Appendix B

# Air Quality and Greenhouse Gas Analysis Technical Data

## Construction Assumptions and Calculations

### Criteria Pollutants and Greenhouse Gases

Mass criteria pollutant and greenhouse gas (GHG) emissions from heavy-duty equipment, on-road vehicle trips, and land disturbance were estimated using the California Emissions Estimator Model (CalEEMod) (version 2013.2.2) and the California Air Resources Board (ARB) EMFAC2011 model. Vehicle and equipment assumptions were provided by the JPB per the preliminary construction schedule (Cocke pers. comm.). Horsepower and load factors were based on CalEEMod default data for equipment types similar to those expected for Proposed Project construction. Re-entrained road dust from construction vehicle operation in the project area was calculated using PM emission factors obtained from the United States Environmental Protection Agency (2011).

### Toxic Air Contaminants

Exposure to construction-related diesel particulate matter (DPM) was assessed by predicting the health risks in terms of excess cancer, non-cancer hazard impacts, and elevated PM2.5 concentrations. A screening-level health risk assessment (HRA) was performed according to the following steps.

1. Evaluation of increased DPM cancer risk and the DPM non-cancer hazard impact based on the mass emissions of PM10 and PM2.5 exhaust estimated with CalEEMod.
2. Using EPA's AERSCREEN model, which is the screening-level model for AERMOD, prediction of PM10 and PM2.5 hourly concentrations at sensitive land uses based on the maximum daily exhaust emissions for each construction period.
3. Calculation of the project-level cancer risk, non-cancer hazard index (HI), and annual PM2.5 concentrations for each Proposed Project phase based on the AERSCREEN hourly concentrations and the construction durations using Bay Area Air Quality Management District (BAAQMD)-approved methodology.
4. Identification of background stationary sources within 1,000 feet of Caltrain corridor using Google Earth map files provided by BAAQMD. The Google Earth map files include estimated risk and hazard impacts at nearby receptors from these sources (BAAQMD 2011).
5. Calculation of the cumulative health risks by adding the background health risk sources identified in step 4 to the project-level health risk and hazard impacts estimated in step 3.

### Carbon Stock (Tree Removal)

The *Draft Tree Inventory and Canopy Assessment* (HortScience 2014, see Appendix F) identifies approximately 2,200 trees that would need to be removed as a result of Proposed Project construction. Removal of these trees would result in a one-time loss of stored carbon within the tree. Carbon stock values for the impacted trees were obtained from the U.S. Forest Service's (2011) Tree Carbon Calculator (CTCC) for each tree species. An average diameter breast height (DBH) of 16 inches was assumed for all trees, based on the tree inventory. Lost carbon stock was calculated by multiplying the TCC values by the number of removed trees.

**2015 Offroad Assumptions**

| 2015 Equipment | # Day | Hrs/ Day | Days | HP | LF | g/hp-hr (CalEEMod) ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Utilities** | | | | | | | | | | | | | | |
| Advance Utility Relocation | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 270 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |
| Excavator | 1 | 3 | 90 | 163 | 0.38 | 0.38 | 4.48 | 3.17 | 0.22 | 0.20 | 0.00 | 511.69 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 1 | 3 | 90 | 98 | 0.37 | 0.57 | 5.42 | 3.83 | 0.42 | 0.39 | 0.00 | 517.37 | 0.15 | 0.01 |
| Concrete Industrial Saws | 1 | 2 | 90 | 81 | 0.42 | 0.68 | 4.79 | 3.65 | 0.37 | 0.37 | 0.01 | 568.30 | 0.06 | 0.01 |
| Generator Sets | 1 | 4 | 90 | 84 | 0.42 | 0.65 | 4.77 | 3.50 | 0.35 | 0.35 | 0.01 | 568.30 | 0.06 | 0.01 |
| Bore/Drill Rigs | 1 | 3 | 90 | 206 | 0.5 | 0.21 | 3.32 | 1.18 | 0.10 | 0.09 | 0.00 | 506.50 | 0.15 | 0.01 |
| **Traction Power Substation Installation** | | | | | | | | | | | | | | |
| Advance Site Preparation - Traction Power Sites | | | | | | | | | | | | | | |
| Off-Highway Trucks | 0 | 0 | 0 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |
| Chainsaws (gas) | 0 | 0 | 0 | 1 | 0.5 | 132.54 | 2.93 | 355.82 | 0.91 | 0.91 | 0.04 | 884.65 | 8.24 | 0.03 |
| Trimmers/Edgers/Brush Cutters (gas) | 0 | 0 | 0 | 1 | 0.5 | 21.45 | 8.45 | 402.11 | 0.54 | 0.54 | 0.03 | 858.88 | 1.21 | 0.03 |
| Chippers/Stump Grinders (gas) | 0 | 0 | 0 | 18 | 0.78 | 13.99 | 8.05 | 566.73 | 6.98 | 6.98 | 0.02 | 858.88 | 0.78 | 0.03 |
| Traction Power Equipment Foundation Construction | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.57 | 5.42 | 3.83 | 0.42 | 0.39 | 0.00 | 517.37 | 0.15 | 0.01 |
| Rubber Tired Loaders | 0 | 0 | 0 | 200 | 0.36 | 0.41 | 5.37 | 1.48 | 0.18 | 0.17 | 0.00 | 508.91 | 0.15 | 0.01 |
| Pumps | 0 | 0 | 0 | 84 | 0.42 | 0.68 | 4.84 | 3.55 | 0.36 | 0.36 | 0.01 | 568.30 | 0.06 | 0.01 |
| Vibratory Plate | 0 | 0 | 0 | 8 | 0.42 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Concrete Mixers | 0 | 0 | 0 | 9 | 0.42 | 0.66 | 4.17 | 3.47 | 0.17 | 0.17 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.64 | 7.62 | 2.65 | 0.35 | 0.32 | 0.00 | 512.45 | 0.15 | 0.01 |
| Traction Power Equipment Installation | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.64 | 7.62 | 2.65 | 0.35 | 0.32 | 0.00 | 512.45 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.57 | 5.42 | 3.83 | 0.42 | 0.39 | 0.00 | 517.37 | 0.15 | 0.01 |
| Traction Power Equipment Testing | | | | | | | | | | | | | | |
| Generator Set | 0 | 0 | 0 | 84 | 0.42 | 0.65 | 4.77 | 3.50 | 0.35 | 0.35 | 0.01 | 568.30 | 0.06 | 0.01 |
| **Overhead Contact System (OCS)** | | | | | | | | | | | | | | |
| OCS Pole Foundation Construction - Crew #1 | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |
| Bore/Drill Rigs | 0 | 0 | 0 | 206 | 0.5 | 0.21 | 3.32 | 1.18 | 0.10 | 0.09 | 0.00 | 506.50 | 0.15 | 0.01 |
| Rubber Tired Loaders | 0 | 0 | 0 | 200 | 0.36 | 0.41 | 5.37 | 1.48 | 0.18 | 0.17 | 0.00 | 508.91 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.65 | 4.77 | 3.50 | 0.35 | 0.35 | 0.01 | 568.30 | 0.06 | 0.01 |
| Pumps | 0 | 0 | 0 | 84 | 0.42 | 0.68 | 4.84 | 3.55 | 0.36 | 0.36 | 0.01 | 568.30 | 0.06 | 0.01 |
| Concrete Mixers | 0 | 0 | 0 | 9 | 0.42 | 0.66 | 4.17 | 3.47 | 0.17 | 0.17 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.64 | 7.62 | 2.65 | 0.35 | 0.32 | 0.00 | 512.45 | 0.15 | 0.01 |
| OCS Pole Foundation Construction - Crew #2 | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bore/Drill Rigs | 0 | 0 | 0 | 206 | 0.5 | 0.21 | 3.32 | 1.18 | 0.10 | 0.09 | 0.00 | 506.50 | 0.15 | 0.01 |
| Rubber Tired Loaders | 0 | 0 | 0 | 200 | 0.36 | 0.41 | 5.37 | 1.48 | 0.18 | 0.17 | 0.00 | 508.91 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.65 | 4.77 | 3.50 | 0.35 | 0.35 | 0.01 | 568.30 | 0.06 | 0.01 |
| Pumps | 0 | 0 | 0 | 84 | 0.42 | 0.68 | 4.84 | 3.55 | 0.36 | 0.36 | 0.01 | 568.30 | 0.06 | 0.01 |
| Concrete Mixers | 0 | 0 | 0 | 9 | 0.42 | 0.66 | 4.17 | 3.47 | 0.17 | 0.17 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.64 | 7.62 | 2.65 | 0.35 | 0.32 | 0.00 | 512.45 | 0.15 | 0.01 |
| OCS Pole & Cantilever Installation - Crew #1 | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.64 | 7.62 | 2.65 | 0.35 | 0.32 | 0.00 | 512.45 | 0.15 | 0.01 |
| Generator | 0 | 0 | 0 | 84 | 0.42 | 0.65 | 4.77 | 3.50 | 0.35 | 0.35 | 0.01 | 568.30 | 0.06 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.57 | 5.42 | 3.83 | 0.42 | 0.39 | 0.00 | 517.37 | 0.15 | 0.01 |
| OCS Pole & Cantilever Installation - Crew #2 | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.64 | 7.62 | 2.65 | 0.35 | 0.32 | 0.00 | 512.45 | 0.15 | 0.01 |
| Generator | 0 | 0 | 0 | 84 | 0.42 | 0.65 | 4.77 | 3.50 | 0.35 | 0.35 | 0.01 | 568.30 | 0.06 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.57 | 5.42 | 3.83 | 0.42 | 0.39 | 0.00 | 517.37 | 0.15 | 0.01 |
| OCS Wire Installation & Testing | | | | | | | | | | | | | | |
| On-Track Wire Installation Equipment | 0 | 0 | 0 | 172 | 0.42 | 0.56 | 6.23 | 3.38 | 0.33 | 0.30 | 0.00 | 509.31 | 0.15 | 0.01 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.65 | 4.77 | 3.50 | 0.35 | 0.35 | 0.01 | 568.30 | 0.06 | 0.01 |
| Grade Crossing Modifications | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.57 | 5.42 | 3.83 | 0.42 | 0.39 | 0.00 | 517.37 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.65 | 4.77 | 3.50 | 0.35 | 0.35 | 0.01 | 568.30 | 0.06 | 0.01 |
| **Communications** | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.38 | 4.53 | 2.04 | 0.17 | 0.16 | 0.00 | 515.84 | 0.15 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.57 | 5.42 | 3.83 | 0.42 | 0.39 | 0.00 | 517.37 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.65 | 4.77 | 3.50 | 0.35 | 0.35 | 0.01 | 568.30 | 0.06 | 0.01 |
| **Integration / Commissioning** | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.65 | 4.77 | 3.50 | 0.35 | 0.35 | 0.01 | 568.30 | 0.06 | 0.01 |

**2015 Onroad Assumptions**

| 2015 | Vehicle Type | Trips/ Day | VMT/ day | VMT/ year | Days | grams per mile (EMFAC) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O | Other |
| **Utilities** | | | | | | | | | | | | | | | |
| Advance Utility Relocation | | | | | | | | | | | | | | | |
| | Employee Vehicle | 15 | 186 | 50,220 | 270 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 13,500 | 270 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| **Traction Power Substation Installation** | | | | | | | | | | | | | | | |
| Advance Site Preparation - Traction Power Sites | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Foundation Construction | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Installation | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| **Overhead Contact System (OCS)** | | | | | | | | | | | | | | | |
| OCS Pole Foundation Construction - Crew #1 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| OCS Pole Foundation Construction - Crew #2 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #1 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #2 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCS Wire Installation & Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| Grade Crossing Modifications | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| **Communications** | | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| **Integration / Commissioning** | | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.15 | 1.45 | 0.00 | 0.00 | 0.00 | 344.50 | - | - | 17.22 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.28 | 9.02 | 1.31 | 0.11 | 0.10 | 0.00 | 1,784.42 | 0.10 | 0.05 | 0.00 |

