis's primrose (*Camissonia lewisii*).

Wildlife

The majority of terrestrial natural communities within the Study Area consist of isolated bluffs that support mostly non-native plant communities, in which few wildlife species were documented or expected to be present. In addition, the bluffs of the Study Area are narrow, effectively small in contiguous area, and generally isolated from larger areas of surrounding native natural communities, such as within Batiquitos, San Elijo, and San Dieguito lagoon areas, by roads, a railroad, and urban development. The terrestrial areas of these lagoons, which were not surveyed as part of this Project, support a predominately native and highly diverse wildlife ecosystem.

<u>Invertebrates</u>
Two species of butterfly were observed along the coastal bluffs during the September 2002 survey. The cabbage white (*Artogeia rapae*) was observed along five of the nine reaches. The western pygmy blue (*Brephidium exilis*) was observed in Reach 6. No sensitive terrestrial invertebrates are known or expected to occur within in the Project footprint area, and none are likely to be affected by the Project.

<u>Reptiles</u>
Beach and bluff natural communities are expected to support several species of reptiles, mainly lizards. The western fence lizard (*Sceloporus occidentalis*) was observed during the September 2002 reconnaissance survey. Other species with substantial potential to occur include California side-blotched lizard (*Uta stansuriana elegans*), coastal western whiptail lizard (*Cnemidophorus tigris multiscutatus*), orange-throated whiptail (*Cnemidophorus hyperythrus beldingi*), and silvery legless lizard (*Anniella pulchra pulchra*) (MEC 1997). No sensitive reptiles are known or expected to occur within the Study Area, and none would likely be affected by the Project.

<u>Birds</u>
A total of 12 terrestrial bird species were observed during the September 2002 reconnaissance-level survey. Numerous species of terrestrial birds are known to occur within the terrestrial portions of the proposed Project footprint. Terrestrial birds associated with the shoreline and bluff natural communities observed during the September 2002 survey consisted of urban adapted species such American crow (*Corvus brachyrhynchos*), house finch (*Carpodacus mexicanus*), and rock pigeon (*Columba livia*). In addition, black phoebe (*Sayornis nigricans*), bushtit (*Psaltriparus minimus*), and song sparrow (*Melospiza melodia*) were commonly observed.

Sensitive Bird Species: Numerous sensitive bird species are known to occur within or near the Study Area; however, most of these species are of transitory nature, would be present for short durations of time and predominately within upland natural communities, or would be only found in nearby areas. These species are not expected to use the bluff portions of the Project activity footprint or Project areas potentially affected by noise or nighttime lighting in any appreciable way. Thus, the following species are not anticipated to be adversely affected by the Project**:** Belding's savannah sparrow (*Passerculus sandwichensis beldingi*), coastal California gnatcatcher (*Polioptila californica californica*), American peregrine falcon *(Falco peregrinus anatum*), Osprey (*Pandion haliaetus*), and light-footed clapper rail (*Rallus longirostris levipes*).

Mammals

Three species of mammals were observed during a September 2002 reconnaissance survey: California ground squirrel (*Spermophilus beecheyi*), desert cottontail (*Sylvilagus audubonii*), and domestic cat (*Felis catus*). Mammal species with the substantial potential to occur in the terrestrial shoreline or bluff natural communities include Botta's pocket gopher (*Thomomys bottae*), house mouse (*Mus musculus*), black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), opossum (*Didelphis virginiana*). Domestic dogs (*Canis familaris*) also have been observed on the beach. No sensitive terrestrial mammal species are known or expected to occur within the Study Area.

**Coastal Lagoons**

Three coastal lagoons occur near the Study Area, and their lagoon mouths occur within the action area: San Elijo Lagoon, Batiquitos Lagoon, and San Dieguito Lagoon. Between the 1880s and 1970s, landfilling for development, the construction of rail and road corridors, and agricultural operations reduced the extent of estuarine open waters and wetlands in these lagoons, while also constraining or eliminating tidal and/or riverine influences in the remaining wetlands (SCE 2005; San Elijo Lagoon Conservancy 2012). The amount of water exchanged between the ocean and these lagoons was subsequently reduced during each tidal cycle. As a consequence of the reduced tidal prism and less frequent flood scouring of the lagoon and mouth, lagoon closures due to natural berming of the river mouth became common from the 1940s onward (SCE 2005). These lagoon closures undoubtedly exacerbated the effects of sewage effluent and urban and agricultural runoff released into the lagoons; for example, sewage effluent was discharged into San Dieguito Lagoon from 1940 to 1974. Episodes of flooding have also resulted in large volumes of sediment being deposited in the existing lagoon wetlands (MEC 1993; SCE 2005; San Elijo Lagoon Conservancy 2012). These lagoons are important relative to the proposed Project because, in their present conditions, these lagoons represent valuable but diminished local beach sand resources relative to historical conditions.

Batiquitos Lagoon

Batiquitos Lagoon is approximately 4.8 mi north of the SO-6 borrow site and about 7.6 mi north of S0-5. The lagoon inlet/outlet is approximately 1.6 mi north of Segment 1, which is the closest proposed Project activity (beach replenishment) area (Figures 2 and 20). The lagoon is about 610 ac.

Batiquitos Lagoon underwent a substantial restoration (beginning in 1994) that included construction of a permanent inlet/outlet to substantially restore tidal flushing to the lagoon. The lagoon mouth is artificially narrow and confined as compared to historical conditions (e.g., as occurred during larger storm flows), due to fill and structures associated with roads and the railroad, as well as the relatively new permanent hard-structure inlet/outlet developed as part of the recent restoration. The lagoon is managed as a State Ecological Reserve by the CDFW and routine dredging is required to maintain hydrological circulation within the lagoon due to sediment deposition. Substantial quantities of sediments settle into the lagoon during stream storms flows, rather than being naturally flushed to the ocean, due to the hydrologically-constraining artificial fill and structures noted above. The primary natural communities of the lagoon are estuarine open water followed by coastal salt marsh. Nesting areas that were created within the lagoon with dredge spoils support endangered California least terns and threatened western snowy plover, as described above. The lagoon also provides very important habitats for marine and estuarine species of invertebrates and fish.

San Elijo Lagoon

The current ocean inlet/outlet to San Elijo Lagoon is in Reach 7, south of Segment 1 and north of Segment 2 (Figures 2, 18, and 21). The inlet/outlet of the lagoon is about 0.8 mi east of site SO-6 and 2.6 mi north of site S0-5. Proposed borrow site SO-6 is situated within what was likely the (pre-development) natural nearshore sand deposition area for the lagoon/Escondido Creek during flood flows in the creek (Figures 18 and 21). The lagoon mouth is artificially narrow as compared to historical conditions (e.g., as likely occurred during larger flood flow events, before the surrounding area was developed with a railroad and roads), and the lagoon inlet/outlet is now artificially confined to the extreme northern edge of the lagoon by road and railroad fill and associated structures (e.g., the Coast Highway 101 bridge and the Burlington Northern Santa Fe Railroad (BNSF) trestle).

Up until the late 19$^{th}$ century, the natural conditions of the lagoon were likely characterized by a lagoon mouth of variable locations and widths across a 5,500 ft wide sand spit dominated by sand bar-building processes. The lagoon outlet of Escondido Creek likely migrated over time from the existing bluffs (Cardiff by the Sea/San Elijo State Beach Campground) to the north (the location of the current creek/lagoon mouth outlet/inlet) south to the bluffs at what is now the northern edge of developed Solana Beach. During this period, fluvial processes likely continued to infill the Escondido Creek valley, but also deposited substantial alluvial sediments into the littoral zone and offshore of the ocean during the larger flood flows during storm flow events.

It has been decades since San Elijo Lagoon and Escondido Creek were naturally connected to the Pacific Ocean. Human modifications to the hydrology of the lagoon occurred at a rapid pace after the 1880s. The first bridge (trestle) and berm crossing the lagoon was constructed around 1881 for the Atchison, Topeka and Santa Fe Railroad (a subsidiary rail line called, at the time, the California Southern Railroad), when a railroad bed was constructed as a filled causeway across the lagoon mouth, with only a small trestle opening provided to pass stream storm flows (which allowed some tidal flow between the ocean and lagoon). This was followed by road construction in 1891, with much of the roadbed on fill extending into the lagoon and only a small bridge opening to pass flood flows (San Elijo Lagoon Conservancy 2012). Between 1880 and 1940 dikes and levees were built in the lagoon for duck hunting, salt harvesting, and sewage settling ponds (San Elijo Lagoon Conservancy 2012). In 1965, Interstate 5 construction was completed across the lagoon, dividing the lagoon in half with a large filled causeway and another narrow bridge opening. This "partitioning" of the lagoon created altered flows for both fresh and saltwater, leading to accelerated sediment deposition, dramatically-reduced water quality, and a degradation of native estuarine natural communities (San Elijo Lagoon Conservancy 2012). Additional structures and fill (e.g., for restaurants, stores, parking lots, sewer lines, etc.) have also been constructed on and near the area of the barrier spit that fronts the lagoon, including construction of U.S. Route 101 (now Coast Highway 101) in 1912. All these features together have altered the previous natural fluvial and surface/subsurface tidal flow conditions in the long-term, forcing the lagoon inlet/outlet to remain at its present northerly location. Since the early 1990's the artificially narrow inlet/outlet of the lagoon has been maintained in an open condition by repeated sediment removal from the inlet/outlet channel using heavy equipment, with funding partially provided by the California State Coastal Conservancy and California Department of Transportation.

San Elijo Lagoon currently encompasses approximately 1,065 ac. Natural communities in and surrounding the lagoon consist of coastal salt marsh, brackish/freshwater marsh, mudflats, tidal creeks, salt pannes, and a mix of upland communities including coastal sage scrub and Eucalyptus woodland. San Elijo Lagoon is one of the highest ranked areas for supporting waterfowl in San Diego County, because of its diverse natural communities, substantial marsh and open water areas, and high ecological productivity (MEC 1993). Belding's savannah sparrow and light-footed clapper rail nest at the lagoon. As noted above, until 2005, the California least tern nested at the lagoon in an extant salt panne east of Interstate-5. Substantial restoration of the lagoon and adjacent areas will likely occur during the 50-year life of the Project, including enhancement or restoration of nesting by Belding's savannah sparrow, light-footed clapper rail, snowy plover, and California least tern.

San Dieguito Lagoon

San Dieguito Lagoon is approximately 0.7 mi east of site SO-5 and about 2.0 mi south of the SO-6 (Figures 2, 18, and 22). The ocean inlet/outlet to San Dieguito Lagoon is approximately 0.3 mi south of the footprint of the nearest proposed Project activities, beach replenishment in Segment 2. The lagoon is part of the San Dieguito River Park System.

The lagoon and San Dieguito River channel are hydrologically constrained by fill and structures associated with Interstate 5, the Del Mar Racetrack, roads and the railroad, and surrounding urban development (SCE 2005). Five bridges cross San Dieguito Lagoon; from west to east, they include Camino Del Mar (Highway 101), the BNSF Railroad, Jimmy Durante Boulevard, Grand Avenue, and Interstate-5. Utility line easements cross portions of the lagoon. The small flow openings associated with these fill constrictions and hydrological choke points have altered the physical behavior of the lagoon over the last 100 years (SCE 2005). These conditions promote the retention of beach sand materials, as well as fine-grained sediment from upland sources, within the lagoon (SCE 2005). This, in turn, reduces the tidal prism and increases sedimentation rates in the lagoon (SCE 2005).

The marsh portion of the lagoon historically was likely over 600 ac, while the entire lagoon probably covered 1,000 ac (San Dieguito River Park 2012). Over the years, San Dieguito Lagoon was subjected to major filling activities, reducing the marsh and lagoon to about half these acreages (San Dieguito River Park 2012). Before the SCE restoration project, the 22nd Agricultural District formerly used a bulldozer to periodically open the lagoon inlet/outlet to tidal flushing. Proposed borrow site SO-5 is situated in what was likely the pre-development nearshore sand deposition area for the lagoon/San Dieguito River.

The lagoon was the location of a 116 ac, $90 million mitigation/restoration project recently implemented (construction phase 2006 to 2011) by SCE (SCE 2012). One primary effort of the restoration project was to remove the sand that had deposited in the river channel and lagoon over the last several decades; approximately 125,000 $yd^3$ of sand was removed from the constrained channel and lagoon (SCE 2012). Implementation of the total San Dieguito Wetlands Restoration Project (of which the SCE restoration project is a part) will require excavation and disposal of approximately 2.3 million $yd^3$ of dredge material (SDRP 2012). The lagoon inlet/outlet is now required to remain open to tidal flushing, per the conditions placed on the restoration project by the California Coastal Commission, and SCE agreed to keep the inlet/outlet open to the ocean in perpetuity as part of the project (SCE 2012). As part of the restoration, four new bird nesting sites (two east and two west of Interstate 5) were created within the constructed sub-tidal basins, using sand as topping for the nesting areas (SCE 2012) (Figure 22). Two of these nesting sites were occupied for the first time in 2013 by least terns that very likely forage in the action area (Friends of San Dieguito River Valley 2013). The lagoon provides foraging and nesting habitats for endangered Belding's savannah sparrows and snowy plover, and least terns forage in the lagoon.

## EFFECTS OF THE PROPOSED PROJECT ON BIOLOGICAL RESOURCES

Implementation of the proposed notch filling and initial and subsequent beach replenishment efforts are expected to result in direct and indirect effects to biological resources during dredging, staging of equipment away from beach replenishment sites, replenishment site equipment access, and the activities of sand placement on the replenishment sites. These effects are expected to include direct mortality to biological resources, especially benthic invertebrates. Indirect effects would likely occur temporarily/periodically from increased turbidity, noise, night-time lighting, and migration of sand from the replenishment sites onto reef, kelp, and seagrass areas. Recurring direct and indirect impacts would likely occur over the proposed 50-year course of the Project through the planned repetitive replenishment of the beach areas in Segments 1 and 2. The Project would likely provide benefits to some biological resources by periodically widening the sand beaches in replenishment areas, with the results of temporarily enhancing certain sand spawning habitats and periodically increasing the beach invertebrate prey base during the periods between sand replenishment events and subsequent passive restoration.