**2016 Offroad Assumptions**

| 2016 Equipment | # Day | Hrs/ Day | Days | HP | LF | g/hp-hr (CalEEMod) ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Utilities** | | | | | | | | | | | | | | |
| Advance Utility Relocation | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 90 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |
| Excavator | 1 | 3 | 90 | 163 | 0.4 | 0.36 | 4.08 | 3.16 | 0.20 | 0.18 | 0.00 | 506.50 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 1 | 3 | 90 | 98 | 0.4 | 0.54 | 5.14 | 3.81 | 0.40 | 0.36 | 0.00 | 511.35 | 0.15 | 0.01 |
| Concrete Industrial Saws | 1 | 2 | 90 | 81 | 0.4 | 0.62 | 4.43 | 3.62 | 0.33 | 0.33 | 0.01 | 568.30 | 0.06 | 0.01 |
| Generator Sets | 1 | 4 | 90 | 84 | 0.4 | 0.58 | 4.41 | 3.47 | 0.31 | 0.31 | 0.01 | 568.30 | 0.05 | 0.01 |
| Bore/Drill Rigs | 0 | 0 | 0 | 206 | 0.5 | 0.19 | 2.90 | 1.13 | 0.09 | 0.08 | 0.00 | 502.13 | 0.15 | 0.01 |
| **Traction Power Substation Installation** | | | | | | | | | | | | | | |
| Advance Site Preparation - Traction Power Sites | | | | | | | | | | | | | | |
| Off-Highway Trucks | 1 | 3 | 180 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |
| Chainsaws (gas) | 1 | 2 | 90 | 1 | 0.5 | 129.47 | 2.92 | 350.34 | 0.84 | 0.84 | 0.04 | 884.65 | 8.05 | 0.03 |
| Trimmers/Edgers/Brush Cutters (gas) | 1 | 2 | 90 | 1 | 0.5 | 20.98 | 8.49 | 396.35 | 0.50 | 0.50 | 0.03 | 858.88 | 1.18 | 0.03 |
| Chippers/Stump Grinders (gas) | 1 | 2 | 90 | 18 | 0.8 | 13.82 | 8.10 | 563.50 | 7.02 | 7.02 | 0.02 | 858.88 | 0.77 | 0.03 |
| Traction Power Equipment Foundation Construction | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 180 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 1 | 3 | 180 | 98 | 0.4 | 0.54 | 5.14 | 3.81 | 0.40 | 0.36 | 0.00 | 511.35 | 0.15 | 0.01 |
| Rubber Tired Loaders | 1 | 3 | 180 | 200 | 0.4 | 0.39 | 5.12 | 1.45 | 0.17 | 0.16 | 0.00 | 503.65 | 0.15 | 0.01 |
| Pumps | 0 | 0 | 0 | 84 | 0.4 | 0.61 | 4.48 | 3.52 | 0.33 | 0.33 | 0.01 | 568.30 | 0.06 | 0.01 |
| Vibratory Plate | 0 | 0 | 0 | 8 | 0.4 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Concrete Mixers | 0 | 0 | 0 | 9 | 0.4 | 0.66 | 4.15 | 3.47 | 0.17 | 0.17 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.3 | 0.62 | 7.38 | 2.58 | 0.33 | 0.31 | 0.00 | 507.16 | 0.15 | 0.01 |
| Traction Power Equipment Installation | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.3 | 0.62 | 7.38 | 2.58 | 0.33 | 0.31 | 0.00 | 507.16 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 0 | 0 | 0 | 98 | 0.4 | 0.54 | 5.14 | 3.81 | 0.40 | 0.36 | 0.00 | 511.35 | 0.15 | 0.01 |
| Traction Power Equipment Testing | | | | | | | | | | | | | | |
| Generator Set | 0 | 0 | 0 | 84 | 0.4 | 0.58 | 4.41 | 3.47 | 0.31 | 0.31 | 0.01 | 568.30 | 0.05 | 0.01 |
| **Overhead Contact System (OCS)** | | | | | | | | | | | | | | |
| OCS Pole Foundation Construction - Crew #1 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 2 | 90 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |
| Bore/Drill Rigs | 1 | 3 | 90 | 206 | 0.5 | 0.19 | 2.90 | 1.13 | 0.09 | 0.08 | 0.00 | 502.13 | 0.15 | 0.01 |
| Rubber Tired Loaders | 1 | 4 | 90 | 200 | 0.4 | 0.39 | 5.12 | 1.45 | 0.17 | 0.16 | 0.00 | 503.65 | 0.15 | 0.01 |
| Generators | 1 | 4 | 90 | 84 | 0.4 | 0.58 | 4.41 | 3.47 | 0.31 | 0.31 | 0.01 | 568.30 | 0.05 | 0.01 |
| Pumps | 0 | 0 | 0 | 84 | 0.4 | 0.61 | 4.48 | 3.52 | 0.33 | 0.33 | 0.01 | 568.30 | 0.06 | 0.01 |
| Concrete Mixers | 0 | 0 | 0 | 9 | 0.4 | 0.66 | 4.15 | 3.47 | 0.17 | 0.17 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.3 | 0.62 | 7.38 | 2.58 | 0.33 | 0.31 | 0.00 | 507.16 | 0.15 | 0.01 |
| OCS Pole Foundation Construction - Crew #2 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 2 | 90 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bore/Drill Rigs | 1 | 3 | 90 | 206 | 0.5 | 0.19 | 2.90 | 1.13 | 0.09 | 0.08 | 0.00 | 502.13 | 0.15 | 0.01 |
| Rubber Tired Loaders | 1 | 4 | 90 | 200 | 0.4 | 0.39 | 5.12 | 1.45 | 0.17 | 0.16 | 0.00 | 503.65 | 0.15 | 0.01 |
| Generators | 1 | 4 | 90 | 84 | 0.4 | 0.58 | 4.41 | 3.47 | 0.31 | 0.31 | 0.01 | 568.30 | 0.05 | 0.01 |
| Pumps | 0 | 0 | 0 | 84 | 0.4 | 0.61 | 4.48 | 3.52 | 0.33 | 0.33 | 0.01 | 568.30 | 0.06 | 0.01 |
| Concrete Mixers | 0 | 0 | 0 | 9 | 0.4 | 0.66 | 4.15 | 3.47 | 0.17 | 0.17 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.3 | 0.62 | 7.38 | 2.58 | 0.33 | 0.31 | 0.00 | 507.16 | 0.15 | 0.01 |
| OCS Pole & Cantilever Installation - Crew #1 | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.3 | 0.62 | 7.38 | 2.58 | 0.33 | 0.31 | 0.00 | 507.16 | 0.15 | 0.01 |
| Generator | 0 | 0 | 0 | 84 | 0.4 | 0.58 | 4.41 | 3.47 | 0.31 | 0.31 | 0.01 | 568.30 | 0.05 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.4 | 0.54 | 5.14 | 3.81 | 0.40 | 0.36 | 0.00 | 511.35 | 0.15 | 0.01 |
| OCS Pole & Cantilever Installation - Crew #2 | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.3 | 0.62 | 7.38 | 2.58 | 0.33 | 0.31 | 0.00 | 507.16 | 0.15 | 0.01 |
| Generator | 0 | 0 | 0 | 84 | 0.4 | 0.58 | 4.41 | 3.47 | 0.31 | 0.31 | 0.01 | 568.30 | 0.05 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.4 | 0.54 | 5.14 | 3.81 | 0.40 | 0.36 | 0.00 | 511.35 | 0.15 | 0.01 |
| OCS Wire Installation & Testing | | | | | | | | | | | | | | |
| On-Track Wire Installation Equipment | 0 | 0 | 0 | 172 | 0.4 | 0.52 | 5.82 | 3.36 | 0.31 | 0.28 | 0.00 | 503.96 | 0.15 | 0.01 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 0 | 90 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |
| Generators | 1 | 0 | 90 | 84 | 0.4 | 0.58 | 4.41 | 3.47 | 0.31 | 0.31 | 0.01 | 568.30 | 0.05 | 0.01 |
| Grade Crossing Modifications | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.4 | 0.54 | 5.14 | 3.81 | 0.40 | 0.36 | 0.00 | 511.35 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.4 | 0.58 | 4.41 | 3.47 | 0.31 | 0.31 | 0.01 | 568.30 | 0.05 | 0.01 |
| **Communications** | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.4 | 0.35 | 4.05 | 1.89 | 0.15 | 0.14 | 0.00 | 509.86 | 0.15 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.4 | 0.54 | 5.14 | 3.81 | 0.40 | 0.36 | 0.00 | 511.35 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.4 | 0.58 | 4.41 | 3.47 | 0.31 | 0.31 | 0.01 | 568.30 | 0.05 | 0.01 |
| **Integration / Commissioning** | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | |
| Generators | 0 | 0 | 0 | 84 | 0.4 | 0.58 | 4.41 | 3.47 | 0.31 | 0.31 | 0.01 | 568.30 | 0.05 | 0.01 |

**2016 Onroad Assumptions**

| 2016 | Vehicle Type | Trips/ Day | VMT/ day | VMT/ year | Days | grams per mile (EMFAC) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O | Other |
| **Utilities** | | | | | | | | | | | | | | | |
| Advance Utility Relocation | | | | | | | | | | | | | | | |
| | Employee Vehicle | 15 | 186 | 16,740 | 90 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 4,500 | 90 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| **Traction Power Substation Installation** | | | | | | | | | | | | | | | |
| Advance Site Preparation - Traction Power Sites | | | | | | | | | | | | | | | |
| | Employee Vehicle | 10 | 124 | 22,320 | 180 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 9,000 | 180 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Foundation Construction | | | | | | | | | | | | | | | |
| | Employee Vehicle | 17.5 | 217 | 39,060 | 180 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 2 | 100 | 18,000 | 180 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 9,000 | 180 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Installation | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| **Overhead Contact System (OCS)** | | | | | | | | | | | | | | | |
| OCS Pole Foundation Construction - Crew #1 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 17.5 | 217 | 19,530 | 90 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 1 | 50 | 4,500 | 90 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 4,500 | 90 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| OCS Pole Foundation Construction - Crew #2 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 17.5 | 217 | 19,530 | 90 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 1 | 50 | 4,500 | 90 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 4,500 | 90 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #1 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #2 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCS Wire Installation & Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | | |
| | Employee Vehicle | 5 | 62 | 5,580 | 90 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 1 | 50 | 4,500 | 90 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| Grade Crossing Modifications | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| **Communications** | | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| **Integration / Commissioning** | | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.04 | 0.13 | 1.29 | 0.00 | 0.00 | 0.00 | 344.71 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.24 | 7.60 | 1.01 | 0.08 | 0.07 | 0.00 | 1,780.94 | 0.10 | 0.05 | 0.00 |

**2017 Offroad Assumptions**

| 2017 Equipment | # Day | Hrs/ Day | Days | HP | LF | g/hp-hr (CalEEMod) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
| **Utilities** | | | | | | | | | | | | | | |
| Advance Utility Relocation | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Excavator | 0 | 0 | 0 | 163 | 0.38 | 0.33 | 3.70 | 3.15 | 0.18 | 0.17 | 0.00 | 498.52 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.50 | 4.81 | 3.78 | 0.36 | 0.33 | 0.00 | 502.80 | 0.15 | 0.01 |
| Concrete Industrial Saws | 0 | 0 | 0 | 81 | 0.42 | 0.56 | 4.09 | 3.60 | 0.29 | 0.29 | 0.01 | 568.30 | 0.05 | 0.01 |
| Generator Sets | 0 | 0 | 0 | 84 | 0.42 | 0.52 | 4.07 | 3.44 | 0.27 | 0.27 | 0.01 | 568.30 | 0.05 | 0.01 |
| Bore/Drill Rigs | 0 | 0 | 0 | 206 | 0.5 | 0.17 | 2.52 | 1.10 | 0.07 | 0.07 | 0.00 | 494.14 | 0.15 | 0.01 |
| **Traction Power Substation Installation** | | | | | | | | | | | | | | |
| Advance Site Preparation - Traction Power Sites | | | | | | | | | | | | | | |
| Off-Highway Trucks | 0 | 0 | 0 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Chainsaws (gas) | 0 | 0 | 0 | 1 | 0.5 | 127.28 | 2.91 | 346.19 | 0.79 | 0.79 | 0.04 | 884.65 | 7.91 | 0.03 |
| Trimmers/Edgers/Brush Cutters (gas) | 0 | 0 | 0 | 1 | 0.5 | 20.58 | 8.53 | 391.40 | 0.46 | 0.46 | 0.03 | 858.88 | 1.16 | 0.03 |
| Chippers/Stump Grinders (gas) | 0 | 0 | 0 | 18 | 0.78 | 13.67 | 8.14 | 560.46 | 7.05 | 7.05 | 0.02 | 858.88 | 0.76 | 0.03 |
| Traction Power Equipment Foundation Construction | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 360 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 1 | 3 | 300 | 98 | 0.37 | 0.50 | 4.81 | 3.78 | 0.36 | 0.33 | 0.00 | 502.80 | 0.15 | 0.01 |
| Rubber Tired Loaders | 1 | 3 | 180 | 200 | 0.36 | 0.37 | 4.75 | 1.42 | 0.16 | 0.15 | 0.00 | 495.95 | 0.15 | 0.01 |
| Pumps | 1 | 4 | 120 | 84 | 0.42 | 0.55 | 4.13 | 3.50 | 0.29 | 0.29 | 0.01 | 568.30 | 0.05 | 0.01 |
| Vibratory Plate | 1 | 4 | 120 | 8 | 0.42 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Concrete Mixers | 1 | 7 | 120 | 9 | 0.42 | 0.66 | 4.15 | 3.47 | 0.17 | 0.17 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 1 | 4 | 120 | 226 | 0.29 | 0.56 | 6.66 | 2.38 | 0.30 | 0.27 | 0.00 | 499.37 | 0.15 | 0.01 |
| Traction Power Equipment Installation | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.56 | 6.66 | 2.38 | 0.30 | 0.27 | 0.00 | 499.37 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.50 | 4.81 | 3.78 | 0.36 | 0.33 | 0.00 | 502.80 | 0.15 | 0.01 |
| Traction Power Equipment Testing | | | | | | | | | | | | | | |
| Generator Set | 0 | 0 | 0 | 84 | 0.42 | 0.52 | 4.07 | 3.44 | 0.27 | 0.27 | 0.01 | 568.30 | 0.05 | 0.01 |
| **Overhead Contact System (OCS)** | | | | | | | | | | | | | | |
| OCS Pole Foundation Construction - Crew #1 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 2 | 360 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Bore/Drill Rigs | 1 | 3 | 70 | 206 | 0.5 | 0.17 | 2.52 | 1.10 | 0.07 | 0.07 | 0.00 | 494.14 | 0.15 | 0.01 |
| Rubber Tired Loaders | 1 | 4 | 150 | 200 | 0.36 | 0.37 | 4.75 | 1.42 | 0.16 | 0.15 | 0.00 | 495.95 | 0.15 | 0.01 |
| Generators | 1 | 4 | 360 | 84 | 0.42 | 0.52 | 4.07 | 3.44 | 0.27 | 0.27 | 0.01 | 568.30 | 0.05 | 0.01 |
| Pumps | 1 | 4 | 100 | 84 | 0.42 | 0.55 | 4.13 | 3.50 | 0.29 | 0.29 | 0.01 | 568.30 | 0.05 | 0.01 |
| Concrete Mixers | 1 | 7 | 100 | 9 | 0.42 | 0.66 | 4.15 | 3.47 | 0.17 | 0.17 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 1 | 4 | 100 | 226 | 0.29 | 0.56 | 6.66 | 2.38 | 0.30 | 0.27 | 0.00 | 499.37 | 0.15 | 0.01 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCS Pole Foundation Construction - Crew #2 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 2 | 360 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Bore/Drill Rigs | 1 | 3 | 160 | 206 | 0.5 | 0.17 | 2.52 | 1.10 | 0.07 | 0.07 | 0.00 | 494.14 | 0.15 | 0.01 |
| Rubber Tired Loaders | 1 | 4 | 285 | 200 | 0.36 | 0.37 | 4.75 | 1.42 | 0.16 | 0.15 | 0.00 | 495.95 | 0.15 | 0.01 |
| Generators | 1 | 4 | 360 | 84 | 0.42 | 0.52 | 4.07 | 3.44 | 0.27 | 0.27 | 0.01 | 568.30 | 0.05 | 0.01 |
| Pumps | 1 | 4 | 100 | 84 | 0.42 | 0.55 | 4.13 | 3.50 | 0.29 | 0.29 | 0.01 | 568.30 | 0.05 | 0.01 |
| Concrete Mixers | 1 | 7 | 100 | 9 | 0.42 | 0.66 | 4.15 | 3.47 | 0.17 | 0.17 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 1 | 7 | 100 | 226 | 0.29 | 0.56 | 6.66 | 2.38 | 0.30 | 0.27 | 0.00 | 499.37 | 0.15 | 0.01 |
| OCS Pole & Cantilever Installation - Crew #1 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 360 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Crane | 1 | 4 | 180 | 226 | 0.29 | 0.56 | 6.66 | 2.38 | 0.30 | 0.27 | 0.00 | 499.37 | 0.15 | 0.01 |
| Generator | 1 | 3 | 360 | 84 | 0.42 | 0.52 | 4.07 | 3.44 | 0.27 | 0.27 | 0.01 | 568.30 | 0.05 | 0.01 |
| Backhoe | 1 | 3 | 180 | 98 | 0.37 | 0.50 | 4.81 | 3.78 | 0.36 | 0.33 | 0.00 | 502.80 | 0.15 | 0.01 |
| OCS Pole & Cantilever Installation - Crew #2 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 270 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Crane | 1 | 4 | 210 | 226 | 0.29 | 0.56 | 6.66 | 2.38 | 0.30 | 0.27 | 0.00 | 499.37 | 0.15 | 0.01 |
| Generator | 1 | 2 | 270 | 84 | 0.42 | 0.52 | 4.07 | 3.44 | 0.27 | 0.27 | 0.01 | 568.30 | 0.05 | 0.01 |
| Backhoe | 1 | 2 | 210 | 98 | 0.37 | 0.50 | 4.81 | 3.78 | 0.36 | 0.33 | 0.00 | 502.80 | 0.15 | 0.01 |
| OCS Wire Installation & Testing | | | | | | | | | | | | | | |
| On-Track Wire Installation Equipment | 1 | 7 | 210 | 172 | 0.42 | 0.50 | 5.49 | 3.34 | 0.29 | 0.27 | 0.00 | 495.93 | 0.15 | 0.01 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 150 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Generators | 1 | 4 | 150 | 84 | 0.42 | 0.52 | 4.07 | 3.44 | 0.27 | 0.27 | 0.01 | 568.30 | 0.05 | 0.01 |
| Grade Crossing Modifications | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.50 | 4.81 | 3.78 | 0.36 | 0.33 | 0.00 | 502.80 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.52 | 4.07 | 3.44 | 0.27 | 0.27 | 0.01 | 568.30 | 0.05 | 0.01 |
| **Communications** | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.33 | 3.67 | 1.75 | 0.14 | 0.13 | 0.00 | 501.44 | 0.15 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.50 | 4.81 | 3.78 | 0.36 | 0.33 | 0.00 | 502.80 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.52 | 4.07 | 3.44 | 0.27 | 0.27 | 0.01 | 568.30 | 0.05 | 0.01 |
| **Integration / Commissioning** | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.52 | 4.07 | 3.44 | 0.27 | 0.27 | 0.01 | 568.30 | 0.05 | 0.01 |