## Dredging and Beach Replenishment Activities

Proposed dredging operations at the borrow sites would result in the mortality of benthic invertebrates present at SO-5, SO-6, and MB-1 in areas disturbed. The total area directly affected at the dredge sites is expected to total about 275 ac disturbed over about a 50 year period. Dredging cycles for replenishment in Segment 1 (Encinitas) would last up to approximately 62 days, and dredging cycles for Segment 2 (Solana Beach) would last up to about 107 days (USACE 2013c).

The potential adverse effects of dredging include: 1) direct removal/burial of organisms; 2) turbidity/siltation effects, including light attenuation from turbidity; 3) contaminant release and uptake, including nutrients, metals and organics; 4) release of oxygen consuming substances; 5) entrainment; 6) noise disturbances; 7) alteration to hydrodynamic regimes and physical habitats; and 8) reduced fish forage base. The dredging impacts of most concern are impacts to the benthic invertebrate community and the alteration to the topography of the seafloor at the borrow sites.

Most benthic invertebrates within the dredging footprint would be killed by the dredging. Following each dredging event, a temporary reduction in the localized prey base for fishes that feed on benthic invertebrates would occur within the borrow site(s). Empirical models for shelf waters such as the North Sea indicate that as much as 30 percent of total fisheries yield to human use is derived from benthic resources, and that these resources become an increasingly important component of the food web in nearshore waters where primary production by seaweeds (macrophytes) and seagrasses living on the sea bed largely replace the productivity of phytoplankton in the water column (Newell et al.1998).

Reportedly all of the proposed borrow sites have been subject to previous dredging disturbance by other projects. Because the Corps has committed to not dredge the same locations within a borrow site twice as part of the Project (USACE 2013b), dredging disturbance would largely not be repeated in the same location by subsequent Project renourishment cycles over the 50-year life of the Project. Nevertheless, some overlap of repeated disturbance is likely inevitable as new areas are dredged adjacent to areas of older dredging, thereby causing repeated re-setting of succession of benthic communities in those areas of overlap. It is also unclear if other dredging projects would avoid these same borrow pit areas in the future. In dredged areas that remain undisturbed following dredging activities, new benthic communities are expected to eventually recolonize the remaining substrates. The change in topography (greater depth) of the ocean floor from the proposed dredging would be about 20 ft where dredging occurred to full design depth.

The primary potential for degradation of water quality from the proposed beach nourishment is through the generation of temporary turbidity during dredging and sediment discharge to the beach. Turbidity at the borrow sites can be influenced by many factors, including sediment re-suspension (primarily determined by the type of dredge), characteristics of dredged material, water depth, and hydrodynamic forces (mixing, currents, etc.). The degree of turbidity depends largely on the size of the sediment particles. Coarse-grained materials, such as sands that are predominately found in all three proposed borrow sites, tend to settle on the order of several minutes at similar depths resulting in small turbidity clouds (USACE 2012e). Approximately 2-18 percent of the sediments to be dredged consist of fine sediments (USACE 2012e), which would take longer to settle out. Use of bottom mounted hydraulic dredges (hopper and hydraulic dredge) result in turbidity that is generally limited to the bottom and is rarely visible at the surface (USACE 2012e). The exception would be from overflow of water from a hopper dredge. This process results in the discharge of turbid water during filling of the hopper. This turbidity is closely tied to the hopper dredge and the extent of any turbidity plume would largely depend on the proportion of fines in sediments being dredged; dredging of pure sands would have a small plume. Unlike a cutterhead dredge, which would create a continuous plume during dredge operations, a hopper dredge would create intermittent plumes during the dredging and disposal (replenishment) cycles (USACE 2012e).

Dredging activities can result in the re-suspension of bottom sediments, release of nutrients from sediments, and promote unseasonable and/or larger than normal algal blooms. Consequences of increased algal blooms can be the depletion of dissolved oxygen levels and the increased potential for fish kills and mortality of other marine biota. However, while the borrow sites do contain fine sediments, sediments at the borrow sites consist primarily of coarse-grained sands with low oxygen demand, as indicated by low total organic carbon (TOC) concentrations and non-detectable levels of dissolved sulfides (USACE 2012e). Water quality monitoring at the borrow sites SO-5 and SO-6 during dredging for RBSP I did not detect any exceedances in permit limits for dissolved oxygen concentrations (USACE 2012e). Given the similarity in dredging activities between RBSP I and the proposed Project, re-suspension of bottom sediments during dredging at SO-5 and SO-6 would not substantially reduce dissolved oxygen concentrations in receiving waters (USACE 2012e). Further, natural mixing from currents, winds, and waves would minimize the potential for dredging operations at these borrow sites to significantly reduce the dissolved oxygen concentrations (USACE 2012e). Similar data for borrow site MB-1 was not found for this report.

Concentrations of evaluated contaminants in borrow sites SO-5 and SO-6 reportedly indicated no probability of adverse biological effects due to contaminant release during sediment re-suspension (USACE 2012e). The low TOC of the sediments, along with the mixing and dilution capacity of the open water at the SO-5 and SO-6 borrow sites, would reportedly be sufficient to ensure low nutrient concentrations such that phytoplankton blooms would not occur (USACE 2012e). Equivalent data for borrow site MB-1 was not found for this report, but similar conditions likely prevail due to the similarities in ocean positions.

Turbidity plumes associated with dredging activities at MB-1, SO-5, and SO-6 would reportedly not likely reach kelp or reef natural communities in the action area, as existing kelp and reef communities are not within the modeled plumes (Figures 18 and 19) (USACE 2013a). Some small patches of kelp formerly occurred near proposed borrow site SO-6; these patches where not recorded from these same locations in 2004/2005 (Figure 18). The location and footprint of each of the borrow site were reportedly designed to reduce indirect impacts to hard bottom natural communities from dredging operations. As noted in 2012 Draft EIS/EIR, turbidity plumes would be expected under typical current speeds that may extend up to 500 ft under maximum current speeds and certain oceanographic conditions (USACE 2012e). By design, a minimum 500-ft buffer has been provided by the Project between the proposed dredge areas and hard-bottom natural communities in the vicinity of SO-6 and SO-5 (USACE 2012e).

Turbidity plumes associated with beach replenishment could temporarily hinder sight-feeding birds, such as the least tern and brown pelican, from effectively capturing their fish prey in the local affected area. Even if schools of fish utilized by terns and other birds are not totally obscured in an affected area, turbid water conditions can adversely affect the success of capturing of prey items. Conversely, surface turbidity plumes may not totally preclude foraging efforts by all seabirds. Monitoring during dredging operations in San Diego Bay in 1996 observed brown pelicans, Forster's terns (*Sterna forsteri*), and royal terns (*Sterna maxima*) foraging within surface turbidity plumes (U.S. Navy 1996). The 2012 Draft EIS/EIR noted that beach replenishment turbidity would be expected to be localized to the discharge location, generally within 500 ft or less, except where carried farther by rip-currents (USACE 2012e).

The Project-associated placement of temporary pipelines, anchoring, installation of mono buoys, and vessel transport have the potential to impact sensitive biological resources in the action area. The 2012 Draft EIS/EIR indicates that:

> "Similar to RBSP I and II, it is assumed that project specifications would include requirements to avoid sensitive resources such as kelp, reefs, and structures such as outfalls. Discharge lines would also be placed to prevent vessels from traversing kelp beds and designated vessel transit corridors also would avoid kelp beds. In addition, an anchor plan would be prepared during the project implementation and design phase for each mono buoy to avoid sensitive resources in the area."

The proposed Project alternatives provided by the Corps for analysis all involve onshore placement of replenishment sand. The receiver site footprints were designed to reduce impacts to sensitive biological resources in the area (e.g. rocky reef and surf grass beds) (USACE 2012e). Under the tentatively recommended plan alternative for the Project, a maximum of 93 ac of beach natural communities would be directly disturbed by construction at Encinitas and 63 ac at Solana Beach (USACE 2013b). The primary direct impact associated with beach nourishment is the potential for burial of beach invertebrates (e.g., clams, sand crabs, worms) living within the substrates at the receiver site (USACE 2012e). Other direct impacts may result from equipment damage associated with placement of pipelines to pump sediment to the beaches, operation of vehicles to move and spread sand at the receiver sites, and movement of vehicles and equipment during access to and from the pipeline and receiver sites. A likely indirect effect of the Project beach disturbance would be the temporary reduction in sandy beach invertebrate populations, with a concomitant reduction in forage base for fish and shorebirds that feed upon these invertebrates under appropriate tidal conditions. The 2012 Draft EIS/EIR concluded that recovery of the invertebrate prey base on directly disturbed portions of the beach would be complete in less than 1 year.

Natural sand movement on the action area beaches is a seasonal cycle, with movement offshore in winter and onshore in summer; sand is also transported down-current between beaches (Cumberland et al. 1997). Following each sand placement event, beach fill would gradually retreat (erode) from the receiver sites, in part due to the overall artificially reduced level of natural sand supply within the littoral system (as noted above). To what extent and rate the retreat of the receiver sites would occur over the life of the proposed Project is unknown, in part due to vagaries of climate, winter storms, and wave energy. Sand that erodes from the receiver sites is expected to be mobilized by waves and redistributed out of the littoral zone and alongshore through natural processes; the sand moving alongshore would move both up and downcoast out of the project area, but predominately downcoast.

Some potential exists for sand introduced into the system to indirectly impact sensitive resources, particularly if sand deposits on those resources occur at increased depths and/or period compared to natural sand transport. The sand movement of the newly placed Project sand would become part of the sand transport system of the littoral zone, and could potentially bury or scour established seagrass and hard substrate natural communities (Cumberland et al. 1997).

The action area has a number of sensitive marine resources that could be adversely affected by the proposed beach replenishment, including those resources associated with the intertidal and subtidal zones, kelp beds, lagoon natural communities, and the general beach environment. In the shallow subtidal zone, sand movement influences substrate type and the presence of associated biota, and natural communities undergo temporal and spatial variation in response to sand movement (AMEC 2002b). For some sensitive marine organisms to remain viable, a firm substrate with little or no sand is required for initial settlement and growth (AMEC 2002b). With time, these organisms may reach a size that will provide a refuge from sand burial; however, repetitive scour and/or burial by sand could eventually cause mortality and variation in population structure (Foster and Schiel 1985). Sand scour and burial can create substrate disturbance; the effects of these disturbances on marine organisms are closely related to reef elevation and can determine if the natural communities involved remain suitable for surf grass, macroalgae, and/or sessile invertebrates (AMEC 2002b). High-relief reefs are normally exposed to less disturbance from burial and scour, which allows recruitment and persistence of particular sessile organisms. Low-relief reefs are more exposed to disturbance from burial and scour and provide less stable habitats for most sessile species (Dayton et al. 1984). If a substrate is highly disturbed, it becomes too unstable to support most organisms (AMEC 2002b).

The 2001 RBSP used analytical and numerical modeling to predict the movement of sand from receiver sites and the potential impacts to sensitive biological resources. The RBSP analyzed the potential impacts to nearshore marine resources by using a Generalized Model for Simulating Shoreline Change (GENESIS) to predict longshore sediment movement. A separate analytical program was used by the RBSP to calculate the seasonal cross-shore transport of sediments. Results for the RBSP as initially proposed indicated that nearshore marine resources would be adversely affected, and the project was subsequently modified to substantially minimize potential impacts. In some cases, receiver site footprints were eliminated and/or modified in length and location to avoid impacts to sensitive resources. The RBSP also did extensive monitoring during and following construction to confirm the predicted low-level effects to nearshore marine resources. Monitoring of the RSBP concluded that dredging and beach replenishment did not appear to result in any long-term adverse effects (Engle 2005).

Per the Project alternatives analyzed in the 2012 Draft EIS/EIR, the largest Project alternatives could involve initial total placement of up to 2,420,000 $yd^3$ of sand. In addition, subsequent replenishment events with some of the Project alternatives could involve sand volumes of as much as 700,000 $yd^3$ in Segment 1, and as much as 960,000 $yd^3$ in Segment 2.

The current proposed Project involves alternatives EN-1B and SB-1B (City of Solana Beach 2013): Alternative EN-1B would have an initial placement volume of 340,000 $yd^3$ within the City of Encinitas that would extend the beach width by 50 feet. Subsequent sand nourishments for alternative EN-1B would occur every 5 years and require placement of about 220,000 $yd^3$ of material, to the same beach width. Alternative SB-1B (within the City of Solana Beach) would have an initial placement volume of 700,000 $yd^3$ that would extend the beach width approximately 150 feet. Subsequent renourishments for SB-1B would occur every 10 years and require placement of 290,000 $yd^3$ of sand, to the same beach width. This proposed initial placement total of 1,040,000 $yd^3$ (both Segments) is about 1.8 times the approximately 580,100 $yd^3$ of sand the RBSP deposited in the Study Area in 2001. The subsequent replenishment events would total about 510,000 $yd^3$, a bit less than the 580,100 $yd^3$ of the RBSP. We are concerned that any sand replenishment project of larger magnitude than the RSBP could result in significant negative effects on nearshore marine resources, in part due to the likelihood of subsequent replenishment events precluding passive restoration of some affected (e.g., buried) resources during the life of the Project.

The Corps has performed substantial modeling regarding potential indirect movement of replenishment sand that would likely result from the proposed Project alternatives. Summaries of this modeling are included in the appendices of the 2012 Draft EIS/EIR. Sediment transport modeling was used to predict the influence of the project on sand elevations in the vicinity of the Project receiver sites over time. Estimates of the areas potentially affected were calculated, including sedimentation and potential impacts to resources (e.g., sandy areas, rocky reef, surf grass, and kelp).

For the proposed Project, a burial criterion of greater or equal to 12 in of sand was used. Project-related impacts above this level were considered in the 2012 Draft EIS/EIR to have potential impacts (e.g., on reef perennial/indicator species and habitats). The potential Project-related impacts were determined by subtracting the most probable impact from natural variation in sand movement. Site conditions vary across the Project area, and sedimentation would have different effects on each site depending on these conditions. Based on the 2012 Draft EIS/EIR analysis, substantial adverse effects to quality or quantity of benthic habitats (e.g., rocky reefs) were predicted by modeling based on sand level changes at Project year 2 following Project implementation for the Solana Beach receiver site and tidal lagoon mouths. This would potentially result from the introduction of significantly more sand into the active littoral environment.

For the Encinitas receiver site (Segment 1), 2012 Draft EIS/EIR sedimentation modeling estimates indicated no Project-related impacts to nearshore biological resources for all Encinitas alternatives under consideration. For the Solana Beach receiver site (Segment 2), the sedimentation modeling estimates indicated potential impacts to "intertidal reef platform" at 0.1 to 0.4 ac and "reefs with other indicator species" at 1.5 to 8.0 ac for all Project alternatives under consideration. No impacts to reefs supporting surf grass were predicted (as compared to natural variation).

For both receiver sites, the Project need for subsequent renourishment events would be based on the equilibrium beach width that would be initially implemented (e.g., if a 100 ft beach width is proposed for the initial placement, renourishment volume would be based on maintaining a 100 ft beach width), thus no larger impacts (i.e., greater acreages affected) were anticipated by the model from each renourishment event, as impacts to nearshore resources would be expected/predicted during the initial beach fill. In addition, an adaptive management and monitoring program is proposed for the Project to help account for potential cumulative effects associated with other beach nourishment activities (e.g., opportunistic programs, lagoon maintenance dredgings, etc.). While the 2012 Draft EIS/EIR analysis relies on predicted impacts, actual impacts would be assessed by implementation of a construction monitoring program. Mitigation (creation of artificial reef) would be triggered only if certain conditions occur during, and persist through, the two year post-construction monitoring period. If mitigation is implemented, mitigation monitoring would also be conducted. The specifics of monitoring and mitigation would be determined in consultation with the resource and regulatory agencies (USACE 2012e).

As noted, some of the sand proposed to be placed on the beach would likely migrate from the receiver sites to the inlets of Batiquitos Lagoon, San Elijo Lagoon, and/or San Dieguito Lagoon causing increased shoaling of the inlets. Expected volumes of sand that would migrate to San Dieguito Lagoon have not been quantified but are thought to be potentially higher than the other lagoons given the proximity and down-coast location of the lagoon to that of the sand placement activities in Encinitas (as noted above, most littoral sand flow naturally moves down-coast). As with natural littoral drift sands that periodically block the mouths to San Elijo and San Dieguito lagoons, sand from the proposed Project would not likely end up deposited into the lagoons themselves (USACE 2012e).

The increased sedimentation of lagoon outlets/inlets has the potential to result in increased closure periods or restrictions of one or more of the lagoon mouths, particularly at San Elijo and San Dieguito lagoons. Most southern California estuarine ecosystems require regular tidal inundation through their mouths to remain healthy, particularly with modified barrier beaches (e.g., with compacted road fills along the beach and the resultant reduced subsurface tidal inflow/outflow through the semi-permeable barrier beach matrix) and urban/agricultural freshwater inflows (e.g., modified runoff lowflows and contaminants). Both San Elijo and San Dieguito lagoon outlets/inlets are currently artificially maintained by periodic dredging and the proposed beach replenishment activities would likely result in increases in costs, volume, and/or frequency of dredging necessary to keep the lagoon outlets/inlets open. Post construction monitoring for the Project would include monitoring of the lagoon entrances to determine if the

Project has caused closure or restrictions in those entrances; as noted in Mitigation above, a lagoon sedimentation fee would be paid to offset the costs of dredging should the Project result in such closures or restrictions.

Placement of sand is also expected to bury and thereby temporarily reduce the benthic invertebrate assemblage on the receiver beaches. Rates of recovery reported in the literature suggest that sand and gravel natural communities may take 2 to 3 years to recover, depending on the proportion of sand and level of environmental disturbance by waves and currents, and may take even longer where rare slow-growing components were present in the community prior to disturbance (Newell et al. 1998; Versar 2004). As the deposits get coarser along a gradient of environmental stability, estimates of 5 to 10 years are probably more realistic for development of the complex biological associations given the slow-growing components of equilibrium (late succession stage) natural communities characteristic of reef structures following removal of disturbance (e.g., reef becoming unburied) (Newell et al. 1998).

On existing cobble and rock beaches, the invertebrate community would likely increase in diversity and biomass following replenishment events and recovery (SAIC 2005). This increase would in turn likely benefit most shorebirds that prey on invertebrates along these beach types, if replenishment cycles are of a sufficient period to allow for substantial recovery. Considering the disturbance to macro-invertebrates associated with replenishment activities on existing sand beaches, it is likely that many foraging birds would obtain comparatively less food at replenished beaches until benthic natural communities recover (Grippo et al. 2007). Overall, upper beach habitats for many shorebirds in Segments 1 and 2 would likely be temporarily improved or restored in many areas by the temporary conversion of cobble or low relief hard substrate shoreline to sand beach, as well as by the temporary widening of existing sand beaches, including additional available beach space at high tide.

Sand placement activities would involve direct effects to a relatively small portion of beach at any one time, but it would disturb some shorebird use. However, most shorebirds would likely avoid the immediate construction area and continue to forage in nearby beach areas. Due to the expected increase in invertebrate diversity and biomass following sand placement events and recovery from disturbance, most shorebirds and gulls that would use the action area would likely benefit overall from the temporary net increase in prey base.

The proposed mitigation reef would result in the conversion of up to 16.8 ac (maximum) of natural soft sandy seafloor substrate natural community to rocky substrate community. Proposed mitigation sites areas are offshore of Solana Beach. The conversion would result in a permanent change to the seafloor topography and natural communities. The creation of a mitigation reef is only expected to convert a small amount of soft sandy substrate seafloor to hard rocky substrate relative to the total amount of sandy seafloor in the action area and region. The created rocky substrate natural community is expected to become of high ecological productivity over time. Reef construction is expected to be completed in 28 days (USACE 2013c). Outside of the noted permanent conversion, any adverse effects from construction would likely be short-term.

Grunion

The proposed initial and repeated sand replenishment activities could cause repeated short-term impacts to grunion if done during its spawning season, depending on timing and location of each replenishment event. During the grunion breeding season, Project-associated vehicle use (e.g., access routes, pipeline installation and removal) has the potential to damage eggs in the upper intertidal, if eggs are present (USACE 2012e). However, grunion spawning habitat in Segments 1 and 2 would likely also be temporarily improved or restored in many areas by the temporary conversion of cobble or hard substrate shoreline to sand beach, as well as by the temporary widening of existing sand beaches. Sand replenishment could result in the building of beach berms that are too steep in the short term for successful grunion spawning in subsequent grunion runs (CDFW 2012). Steep slopes or widened beaches also could, in the short term prevent any recently placed eggs from hatching if the next high tide cannot reach the area where eggs are incubating (CDFW 2012).

The proposed Project includes preconstruction grunion habitat suitability assessments and monitoring that would be used to reduce adverse effects to grunion during their spawning season. A habitat suitability survey would be conducted prior to construction, and monitoring would occur during construction to reduce potential impacts to the species (USACE 2012e). If suitable grunion spawning habitat is observed, a Grunion Protection Plan would be prepared in consultation with National Marine Fisheries Service, CDFW, and CCC (USACE 2012e).

As proposed, the Corps would monitor and avoid potential direct Project impacts to grunion in the entire construction area footprint identified as suitable habitat (USACE 2013c). Most Project-related equipment would remain above the mean high tide line during Project activities. Pre-construction grunion surveys would be performed prior to all predicted grunion runs in Project construction years, including surveys conducted to assess the potential for suitable grunion spawning habitat within all Project activity footprints occurring in beach areas (USACE 2013c). If Project beach replenishment activities would occur during the grunion spawning season, suitable habitats would be surveyed by the Corps during predicted runs for grunion spawning in construction areas. If grunion spawning is detected within beach replenishment activity areas, the Corps would establish a Project activity buffer, where practicable, extending 100 ft upcoast and downcoast (total 200 ft) of the spawning area. The buffer would remain until grunion eggs hatch (minimum of one lunar month) and surveys show no subsequent spawning (City of Solana Beach 2013; USACE 2013c).

The proposed Project measures noted above would likely avoid most direct adverse effects to grunion. Protective measures are not proposed for the Project for nighttime lighting, surf zone turbidity, and short-term sand movement into potential spawning areas during the breeding season that could temporarily impact grunion breeding in some areas adjacent to sand placement areas. This should be considered in the context that most of the Project footprint and environs would likely be poor grunion habitat during Project activities. Almost all of the sand receiver sites, vehicle access routes, and potential pipeline routes are currently poor breeding habitat for grunion (due to narrow beach widths), and these areas would likely be poor breeding habitat during the repeated periods of beach replenishment, as these beaches would all likely be depleted and narrow directly before proposed replenishment cycles. One notable exception is Moonlight State Beach in Segment 1 where grunion occupation has recently been reported.

The primary benefit of the proposed Project to grunion would be to temporarily increase an undetermined amount and persistence of sandy beach grunion habitat in the action area. It is likely that for a number of years following each replenishment cycle (and following a recovery period involving natural movement of replenishment sand by waves, such as re-setting of natural beach sand slopes and contours), that habitat enhancement for grunion spawning would result from increased beach widths and reduction in areas of surface cobble.

Least Tern

Turbidity (as outlined above) is of concern for the least tern because dredging and sand placement activities would potentially occur during the least tern nesting season (April 1 to September 15). The least terns would probably be most sensitive to any substantial turbidity plumes in primary foraging areas in the early May through late July period when eggs, chicks, or fledglings would very likely be present in nesting areas and foraging displacement (and associated time and energy losses) could be important. Turbidity plumes, potentially generated by dredging activities and/or carriage water return from beach replenishment, may obscure and/or attract forage fish in portions of the surf zone or nearshore waters that are used by least terns for foraging. Any turbidity plumes generated by the Project would likely be from the fines within the materials to be dredged and placed, rather than from the larger particles of sand that make up most of the dredged material.

The 2012 Draft EIS/EIR indicates that "[t]he receiver and borrow sites are located far from nesting site locations that may be seasonally used by endangered least terns…The three borrow sites are located off shore in deep water. Few terns are expected to forage so far offshore." This is incorrect. In least tern colonies where feeding activities have been studied, the birds foraged mostly within 2 mi of the breeding area and primarily in nearshore waters less than 60 ft deep (USFWS 2006). Current and expected/potential nesting sites are not "far" from Project receiver and borrow sites, considering existing and expected nesting sites at Batiquitos, San Dieguito, and San Elijo lagoons and Mariner's Point (Figures 20 through 23). About 25 percent of Segment 1 and all of Segment 2 are within the primary foraging distance, about 2 mi (USFWS 2006), of these existing or expected nesting sites. About 25 percent of site SO-6 is within the primary foraging range for least terns at the historical/potential nesting site at San Elijo lagoon. All of site SO-5 is within primary foraging range of the San Dieguito lagoon nest sites, and all of site MB-1 is within the primary foraging range from the Mariner's Point nest site. Two of the borrow sites are not in "deep water"; a large portion of site SO-5 and all of SO-6 are in waters less than 60 ft deep (Figures 21 and 22). Site MB-1 is in waters 60 to 74 ft deep (outside of the typical primary least tern foraging water depth of 60 ft or less) (Figure 23). The proposed borrow sites are not "located far offshore": borrow sites SO-5 and SO-6 are well within the primary foraging range from shore for least terns. Most least terns forage within 1 mi of shore, with some foraging 1 to 2 mi from shore (Collins et al. 1979; Atwood and Minsky 1983).

Proposed borrow site SO-5 is 0.5 to 0.7 mi from shore; site SO-6 is 0.5 to 0.9 mi from shore; site MB-1 is 1.0 to 1.4 mi from shore (although the depth makes use of this area less likely).

The closest currently active tern nesting area to Project activity areas of SO-5, SO-6, or the two proposed beach replenishment segments is in San Dieguito lagoon (Figure 22). Least terns first nested in 2013 in nest sites created in the lagoon over the last several years (Friends of the San Dieguito River Valley 2013). The 2012 Draft EIS/EIR indicates that "no nest sites have ever been recorded for the San Dieguito Lagoon" but did not fully consider the significant potential for future nesting at this lagoon, and thus the potential for Project impacts during the life of the Project. The least tern nesting areas at San Dieguito Lagoon were created in 2008 and are approximately 1.2 mi southeast of the southern end of proposed Project beach replenishment in of Segment 2 and 1.3 mi east of SO-5. San Dieguito Lagoon had a total of five least tern nests recorded for two of the nesting sites (sites "NS-11" and"NS-12") in 2013, with two nests successfully producing chicks (Friends of San Dieguito River Valley 2013). These nesting sites are expected to be substantially more productive for least terns during the 50-year Project life. All of SO-5 and associated Project boat traffic zones, and more than half of Segment 2 are within the 2-mi primary foraging range of least terns from these nesting sites. This is particularly important at San Dieguito Lagoon because these nesting areas are 0.7 and 0.9 mi inland from the ocean shoreline (increasing the relative value of available ocean areas within 2 mi), and foraging in adjacent lagoon areas is not likely sufficient for all the needs of least terns nesting there.