**2017 Onroad Assumptions**

| 2017 | Vehicle Type | Trips/ Day | VMT/ day | VMT/ year | Days | grams per mile (EMFAC) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O | Other |
| **Utilities** | | | | | | | | | | | | | | | |
| Advance Utility Relocation | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| **Traction Power Substation Installation** | | | | | | | | | | | | | | | |
| Advance Site Preparation - Traction Power Sites | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Foundation Construction | | | | | | | | | | | | | | | |
| | Employee Vehicle | 17.5 | 217 | 78,120 | 360 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 2 | 100 | 36,000 | 360 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 18,000 | 360 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Installation | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| **Overhead Contact System (OCS)** | | | | | | | | | | | | | | | |
| OCS Pole Foundation Construction - Crew #1 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 17.5 | 217 | 78,120 | 360 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 1 | 50 | 18,000 | 360 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 18,000 | 360 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| OCS Pole Foundation Construction - Crew #2 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 17.5 | 217 | 78,120 | 360 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 1 | 50 | 18,000 | 360 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 18,000 | 360 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #1 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 10 | 124 | 44,640 | 360 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 1 | 50 | 18,000 | 360 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #2 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 10 | 124 | 33,480 | 270 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 1 | 50 | 13,500 | 270 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCS Wire Installation & Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 2.5 | 31 | 6,510 | 210 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | | |
| | Employee Vehicle | 5 | 62 | 9,300 | 150 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 1 | 50 | 7,500 | 150 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| Grade Crossing Modifications | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| **Communications** | | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| **Integration / Commissioning** | | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | | | | | | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* |

**2018 Offroad Assumptions**

| 2018 Equipment | # Day | Hrs/ Day | Days | HP | LF | g/hp-hr (CalEEMod) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
| **Utilities** | | | | | | | | | | | | | | |
| Advance Utility Relocation | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |
| Excavator | 0 | 0 | 0 | 163 | 0.38 | 0.27 | 2.92 | 3.09 | 0.14 | 0.13 | 0.00 | 490.67 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.42 | 4.15 | 3.69 | 0.29 | 0.27 | 0.00 | 494.12 | 0.15 | 0.01 |
| Concrete Industrial Saws | 0 | 0 | 0 | 81 | 0.42 | 0.50 | 3.75 | 3.57 | 0.26 | 0.26 | 0.01 | 568.30 | 0.04 | 0.01 |
| Generator Sets | 0 | 0 | 0 | 84 | 0.42 | 0.46 | 3.75 | 3.42 | 0.24 | 0.24 | 0.01 | 568.30 | 0.04 | 0.01 |
| Bore/Drill Rigs | 0 | 0 | 0 | 206 | 0.5 | 0.15 | 2.15 | 1.07 | 0.06 | 0.06 | 0.00 | 484.56 | 0.15 | 0.01 |
| **Traction Power Substation Installation** | | | | | | | | | | | | | | |
| Advance Site Preparation - Traction Power Sites | | | | | | | | | | | | | | |
| Off-Highway Trucks | 0 | 0 | 0 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |
| Chainsaws (gas) | 0 | 0 | 0 | 1 | 0.5 | 125.38 | 2.89 | 342.56 | 0.74 | 0.74 | 0.04 | 884.65 | 7.79 | 0.03 |
| Trimmers/Edgers/Brush Cutters (gas) | 0 | 0 | 0 | 1 | 0.5 | 20.24 | 8.55 | 387.19 | 0.42 | 0.42 | 0.03 | 858.88 | 1.14 | 0.03 |
| Chippers/Stump Grinders (gas) | 0 | 0 | 0 | 18 | 0.78 | 13.52 | 8.18 | 557.81 | 7.08 | 7.08 | 0.02 | 858.88 | 0.75 | 0.03 |
| Traction Power Equipment Foundation Construction | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.42 | 4.15 | 3.69 | 0.29 | 0.27 | 0.00 | 494.12 | 0.15 | 0.01 |
| Rubber Tired Loaders | 0 | 0 | 0 | 200 | 0.36 | 0.33 | 4.13 | 1.35 | 0.14 | 0.13 | 0.00 | 487.90 | 0.15 | 0.01 |
| Pumps | 0 | 0 | 0 | 84 | 0.42 | 0.49 | 3.81 | 3.47 | 0.25 | 0.25 | 0.01 | 568.30 | 0.04 | 0.01 |
| Vibratory Plate | 0 | 0 | 0 | 8 | 0.42 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Concrete Mixers | 0 | 0 | 0 | 9 | 0.42 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.48 | 5.77 | 2.13 | 0.25 | 0.23 | 0.00 | 491.41 | 0.15 | 0.01 |
| Traction Power Equipment Installation | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 360 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |
| Crane | 2 | 3 | 240 | 226 | 0.29 | 0.48 | 5.77 | 2.13 | 0.25 | 0.23 | 0.00 | 491.41 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 1 | 3 | 240 | 98 | 0.37 | 0.42 | 4.15 | 3.69 | 0.29 | 0.27 | 0.00 | 494.12 | 0.15 | 0.01 |
| Traction Power Equipment Testing | | | | | | | | | | | | | | |
| Generator Set | 1 | 7 | 210 | 84 | 0.42 | 0.46 | 3.75 | 3.42 | 0.24 | 0.24 | 0.01 | 568.30 | 0.04 | 0.01 |
| **Overhead Contact System (OCS)** | | | | | | | | | | | | | | |
| OCS Pole Foundation Construction - Crew #1 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 2 | 120 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |
| Bore/Drill Rigs | 0 | 0 | 0 | 206 | 0.5 | 0.15 | 2.15 | 1.07 | 0.06 | 0.06 | 0.00 | 484.56 | 0.15 | 0.01 |
| Rubber Tired Loaders | 0 | 0 | 0 | 200 | 0.36 | 0.33 | 4.13 | 1.35 | 0.14 | 0.13 | 0.00 | 487.90 | 0.15 | 0.01 |
| Generators | 1 | 4 | 120 | 84 | 0.42 | 0.46 | 3.75 | 3.42 | 0.24 | 0.24 | 0.01 | 568.30 | 0.04 | 0.01 |
| Pumps | 1 | 4 | 60 | 84 | 0.42 | 0.49 | 3.81 | 3.47 | 0.25 | 0.25 | 0.01 | 568.30 | 0.04 | 0.01 |
| Concrete Mixers | 1 | 7 | 60 | 9 | 0.42 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 1 | 4 | 60 | 226 | 0.29 | 0.48 | 5.77 | 2.13 | 0.25 | 0.23 | 0.00 | 491.41 | 0.15 | 0.01 |
| OCS Pole Foundation Construction - Crew #2 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 2 | 300 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bore/Drill Rigs | 0 | 0 | 0 | 206 | 0.5 | 0.15 | 2.15 | 1.07 | 0.06 | 0.06 | 0.00 | 484.56 | 0.15 | 0.01 |
| Rubber Tired Loaders | 0 | 0 | 0 | 200 | 0.36 | 0.33 | 4.13 | 1.35 | 0.14 | 0.13 | 0.00 | 487.90 | 0.15 | 0.01 |
| Generators | 1 | 4 | 300 | 84 | 0.42 | 0.46 | 3.75 | 3.42 | 0.24 | 0.24 | 0.01 | 568.30 | 0.04 | 0.01 |
| Pumps | 1 | 4 | 150 | 84 | 0.42 | 0.49 | 3.81 | 3.47 | 0.25 | 0.25 | 0.01 | 568.30 | 0.04 | 0.01 |
| Concrete Mixers | 1 | 7 | 150 | 9 | 0.42 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 1 | 7 | 150 | 226 | 0.29 | 0.48 | 5.77 | 2.13 | 0.25 | 0.23 | 0.00 | 491.41 | 0.15 | 0.01 |
| OCS Pole & Cantilever Installation - Crew #1 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 210 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |
| Crane | 1 | 4 | 180 | 226 | 0.29 | 0.48 | 5.77 | 2.13 | 0.25 | 0.23 | 0.00 | 491.41 | 0.15 | 0.01 |
| Generator | 1 | 3 | 210 | 84 | 0.42 | 0.46 | 3.75 | 3.42 | 0.24 | 0.24 | 0.01 | 568.30 | 0.04 | 0.01 |
| Backhoe | 1 | 3 | 180 | 98 | 0.37 | 0.42 | 4.15 | 3.69 | 0.29 | 0.27 | 0.00 | 494.12 | 0.15 | 0.01 |
| OCS Pole & Cantilever Installation - Crew #2 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 360 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |
| Crane | 1 | 4 | 270 | 226 | 0.29 | 0.48 | 5.77 | 2.13 | 0.25 | 0.23 | 0.00 | 491.41 | 0.15 | 0.01 |
| Generator | 1 | 2 | 360 | 84 | 0.42 | 0.46 | 3.75 | 3.42 | 0.24 | 0.24 | 0.01 | 568.30 | 0.04 | 0.01 |
| Backhoe | 1 | 2 | 270 | 98 | 0.37 | 0.42 | 4.15 | 3.69 | 0.29 | 0.27 | 0.00 | 494.12 | 0.15 | 0.01 |
| OCS Wire Installation & Testing | | | | | | | | | | | | | | |
| On-Track Wire Installation Equipment | 1 | 7 | 360 | 172 | 0.42 | 0.44 | 4.75 | 3.26 | 0.25 | 0.23 | 0.00 | 487.99 | 0.15 | 0.01 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.46 | 3.75 | 3.42 | 0.24 | 0.24 | 0.01 | 568.30 | 0.04 | 0.01 |
| Grade Crossing Modifications | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 240 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |
| Backhoe | 1 | 3 | 150 | 98 | 0.37 | 0.42 | 4.15 | 3.69 | 0.29 | 0.27 | 0.00 | 494.12 | 0.15 | 0.01 |
| Generators | 1 | 4 | 240 | 84 | 0.42 | 0.46 | 3.75 | 3.42 | 0.24 | 0.24 | 0.01 | 568.30 | 0.04 | 0.01 |
| **Communications** | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 360 | 400 | 0.38 | 0.29 | 3.09 | 1.56 | 0.11 | 0.10 | 0.00 | 493.51 | 0.15 | 0.01 |
| Backhoe | 1 | 3 | 180 | 98 | 0.37 | 0.42 | 4.15 | 3.69 | 0.29 | 0.27 | 0.00 | 494.12 | 0.15 | 0.01 |
| Generators | 1 | 4 | 360 | 84 | 0.42 | 0.46 | 3.75 | 3.42 | 0.24 | 0.24 | 0.01 | 568.30 | 0.04 | 0.01 |
| **Integration / Commissioning** | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.46 | 3.75 | 3.42 | 0.24 | 0.24 | 0.01 | 568.30 | 0.04 | 0.01 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCS Wire Installation & Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 2.5 | 31 | 6,510 | 210 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | | |
| | Employee Vehicle | 5 | 62 | 9,300 | 150 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 1 | 50 | 7,500 | 150 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| Grade Crossing Modifications | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| **Communications** | | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| **Integration / Commissioning** | | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.03 | 0.12 | 1.14 | 0.00 | 0.00 | 0.00 | 344.87 | - | - | 17.24 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 6.73 | 0.94 | 0.07 | 0.06 | 0.00 | 1,777.07 | 0.10 | 0.05 | 0.00 |

**2018 Onroad Assumptions**

| 2018 | Vehicle Type | Trips/ Day | VMT/ day | VMT/ year | Days | grams per mile (EMFAC) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O | Other |
| **Utilities** | | | | | | | | | | | | | | | |
| Advance Utility Relocation | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| **Traction Power Substation Installation** | | | | | | | | | | | | | | | |
| Advance Site Preparation - Traction Power Sites | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Foundation Construction | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Installation | | | | | | | | | | | | | | | |
| | Employee Vehicle | 10 | 124 | 44,640 | 360 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 1 | 50 | 18,000 | 360 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 2.5 | 31 | 6,510 | 210 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| **Overhead Contact System (OCS)** | | | | | | | | | | | | | | | |
| OCS Pole Foundation Construction - Crew #1 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 17.5 | 217 | 26,040 | 120 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 1 | 50 | 6,000 | 120 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 6,000 | 120 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| OCS Pole Foundation Construction - Crew #2 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 17.5 | 217 | 65,100 | 300 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 1 | 50 | 15,000 | 300 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 1 | 50 | 15,000 | 300 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #1 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 10 | 124 | 26,040 | 210 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 1 | 50 | 10,500 | 210 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #2 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 10 | 124 | 44,640 | 360 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flatbed | 1 | 50 | 18,000 | 360 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| OCS Wire Installation & Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 2.5 | 31 | 11,160 | 360 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| Grade Crossing Modifications | | | | | | | | | | | | | | | |
| | Employee Vehicle | 7.5 | 93 | 22,320 | 240 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 1 | 50 | 12,000 | 240 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| **Communications** | | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | | |
| | Employee Vehicle | 7.5 | 93 | 33,480 | 360 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 1 | 50 | 18,000 | 360 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| **Integration / Commissioning** | | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |

**2019 Offroad Assumptions**

| 2019 Equipment | # Day | Hrs/ Day | Days | HP | LF | g/hp-hr (CalEEMod) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O |
| **Utilities** | | | | | | | | | | | | | | |
| Advance Utility Relocation | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |
| Excavator | 0 | 0 | 0 | 163 | 0.38 | 0.25 | 2.53 | 3.08 | 0.12 | 0.11 | 0.00 | 482.68 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.37 | 3.69 | 3.64 | 0.25 | 0.23 | 0.00 | 485.85 | 0.15 | 0.01 |
| Concrete Industrial Saws | 0 | 0 | 0 | 81 | 0.42 | 0.44 | 3.44 | 3.55 | 0.22 | 0.22 | 0.01 | 568.30 | 0.04 | 0.01 |
| Generator Sets | 0 | 0 | 0 | 84 | 0.42 | 0.41 | 3.45 | 3.40 | 0.21 | 0.21 | 0.01 | 568.30 | 0.04 | 0.01 |
| Bore/Drill Rigs | 0 | 0 | 0 | 206 | 0.5 | 0.14 | 1.89 | 1.06 | 0.05 | 0.05 | 0.00 | 475.79 | 0.15 | 0.01 |
| **Traction Power Substation Installation** | | | | | | | | | | | | | | |
| Advance Site Preparation - Traction Power Sites | | | | | | | | | | | | | | |
| Off-Highway Trucks | 0 | 0 | 0 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |
| Chainsaws (gas) | 0 | 0 | 0 | 1 | 0.5 | 123.70 | 2.88 | 339.38 | 0.70 | 0.70 | 0.04 | 884.65 | 7.69 | 0.03 |
| Trimmers/Edgers/Brush Cutters (gas) | 0 | 0 | 0 | 1 | 0.5 | 19.98 | 8.57 | 384.06 | 0.39 | 0.39 | 0.03 | 858.88 | 1.12 | 0.03 |
| Chippers/Stump Grinders (gas) | 0 | 0 | 0 | 18 | 0.78 | 13.43 | 8.20 | 556.11 | 7.10 | 7.10 | 0.02 | 858.88 | 0.75 | 0.03 |
| Traction Power Equipment Foundation Construction | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.37 | 3.69 | 3.64 | 0.25 | 0.23 | 0.00 | 485.85 | 0.15 | 0.01 |
| Rubber Tired Loaders | 0 | 0 | 0 | 200 | 0.36 | 0.31 | 3.74 | 1.30 | 0.13 | 0.12 | 0.00 | 480.10 | 0.15 | 0.01 |
| Pumps | 0 | 0 | 0 | 84 | 0.42 | 0.43 | 3.50 | 3.45 | 0.22 | 0.22 | 0.01 | 568.30 | 0.04 | 0.01 |
| Vibratory Plate | 0 | 0 | 0 | 8 | 0.42 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Concrete Mixers | 0 | 0 | 0 | 9 | 0.42 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.43 | 5.08 | 1.94 | 0.22 | 0.20 | 0.00 | 483.46 | 0.15 | 0.01 |
| Traction Power Equipment Installation | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 120 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |
| Crane | 2 | 3 | 120 | 226 | 0.29 | 0.43 | 5.08 | 1.94 | 0.22 | 0.20 | 0.00 | 483.46 | 0.15 | 0.01 |
| Tractor/Loader/Backhoe | 1 | 3 | 120 | 98 | 0.37 | 0.37 | 3.69 | 3.64 | 0.25 | 0.23 | 0.00 | 485.85 | 0.15 | 0.01 |
| Traction Power Equipment Testing | | | | | | | | | | | | | | |
| Generator Set | 1 | 7 | 180 | 84 | 0.42 | 0.41 | 3.45 | 3.40 | 0.21 | 0.21 | 0.01 | 568.30 | 0.04 | 0.01 |
| **Overhead Contact System (OCS)** | | | | | | | | | | | | | | |
| OCS Pole Foundation Construction - Crew #1 | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |
| Bore/Drill Rigs | 0 | 0 | 0 | 206 | 0.5 | 0.14 | 1.89 | 1.06 | 0.05 | 0.05 | 0.00 | 475.79 | 0.15 | 0.01 |
| Rubber Tired Loaders | 0 | 0 | 0 | 200 | 0.36 | 0.31 | 3.74 | 1.30 | 0.13 | 0.12 | 0.00 | 480.10 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.41 | 3.45 | 3.40 | 0.21 | 0.21 | 0.01 | 568.30 | 0.04 | 0.01 |
| Pumps | 0 | 0 | 0 | 84 | 0.42 | 0.43 | 3.50 | 3.45 | 0.22 | 0.22 | 0.01 | 568.30 | 0.04 | 0.01 |
| Concrete Mixers | 0 | 0 | 0 | 9 | 0.42 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.43 | 5.08 | 1.94 | 0.22 | 0.20 | 0.00 | 483.46 | 0.15 | 0.01 |
| OCS Pole Foundation Construction - Crew #2 | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bore/Drill Rigs | 0 | 0 | 0 | 206 | 0.5 | 0.14 | 1.89 | 1.06 | 0.05 | 0.05 | 0.00 | 475.79 | 0.15 | 0.01 |
| Rubber Tired Loaders | 0 | 0 | 0 | 200 | 0.36 | 0.31 | 3.74 | 1.30 | 0.13 | 0.12 | 0.00 | 480.10 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.41 | 3.45 | 3.40 | 0.21 | 0.21 | 0.01 | 568.30 | 0.04 | 0.01 |
| Pumps | 0 | 0 | 0 | 84 | 0.42 | 0.43 | 3.50 | 3.45 | 0.22 | 0.22 | 0.01 | 568.30 | 0.04 | 0.01 |
| Concrete Mixers | 0 | 0 | 0 | 9 | 0.42 | 0.66 | 4.14 | 3.47 | 0.16 | 0.16 | 0.01 | 568.30 | 0.06 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.43 | 5.08 | 1.94 | 0.22 | 0.20 | 0.00 | 483.46 | 0.15 | 0.01 |
| OCS Pole & Cantilever Installation - Crew #1 | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |
| Crane | 0 | 0 | 0 | 226 | 0.29 | 0.43 | 5.08 | 1.94 | 0.22 | 0.20 | 0.00 | 483.46 | 0.15 | 0.01 |
| Generator | 0 | 0 | 0 | 84 | 0.42 | 0.41 | 3.45 | 3.40 | 0.21 | 0.21 | 0.01 | 568.30 | 0.04 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.37 | 3.69 | 3.64 | 0.25 | 0.23 | 0.00 | 485.85 | 0.15 | 0.01 |
| OCS Pole & Cantilever Installation - Crew #2 | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 60 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |
| Crane | 1 | 4 | 0 | 226 | 0.29 | 0.43 | 5.08 | 1.94 | 0.22 | 0.20 | 0.00 | 483.46 | 0.15 | 0.01 |
| Generator | 1 | 2 | 60 | 84 | 0.42 | 0.41 | 3.45 | 3.40 | 0.21 | 0.21 | 0.01 | 568.30 | 0.04 | 0.01 |
| Backhoe | 1 | 2 | 0 | 98 | 0.37 | 0.37 | 3.69 | 3.64 | 0.25 | 0.23 | 0.00 | 485.85 | 0.15 | 0.01 |
| OCS Wire Installation & Testing | | | | | | 0.41 | 4.43 | 3.26 | 0.23 | 0.21 | 0.00 | 480.45 | 0.15 | 0.01 |
| On-Track Wire Installation Equipment | 1 | 7 | 150 | 172 | 0.42 | 0.41 | 4.43 | 3.26 | 0.23 | 0.21 | 0.00 | 480.45 | 0.15 | 0.01 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | |
| Off-Highway Truck | 0 | 0 | 0 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |
| Generators | 0 | 0 | 0 | 84 | 0.42 | 0.41 | 3.45 | 3.40 | 0.21 | 0.21 | 0.01 | 568.30 | 0.04 | 0.01 |
| Grade Crossing Modifications | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 150 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |
| Backhoe | 1 | 3 | 90 | 98 | 0.37 | 0.37 | 3.69 | 3.64 | 0.25 | 0.23 | 0.00 | 485.85 | 0.15 | 0.01 |
| Generators | 1 | 4 | 150 | 84 | 0.42 | 0.41 | 3.45 | 3.40 | 0.21 | 0.21 | 0.01 | 568.30 | 0.04 | 0.01 |
| **Communications** | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | |
| Off-Highway Truck | 1 | 3 | 150 | 400 | 0.38 | 0.26 | 2.67 | 1.48 | 0.10 | 0.09 | 0.00 | 485.38 | 0.15 | 0.01 |
| Backhoe | 0 | 0 | 0 | 98 | 0.37 | 0.37 | 3.69 | 3.64 | 0.25 | 0.23 | 0.00 | 485.85 | 0.15 | 0.01 |
| Generators | 1 | 4 | 150 | 84 | 0.42 | 0.41 | 3.45 | 3.40 | 0.21 | 0.21 | 0.01 | 568.30 | 0.04 | 0.01 |
| **Integration / Commissioning** | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | |
| Generators | 1 | 4 | 210 | 84 | 0.42 | 0.41 | 3.45 | 3.40 | 0.21 | 0.21 | 0.01 | 568.30 | 0.04 | 0.01 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flatbed | 1 | 50 | 18,000 | 360 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| OCS Wire Installation & Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 2.5 | 31 | 11,160 | 360 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| Grade Crossing Modifications | | | | | | | | | | | | | | | |
| | Employee Vehicle | 7.5 | 93 | 22,320 | 240 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 1 | 50 | 12,000 | 240 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| **Communications** | | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | | |
| | Employee Vehicle | 7.5 | 93 | 33,480 | 360 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 1 | 50 | 18,000 | 360 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| **Integration / Commissioning** | | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.11 | 1.01 | 0.00 | 0.00 | 0.00 | 345.03 | - | - | 17.25 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.23 | 5.99 | 0.94 | 0.06 | 0.06 | 0.00 | 1,773.36 | 0.10 | 0.05 | 0.00 |

**2019 Onroad Assumptions**

| 2019 | Vehicle Type | Trips/ Day | VMT/ day | VMT/ year | Days | grams per mile (EMFAC) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ROG | NOX | CO | PM10 | PM2.5 | SO2 | CO2 | CH4 | N2O | Other |
| **Utilities** | | | | | | | | | | | | | | | |
| Advance Utility Relocation | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| **Traction Power Substation Installation** | | | | | | | | | | | | | | | |
| Advance Site Preparation - Traction Power Sites | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Foundation Construction | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Installation | | | | | | | | | | | | | | | |
| | Employee Vehicle | 10 | 124 | 14,880 | 120 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 1 | 50 | 6,000 | 120 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| Traction Power Equipment Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 2.5 | 31 | 5,580 | 180 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| **Overhead Contact System (OCS)** | | | | | | | | | | | | | | | |
| OCS Pole Foundation Construction - Crew #1 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| OCS Pole Foundation Construction - Crew #2 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #1 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #2 | | | | | | | | | | | | | | | |
| | Employee Vehicle | 10 | 124 | 7,440 | 60 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flatbed | 1 | 50 | 3,000 | 60 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| OCS Wire Installation & Testing | | | | | | | | | | | | | | | |
| | Employee Vehicle | 2.5 | 31 | 4,650 | 150 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| **Signal & Grade Crossings** | | | | | | | | | | | | | | | |
| Signaling Equipment Installation at CPs & Houses | | | | | | | | | | | | | | | |
| | Employee Vehicle | 0 | 0 | 0 | 0 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| Grade Crossing Modifications | | | | | | | | | | | | | | | |
| | Employee Vehicle | 7.5 | 93 | 13,950 | 150 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 1 | 50 | 7,500 | 150 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| **Communications** | | | | | | | | | | | | | | | |
| Communication System Installation (incl. SCADA) | | | | | | | | | | | | | | | |
| | Employee Vehicle | 7.5 | 93 | 13,950 | 150 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 1 | 50 | 7,500 | 150 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| **Integration / Commissioning** | | | | | | | | | | | | | | | |
| Integration Testing & Commissioning | | | | | | | | | | | | | | | |
| | Employee Vehicle | 2.5 | 31 | 6,510 | 210 | 0.02 | 0.10 | 0.91 | 0.00 | 0.00 | 0.00 | 345.16 | - | - | 17.26 |
| | Flatbed | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |
| | Dump | 0 | 0 | 0 | 0 | 0.22 | 5.40 | 0.93 | 0.06 | 0.06 | 0.00 | 1,770.35 | 0.10 | 0.05 | 0.00 |

**Re-Entrained Road Dust Calculations**

**Methodology**

Calculation Methodology: USEPA AP-42, Paved Roads, Section 13.2.1, Revised January 2011:
http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf
Avg Vehicle Weight, Silt Loading, and Precipitation Days (>0.254mm) for BAAQMD

**Emission Factor Calculation**

$$E_{ext} = [\, k\,(sL)^{0.91} \times (W)^{1.02} \,]\,(1 - P/4N)$$

| Pollutant | Variables | | | | | Emission Factor |
|---|---|---|---|---|---|---|
| | k | sL | W | P | N | (lbs per VMT) |
| $PM_{10}$ | 0.0022 | 0.1 | 2.4 | 64 | 365 | 0.00063 |
| $PM_{2.5}$ | 0.00054 | 0.1 | 2.4 | 64 | 365 | 0.00016 |

E = particulate emission factor (grams of particulate matter/VMT)
k = particle size multiplier (lb/VMT) *default from AP-42*
sL = roadway silt loading (g/m2) *Caleemod Default*
W = average weight of vehicles on the road (tons) *Caleemod Default*
P = number of wet days with > 0.254mm of precipitation *Caleemod Default for BAAQMD*
N = number of days in the averaging period *annual days*

| | 2015 | | | 2016 | | |
|---|---|---|---|---|---|---|
| **Segment/Phase** | **Daily VMT** | **Daily PM10** | **Daily PM2.5** | **Daily VMT** | **Daily PM10** | **Daily PM2.5** |
| **Utilities** | **236** | **0.15** | **0.04** | **236** | **0.15** | **0.04** |
| Advance Utility Relocation | 236 | 0.15 | 0.04 | 236 | 0.15 | 0.04 |
| **Traction Power Substation Installation** | **0** | **0.00** | **0.00** | **541** | **0.34** | **0.08** |
| Advance Site Preparation - Traction Power Sites | 0 | 0.00 | 0.00 | 174 | 0.11 | 0.03 |
| Traction Power Equipment Foundation Construction | 0 | 0.00 | 0.00 | 367 | 0.23 | 0.06 |
| Traction Power Equipment Installation | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| Traction Power Equipment Testing | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| **Overhead Contact System (OCS)** | **0** | **0.00** | **0.00** | **634** | **0.40** | **0.10** |
| OCS Pole Foundation Construction - Crew #1 | 0 | 0.00 | 0.00 | 317 | 0.20 | 0.05 |
| OCS Pole Foundation Construction - Crew #2 | 0 | 0.00 | 0.00 | 317 | 0.20 | 0.05 |
| OCS Pole & Cantilever Installation - Crew #1 | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #2 | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| OCS Wire Installation & Testing | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| **Signal & Grade Crossings** | **0** | **0.00** | **0.00** | **112** | **0.07** | **0.02** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Signaling Equipment Installation at CPs & Houses | 0 | 0.00 | 0.00 | 112 | 0.07 | 0.02 |
| Grade Crossing Modifications | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| **Communications** | **0** | **0.00** | **0.00** | **0** | **0.00** | **0.00** |
| Communication System Installation (incl. SCADA) | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| **Integration / Commissioning** | **0** | **0.00** | **0.00** | **0** | **0.00** | **0.00** |
| Integration Testing & Commissioning | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| | | **2017** | | | **2018** | |
| **Segment/Phase** | **Daily VMT** | **Daily PM10** | **Daily PM2.5** | **Daily VMT** | **Daily PM10** | **Daily PM2.5** |
| **Utilities** | **0** | **0.00** | **0.00** | **0** | **0.00** | **0.00** |
| Advance Utility Relocation | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| **Traction Power Substation Installation** | **367** | **0.23** | **0.06** | **205** | **0.13** | **0.03** |
| Advance Site Preparation - Traction Power Sites | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |
| Traction Power Equipment Foundation Construction | 367 | 0.23 | 0.06 | 0 | 0.00 | 0.00 |
| Traction Power Equipment Installation | 0 | 0.00 | 0.00 | 174 | 0.11 | 0.03 |
| Traction Power Equipment Testing | 0 | 0.00 | 0.00 | 31 | 0.02 | 0.00 |
| **Overhead Contact System (OCS)** | **1,013** | **0.64** | **0.16** | **1,013** | **0.64** | **0.16** |
| OCS Pole Foundation Construction - Crew #1 | 317 | 0.20 | 0.05 | 317 | 0.20 | 0.05 |
| OCS Pole Foundation Construction - Crew #2 | 317 | 0.20 | 0.05 | 317 | 0.20 | 0.05 |
| OCS Pole & Cantilever Installation - Crew #1 | 174 | 0.11 | 0.03 | 174 | 0.11 | 0.03 |
| OCS Pole & Cantilever Installation - Crew #2 | 174 | 0.11 | 0.03 | 174 | 0.11 | 0.03 |
| OCS Wire Installation & Testing | 31 | 0.02 | 0.00 | 31 | 0.02 | 0.00 |
| **Signal & Grade Crossings** | **112** | **0.07** | **0.02** | **143** | **0.09** | **0.02** |
| Signaling Equipment Installation at CPs & Houses | 112 | 0.07 | 0.02 | 0 | 0.00 | 0.00 |
| Grade Crossing Modifications | 0 | 0.00 | 0.00 | 143 | 0.09 | 0.02 |
| **Communications** | **0** | **0.00** | **0.00** | **143** | **0.09** | **0.02** |
| Communication System Installation (incl. SCADA) | 0 | 0.00 | 0.00 | 143 | 0.09 | 0.02 |
| **Integration / Commissioning** | **0** | **0.00** | **0.00** | **0** | **0.00** | **0.00** |
| Integration Testing & Commissioning | 0 | 0.00 | 0.00 | 0 | 0.00 | 0.00 |

| | | | |
|---|---|---|---|
| | **2019** | | |
| **Segment/Phase** | **Daily VMT** | **Daily PM10** | **Daily PM2.5** |
| **Utilities** | **0** | **0.00** | **0.00** |
| Advance Utility Relocation | 0 | 0.00 | 0.00 |
| **Traction Power Substation Installation** | **205** | **0.13** | **0.03** |
| Advance Site Preparation - Traction Power Sites | 0 | 0.00 | 0.00 |
| Traction Power Equipment Foundation Construction | 0 | 0.00 | 0.00 |
| Traction Power Equipment Installation | 174 | 0.11 | 0.03 |
| Traction Power Equipment Testing | 31 | 0.02 | 0.00 |
| **Overhead Contact System (OCS)** | **205** | **0.13** | **0.03** |
| OCS Pole Foundation Construction - Crew #1 | 0 | 0.00 | 0.00 |
| OCS Pole Foundation Construction - Crew #2 | 0 | 0.00 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #1 | 0 | 0.00 | 0.00 |
| OCS Pole & Cantilever Installation - Crew #2 | 174 | 0.11 | 0.03 |
| OCS Wire Installation & Testing | 31 | 0.02 | 0.00 |

| | | | |
|---|---|---|---|
| **Signal & Grade Crossings** | **143** | **0.09** | **0.02** |
| Signaling Equipment Installation at CPs & Houses | 0 | 0.00 | 0.00 |
| Grade Crossing Modifications | 143 | 0.09 | 0.02 |
| **Communications** | **143** | **0.09** | **0.02** |
| Communication System Installation (incl. SCADA) | 143 | 0.09 | 0.02 |
| **Integration / Commissioning** | **31** | **0.02** | **0.00** |
| Integration Testing & Commissioning | 31 | 0.02 | 0.00 |