The second closest currently active tern nesting area to proposed Project activities is in Batiquitos Lagoon (Figure 20). The closest tern nesting area at Batiquitos Lagoon is approximately 1.6 mi north of the northern end of proposed Project beach replenishment in Segment 1 (Figure 20). Batiquitos Lagoon in the recent past has typically experienced a large nesting subpopulation with up to 574 nesting pairs observed in 2003 (CDFG 2004). About 25 percent of Segment 1 and associated boat traffic zones are within the primary foraging zone of least terns from Batiquitos Lagoon.

The historical/potential tern nesting area at San Elijo Lagoon is about 1.5 mi from the northern end of proposed beach replenishment in Segment 2 and about 1.8 mi from the eastern end of SO-6 (Figure 21). These distances for Segment 2 and SO-6 are also particularly important because this (potential) nesting site is 1.3 mi inland from the ocean and the lagoon itself is not expected to provide sufficient forage for least terns, increasing the proportional value of the suitable ocean areas within the 2-mi primary foraging zone of the site. A range of 1 to 15 pairs nested form 1998 to 2004 within San Elijo Lagoon (Patton 2002; CDFG 2004).

In concluding that the Project would not affect the least tern, the 2012 Draft EIS/EIR provided the statement that "the San Elijo site has not had a nest since 2005" and concluded that San Elijo Lagoon was not likely to be used for nesting by least terns. That conclusion was based on the "conversion of San Elijo Lagoon from an open water lagoon to a salt water marsh" (USACE 2013d). Regarding San Elijo Lagoon, the Corps has stated "The nest site is now over one mile away from the nearest foraging sites located in the open ocean. Until this is rectified and either open water restored to San Elijo Lagoon or the nest site is moved closer to the ocean, the Corps feels that the lagoon will continue to be unused as a nesting site for CLT." (USACE 2013d). We disagree. Nesting by least terns likely has not occurred (or failed) at San Elijo Lagoon since 2005 predominately due to greatly increased predation pressure by American crows over the last decade, not due to unavailability of nesting or foraging habitat (R. Patton, consulting biologist, pers. comm. 2013). Our review of aerial photos indicates that similar amounts of open water have remained within the lagoon over the last couple decades. The lagoon likely has larger areas of open salt and estuarine waters currently compared to what existed in lagoon during the several decades prior to regular dredging of the lagoon mouth that began in the 1990's. The diversity and abundance of fish of the lagoon waters is higher (likely including the size-class of fish taken by terns), and the water quality has improved, with the dredging of the mouth and resultant tidal flushing (San Elijo Lagoon Conservancy 2013). As such, foraging potential for least terns in the lagoon has likely improved in the last few decades (R. Patton, consulting biologist, pers. comm. 2013). Additionally, we expect the least tern use of the pre-2005 nest site has generally involved traveling the 1.3 to 2 miles to reach the primary foraging areas of the ocean. As such, we do not consider the current availability of foraging habitat for least terns in San Elijo Lagoon to be a main limiting factor to nesting in or near the lagoon.

Further, the Corps had stated that the Service's conclusion that least terns may nest again at San Elijo Lagoon is "…speculative…The lagoon currently does not include suitable habitat. Planned restoration may or may not occur" (USACE 2013a). We disagree. Suitable nesting habitat currently exists in the lagoon east of Interstate 5 in an extant salt panne location where nesting occurred in the years previous to 2005 (R. Patton, consulting biologist, pers. comm. 2013). Least terns have high potential to nest again at San Elijo Lagoon during the life of the Project. This is due, in part, to the consideration that restoration of the lagoon will likely be implemented during the Project life (with ecological improvements related to overall least tern ecology, and the potential creation of new nesting areas), but more importantly to the consideration that predator control (e.g., crow traps and exotic tree/perch removal) at the lagoon will likely be implemented in the future even without lagoon restoration. For the reasons noted above, we expect least tern nesting at San Elijo Lagoon to be likely over the 50-year life of the proposed Project, independent of any lagoon restoration. The Corps has stated that restoration of the lagoon may change the nesting status of the least tern for future proposed sand renourishment events (outside of the proposed initial sand replenishment) and has agreed to "revise the assessment to include this possibility" (USACE 2013d).

The closest active tern nesting area to MB-1 is approximately 1.2 mi away at Mariner's Point in Mission Bay (Figure 23). Mariner's Point has been one of the more successful breeding areas in the state in the past with between 220 and 562 breeding pairs from 1998 to 2004 (CDFG 2004).

Success in effectively capturing fish as prey is significant for the least tern. During the nesting season, the least tern feeds predominately on small marine fish captured in nearshore waters of the Pacific Ocean, local coastal lagoons, and river mouths. In general, foraging activity by breeding least tern is especially high in nearshore ocean waters near major river mouths (Atwood and Minsky 1983). Adult least terns catch and deliver small fish to flightless young; these fish are typically smaller than those consumed by adult least terns. The young begin to fly at about 20 days of age, but continue to be fed and are taught how to feed by their parents for some time after fledging. Reproductive success is, therefore, closely related to the availability of undisturbed nest sites and nearby waters with adequate supplies of appropriately sized fishes. Reduced food availability at a southern California least tern colony site was determined to affect the reproductive success of the tern including smaller clutch sizes, significantly lower weights of chicks, and increased levels of egg abandonment and non-predator chick mortality (Atwood and Kelly 1984). Increased chick mortality decreases recruitment to the breeding population.

Because the sediments at the SO-5, SO-6, and the MB-1 borrow sites have a relatively low proportion of fines (e.g., 2-18 percent silt/clay), the Corps does not expect dredging-related activities to generate relatively large turbidity plumes (USACE 2012e). The 2012 Draft EIS/EIR indicated that (USACE 2012e; USACE 2013a):

> "Dredging at the borrow sites and placement of sand at the receiver sites would generate turbidity that would be expected to be localized and rapidly dissipate due to the sandy nature of the sediments…Turbidity from beach nourishment activities would not be expected to affect foraging of the [least tern] based on the localized nature of turbidity plumes expected during construction and their confinement to the naturally turbid surf zone where least terns do not forage (see Section 5.3)."

We disagree. As proposed, the replenishment sand would be placed onto the beach behind berms that would allow much of the sediment to settle out before the associated carriage water discharges back into the ocean. Also, replenishment-activity associated turbidity would occur mainly within the surf zone. Nevertheless, we expect appreciable Project-related turbidity to be moved into the surf zone and nearshore areas by rip currents from sand placed on the beaches, as occurred during monitoring for the RBSP (USACE 2012e). We expect that even though the fine sediments content of the dredge material is not particularly high, some of the sediments to be placed do contain a substantial proportion of fines, as noted above. As such, turbidity plumes of small to moderate size would likely occur in some primary tern foraging areas within the action area. One of the three main foraging areas typically noted for least terns is just outside the surf zone[6] (Collins et al. 1979), and least terns in the Project area have been observed foraging mostly within the surf zone (R. Patton, consulting biologist, pers. comm. 2013) and thus would likely be affected by these turbidity plumes.

One example that has been identified as indicating a lack of dredging-related effects is from Orange County, California. MEC Analytical Systems, Inc. (1997) evaluated tern foraging during a sand placement project between eastern Anaheim Bay Jetty and Warner Avenue in Huntington Beach, California. The project involved the use of a cutterhead dredge. Disposal involved pumping sand slurry directly into a 1,970 ft long by 50 ft wide sedimentation pond on the beach. While field observers documented least tern foraging during dredging operations, it appeared that least terns foraged more frequently in the fringe areas of the dredged-induced turbidity plumes than other locations surveyed (including inside and totally outside the plume). We consider these observations to be anecdotal due to an insufficient baseline and the absence of

[6] The region of breaking waves defines the surf zone.

reporting that addressed the level of success for each foraging dive and the amount of additional time that may have been needed by a bird to successfully locate and capture an individual prey item. These factors may be important in influencing egg predation, chick survival, clutch sizes, and egg abandonment. For example, situations where tern adults must spend additional time away (due to human activities within foraging areas) from eggs or chicks in a nest often provide additional opportunities for nest predators such as American crows. In contrast to potential project-level impacts such as these, it should be noted that years of poor fish availability are known to occur on a regional scale, and least tern nest productivity is usually low range-wide as a result, largely regardless of surrounding human activities.

In response to the information above, the Corps has responded (USACE 2013a) that:

> "More recent observations, including Marina del Rey, indicate that the presence of a dredge has no effect on least tern behavior, including foraging. They react as they do to other vessels, avoiding the actual structure, but foraging in the immediate vicinity. The visible plume expected at the dredge site would be during overflow of a hopper dredge. Few birds are expected to forage this far off shore."

We do not agree. Some of the proposed dredging sites are within primary foraging areas for least terns. The reports associated with dredging at Marina del Rey were inconclusive regarding least tern foraging and dredging. We maintain that vessel activity and turbidity plumes likely cause some displacement and/or decrease in the level of success of tern foraging behavior commensurate with the level of activity and any visible plume sizes within potential foraging areas. According to the California Least Tern Foraging Study, Marina Del Rey Dredging Project (Dutra Group and Keanne Biological 2013):

> "The results of the [California least tern; "CLT"] foraging study summarized in this report cannot be considered conclusive regarding CLT foraging behavior with respect to dredging, since, because of unsuccessful nesting at the [Venice Beach Nesting Site; "VBNS"], it was not possible to collect CLT foraging data during the hatching, fledging and post-fledging stages of nesting…

The only other study on CLT foraging during dredging was during 2002 to 2005 near the CLT nesting site at Alameda Point in the San Francisco Bay area (TetraTech 2006). The purpose of the study was to determine whether the Oakland Harbor Deepening project… had any effect on CLT foraging and chick provisioning. CLT were observed diving on prey in [the project area] during active sediment deposition activities, but the study's authors concluded that 'no conclusory test of an immediate effect of the deposition on tern foraging behavior was possible' (TetraTech 2006)."

The 2012 Draft EIS/EIR provided the following:

> "Recent and ongoing monitoring of least terns near a Corps dredging project at Marina del Rey has recorded numerous observations of least terns foraging within 100 to 200 feet of dredging when the dredge is actively removing sediments and depositing them in a

scow (Keane, preliminary data). Similar observations have been made on an anecdotal basis for dredging elsewhere within the boundaries of the Los Angeles District. These observations suggest that, when prey fish are available, least terns forage near dredging operations similarly to other in-water obstructions such as boats and docks. This behavior indicates that the presence of the dredge does not impose any stressors on those few, individual birds that may forage in the proposed borrow sites."

Project-associated boat presence and traffic would occur within dredging areas and between dredging areas, pipeline, harbor, and replenishment areas. Sand replenishment pipelines would also likely occur within nearshore areas. Some of these features and activities would occur within primary foraging zones of least terns in the action area; as such, we maintain that this would likely cause minor displacement or diminution of success of foraging activities by least terns.

Overall, we expect likely adverse effects (notably foraging displacement) to least terns to be relatively small from the Project. This is considering the relatively small sizes and moderate periods of predicted turbidity plumes, the distances of the borrow sites from shore and potential nesting sites, the relative extent of otherwise available forage areas for least terns in the region, the distances of these potential plumes relative to the three occupied or potential nesting sites in area, the status of the species, and the relatively small/moderate level of Project-associated boat traffic expected in foraging areas. Nesting areas would likely not be affected (e.g., by Project-associated noise or nighttime lighting). We disagree with the Corps determination that the proposed Project "will not affect California least tern" (USACE 2012e; USACE 2013a), but instead we put forward that based on this information the adverse effects are expected to be limited.

Snowy Plover

Western snowy plovers have considerable potential to breed or winter within the Project footprint during the proposed 50-year life of the Project. The likelihood of snowy plovers being affected by the proposed Project is considerable for a number of reasons: 1) while receiver beaches are currently very narrow and have little potential for plover breeding along most of their lengths, substantial exceptions will likely exist in Segment 1 during the Project life, including Moonlight State Beach, as even in current conditions this beach area is extant at high tide; 2) surveys for plovers within Segments 1 and 2 have been very limited and are apparently not current (a lack of survey data is not evidence of snowy plover absence); 3) snowy plovers are known to occur on beaches near the receiver sites, including wintering/non-breeding occupation on beaches that are narrow and subject to substantial disturbance; 4) conditions in Segments 1 and 2 are expected to change substantially over the life of the Project, including at least periodic improvements in habitat suitability and beach protection for plovers; and 5) snowy plovers occupy Cardiff State Beach adjacent to a staging area and beach access route proposed in and from the Seaside parking lot.

The 2012 Draft EIS/EIR indicated the following regarding snowy plovers and potential impacts (USACE 2012e):

> "The Encinitas receiver site is located approximately 1.3 mi from snowy plover critical habitat located adjacent to Batiquitos Lagoon. This species nests at Batiquitos Lagoon, and has been observed to forage at the beach in the vicinity of the Batiquitos receiver site. Since no construction would occur within designated or proposed critical habitat, the Corps has determined that the project will not affect western snowy plover."

We disagree. Snowy plovers currently nest at Batiquitos Lagoon, are expected to nest in the future at San Dieguito Lagoon within a recently implemented restoration project site, and at San Elijo Lagoon in the future at a recently funded restoration project site (San Dieguito River Park 2012; Del Mar Times 2011). Snowy plovers have considerable potential to utilize the receiver sites during the 50-year life of the Project, and wintering/non-breeding snowy plovers currently occupy an area adjacent to the Project direct footprint at Cardiff State Beach (Figure 21). Critical habitat for the species would not likely be affected by the Project, but the Project as proposed would likely affect the species (a separate determination from the potential effects to critical habitat).