**Grading Calculations**

| Phase | SF | Acres | Acres/Day | PM10 | PM2.5 |
|---|---|---|---|---|---|
| Advance Site Preparation - Traction Power Sites | 120,960 | 2.78 | 0.69 | 6.94 | 1.44 |

**Average Daily Equipment Hours**

The maximum daily hours were used to evaluate criteria pollutant emissions. Annual greenhouse gas emissions were evaluated using the following average daily assumptions.

| Electrification Activities | Equipment | Ave Hr per day |
|---|---|---|
| **Utilities** | | |
| *Advance Utility Relocation* | Off-Highway Truck | 1.8 |
| | Excavator | 1.8 |
| | Tractor/Loader/Backhoe | 1.8 |
| | Concrete Industrial Saws | 1.2 |
| | Generator Sets | 2.4 |
| | Bore/Drill Rigs | 1.8 |
| **Traction Power Substation Installation** | | |
| *Advance Site Preparation - Traction Power Sites* | Off-Highway Truck | 1.8 |
| | Chainsaw | 1.2 |
| | Trimmer/Edger/Brush Cutter | 1.2 |
| | Chippers/Stump Grinders | 1.2 |
| *Traction Power Equipment Foundation Construction* | Off-Highway Truck | 1.8 |
| | Tractor/Loader/Backhoe | 1.8 |
| | Rubber Tired Loaders | 1.8 |
| | Pumps | 2 |
| | Vibratory Plate | 2 |
| | Concrete Mixers | 4 |
| | Crane | 2 |
| *Traction Power Equipment Installation* | Off-Highway Truck | 1.8 |
| | Crane | 1.8 |
| | Tractor/Loader/Backhoe | 1.8 |
| *Traction Power Equipment Testing* | Generator Set | 4 |
| **Overhead Contact System (OCS)** | | |
| *OCS Pole Foundation Construction - Crew #1* | Off-Highway Truck | 1.2 |
| | Bore/Drill Rigs | 1.8 |
| | Rubber Tired Loaders | 2.4 |
| | Generators | 2.4 |
| | Pumps | 2 |
| | Concrete Mixers | 4 |
| | Crane | 2 |
| *OCS Pole Foundation Construction - Crew #2* | Off-Highway Truck | 1.2 |
| | Bore/Drill Rigs | 1.8 |
| | Rubber Tired Loaders | 2.4 |
| | Generators | 2.4 |
| | Pumps | 2 |
| | Concrete Mixers | 4 |
| | Crane | 2 |
| *OCS Pole & Cantilever Installation - Crew #1* | Off-Highway Truck | 1.2 |
| | Crane | 2.4 |
| | Generator | 1.2 |
| | Backhoe | 1.2 |
| *OCS Pole & Cantilever Installation - Crew #2* | Off-Highway Truck | 1.2 |
| | Crane | 2.4 |
| | Generator | 1.2 |
| | Backhoe | 1.2 |
| *OCS Wire Installation & Testing* | On-Track Wire Installation Equipment | 4 |
| **Signal & Grade Crossings** | | |

| | | |
|---|---|---|
| *Signaling Equipment Installation at CPs & Houses* | Off-Highway Truck | 1.2 |
| | Generators | 2.4 |
| *Grade Crossing Modifications* | Off-Highway Truck | 1.2 |
| | Backhoe | 1.2 |
| | Generators | 2.4 |
| **Communications** | | |
| *Communication System Installation (incl. SCADA)* | Off-Highway Truck | 1.2 |
| | Backhoe | 1.2 |
| | Generators | 2.4 |
| **Integration / Commissioning** | | |
| *Integration Testing & Commissioning* | Generators | 2.4 |
| | | |

**Caltrain Electrification**

**Screen Level Health Risk Assessment - Construction**

**Construction Emissions and Emission Rates***

| Construction Phase | PM10 Emissions (tons/year) | PM2.5 Emissions (tons/year) | Average hours/day | Average days/phase | PM10 Emission Rate (g/s) | PM2.5 Emission Rate (g/s) |
|---|---|---|---|---|---|---|
| Utilities (2015) | 0.03 | 0.02 | 1.8 | 120 | 0.03037 | 0.028 |
| Traction Power Substation Installation (2016) | 0.04 | 0.04 | 2.0 | 66.0 | 0.07562 | 0.071 |
| Overhead Contact System (OCS) (2017) | 0.14 | 0.13 | 2.1 | 215.4 | 0.07975 | 0.075 |
| Signal & Grade Crossings (2016) | 0.01 | 0.01 | 1.7 | 36.0 | 0.02206 | 0.021 |
| Communications (2018) | 0.02 | 0.02 | 1.6 | 300.0 | 0.00972 | 0.009 |
| Integration / Commissioning (2019) | 0.00 | 0.00 | 2.4 | 210 | 0.00192 | 0.002 |

*DPM emissions are assumed to be equal to PM exhaust emission. Analysis conducted for highest DPM emissions.

**Construction Health Risk (Table 3.2-8. Maximum Project-Level Health Risks during Construction)**

| | | Concentrations (AERMOD) | | | Project-Level Risk | | |
|---|---|---|---|---|---|---|---|
| Construction Phase | Max Receptor Distance (m) | Hourly PM10 Concentration (ug/m3) | Hourly PM2.5 Concentration (ug/m3) | Annual DPM Concentration (ug/m3) | Chronic Non-Cancer Hazard Index (HI) | DPM Cancer Risk (per Million) | Annual PM2.5 Concentration (ug/m3) |
| Utilities (2015) | 50 | 0.19 | 0.18 | 0.0193 | 0.004 | 0.149 | 0.000 |
| Traction Power Substation Installation (2016) | 50 | 0.48 | 0.45 | 0.0481 | 0.010 | 0.372 | 0.001 |
| Overhead Contact System (OCS) (2017) | 50 | 0.51 | 0.48 | 0.0507 | 0.010 | 0.392 | 0.002 |
| Signal & Grade Crossings (2016) | 50 | 0.14 | 0.13 | 0.0141 | 0.003 | 0.109 | 0.000 |
| Communications (2018) | 50 | 0.06 | 0.06 | 0.0062 | 0.001 | 0.048 | 0.000 |
| Integration / Commissioning (2019) | 50 | 0.01 | 0.01 | 0.0012 | 0.000 | 0.009 | 0.000 |
| **BAAQMD Thresholds** | | | | | **1** | **10** | **0.3** |

**Health Risk Calculation Factors**

| | | |
|---|---|---|
| Hourly to Annual Concentration scaling factor | 0.1 | (per BAAQMD 2007 guidance) |
| Chronic Reference Exposure Level | 5 | (per OEHHA) |
| Daily Breath Rate - adult (L/kg-day) | 302 | |
| Daily Breath Rate - child (L/kg-day) | 581 | |
| Conversion Factor (mg/ug ) | 0.001 | |
| Conversion Factor (m3/L ) | 0.001 | |
| DPM Cancer Potency Factor ($[mg/kg\text{-}day]^{-1}$) | 1.1 | |
| Average Age Sensitivity Factor - residence | 1.7 | |
| Average Age Sensitivity Factor - office | 1 | |
| Average Age Sensitivity Factor - school | 3 | |
| Average Life Time (years) | 70 | |
| Average Life Time (days) | 25550 | |

| Exposure Frequency | Hours/day | Days/year | Years |
|---|---|---|---|
| Residence | 24 | 350 | 70 |
| School | 8 | 200 | 6 |
| Office | 12 | 280 | 30 |

**Carbon Stock Calculations**

| Common Name | Scientific Name | % | Trees Removed | Carbon Stock Removed (MT CO2) |
|---|---|---|---|---|
| Acacia | *Acacia sp.* | 6% | 134 | 201.50 |
| Calif. Buckeye | *Aesculus californica* | 0% | 1 | 1.33 |
| Eucalyptus | *Eucalyptus sp.* | 8% | 185 | 348.87 |
| Fig | *Ficus sp.* | 0% | 2 | 1.74 |
| Monterey Cypress | *Hesperocyparis macrocarpa* | 1% | 20 | 16.18 |
| Myoporum | *Myoporum sp.* | 0% | 6 | 7.03 |
| London plane | *Platanus x hispanica* | 3% | 73 | 94.53 |
| Alder | *Alnus sp.* | 0% | 3 | 3.29 |
| Brisbane box | *Lophostemon confertus* | 2% | 36 | 21.63 |
| Mayten | *Maytenus boaria* | 0% | 1 | 0.73 |
| Pine | *Pinus sp.* | 4% | 88 | 86.63 |
| Pittosporum | *Pittosporum sp.* | 0% | 7 | 7.83 |
| Willow | *Salix sp.* | 0% | 5 | 6.66 |
| Pepper | *Schinus sp.* | 2% | 48 | 50.51 |
| Bottlebrush | *Melaleuca citrina* | 0% | 2 | 0.63 |
| Lombardy poplar | *Populus nigra* | 1% | 27 | 56.33 |
| Canary Island Date Palm | *Phoenix canariensis* | 0% | 10 | 3.32 |
| Oak | *Quercus sp.* | 8% | 188 | 410.66 |
| Maple | *Acer sp.* | 0% | 6 | 9.90 |
| Citrus | *Citrus sp.* | 0% | 1 | 1.04 |
| Ash | *Fraxinus sp.* | 1% | 21 | 28.28 |
| Black walnut | *Juglans nigra* | 2% | 37 | 55.60 |
| Glossy privet | *Ligustrum lucidum* | 1% | 15 | 18.26 |
| Purple leaf plum | *Prunus cerasifera* | 0% | 2 | 0.95 |
| Coast redwood | *Sequoia sempervirens* | 10% | 227 | 179.10 |
| Bailey acacia | *Acacia baileyana* | 1% | 17 | 25.82 |
| Blackwood acacia | *Acacia melanoxylon* | 1% | 29 | 44.03 |
| Blue gum | *Eucalyptus globulus* | 0% | 7 | 12.33 |
| Coast live oak | *Quercus agrifolia* | 8% | 182 | 398.42 |
| Monterey pine | *Pinus radiata* | 0% | 10 | 9.50 |
| Mulberry | *Morus alba* | 0% | 0 | 0.24 |
| Plum | *Prunus domestica* | 0% | 1 | 2.86 |
| River red gum | *Eucalyptus camaldulensis* | 0% | 0 | 0.37 |
| Valley oak | *Quercus lobata* | 0% | 11 | 23.44 |
| Carrotwood | *Cupaniopsis anacardioides* | 0% | 1 | 0.72 |
| Melaleuca | *Melaleuca sp.* | 3% | 73 | 41.46 |
| Palm | *Phoenix sp. or Washingtonia* | 1% | 23 | 7.85 |
| African sumac | *Rhus lancea* | 0% | 5 | 4.75 |
| Zelkova | *Zelkova sp.* | 0% | 1 | 1.80 |
| Canary Island palm | *Phoenix canariensis* | 0% | 4 | 1.24 |
| Canary island pine | *Pinus canariensis* | 0% | 1 | 0.95 |
| Pear | *Pyrus sp.* | 2% | 54 | 89.69 |
| Evergreen pear | *Pyrus kawakamii* | 1% | 13 | 21.42 |
| She-oak | *Casuarina sp.* | 0% | 5 | 10.80 |
| Italian cypress | *Cupressus sempervirens* | 2% | 46 | 36.22 |
| Dragon tree | *Dracaena draco* | 0% | 1 | 1.84 |
| Locust | *Robinia sp.* | 0% | 5 | 10.09 |
| Redwood | *Sequoia sempervirens* | 0% | 4 | 3.49 |
| Elm | *Ulmus sp.* | 0% | 7 | 9.52 |
| Crape myrtle | *Lagerstroemia indica* | 2% | 37 | 33.56 |
| Camphor | *Cinnamomum camphora* | 2% | 35 | 40.20 |
| Sweetgum | *Liquidambar stryaciflua* | 3% | 60 | 67.37 |
| Tree of heaven | *Ailanthus altissima* | 4% | 96 | 120.16 |
| Hackberry | *Celtis occidentalis* | 0% | 1 | 3.04 |

| | | | | |
|---|---|---|---|---|
| Hawthorn | *Crataegus sp.* | 0% | 3 | 8.04 |
| Southern magnolia | *Magnolia grandiflora* | 0% | 3 | 4.37 |
| Chinese pistache | *Pistacia chinensis* | 0% | 7 | 5.26 |
| American elm | *Ulmus americana* | 0% | 3 | 6.18 |
| California black walnut | *Juglans hindsii* | 0% | 1 | 1.55 |
| Callery pear | *Pyrus calleryana* | 0% | 1 | 1.72 |
| Compact blue gum | *Eucalyptus globulus* | 0% | 6 | 11.78 |
| Italian buckthorn | *Rhamnus alaternus* | 0% | 2 | 2.61 |
| Pittosporum sp. | *Pittosporum sp.* | 0% | 9 | 9.96 |
| Podocarpus | *Podocarpus sp.* | 1% | 20 | 5.62 |
| Arizona cypress | *Cupressus arizonica* | 0% | 1 | 1.34 |
| California black | n/a | 0% | 0 | 0.00 |
| English walnut | *Juglans regia* | 0% | 3 | 3.96 |
| Italian stone pine | *Pinus pinea* | 0% | 1 | 0.91 |
| Fremont | n/a | 0% | 0 | 0.00 |
| cottonwood | *Populus fremontii* | 0% | 1 | 2.10 |
| Portuguese laurel | *Prunus lusitanica* | 0% | 2 | 1.53 |
| Holly Oak | *Quercus ilex* | 0% | 1 | 2.34 |
| n/a | *Robinia x ambigua* | 0% | 0 | 0.00 |
| Windmill palm | *Trachycarpus fortunei* | 0% | 1 | 0.37 |
| California bay | *Umbellularia californica* | 0% | 3 | 4.02 |
| Casuarina | *Casuarina sp.* | 0% | 1 | 1.57 |
| Walnut | *Juglans sp.* | 0% | 5 | 8.08 |
| Fremont cottonwood | *Populus fremontii* | 0% | 4 | 7.14 |
| Chinese elm | *Ulmus parvifolia* | 1% | 15 | 21.14 |
| Deodar cedar | *Cedrus deodara* | 0% | 9 | 6.34 |
| Carob | *Ceratonia siliqua* | 0% | 7 | 7.28 |
| Blue gum | *Eucalyptus globulus* | 0% | 7 | 12.33 |
| Compacta | n/a | 0% | 2 | 2.73 |
| Manna gum | n/a | 0% | 2 | 2.43 |
| Juniper | n/a | 0% | 1 | 1.37 |
| Glossy privet | n/a | 0% | 2 | 2.73 |
| Austrian pine | n/a | 0% | 7 | 5.58 |
| Monterey pine | n/a | 0% | 2 | 2.16 |
| Victorian box | n/a | 0% | 2 | 2.32 |
| Almond | n/a | 0% | 1 | 1.37 |
| Coast Live Oak | n/a | 3% | 57 | 124.00 |
| Holly Oak | n/a | 0% | 4 | 9.54 |
| California pepper | n/a | 0% | 2 | 2.30 |
| Jacaranda | *Jacaranda mimosifolia* | 1% | 24 | 9.95 |
| Olive | *Olea europaea* | 0% | 3 | 1.98 |
| Silk tree | *Albizia julibrissin* | 0% | 10 | 12.98 |
| Strawberry tree | *Arbutus unedo* | 0% | 5 | 6.49 |
| Loquat | *Eriobotrya sp.* | 0% | 5 | 6.49 |
| Australian willow | *Geijera parviflora* | 1% | 16 | 23.18 |
| Bottle brush | *Melaleuca citrina* | 3% | 73 | 28.24 |
| Madrone | *Arbutus menziesii* | 0% | 2 | 2.51 |
| Fruit | *Prunus sp.* | 0% | 3 | 6.91 |
| Box elder | *Acer negundo* | 0% | 2 | 2.77 |
| Pistache | *Pistacia sp.* | 0% | 2 | 1.23 |
| Elderberry | *Sambucus sp.* | 0% | 2 | 2.05 |
| Total | | | **2,220** | **3,035** |

**Construction Results (Critiera Pollutants and GHGs)**

**Table 1. Maximum Unmitigated Construction Emissions (pounds per day)**

| Year | ROG | $NO_X$ | CO | PM10 | | PM2.5 | |
|---|---|---|---|---|---|---|---|
| | | | | Exhaust | Dust | Exhaust | Dust |
| 2015 | 1 | 13 | 7 | 1 | 0 | 1 | 0 |
| 2016 | 3 | 39 | 45 | 1 | 7 | 1 | 2 |
| 2017 | 6 | 75 | 36 | 3 | 1 | 3 | 0 |
| 2018 | 5 | 60 | 33 | 3 | 1 | 2 | 0 |
| 2019 | 3 | 32 | 21 | 1 | 0 | 1 | 0 |
| Threshold | 54 | 54 | - | 82 | BMPs | 54 | BMPs |

**Table 2. Construction GHG Emissions (metric tons $CO_2e$)**

| Construction Phase | 2015 | 2016 | 2017 | 2018 | 2019 | Phase Total |
|---|---|---|---|---|---|---|
| Utilities | 105 | 42 | 0 | 0 | 0 | 146 |
| Traction Power Substation Installatio | 0 | 157 | 211 | 153 | 67 | 589 |
| Overhead Contact System | 0 | 105 | 601 | 434 | 38 | 1178 |
| Signal and At-Grade Crossings | 0 | 19 | 31 | 56 | 34 | 140 |
| Communications | 0 | 0 | 0 | 83 | 33 | 115 |
| Integration / Commissioning | 0 | 0 | 0 | 0 | 13 | 13 |
| **Construction Subtotal** | **105** | **323** | **844** | **726** | **184** | **2,181** |
| *Loss of carbon stock due to tree removal (one-time loss)* | | | | | | *3,035* |
| **Construction Total** | **105** | **323** | **844** | **726** | **184** | **5,216** |

## Operational Assumptions and Calculations

### Criteria Pollutants and Greenhouse Gases

Locomotive fuel consumption data for existing conditions, the Proposed Project and No Project scenarios were provided by JPB (Cocke pers. comm.) and regional vehicle miles traveled (VMT) in the study area were provided by Santa Clara Valley Transportation Authority travel forecasting model (see Appendix I). Criteria pollutants and GHGs generated by locomotive fuel consumption were estimated using emission factors obtained from the EPA and Climate Registry. Mass emissions from changes in regional VMT and onroad fuel consumption were quantified using the Caltrans' CT-EMFAC emissions model. GHG emissions associated with electricity generation and transmission were calculated based on expected energy demand and utility emission factors published by Pacific Gas and Electric Company (2013), Delucchi (2003), and CalEEMod.

### Carbon Sequestration (Tree Removal and Planting)

The *Draft Tree Inventory and Canopy Assessment* (HortScience 2014, see Appendix F) identifies approximately 2,200 trees that would need to be removed as a result of Proposed Project construction. Removal of these trees would result in an annual loss of $CO_2$ that would have been sequestered through photosynthesis. Carbon sequestration values for the impacted trees were obtained from the U.S. Forest Service's (2011) CTCC for each tree species. An average diameter breast height (DBH) of 16 inches was assumed for all trees, based on the tree inventory. Lost $CO_2$ sequestration was calculated by multiplying the TCC values by the number of removed trees.

Pursuant to Mitigation Measure BIO-5 in Section 3.3, *Biological Resources,* the 2,200 trees removed by the Proposed Project would, for the most part, be replaced either on-site or off-site. While replacement requirements vary, on an overall project basis, Mitigation Measure BIO-5 should result in somewhat more than 2,200 trees being planted but for this analysis it was assumed that 2,200 trees would be planted as a conservative assumption. Newly planted trees would sequester $CO_2$, but at a relatively slow rate until they mature. It was assumed that the trees would be planted in 2019. Annual $CO_2$ sequestration was estimated in 2020 and 2040, assuming the trees would be 1-year and 21-years old, respectively. The net effect on GHG emissions under 2020 and 2040 conditions represents the difference between the $CO_2$ sequestration rates for the removed and planted trees.

**Fuel and Electricity Consumption**

| Condition | Description | Diesel Consumption (gal/yr) | Electricity (kWh/yr) | Diesel Consumption (gal/day) | Electricity (kWh/day) |
|---|---|---|---|---|---|
| Existing/ 2020 No Project/ 2040 No Project | All diesel | 4,452,984 | 3,945,021 | 14,944 | 13,239 |
| 2020 Project | 9 diesel locomotives<br>96 EMUs<br>45 trailer cars | 1,124,048 | 83,131,139 | 4,323 | 319,735 |
| 2040 Caltrain Full Elect | 6 diesel locomotives<br>138 to 150 EMUs<br>31 trailer cars | 146,615 | 104,855,697 | 564 | 403,291 |

Source: Caltrain Operations

**Regional VMT Calculations**

| Speed, | 2020 Project (Net) | | | 2040 Caltrain Full Electrification (Net) | | |
|---|---|---|---|---|---|---|
| **MPH** | **Peak** | **Off-peak** | **Daily** | **Peak** | **Off-peak** | **Daily** |
| 5 mph | -309 | 1,288 | 979 | -35,915 | -10,513 | -46,428 |
| 10 mph | -5,260 | -2,456 | -7,716 | -13,230 | 4,146 | -9,084 |
| 15 mph | -24,534 | -7,858 | -32,392 | -134,085 | 9,389 | -124,696 |
| 20 mph | 36,251 | 9,986 | 46,237 | -34,720 | -15,946 | -50,666 |
| 25 mph | -91,214 | -10,203 | -101,417 | -188,961 | 18,382 | -170,579 |
| 30 mph | -90,101 | 25,813 | -64,288 | -110,861 | -36,065 | -146,926 |
| 35 mph | 31,847 | -23,413 | 8,434 | 59,458 | -94,249 | -34,791 |
| 40 mph | -332,910 | -8,954 | -341,864 | -82,254 | 81,769 | -485 |
| 45 mph | 258,111 | -2,158 | 255,953 | 147,545 | -100,049 | 47,496 |
| 50 mph | 18,832 | -40,240 | -21,408 | -62,831 | 33,483 | -29,348 |
| 55 mph | 32,917 | -10,300 | 22,617 | 200,962 | 182,213 | 383,175 |
| 60 mph | -56,364 | 87,567 | 31,203 | -375,363 | -165,788 | -541,151 |
| 65 mph | 35,129 | -66,048 | -30,919 | 112,954 | -8,378 | 104,576 |
| **All** | **-187,605** | **-46,976** | **-234,581** | **-517,301** | **-101,606** | **-618,907** |

*Source: Fehr & Peers Transportation Analysis, 2014 (see Appendix D)*

**2020 Project NET Emissions (lbs/day and MT/year)**

| | Peak | | | | | | Off Peak | | | | | | Total | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Speed | ROG | NOx | CO | PM10 | PM2.5 | CO2 | ROG | NOx | CO | PM10 | PM2.5 | CO2 | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
| 5 mph | 0 | -1 | -3 | 0 | 0 | -149 | 2 | 4 | 14 | 0 | 0 | 619 | 1 | 3 | 10 | 0 | 0 | 471 |
| 10 mph | -6 | -12 | -46 | -1 | -1 | -1,900 | -3 | -6 | -22 | 0 | 0 | -887 | -9 | -18 | -68 | -1 | -1 | -2,786 |
| 15 mph | -22 | -45 | -181 | -4 | -2 | -6,840 | -7 | -14 | -58 | -1 | -1 | -2,191 | -29 | -60 | -239 | -5 | -3 | -9,030 |
| 20 mph | 27 | 55 | 230 | 5 | 3 | 8,057 | 7 | 15 | 63 | 1 | 1 | 2,220 | 35 | 70 | 294 | 7 | 3 | 10,277 |
| 25 mph | -62 | -128 | -515 | -12 | -6 | -16,999 | -7 | -14 | -58 | -1 | -1 | -1,901 | -69 | -143 | -572 | -14 | -7 | -18,900 |
| 30 mph | -57 | -119 | -460 | -12 | -6 | -14,597 | 16 | 34 | 132 | 3 | 2 | 4,182 | -41 | -85 | -328 | -8 | -4 | -10,415 |
| 35 mph | 19 | 40 | 150 | 4 | 2 | 4,639 | -14 | -30 | -110 | -3 | -1 | -3,411 | 5 | 11 | 40 | 1 | 1 | 1,229 |
| 40 mph | -194 | -411 | -1,466 | -43 | -20 | -45,145 | -5 | -11 | -39 | -1 | -1 | -1,214 | -200 | -422 | -1,506 | -44 | -21 | -46,360 |
| 45 mph | 148 | 315 | 1,087 | 33 | 16 | 33,745 | -1 | -3 | -9 | 0 | 0 | -282 | 147 | 313 | 1,078 | 33 | 16 | 33,462 |
| 50 mph | 11 | 23 | 77 | 2 | 1 | 2,453 | -23 | -49 | -166 | -5 | -3 | -5,241 | -12 | -26 | -88 | -3 | -1 | -2,788 |
| 55 mph | 19 | 42 | 136 | 4 | 2 | 4,425 | -6 | -13 | -43 | -1 | -1 | -1,385 | 13 | 29 | 94 | 3 | 1 | 3,041 |
| 60 mph | -34 | -74 | -243 | -8 | -4 | -8,048 | 52 | 115 | 377 | 12 | 6 | 12,503 | 19 | 41 | 134 | 4 | 2 | 4,455 |
| 65 mph | 22 | 47 | 164 | 5 | 2 | 5,523 | -41 | -89 | -309 | -9 | -5 | -10,385 | -19 | -42 | -144 | -4 | -2 | -4,861 |
| **All** | -129 | -268 | -1,069 | -25 | -13 | -34,834 | -30 | -62 | -227 | -6 | -3 | -7,372 | -159 | -330 | -1,296 | -32 | -16 | -42,207 |

**2040 2040 Caltrain Full Electrification (lbs/day and MT/year)**

| | Peak | | | | | | Off Peak | | | | | | Total | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Speed | ROG | NOx | CO | PM10 | PM2.5 | CO2 | ROG | NOx | CO | PM10 | PM2.5 | CO2 | ROG | NOx | CO | PM10 | PM2.5 | CO2 |
| 5 mph | -55 | -109 | -379 | -7 | -5 | -17,266 | -16 | -32 | -111 | -2 | -1 | -5,054 | -71 | -140 | -490 | -9 | -6 | -22,321 |
| 10 mph | -15 | -31 | -116 | -2 | -1 | -4,778 | 5 | 10 | 36 | 1 | 0 | 1,497 | -11 | -21 | -80 | -2 | -1 | -3,280 |
| 15 mph | -121 | -247 | -988 | -21 | -12 | -37,381 | 9 | 17 | 69 | 1 | 1 | 2,618 | -113 | -230 | -919 | -19 | -11 | -34,763 |
| 20 mph | -26 | -53 | -221 | -5 | -3 | -7,717 | -12 | -24 | -101 | -2 | -1 | -3,544 | -38 | -77 | -322 | -7 | -4 | -11,261 |
| 25 mph | -128 | -266 | -1,066 | -26 | -13 | -35,215 | 12 | 26 | 104 | 2 | 1 | 3,426 | -116 | -240 | -963 | -23 | -12 | -31,790 |
| 30 mph | -70 | -147 | -566 | -15 | -7 | -17,960 | -23 | -48 | -184 | -5 | -2 | -5,843 | -93 | -195 | -751 | -19 | -10 | -23,802 |
| 35 mph | 36 | 75 | 280 | 8 | 4 | 8,661 | -57 | -120 | -443 | -12 | -6 | -13,729 | -21 | -44 | -164 | -4 | -2 | -5,068 |
| 40 mph | -48 | -102 | -362 | -11 | -5 | -11,154 | 48 | 101 | 360 | 10 | 5 | 11,089 | 0 | -1 | -2 | 0 | 0 | -66 |
| 45 mph | 85 | 180 | 621 | 19 | 9 | 19,290 | -57 | -122 | -421 | -13 | -6 | -13,080 | 27 | 58 | 200 | 6 | 3 | 6,209 |
| 50 mph | -36 | -77 | -259 | -8 | -4 | -8,183 | 19 | 41 | 138 | 4 | 2 | 4,361 | -17 | -36 | -121 | -4 | -2 | -3,822 |
| 55 mph | 116 | 254 | 832 | 26 | 13 | 27,016 | 106 | 230 | 754 | 24 | 12 | 24,496 | 222 | 484 | 1,586 | 50 | 25 | 51,512 |
| 60 mph | -224 | -492 | -1,616 | -50 | -25 | -53,596 | -99 | -217 | -714 | -22 | -11 | -23,672 | -323 | -709 | -2,330 | -72 | -36 | -77,268 |
| 65 mph | 70 | 153 | 528 | 16 | 8 | 17,760 | -5 | -11 | -39 | -1 | -1 | -1,317 | 65 | 141 | 489 | 14 | 7 | 16,443 |
| **All** | -416 | -860 | -3,313 | -76 | -41 | -120,523 | -71 | -149 | -553 | -14 | -7 | -18,754 | -487 | -1,009 | -3,866 | -90 | -48 | -139,277 |

**Re-entrained Paved Road Dust Emission Factor Calculation**

**Methodology**

Calculation Methodology: USEPA AP-42, Paved Roads, Section 13.2.1, Revised January 2011:
http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf
Avg Vehicle Weight, Silt Loading, and Precipitation Days greater than 0.254mm for Santa Clara County

**Emission Factor Calculation**

| Pollutant | Variables | | | | | Emission Factor |
|---|---|---|---|---|---|---|
| | k | sL | W | P | N | (lbs per VMT) |
| $PM_{10}$ | 0.0022 | 0.1 | 2.4 | 56 | 365 | 0.00064 |
| $PM_{2.5}$ | 0.00054 | 0.1 | 2.4 | 56 | 365 | 0.00016 |

E = particulate emission factor (grams of particulate matter/VMT)
k = particle size multiplier (lb/VMT) *default from AP-42*
sL = roadway silt loading (g/m2) *Caleemod Default*
W = average weight of vehicles on the road (tons) *Caleemod Default*
P = number of wet days with at least 0.254mm of precipitation *Caleemod Default for Santa Clara County*
N = number of days in the averaging period *annual days (365)*

| Condition | Daily VMT | PM10 | PM2.5 |
|---|---|---|---|
| Existing (2013) | 0 | 0 | 0 |
| 2020 No Project | 0 | 0 | 0 |
| 2020 Project | -234,581 | -149 | -37 |
| 2040 No Project | 0 | 0 | 0 |
| 2040 Caltrain Full Electrification | -618,907 | -393 | -97 |

**Locomotive Emission Factors**

| Pollutant | Grams/Gallon | | | Source |
|---|---|---|---|---|
| | 2013 | 2020 | 2040 | |
| HC | 6.9 | 3.1 | 0.5 | EPA 2009 (Table 7) |
| ROG | 7.3 | 3.3 | 0.5 | Author calculation based on EPA 2009. |
| NOx | 147 | 93 | 23 | EPA 2009 (Table 5) |
| CO | 26.6 | 26.6 | 26.6 | EPA 2009 (Tables 1 and 3) |
| PM10 | 3.9 | 2.1 | 0.3 | EPA 2009 (Table 6) |
| PM2.5 | 3.8 | 2.0 | 0.3 | Author calculation based on EPA 2009. |
| CO2 | 10,210 | 10,210 | 10,210 | The Climate Registry 2013 (Table 12.1) |
| CH4 | 0.8 | 0.8 | 0.8 | The Climate Registry 2013 (Table 13.7) |
| N2O | 0.26 | 0.26 | 0.26 | The Climate Registry 2013 (Table 13.7) |