The Corps has indicated in the past that snowy plovers would "not be impacted by this project" and that "past experience at Surfside/Sunset Beach has shown that snowy plovers do not react to beach fill activities in adjacent areas" (USACE 2013a). Contrariwise, studies of wintering/non-breeding snowy plovers demonstrate visible reaction to disturbance at distances of about 130 ft, and breeding snowy plovers show detectable reactions to disturbance at about 260 ft (Laferty 2001). Over short time scales, plovers do not acclimate to or successfully find refuge from disturbance, and feeding rates decline with increased human activity near plovers (Laferty 2001). Additionally, our experience is that snowy plovers are highly susceptible to crushing by vehicle activity on the beaches where they occur. Operating vehicles in breeding habitat can cause destruction of eggs, chicks, and adults, abandonment of nests, and considerable stress and harassment to western snowy plover family groups, including increased threats at night (Casler et al. 1993; USFWS 2007). At wintering/non-breeding sites, disturbance from motorized vehicles and foot traffic can harass snowy plovers and disrupt their foraging and roosting activities, thereby decreasing energy reserves needed for migration and reproduction (USFWS 2007). Snowy plovers have some (albeit rather limited) potential to occupy beaches proposed as receiver sites during Project activity periods. More importantly, plovers are known occupy areas adjacent to a proposed staging area and vehicle access route. As such, the potential for snowy plovers to be adversely affected by the Project is not discountable. The proposed Project would likely affect the snowy plover during the 50-year life of the Project; as such we disagree with the Corps' past determinations that the Project will not affect the snowy plover (e.g., USACE 2012e; USACE 2013a; USACE 2013e). The Corps' current determination relative to the proposed staging (including the Seaside parking lot) and direct beach replenishment activities is that these activities will not affect the snowy plover (USACE 2013f). Conversely, the Corps' current determination has changed regarding a specific element of the proposed activity: the Corps has determined that the proposed Project use of the beach access route to and from the Seaside parking lot may affect the snowy plover (USACE 2013f), warranting consultation on the issue.

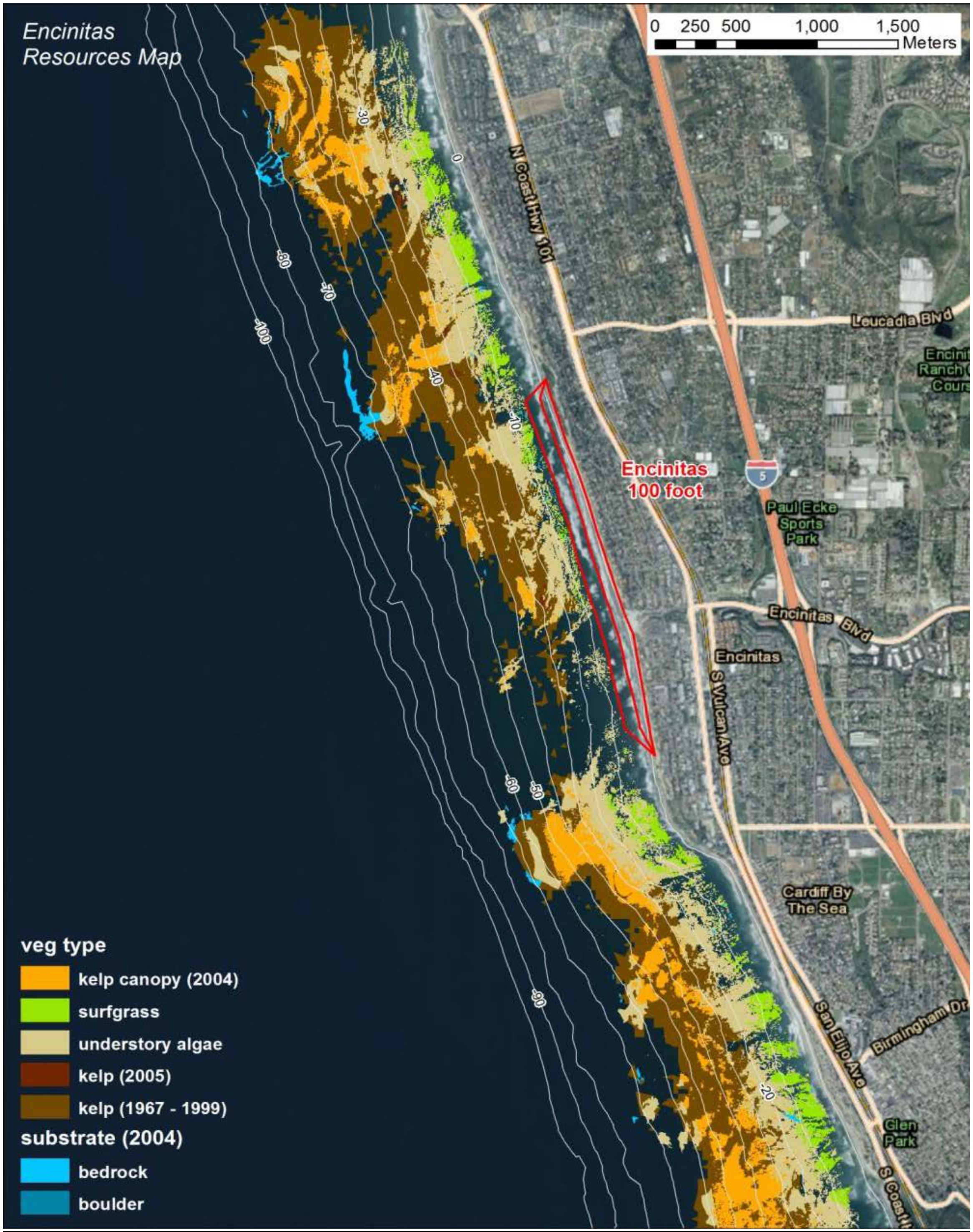


**Figure 12. Natural communities and substrates of Encinitas receiver site/Segment 1 and footprint of proposed alternatives EN-1A and EN-2B (low and high sea level rise)** (USACE 2012e)

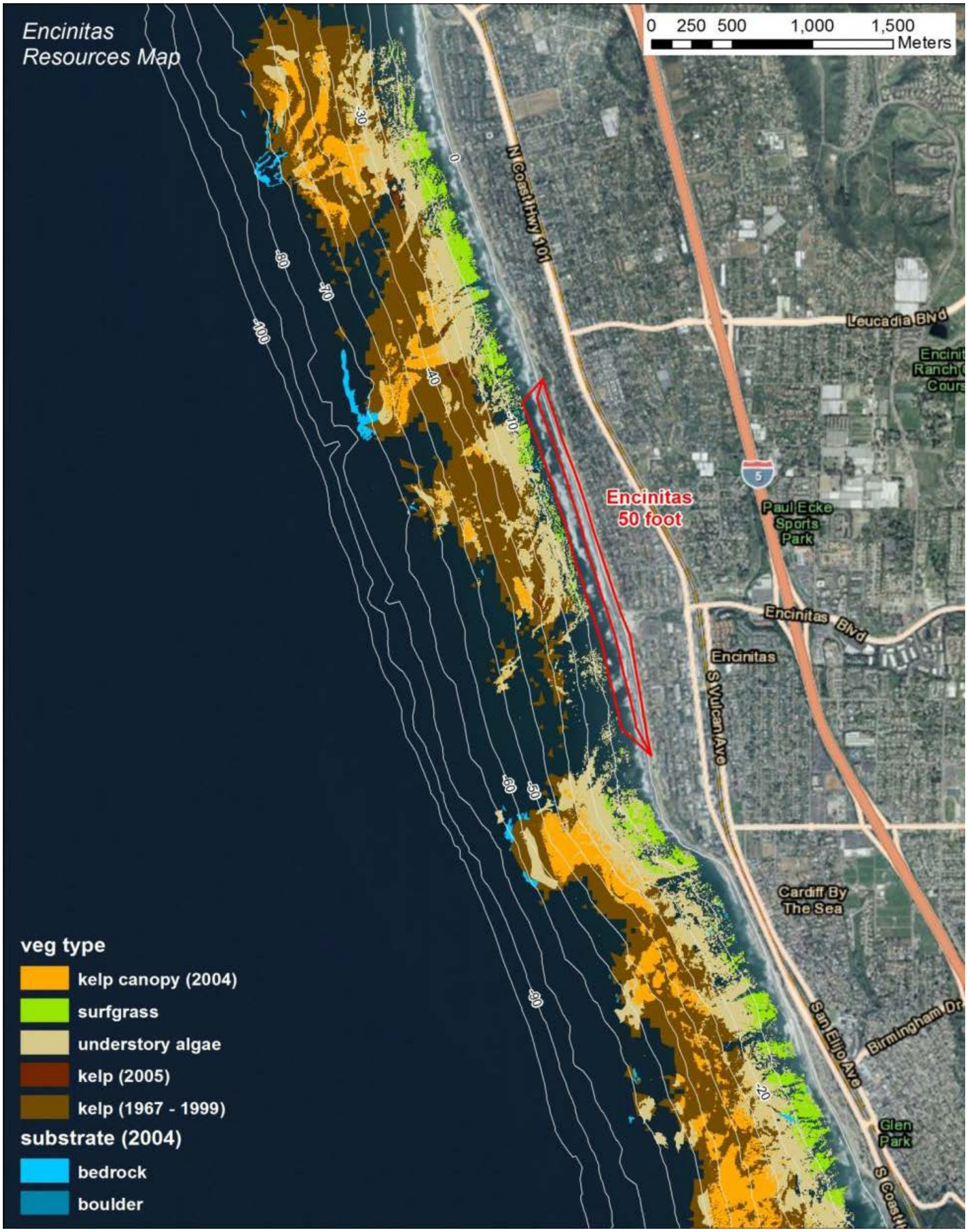


**Figure 13. Natural communities and substrates of Encinitas receiver site/Segment 1 and footprint of proposed alternatives EN-1B and EN-2A (low and high sea level rise)** (USACE 2012e)

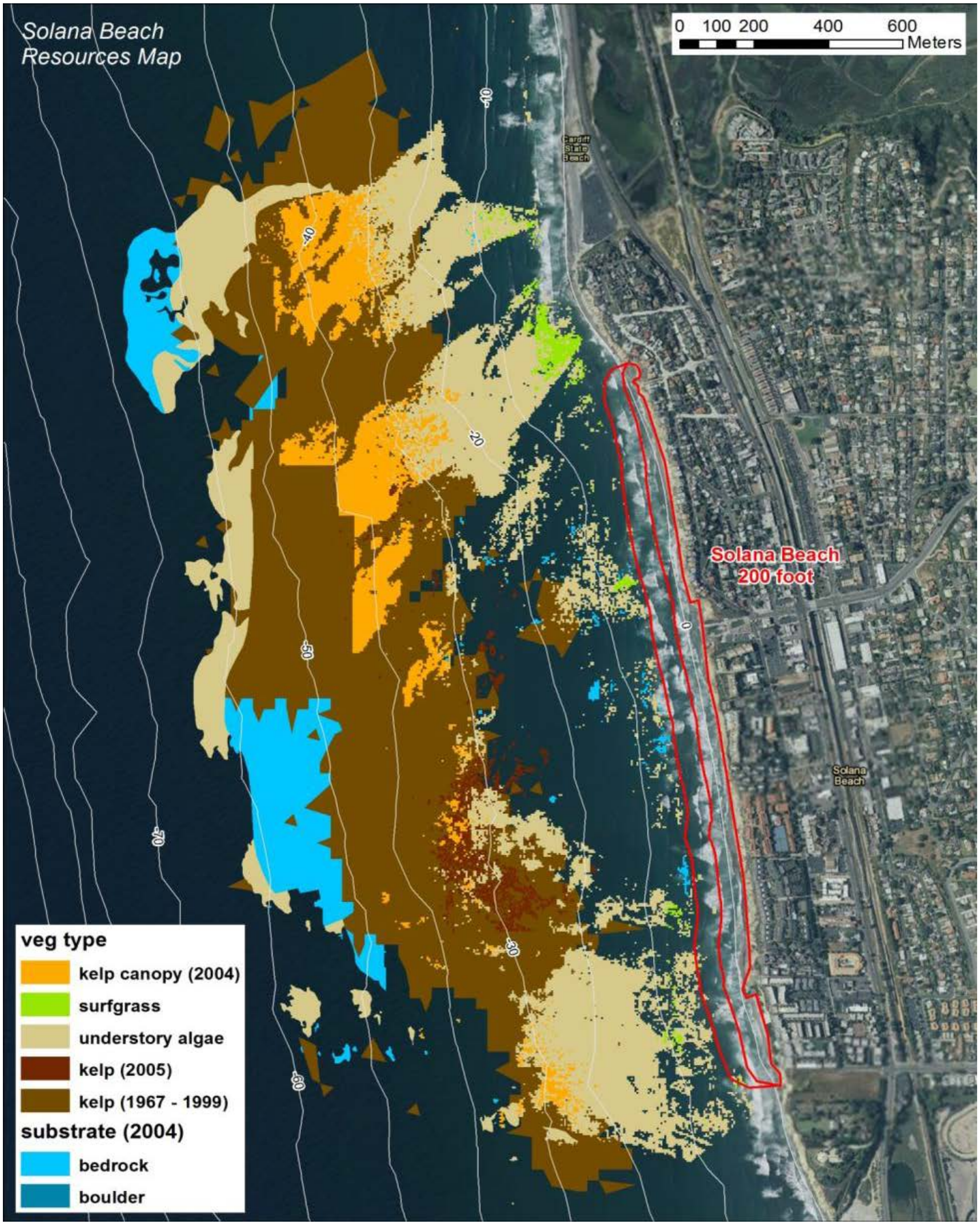


**Figure 14. Natural communities and substrates of Solana Beach receiver site/Segment 2 and footprint of proposed alternative SB-1A low sea level rise** (USACE 2012e)