**Electricity Emission Factors**

**Existing Emission Factors**

| | | | |
|---|---|---|---|
| CO2 | 431 | lbs/MWh | PG&E 2013 |
| CH4 | 0.0290 | lb/MWh | CalEEMod |
| N2O | 0.0062 | lb/MWh | CalEEMod |
| SF6 | 0.0002 | lb/MWh | ARB 2013; CEC 2013 |
| NMHC | 0.0097 | g/kWh | Delucchi 2003; PG&E 2004; PG&E 2010 |
| NOx | 0.2083 | g/kWh | Delucchi 2003; PG&E 2004; PG&E 2010 |
| CO | 0.1709 | g/kWh | Delucchi 2003; PG&E 2004; PG&E 2010 |
| PM10 | 0.0102 | g/kWh | Delucchi 2003; PG&E 2004; PG&E 2010 |

**RPS Adjusted (2020+)**

| | | | |
|---|---|---|---|
| CO2 | 290 | lbs/MWh | PG&E 2013 |
| CH4 | 0.0200 | lb/MWh | CalEEMod; CEC 2012 |
| N2O | 0.0043 | lb/MWh | CalEEMod; CEC 2012 |
| SF6 | 0.0002 | lb/MWh | ARB 2013; CEC 2013 |
| NMHC | 0.0065 | g/kWh | Delucchi 2003; PG&E 2010 |
| NOx | 0.1398 | g/kWh | Delucchi 2003; PG&E 2010 |
| CO | 0.1147 | g/kWh | Delucchi 2003; PG&E 2010 |
| PM10 | 0.0068 | g/kWh | Delucchi 2003; PG&E 2010 |

**Carbon Sequestration Calculations**

| Common Name | Scientific Name | % | Number of Trees | 2020 Sequestration (MT CO2) | | 2040 Sequestration (MT CO2) | |
|---|---|---|---|---|---|---|---|
| | | | | Removed (Lost) | Removed (Gained) | Removed (Lost) | Removed (Gained) |
| Acacia | *Acacia sp.* | 6% | 134 | 18.36 | 0.08 | 18.36 | 6.83 |
| Calif. Buckeye | *Aesculus californica* | 0% | 1 | 0.09 | 0.00 | 0.09 | 0.07 |
| Eucalyptus | *Eucalyptus sp.* | 8% | 185 | 43.47 | 0.13 | 43.47 | 51.22 |
| Fig | *Ficus sp.* | 0% | 2 | 0.10 | 0.00 | 0.10 | 0.10 |
| Monterey Cypress | *Hesperocyparis macrocarpa* | 1% | 20 | 2.09 | 0.00 | 2.09 | 2.36 |
| Myoporum | *Myoporum sp.* | 0% | 6 | 0.47 | 0.02 | 0.47 | 0.36 |
| London plane | *Platanus x hispanica* | 3% | 73 | 7.16 | 0.01 | 7.16 | 4.76 |
| Alder | *Alnus sp.* | 0% | 3 | 0.22 | 0.01 | 0.22 | 0.17 |
| Brisbane box | *Lophostemon confertus* | 2% | 36 | 0.00 | 0.16 | 0.00 | 0.46 |
| Mayten | *Maytenus boaria* | 0% | 1 | 0.05 | 0.00 | 0.05 | 0.04 |
| Pine | *Pinus sp.* | 4% | 88 | 9.14 | 0.02 | 9.14 | 7.05 |
| Pittosporum | *Pittosporum sp.* | 0% | 7 | 0.00 | 0.01 | 0.00 | 0.23 |
| Willow | *Salix sp.* | 0% | 5 | 0.44 | 0.02 | 0.44 | 0.34 |
| Pepper | *Schinus sp.* | 2% | 48 | 3.26 | 0.13 | 3.26 | 1.64 |
| Bottlebrush | *Melaleuca citrina* | 0% | 2 | 0.00 | 0.00 | 0.00 | 0.01 |
| Lombardy poplar | *Populus nigra* | 1% | 27 | 4.42 | 0.21 | 4.42 | 3.42 |
| Canary Island Date Palm | *Phoenix canariensis* | 0% | 10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Oak | *Quercus sp.* | 8% | 188 | 33.25 | 0.36 | 33.25 | 24.61 |
| Maple | *Acer sp.* | 0% | 6 | 0.51 | 0.01 | 0.51 | 0.13 |
| Citrus | *Citrus sp.* | 0% | 1 | 0.07 | 0.00 | 0.07 | 0.05 |
| Ash | *Fraxinus sp.* | 1% | 21 | 1.94 | 0.00 | 1.94 | 0.74 |
| Black walnut | *Juglans nigra* | 2% | 37 | 3.52 | 0.00 | 3.52 | 2.36 |
| Glossy privet | *Ligustrum lucidum* | 1% | 15 | 1.22 | 0.06 | 1.22 | 0.94 |
| Purple leaf plum | *Prunus cerasifera* | 0% | 2 | 0.00 | 0.00 | 0.00 | 0.03 |
| Coast redwood | *Sequoia sempervirens* | 10% | 227 | 23.14 | 0.04 | 23.14 | 26.10 |
| Bailey acacia | *Acacia baileyana* | 1% | 17 | 2.35 | 0.01 | 2.35 | 0.87 |
| Blackwood acacia | *Acacia melanoxylon* | 1% | 29 | 4.01 | 0.02 | 4.01 | 1.49 |
| Blue gum | *Eucalyptus globulus* | 0% | 7 | 1.54 | 0.00 | 1.54 | 1.81 |
| Coast live oak | *Quercus agrifolia* | 8% | 182 | 32.26 | 0.35 | 32.26 | 23.88 |
| Monterey pine | *Pinus radiata* | 0% | 10 | 1.00 | 0.00 | 1.00 | 0.77 |
| Mulberry | *Morus alba* | 0% | 0 | 0.02 | 0.00 | 0.02 | 0.01 |
| Plum | *Prunus domestica* | 0% | 1 | 0.19 | 0.00 | 0.19 | 0.05 |
| River red gum | *Eucalyptus camaldulensis* | 0% | 0 | 0.05 | 0.00 | 0.05 | 0.05 |
| Valley oak | *Quercus lobata* | 0% | 11 | 1.90 | 0.02 | 1.90 | 1.40 |
| Carrotwood | *Cupaniopsis anacardioides* | 0% | 1 | 0.00 | 0.00 | 0.00 | 0.02 |
| Melaleuca | *Melaleuca sp.* | 3% | 73 | 3.40 | 0.03 | 3.40 | 2.53 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Palm | *Phoenix sp. or Washingtonia* | 1% | 23 | 0.00 | 0.00 | 0.00 | 0.00 |
| African sumac | *Rhus lancea* | 0% | 5 | 0.36 | 0.00 | 0.36 | 0.22 |
| Zelkova | *Zelkova sp.* | 0% | 1 | 0.12 | 0.01 | 0.12 | 0.09 |
| Canary Island palm | *Phoenix canariensis* | 0% | 4 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canary island pine | *Pinus canariensis* | 0% | 1 | 0.09 | 0.00 | 0.09 | 0.09 |
| Pear | *Pyrus sp.* | 2% | 54 | 9.04 | 0.14 | 9.04 | 8.27 |
| Evergreen pear | *Pyrus kawakamii* | 1% | 13 | 1.64 | 0.08 | 1.64 | 0.95 |
| She-oak | *Casuarina sp.* | 0% | 5 | 0.87 | 0.01 | 0.87 | 0.65 |
| Italian cypress | *Cupressus sempervirens* | 2% | 46 | 4.68 | 0.01 | 4.68 | 5.28 |
| Dragon tree | *Dracaena draco* | 0% | 1 | 0.12 | 0.01 | 0.12 | 0.09 |
| Locust | *Robinia sp.* | 0% | 5 | 0.80 | 0.01 | 0.80 | 0.50 |
| Redwood | *Sequoia sempervirens* | 0% | 4 | 0.45 | 0.00 | 0.45 | 0.51 |
| Elm | *Ulmus sp.* | 0% | 7 | 0.50 | 0.01 | 0.50 | 0.39 |
| Crape myrtle | *Lagerstroemia indica* | 2% | 37 | 1.34 | 0.07 | 1.34 | 0.15 |
| Camphor | *Cinnamomum camphora* | 2% | 35 | 2.12 | 0.09 | 2.12 | 0.41 |
| Sweetgum | *Liquidambar stryaciflua* | 3% | 60 | 4.37 | 0.01 | 4.37 | 3.03 |
| Tree of heaven | *Ailanthus altissima* | 4% | 96 | 8.02 | 0.36 | 8.02 | 6.18 |
| Hackberry | *Celtis occidentalis* | 0% | 1 | 0.13 | 0.05 | 0.13 | 0.13 |
| Hawthorn | *Crataegus sp.* | 0% | 3 | 0.24 | 0.00 | 0.24 | 0.15 |
| Southern magnolia | *Magnolia grandiflora* | 0% | 3 | 0.29 | 0.01 | 0.29 | 0.23 |
| Chinese pistache | *Pistacia chinensis* | 0% | 7 | 0.00 | 0.00 | 0.00 | 0.10 |
| American elm | *Ulmus americana* | 0% | 3 | 0.41 | 0.06 | 0.41 | 0.29 |
| California black walnut | *Juglans hindsii* | 0% | 1 | 0.10 | 0.00 | 0.10 | 0.07 |
| Callery pear | *Pyrus calleryana* | 0% | 1 | 0.17 | 0.00 | 0.17 | 0.16 |
| Compact blue gum | *Eucalyptus globulus* | 0% | 6 | 1.47 | 0.00 | 1.47 | 1.73 |
| Italian buckthorn | *Rhamnus alaternus* | 0% | 2 | 0.17 | 0.01 | 0.17 | 0.13 |
| Pittosporum sp. | *Pittosporum sp.* | 0% | 9 | 0.00 | 0.01 | 0.00 | 0.29 |
| Podocarpus | *Podocarpus sp.* | 1% | 20 | 0.00 | 0.01 | 0.00 | 0.13 |
| Arizona cypress | *Cupressus arizonica* | 0% | 1 | 0.09 | 0.00 | 0.09 | 0.07 |
| California black | n/a | 0% | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| English walnut | *Juglans regia* | 0% | 3 | 0.26 | 0.01 | 0.26 | 0.20 |
| Italian stone pine | *Pinus pinea* | 0% | 1 | 0.11 | 0.00 | 0.11 | 0.11 |
| Fremont | n/a | 0% | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| cottonwood | *Populus fremontii* | 0% | 1 | 0.18 | 0.01 | 0.18 | 0.18 |
| Portuguese laurel | *Prunus lusitanica* | 0% | 2 | 0.09 | 0.00 | 0.09 | 0.09 |
| Holly Oak | *Quercus ilex* | 0% | 1 | 0.19 | 0.00 | 0.19 | 0.14 |
| n/a | *Robinia x ambigua* | 0% | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| Windmill palm | *Trachycarpus fortunei* | 0% | 1 | 0.00 | 0.00 | 0.00 | 0.00 |
| California bay | *Umbellularia californica* | 0% | 3 | 0.27 | 0.01 | 0.27 | 0.21 |
| Casuarina | *Casuarina sp.* | 0% | 1 | 0.08 | 0.00 | 0.08 | 0.03 |
| Walnut | *Juglans sp.* | 0% | 5 | 0.51 | 0.00 | 0.51 | 0.34 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fremont cottonwood | *Populus fremontii* | 0% | 4 | 0.61 | 0.02 | 0.61 | 0.63 |
| Chinese elm | *Ulmus parvifolia* | 1% | 15 | 1.11 | 0.01 | 1.11 | 0.88 |
| Deodar cedar | *Cedrus deodara* | 0% | 9 | 0.73 | 0.00 | 0.73 | 0.70 |
| Carob | *Ceratonia siliqua* | 0% | 7 | 0.52 | 0.00 | 0.52 | 0.28 |
| Blue gum | *Eucalyptus globulus* | 0% | 7 | 1.54 | 0.00 | 1.54 | 1.81 |
| Compacta | n/a | 0% | 2 | 0.18 | 0.01 | 0.18 | 0.14 |
| Manna gum | n/a | 0% | 2 | 0.16 | 0.00 | 0.16 | 0.11 |
| Juniper | n/a | 0% | 1 | 0.09 | 0.00 | 0.09 | 0.07 |
| Glossy privet | n/a | 0% | 2 | 0.18 | 0.01 | 0.18 | 0.14 |
| Austrian pine | n/a | 0% | 7 | 0.43 | 0.01 | 0.43 | 0.27 |
| Monterey pine | n/a | 0% | 2 | 0.23 | 0.00 | 0.23 | 0.18 |
| Victorian box | n/a | 0% | 2 | 0.00 | 0.00 | 0.00 | 0.07 |
| Almond | n/a | 0% | 1 | 0.09 | 0.00 | 0.09 | 0.07 |
| Coast Live Oak | n/a | 3% | 57 | 10.04 | 0.11 | 10.04 | 7.43 |
| Holly Oak | n/a | 0% | 4 | 0.77 | 0.01 | 0.77 | 0.57 |
| California pepper | n/a | 0% | 2 | 0.15 | 0.01 | 0.15 | 0.07 |
| Jacaranda | *Jacaranda mimosifolia* | 1% | 24 | 0.00 | 0.04 | 0.00 | 0.20 |
| Olive | *Olea europaea* | 0% | 3 | 0.08 | 0.00 | 0.08 | 0.07 |
| Silk tree | *Albizia julibrissin* | 0% | 10 | 0.87 | 0.04 | 0.87 | 0.67 |
| Strawberry tree | *Arbutus unedo* | 0% | 5 | 0.43 | 0.02 | 0.43 | 0.33 |
| Loquat | *Eriobotrya sp.* | 0% | 5 | 0.43 | 0.02 | 0.43 | 0.33 |
| Australian willow | *Geijera parviflora* | 1% | 16 | 1.68 | 0.00 | 1.68 | 1.56 |
| Bottle brush | *Melaleuca citrina* | 3% | 73 | 0.00 | 0.01 | 0.00 | 0.43 |
| Madrone | *Arbutus menziesii* | 0% | 2 | 0.17 | 0.01 | 0.17 | 0.13 |
| Fruit | *Prunus sp.* | 0% | 3 | 0.46 | 0.00 | 0.46 | 0.12 |
| Box elder | *Acer negundo* | 0% | 2 | 0.24 | 0.08 | 0.24 | 0.26 |
| Pistache | *Pistacia sp.* | 0% | 2 | 0.00 | 0.00 | 0.00 | 0.02 |
| Elderberry | *Sambucus sp.* | 0% | 2 | 0.14 | 0.01 | 0.14 | 0.11 |
| Total | | | **2,220** | **260** | **3** | **260** | **216** |

**Operational Results (Critiera Pollutants and GHGs)**

**Table 1. Estimated Operational Emissions (pounds per day)**

| Condition | ROG | NOx | CO | PM10 | PM2.5 |
|---|---|---|---|---|---|
| **Existing (2013)** | | | | | |
| Caltrain Diesel Consumption | 239 | 4,843 | 877 | 128 | 125 |
| Caltrain Electricity Consumption | 0 | 6 | 5 | 0 | 0 |
| Total Caltrain System Emissions | 240 | 4,849 | 882 | 129 | 125 |
| **No Project (2020)** | | | | | |
| Caltrain Diesel Consumption | 108 | 3,064 | 877 | 69 | 67 |
| Caltrain Electricity Consumption | 0 | 4 | 3 | 0 | 0 |
| Total Caltrain System Emissions | 108 | 3,068 | 880 | 69 | 67 |
| **Project (2020)** | | | | | |
| Caltrain Diesel Consumption | 31 | 886 | 254 | 20 | 19 |
| Caltrain Electricity Consumption | 5 | 99 | 81 | 5 | 5 |
| Total Caltrain System Emissionsa | 36 | 985 | 335 | 25 | 24 |
| *Change in VMT emissions* | *-159* | *-330* | *-1,296* | *-181* | *-53* |
| Total Project Emissions | -123 | 655 | -961 | -156 | -28 |
| **No Project (2040)** | | | | | |
| Caltrain Diesel Consumption | 17 | 758 | 877 | 10 | 10 |
| Caltrain Electricity Consumption | 0 | 4 | 3 | 0 | 0 |
| Total Caltrain System Emissions | 18 | 762 | 880 | 10 | 10 |
| **Project with Full Electrification (2040)** | | | | | |
| Caltrain Diesel Consumption | 1 | 29 | 33 | 0 | 0 |
| Caltrain Electricity Consumption | 6 | 124 | 135 | 6 | 6 |
| Total Caltrain System Emissions | 6 | 153 | 135 | 6 | 6 |
| *Change in VMT Emissions* | *-487* | *-1,009* | *-3,866* | *-483* | *-145* |
| Total Project Emissions | -481 | -856 | -3,731 | -477 | -138 |
| **Comparisons** | | | | | |
| 2020 Caltrain System vs. Existing (2013) | -204 | -3,864 | -547 | -104 | -101 |
| 2040 Caltrain System with Full Electrification vs. Existing (2013) | -233 | -4,696 | -747 | -122 | -118 |
| 2020 Project vs. 2020 No Project | -231 | -2,413 | -1,842 | -225 | -96 |
| 2040 Project with Full Electrification vs. 2040 No Project | -498 | -1,618 | -4,611 | -487 | -148 |
| **BAAQMD Thresholds** | **54** | **54** | **--** | **82** | **54** |

**Table 2. Estimated Operational Emissions (metric tons per year)**

| Condition | $CO_2e$ |
|---|---|
| **Existing (2013)** | |
| Caltrain Diesel Consumption | 45,899 |
| Caltrain Electricity Consumption | 785 |
| Total Caltrain System Emissions | 46,684 |
| **No Project (2020)** | |
| Caltrain Diesel Consumption | 45,899 |
| Caltrain Electricity Consumption | 531 |
| Total Caltrain System Emissions | 46,430 |
| **Project (2020)** | |
| Caltrain Diesel Consumption | 11,586 |
| Caltrain Electricity Consumption | 11,192 |
| Total Caltrain System Emissions | 22,778 |
| *Change in VMT from Increased Ridership* | *-44,317* |
| *Emissions due to loss in carbon sequestration due to tree removal* | *260* |
| Total Project Emissions | -21,279 |
| **Cumulative No Build (2040)** | |
| Caltrain Diesel Consumption | 45,899 |
| Caltrain Electricity Consumption | 531 |
| Total Caltrain System Emissions | 46,430 |
| **Cumulative Project (2040)** | |
| Caltrain Diesel Consumption | 1,511 |
| Caltrain Electricity Consumption | 14,117 |
| Total Caltrain System Emissions | 15,628 |
| *Change in VMT from Increased Ridership* | *-146,241* |
| *Emissions due to loss in carbon sequestration due to tree removal* | *260* |
| Total Project Emissions | -130,353 |
| 2020 Caltrain System vs. Existing (2013) | -23,906 |
| 2040 Caltrain System with Full Electrification vs. Existing (2013) | -31,056 |
| 2020 Project vs. 2020 No Project | -67,709 |
| 2040 Project with Full Electrification vs. 2020 No Project | -176,783 |
| Thresholds | 1,100/10,000 |

## Diesel Multiple Unit (DMU) Assumptions and Calculations

Criteria pollutant and GHG emissions resulting from DMU operation were estimated using emission factors obtained from the EPA (2009). It was assumed that the DMU Alternative would result in the same increased ridership as the Proposed Project for 2020 but only 75 percent of the increased ridership as the Proposed Project in 2040 because the DMU Alternative would end at the San Francisco 4th and King Station, while the Proposed Project would terminate at the San Francisco Transbay Terminal Center downtown. Fuel consumption under DMU Alternative was estimated using a fuel consumption factor of 3.9 gallons per mile (EOT 2008). This value is consistent with published literature for similar 8-car DMUs. Emissions associated with the Gilroy shuttle and changes in regional VMT were assumed to remain consistent with what was analyzed for the Proposed Project.

| Assumptions | | | |
|---|---|---|---|
| Single Level DMU Fuel Consumption | 3.9 | gallons/mile | Jacobs 2008 |
| 2020 trips per day (SF-SJ weekday) | 4,500 | miles/day | Calculated based on Proposed Project EMU trips/day |
| 2020 trips per year (SF-SJ) | 1,528,100 | miles/year | Calculated based on Proposed Project EMU trips/day |
| 2040 trips per day (SF-SJ weekday) | 5,700 | miles/day | Calculated based on Proposed Project EMU trips/day |
| 2040 trips per year (SF-SJ) | 1,841,300 | miles/year | Calculated based on Proposed Project EMU trips/day |
| Non-Revenue Factor | 1.00 | - | Fuel consumption factor includes non-revenue moves and idling time |
| | | | |
| HC Emissions | 0.04 | g/bhp-hr | EPA 2009 |
| NOx Emissions | 1 | g/bhp-hr | EPA 2009 |
| CO Emissions | 1.28 | g/bhp-hr | EPA 2009 |
| PM10 Emissions | 0.015 | g/bhp-hr | EPA 2009 |
| Bhp-Gal Conversion | 20.8 | bhp-hr/gal | EPA 2009 |
| VOC/HC Conversion | 1.053 | - | EPA 2009 |
| PM2.5/PM10 Conversion | 0.97 | - | EPA 2009 |
| | | | |
| ROG Emission Factor | 0.9 | g/gal | Calculated based on EPA 2009 |
| NOx Emission Factor | 20.8 | g/gal | Calculated based on EPA 2009 |
| CO Emission Factor | 26.6 | g/gal | Calculated based on EPA 2009 |
| PM10 Emission Factor | 0.3 | g/gal | Calculated based on EPA 2009 |
| PM25 Emission Factor | 0.3 | g/gal | Calculated based on EPA 2009 |
| CO2 Emission Factor | 10,210 | g/gal | Climate Registry 2013 |
| CH4 Emission Factor | 0.8 | g/gal | Climate Registry 2013 |
| N2O Emission Factor | 0.3 | g/gal | Climate Registry 2013 |

| | Pounds per Day | | | | | Metric tons/ year | | | |
|---|---|---|---|---|---|---|---|---|---|
| Condition | ROG | NOx | CO | PM10 | PM2.5 | CO2 | CH4 | N2O | CO2e |
| Existing (2013) | 239 | 4,843 | 877 | 128 | 125 | 45,465 | 4 | 1 | 45,899 |
| 2020 No Build | 108 | 3,064 | 877 | 69 | 67 | 45,465 | 4 | 1 | 45,899 |
| 2020 25% Diesel Mix | 31 | 886 | 254 | 20 | 19 | 11,477 | 1 | 0 | 11,586 |
| 2040 No Build | 17 | 758 | 877 | 10 | 10 | 45,465 | 4 | 1 | 45,899 |
| 2040 Gilroy Shuttle | 1 | 29 | 33 | 0 | 0 | 1,497 | 0 | 0 | 1,511 |

| Daily Criteria Pollutant Analysis (pounds) | | | | | | |
|---|---|---|---|---|---|---|
| **Type** | **Fuel (gal/d)** | **ROG** | **NOX** | **CO** | **PM10** | **PM2.5** |
| 2020 Single Level DMU Alternative | 17,550 | 33.9 | 805 | 1030 | 12.1 | 11.7 |
| 2040 Single Level DMU Alternative | 22,230 | 42.9 | 1019 | 1305 | 15.3 | 14.8 |
| 2020 Diesel Locomotive | 4,323 | - | - | - | - | - |
| 2040 Diesel Locomotive | 564 | - | - | - | - | - |
| Total 2020 DMU Alternative | 21,873 | - | - | - | - | - |
| Total 2040 DMU Alternative | 22,794 | - | - | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2020 No Project | 14,944 | - | - | - | - | - |
| 2040 No Project | 14,944 | - | - | - | - | - |

**Annual GHG Analysis (metric tons)**

| Type | Fuel (gal/y) | CO2 | CH4 | N2O | CO2e |
|---|---|---|---|---|---|
| 2020 Single Level DMU Alternative | 5,959,590 | 60,847 | 4.8 | 1.5 | 61,428 |
| 2040 Single Level DMU Alternative | 7,181,070 | 73,319 | 5.7 | 1.9 | 74,019 |
| 2020 Diesel Locomotive | 1,124,048 | - | - | - | - |
| 2040 Diesel Locomotive | 146,615 | - | - | - | - |
| Total 2020 DMU Alternative | 7,083,638 | - | - | - | - |
| Total 2040 DMU Alternative | 7,327,685 | - | - | - | - |
| 2020 No Project | 4,452,984 | - | - | - | - |
| 2040 No Project | 4,452,984 | - | - | - | - |

**Results**

| **Total Emissions - 2020** | **ROG** | **NOx** | **CO** | **PM10** | **PM2.5** |
|---|---|---|---|---|---|
| Caltrain Diesel (DMU + Locomotive) | 65 | 1,691 | 1,284 | 32 | 31 |
| Electricity ("2020 No Project") | 0 | 4 | 3 | 0 | 0 |
| Subtotal | 65 | 1,695 | 1,287 | 32 | 31 |
| Change in VMT | *-159* | *-330* | *-1,296* | *-181* | *-53* |
| 2020 DMU Alternative | -94 | 1,365 | -9 | -148 | -21 |
| *2020 No Project* | *108* | *3,068* | *880* | *69* | *67* |
| *2020 Project* | *-123* | *655* | *-961* | *-156* | *-28* |
| **2020 DMU Alternative vs. 2020 No Project** | **-202** | **-1,703** | **-889** | **-218** | **-89** |
| **2020 Project vs. 2020 No Project** | **-231** | **-2,413** | **-1,842** | **-225** | **-96** |
| **2020 Project vs. 2020 DMU Alternative** | **-29** | **-710** | **-953** | **-7** | **-7** |

| **Total Emissions - 2040** | **ROG** | **NOx** | **CO** | **PM10** | **PM2.5** |
|---|---|---|---|---|---|
| Caltrain Diesel (DMU + Locomotive) | 44 | 1,048 | 1,338 | 16 | 15 |
| Electricity ("2040 No Project") | 0 | 4 | 3 | 0 | 0 |
| Subtotal | 44 | 1,052 | 1,341 | 16 | 15 |
| Change in VMT | *-365* | *-757* | *-2,900* | *-363* | *-108* |
| 2040 DMU Alternative | -322 | 295 | -1,558 | -347 | -93 |
| *2040 No Project* | 18 | 762 | 880 | 10 | 10 |
| *2040 Project* | -481 | -856 | -3,731 | -477 | -138 |
| **2040 DMU Alternative vs. 2040 No Project** | **-339** | **-466** | **-2,439** | **-357** | **-103** |
| **2040 Project vs. 2040 No Project** | **-498** | **-1,618** | **-4,611** | **-487** | **-148** |
| **2040 Project vs. 2040 DMU Alternative** | **-159** | **-1,151** | **-2,173** | **-130** | **-45** |

| **Total Emissions - 2020** | | | **CO2e** |
|---|---|---|---|
| Caltrain Diesel (DMU + Locomotive) | | | 73,014 |

| | | | |
|---|---|---|---|
| Electricity ("2020 No Project") | | | 531 |
| Subtotal | | | 73,546 |
| Change in VMT | | | *-44,317* |
| 2020 DMU Alternative | | | 29,229 |
| *2020 No Project* | | | *46,430* |
| *2020 Project* | | | *-21,279* |
| **2020 DMU Alternative vs. 2020 No Project** | | | **-67,709** |
| **2020 Project vs. 2020 No Project** | | | **-17,201** |
| **2020 Project vs. 2020 DMU Alternative** | | | **-50,508** |
| | | | |
| **Total Emissions - 2040** | | | |
| Caltrain Diesel (DMU + Locomotive) | | | 75,530 |
| Electricity ("2040 No Project") | | | 531 |
| Subtotal | | | 76,061 |
| Change in VMT | | | *-109,681* |
| 2040 DMU Alternative | | | -33,620 |
| *2040 No Project* | | | 46,430 |
| *2040 Project* | | | -130,353 |
| **2040 DMU Alternative vs. 2040 No Project** | | | **-176,783** |
| **2040 Project vs. 2040 No Project** | | | **-80,050** |
| **2040 Project vs. 2040 DMU Alternative** | | | **-96,733** |

## Freight Service Assumptions and Calculations

Nitrogen oxide ($NO_X$) and GHGs emissions generated by freight movement via locomotives were estimated using emission factors obtained from the EPA (2009) and Climate Registry (2013). It was assumed that 15,000 tons of freight is hauled on the Caltrain corridor between San Francisco and Santa Clara on average per day, carried by three locomotives. This equates to 48.1 million ton-miles per year, based on a trip length of 37 miles and a service period 260 days. Emissions generated by locomotive fuel consumption were quantified by multiplying the annual ton-mileage by emission factors from the EPA (2009) and Climate Registry (2013).

Emissions generated by haul trucks used to transport an equivalent amount of freight were quantified based on a literature review of transportation efficiencies. The EPA has noted that, on a ton-mile basis, trains are 2 to 4 times more fuel efficient and have one-half to one-third the NOx emissions compared with trucks (United States Environmental Protection Agency 2010). The EPA also concluded that, on a ton-mile basis, trains emit one-third the GHG emissions of trucks. $NO_X$ and GHG emissions generated by haul trucks were estimated by multiplying the NOx rail emissions factors of two and three and multiplying the GHG rail emissions factor by three.

**Calculation of Freight Rail Emissions**

| Parameter | Value |
|---|---|
| tons/day | 5,000 |
| miles | 37 |
| locomotives/day | 1-3 |
| locomotive miles per day | 37 |
| ton-miles per day | 185,000 |
| day/year | 260 |
| locomotive miles per year | 9,620 |
| ton-miles per year | 48,100,000 |

| Pollutant | Grams/Ton-Mile | | |
|---|---|---|---|
| | 2020 | 2040 | |
| NOx | 0.25 | 0.07 | Calculated from EPA 2009 |
| CO2 | 25.53 | 25.53 | Calculated from EPA 2009 |

| | | |
|---|---|---|
| Truck : Rail conversion (NOx low) | 2 | EPA 2010 |
| Truck : Rail conversion (NOx high; GHG) | 3 | EPA 2010 |

**Summary of Criteria Pollutant Emissions for Rail (pounds per day)**

| | 1 Train per day | | 3 Train per day | |
|---|---|---|---|---|
| **Year** | **NOX - High** | **NOX - Low** | **NOX - High** | **NOX - Low** |
| 2020 | | | | |
| Truck | 302.8 | 201.9 | 908.5 | 605.7 |
| Rail | 100.9 | 100.9 | 302.8 | 302.8 |
| *Difference (Truck minus Rail)* | *201.9* | *100.9* | *605.7* | *302.8* |
| 2040 | | | | |
| Truck | 85.6 | 54.3 | 256.9 | 162.9 |
| Rail | 28.5 | 27.1 | 85.6 | 81.4 |
| *Difference (Truck minus Rail)* | *57.1* | *27.1* | *171.3* | *81.4* |

**Summary of GHG Emissions (metric tons CO2 per year)**

| Year | 1 train per day | 3 train per day |
|---|---|---|
| 2020 | | |
| Truck | 3,718 | 11,155 |
| Rail | 1,239 | 3,718 |
| *Difference (Truck minus Rail)* | *2,479* | 7,437 |
| 2040 | | |
| Truck | 3,718 | 11,155 |
| Rail | 1,239 | 3,718 |
| *Difference (Truck minus Rail)* | *2,479* | 7,437 |

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