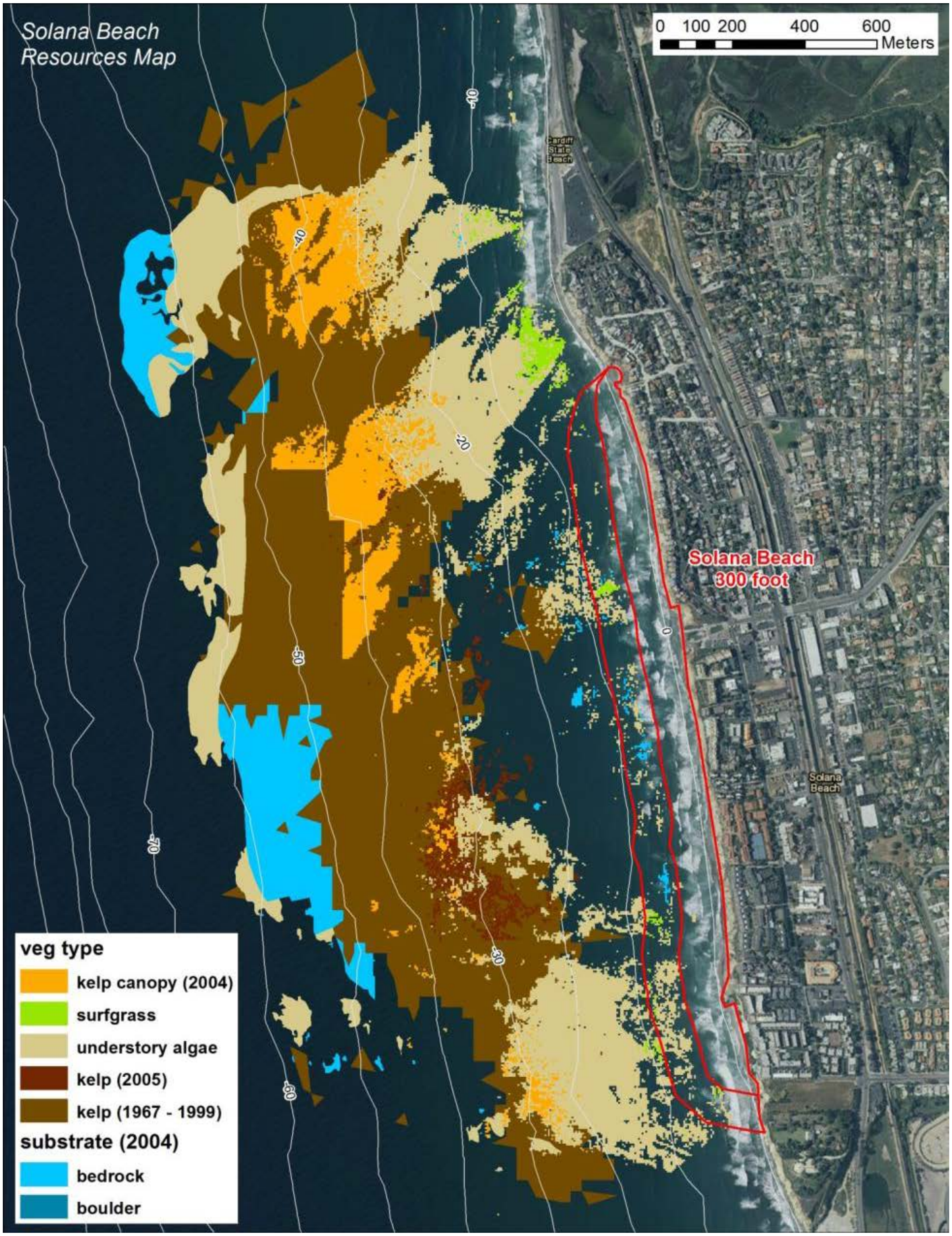


**Figure 15. Natural communities and substrates of Solana Beach receiver site/Segment 2 and footprint of proposed alternative SB-1A high sea level rise** (USACE 2012e)

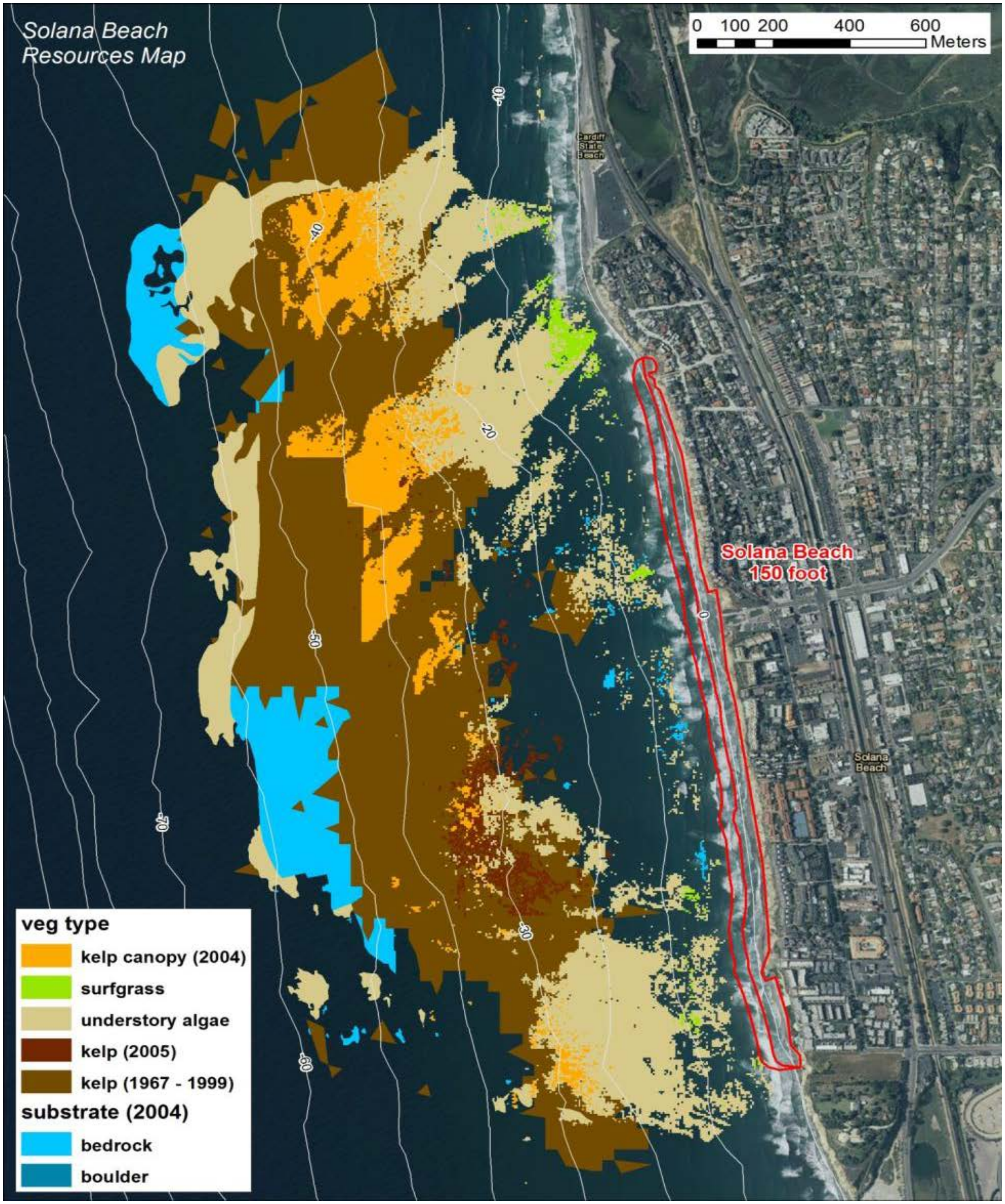


**Figure 16. Natural communities and substrates of Solana Beach receiver site/Segment 2 and footprint of proposed alternatives SB-1B and SB-2A (high and low sea level rise)** (USACE 2012e)

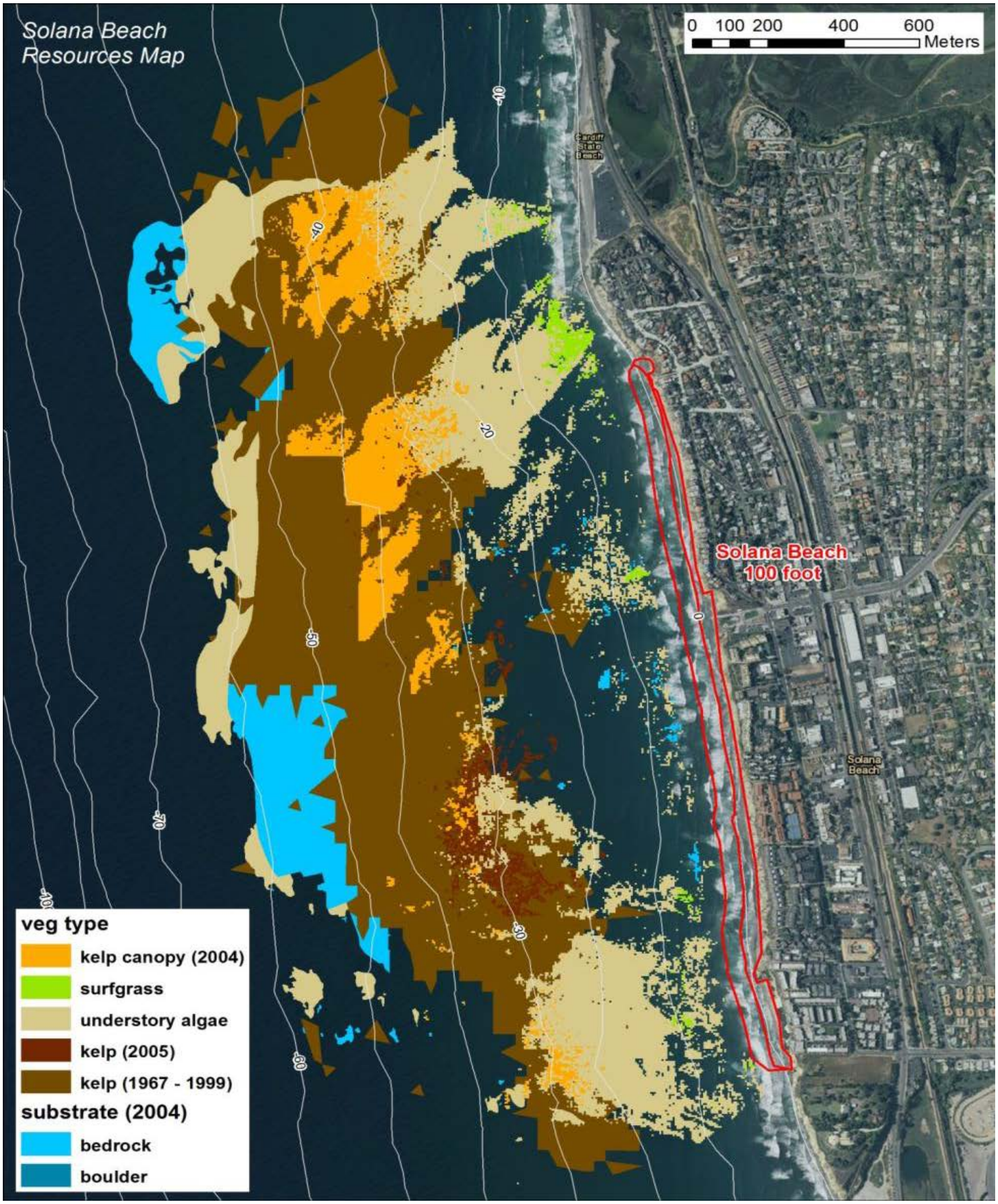


**Figure 17. Natural communities and substrates of Solana Beach receiver site/Segment 2 and footprint of proposed alternatives SB-1C and SB-2C (high and low sea level rise)** (USACE 2012e)

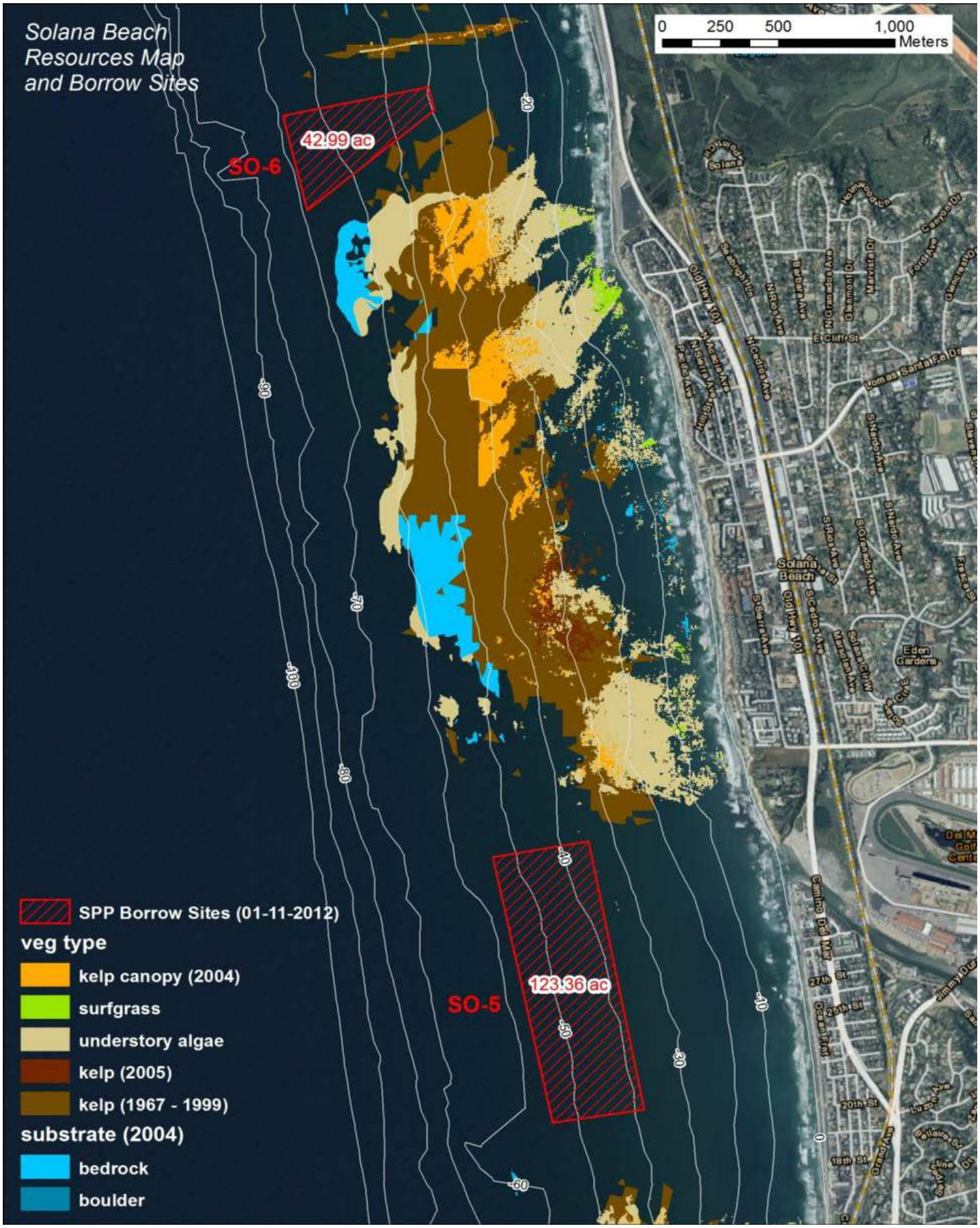


**Figure 18. Natural communities, substrates, and footprints of proposed SO-5 and SO-6 borrow sites** (USACE 2012e)

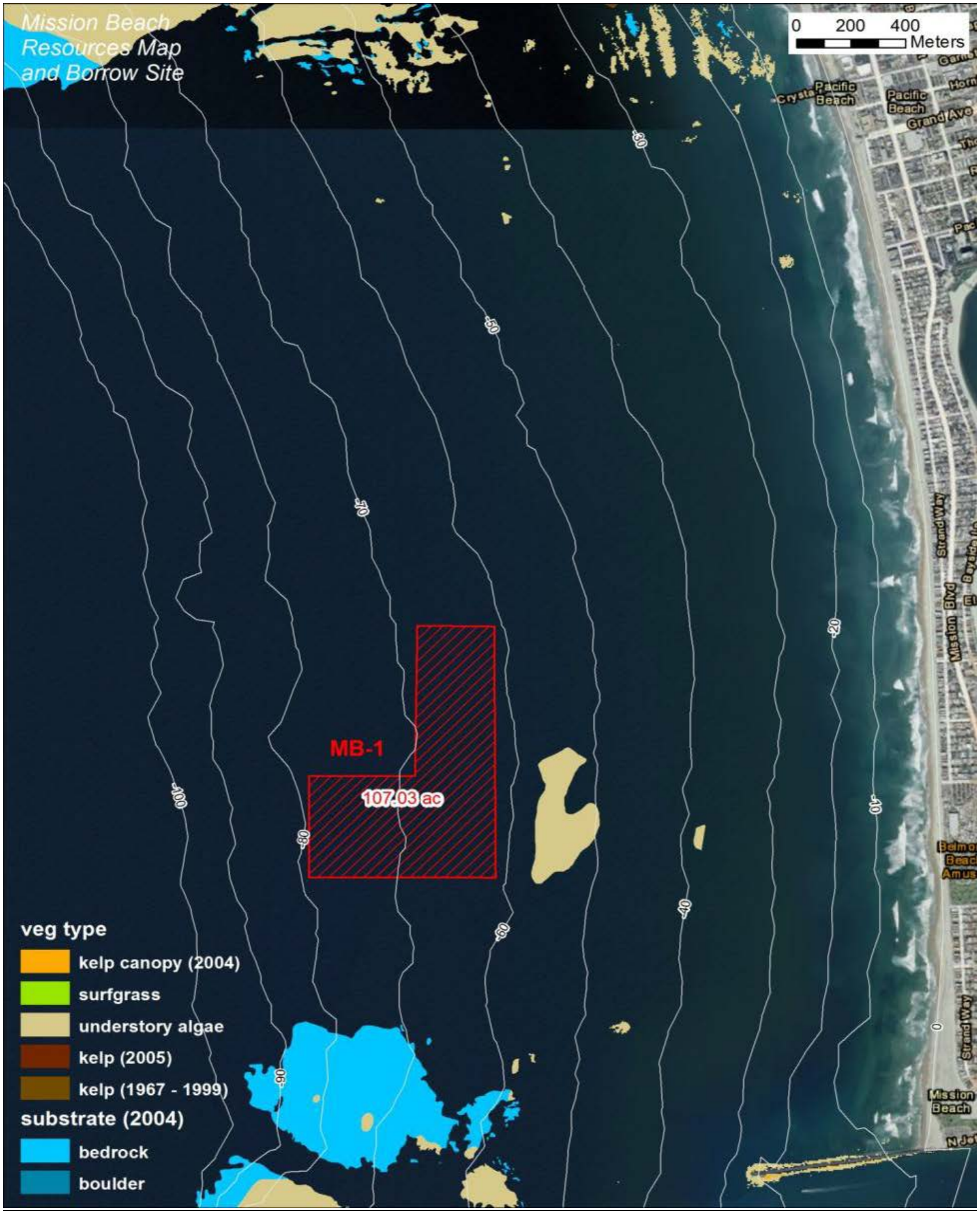


**Figure 19. Natural communities, substrates, and footprint of proposed MB-1 borrow site** (USACE 2012e)


**Figure 20. Least tern nesting sites and primary foraging areas and proximity to Segment 1 receiver site**

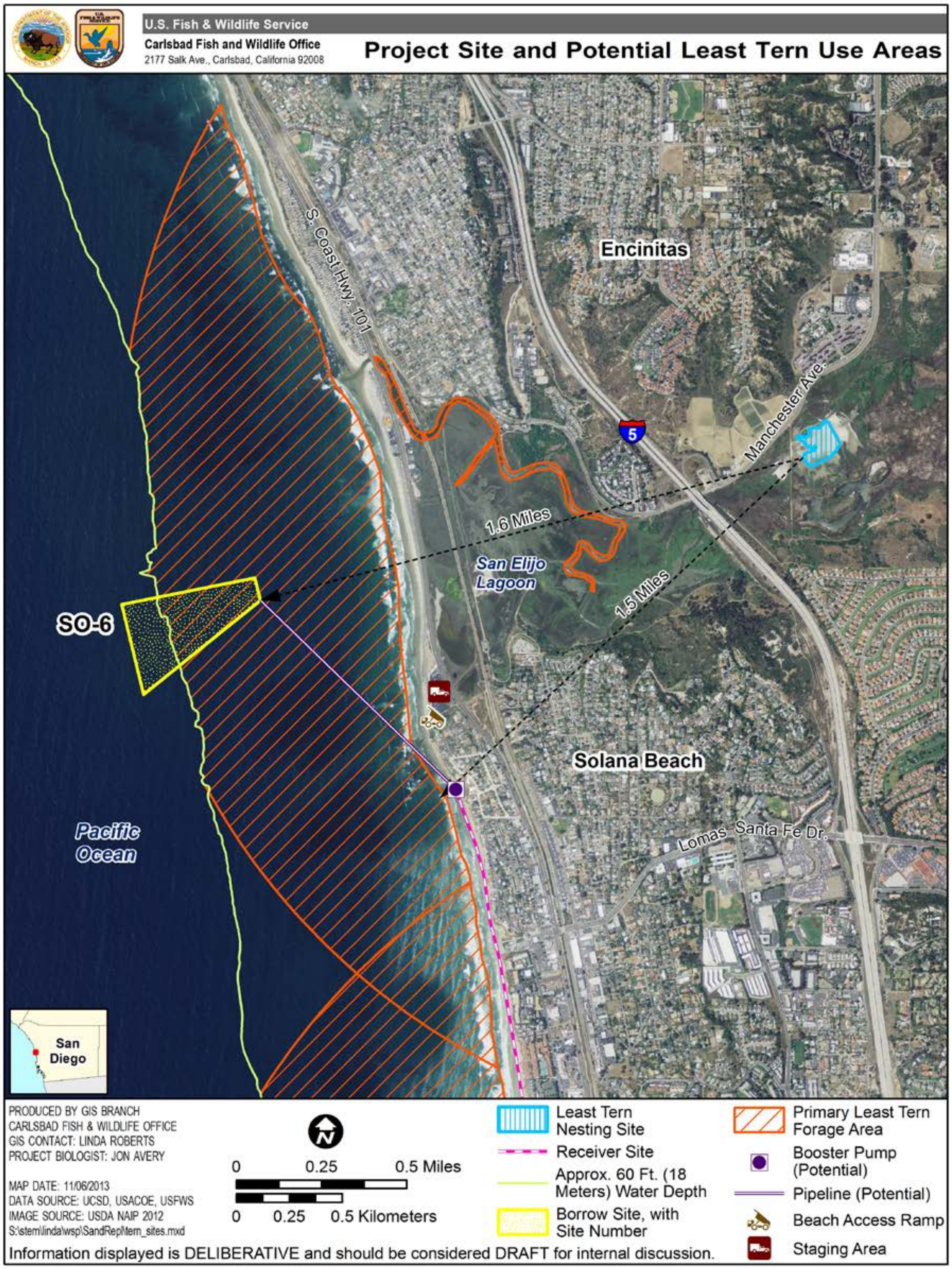


**Figure 21. Potential Least tern nesting site and primary foraging areas in proximity to Segment 2 receiver site and borrow site SO-6**


**Figure 22. Least tern nesting sites and primary foraging areas in proximity to Segment 2 receiver site and borrow site SO-5**

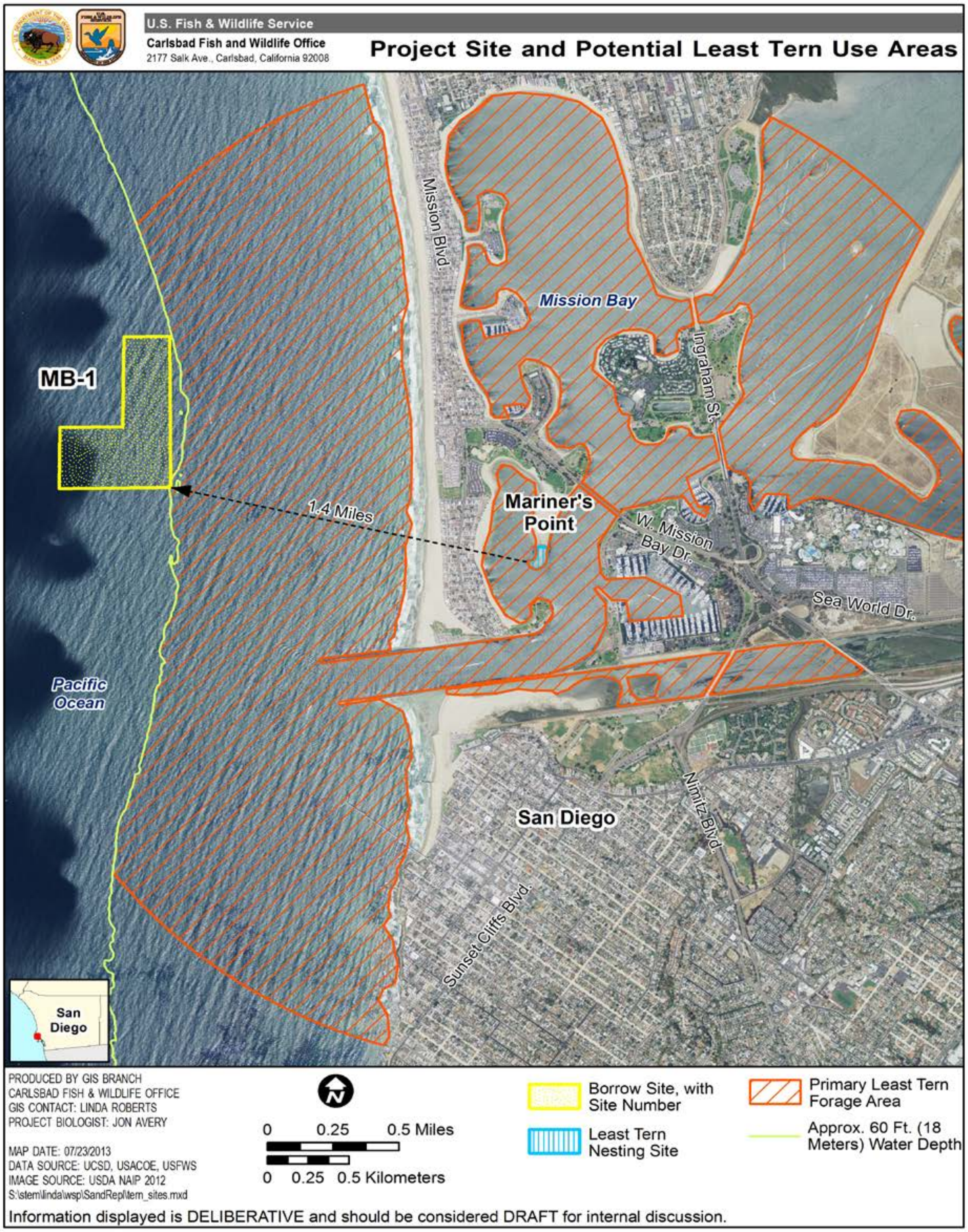


**Figure 23. Least tern nesting site and primary foraging area in proximity to borrow site MB-1**

## Notch Filling

The proposed process of filling notches with engineered concrete would likely have minimal impacts on marine, shoreline, and bluff natural communities and their associated biota. Equipment and Project personnel on the upper beach would disturb shorebirds and gulls in the immediate vicinity of the activity. Marine birds would likely avoid the work areas. In addition, because the area of disturbance would be relatively small compared to the amount of beach available, the impacts of notch fills on marine resources are expected to be insignificant, provided vehicle access avoids areas in use at the same time by western snowy plovers. Because the bluffs notches to be filled are unvegetated and almost all potential native or sensitive species potentially affected by notch filling are located further upslope/inland from the actual Project footprint (with the potential exception of snowy plovers as noted above), we do not expect any impacts to sensitive terrestrial plant or animal species.

Most shore protection structures such as seawalls reflect wave energy rather than dissipating energy, as a wide or "equilibrium" sandy beach does (Scripps 2004). Depending on the final geometry of the notch fill face, a notch fill could reflect energy much like a typical seawall in this regard (compared to the original notch geometry). Dissipative structures such as rock riprap occupy beach space and constrain the beach's ability to establish equilibrium (Scripps 2004). Because proposed notch fills would be relatively small fills (occupying a small area of beach space), the hard/protective covering on portions of an existing bluff likely would be the most important aspect of the fill: the effects would mostly involve reflecting wave energy of larger waves during high tides, reducing bluff erosion, slowing bluff collapse and the landward migration of the local bluff, and slightly reducing the contribution of the bluff to the sands of the littoral system.

## Cumulative Effects

SANDAG initiated a second RSBP in September 2012, which included six beaches within the Oceanside littoral cell (SANDAG 2012a). The sand volumes for the 2012 RBSP project could be additive to the volumes of the proposed Project depending on the beach profiles when the proposed replenishment activities would occur. Potential turbidity impacts of the proposed Project would be essentially unaffected by the 2012 RBSP project. However, potential impacts from burying (e.g., reefs, seagrass beds, kelp beds) could be increased with the additive volumes of the 2012 RBSP and other future sand replenishment projects in and near the action area.

The following are portions of the 2012 RBSP project within Oceanside littoral cell:

> **Oceanside**: Approximately 292,000 $yd^3$ of new sand deposited on more than 3,900 ft of beach between Buccaneer Beach and just north of Hayes Street. Replenishment occurred October 2012.

**North Carlsbad**: Approximately 218,000 $yd^3$ of new sand was spread on 3,000 ft of beach between Carlsbad Village Drive and the Buena Vista Lagoon mouth. Replenishment occurred November/December 2012.

**South Carlsbad**: Approximately 140,000 $yd^3$ of new sand was spread on 2,000 ft of beach south of Palomar Airport Road to the southern end of Oceanview Drive. Sand placement occurred November 2012.

**Batiquitos Beach**: Approximately 106,000 $yd^3$ of sand was placed on 1,500 ft of beach between the Batiquitos Lagoon mouth and the bluff-backed area of the beach. Replenishment occurred October/November 2012.

**Cardiff State Beach**: Approximately 89,000 $yd^3$ of sand was placed on about 1,100 ft of beach in October 2012 between the Chart House restaurant and just south of Las Olas restaurant.

**Moonlight State Beach**: Approximately 92,000 $yd^3$ of sand was spread north of the D Street at Moonlight State Beach in October 2012 on about 750 ft of beach.

**Solana Beach**: Approximately 140,000 $yd^3$ of sand was placed at Fletcher Cove on about 1,600 ft of beach in November 2012.

## RECOMMENDATIONS

The FWCA states that "…wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs through the effectual and harmonious planning, development, maintenance, and coordination of wildlife conservation…" In accordance with the FWCA, we make the following recommendations to avoid, minimize, rectify, and/or compensate for the potential negative effects to fish and wildlife resources, and to enhance those resources (Smalley and Mueller 2004).

1. Considering the RBSP pre-project modeling, the subsequent reduction in sand replenishment quantities of the RBSP based on this modeling, and post-project monitoring that determined no significant long-term impacts to biological resources occurred, the Corps should use similar sand replenishment quantities as those used in the RBSP to the extent practicable. The proposed Project beach replenishment quantities, associated activities (e.g., pipelines and access routes), and/or timing should, to the extent practicable, be modified to avoid any substantial repetitive or long-term impacts to biological resources. Any predicted or detected remaining biological impacts from replenishment activities (e.g., repeated burying) should be mitigated as directed by a biological working group consisting of representatives from the California Department of Fish and Wildlife, Corps, National Marine Fisheries Service, and the Service.[7]

2. The Corps should provide to the Service a complete composite map showing the direct footprints (as polygons) of all potential Project activities, including activities associated with access and transport routes (outside of existing paved public roads), submerged/floating/beach pipelines, booster pumps, staging, etc., inside and outside Segments 1 and 2. Footprint areas of optional Project activities should be separately demarcated. We recommend provision of such maps for almost all projects subject to the FWCA (and NEPA or Endangered Species Act consultation) to improve evaluation efficiency and accuracy.

3. After initial replenishment activities, subsequent beach replenishment events and sand placement quantities should be timed and/or have sand replenishment volumes calculated to the beach profiles (e.g., beach widths) that actually exist just prior to replenishment events, rather than simply conducting replenishment as scheduled/planned. This approach would accommodate natural and artificial littoral cell variations in the region. Any replenishment events of greater sand volumes, or shorter cycle periods, than those

[7] Per this issue, the Corps has indicated (USACE 2013a): "Any indirect biological impacts from replenishment sand to rocky reef and/or surf grass habitats would be mitigated based on post-construction monitoring. Determination of actual impacts will be made by the U.S. Army Corps of Engineers in consultation with a biological working group consisting of representatives from the California Department of Fish and Wildlife, National Marine Fisheries Service, and the U.S. Fish and Wildlife Service."

evaluated within the 2012 Draft EIS/EIR should be subject to new environmental review, as appropriate.

4. The Corps should implement the proposed Project monitoring protocol/program to include determinations as to whether the Project has caused any substantial repetitive short- or mid-term impacts to biological resources during the 50-year life of the Project. If the proposed monitoring program detects biological impacts appreciably greater or different than those predicted and mitigated for (e.g., greater areas, repetition, duration, or other effects of burying of vegetated substrates by sand), than additional compensatory measures should be implemented. If additional mitigation to fully mitigate for these impacts will not (or cannot) be accomplished, then all future Project replenishment cycles should be reduced in sand volume and/or beach width to match impacts to the mitigation performed.[8]

5. To the maximum extent practicable, Project activities should be avoided within 130 ft, and minimized within 260 ft, of occupied snowy plover use areas as determined by surveys/monitoring. A temporary construction "safety fence" or equivalent should be erected (at the edge of the Project footprint) between Project activities (e.g., staging, access and access routes) and any snowy plovers occupying areas within 260 ft of Project activity areas, in part to help visually block views of project activity by snowy plovers. Any Project-associated nighttime lighting should be fully directed and shielded away from occupied areas, such as occupied portions of southern Cardiff State Beach and the vacant upland area adjacent to north of the Seaside parking lot. [9]

6. The Corps should perform weekly monitoring surveys for least terns over appropriate waters near ongoing Project beach replenishment and dredging activities occurring during the breeding season. Directed surveys performed by qualified personnel should be performed in such a way to demonstrate presence/absence and the extent of any areas utilized by least terns. If Project activities would potentially affect ("may affect") least

[8] Per this issue, the Corps provided the following comment (USACE 2013a): "Implementation of a monitoring program will be done by the U.S. Army Corps of Engineers in consultation with a biological working group consisting of representatives from the California Department of Fish and Wildlife, Corps, National Marine Fisheries Service, and the U.S. Fish and Wildlife Service. The biological working group would also review monitoring reports and make recommendations for the replenishment activities during the 50-year life of the proposed Project."

[9] As of October 2013 the Corps has determined that Project access through Cardiff State Beach may affect snowy plovers and has agreed to informally consult with the Service on snowy plovers (USACE 2013f).

terns, then consultation with Service under the Endangered Species Act should occur consistent with 50 CFR 402.[10]

7. As was done for the RBSP, the Corps should set aside contingency funds of sufficient quantity to guarantee a means to mitigate potential substantial adverse biological impacts (documented by the monitoring program) that may occur beyond the impacts predicted.[11]

8. As part of the proposed dredge and beach fill monitoring, the Corps should provide a post-Project letter report to the Service on Project turbidity plumes, if the Project causes appreciable visible turbidity in areas or environs utilized for foraging in the same space and time as least terns.

9. If a hopper dredge is used, a morning glory spillway or similar type spillway that conveys overflow water below the bottom of the hull for discharge should be used.

10. If a cutterhead dredge is used, it should back flush a minimum of 16 ft below the surface and not at the surface. Turbidity monitoring for cutterhead dredging (as recommended herein) would not be necessary if this back flush method is implemented.

11. To help avoid and/or minimize potential biological impacts due to operation of equipment offshore of the beach replenishment sites, the Corps should develop a plan that includes details of the proposed/potential locations (or polygons) of all pipelines, cables, anchors, and any other equipment to be used, and overlay this plan with mapped biological resources. If submerged pump lines are used to transport dredged material

[10] As of October 2013 the Corps has determined that the proposed Project would not affect the California least tern (USACE 2013f).

[11] In regards to this issue, the Corps has noted (USACE 2013b): "The Draft EIS/EIR estimated 8.4 acres of reef impacts (0.4 acres of intertidal reef platform and 8.0 acres of subtidal reefs with other indicators) and no impacts to surf grass for the Solana Beach recommended plan. There are no reef or surf grass impacts from the Encinitas recommended plan. The cost for this mitigation (including pre-construction monitoring, project construction, post-construction monitoring for two years, and post-mitigation-construction monitoring for five years) is approximately $2.455 M. Estimated costs including the 46% contingency is approximately $3.907 M. All values that include natural variation are well under the contingency amount. Both fall values that do not include natural variation are well under the contingency amount. However, both spring values that do not include natural variation are slightly above the contingency amount. The amount that the two spring values exceed the contingency (approximately $200-300 K) is small enough that contingency funds from other aspects of project construction could be shifted, if needed. Additional funds could also be requested without having to re-authorize the project. Since both values represent a case where natural variation is not included in the project impacts, we feel that it is a very conservative estimate that we are unlikely to approach. We feel that even in this extreme case scenario, we could cover the mitigation costs with authorized funds. Additionally, we anticipate initial construction will occur under the low sea level rise scenario, which is the smaller of the two with smaller consequences."

onto the beach, they should be outfitted with tractor tires or equivalent bumpers to minimize abrasion of the ocean floor or reefs, as appropriate. Construction monitoring should include appropriate monitoring of equipment and activities offshore of the beach replenishment sites.

12. As part of proposed best management practices regarding equipment staging and maintenance, the Corps should ensure maintenance and operation of all Project-related equipment in such a manner as to prevent contaminants (e.g., pump-outs, fuel, oil, grease, coolant, hydraulic fluid, etc.) from entering the ocean, local streams/storm drains, or beach areas directly or indirectly. Fueling of and fluid changes on equipment should occur in paved staging areas. Pumpout of fluids from equipment (such as holds or ballast tanks on dredges) should be avoided in the action area; such activities should be performed at appropriate docking facilities that safely accommodate such fluids.

13. All Project-related onshore equipment should be staged or parked in local parking lots or streets, and not on beaches, stream mouths, lagoon areas, or potential bird nesting or loafing areas. Vehicle use in these noted areas should be minimized. Project activity limits should be clearly demarcated and sensitive areas protected from nearby activities by accurately placed construction barriers, based on clear descriptions/mapping and monitoring of Project limits and barrier locations provided by the Corps. Barriers should be maintained daily during the Project activity period.

14. The Corps and the Cities should develop long-term protective measures for snowy plovers on Cardiff State Beach, particularly in the area of the Seaside parking lot. Signage and barriers in appropriate locations would likely substantially improve conditions for wintering and breeding snowy plovers in the vacant lot and upper beach areas near the parking lot, particularly in regards to dog and pedestrian traffic. Because the project region is not well surveyed for snowy plovers (and use of the area is not well understood), the Corps and Cities should contract for annual wintering and breeding season snowy plovers surveys of the project region during the life of the project.

The Service offers the following related suggestion that is much larger in scope than, and not specific to, the proposed Project:

With the goal of partially restoring natural sand delivery to the ocean and beaches of the Project region, the Corps and Cities should work with the California Department of Transportation, San Diego Association of Governments, North County Transit District, the cities of Oceanside, Carlsbad, and Del Mar, resource agencies, and others, to develop and implement hydrological/fluvial solutions to the sediment capturing effects of the artificial fill (e.g., road and railroad berms) and bridge-related structures associated with the freeway, railroad, and road crossings of the lagoons and stream/rivers in north San Diego County. As noted above, it is reported that sand and gravel delivery to the ocean by the streams between Carlsbad and La Jolla has been reduced by more than 90 percent compared to historical levels (USACE 1991). For example, the Corps and Cities should investigate the benefits and costs of partially restoring flood flow sediment delivery capacity of Escondido Creek/San Elijo Lagoon to the ocean, through significantly expanding the flood water-flow openings of the road and railroad crossings (two bridges and a trestle) over the lagoon and beach barrier spit. The potential benefits of this would be to: a) restore more natural levels of sediment delivery to the ocean and beaches; b) reduce the anthropocentric trapping of sediments in, and concomitant degradation of, local lagoons; c) increase natural tidal flow through lagoon mouths in and out local lagoons; and d) increase the effective longevity, and reduce the need for, costs, and impacts of, beach replenishment and lagoon restoration efforts in north San Diego County. Such actions would build on what the Corps has indicated that the Cities are actively working on locally, regionally, and at the State level to improve sediment management practices in San Diego County and implement sand retention projects as part of a comprehensive and long-term shoreline management program (USACE 2013a).

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