

Energy Calculations

Construction-Related Petroleum Fuels

The off-road construction equipment fuel usage was calculated through use of the off-road equipment assumptions utilized in the CalEEMod model run (see Appendix C) and the fuel usage calculations provided in the 2017 Off-road Diesel Emission Factors spreadsheet, prepared by CARB (<https://ww3.arb.ca.gov/msei/ordiesel.htm>). The Spreadsheet provides the following formula to calculate fuel usage from off-road equipment:

Fuel Used = Load Factor x Horsepower x Total Operational Hours x BSFC / Unit Conversion

Where:

Load Factor - Obtained from CalEEMod default values

Horsepower – Obtained from CalEEMod default values

Total Operational Hours – Calculated by multiplying CalEEMod default daily hours by the estimated number of working days for each phase of construction

BSFC – Brake Specific Fuel Consumption (pounds per horsepower-hour) – If less than 100 Horsepower = 0.408, if greater than 100 Horsepower = 0.367

Unit Conversion – Converts pounds to gallons = 7.109

The Following Table shows the off-road construction equipment fuel calculations based on the above formula, which shows that the off-road equipment utilized during construction of the proposed project would consume 47,069 gallons of fuel.

Off-Road Construction Equipment Modeled in CalEEMod and Fuel Used

Equipment Type	Equipment Quantity	Horse-Power	Load Factor	Operating Hours Per Day	Total Operational Hours ¹	Fuel Used (gallons)
Demolition of Existing Parking Lot						
Concrete/Industrial Saws	1	81	0.73	8	160	543
Excavators	3	158	0.38	8	1,008	3,124
Rubber Tired Dozers	2	97	0.37	8	3,184	6,558
Grading (Excavation)						
Bore/Drill Rigs	1	221	0.5	8	336	1,917
Excavators	1	158	0.38	8	336	1,041
Graders	1	187	0.41	8	336	1,330
Rubber Tired Dozers	1	247	0.4	8	336	1,714
Tractors/Loaders/Backhoes	3	97	0.37	8	1,008	2,076
Bridge Construction						
Cranes	1	231	0.29	7	1,393	4,817
Forklifts	3	89	0.20	8	4,776	4,879
Generator Sets	1	84	0.74	8	1,592	5,679
Tractors/Loaders/Backhoes	3	97	0.37	7	4,179	8,608
Welders	1	6	0.45	8	1,592	1,891
Paving						
Cement and Mortar Mixers	2	9	0.56	6	252	73
Pavers	1	130	0.42	8	168	474
Paving Equipment	2	132	0.36	8	336	586
Rollers	2	80	0.38	8	336	586
Tractors/Loaders/Backhoes	1	97	0.37	8	168	346
Painting/Landscaping						
Air Compressor	1	78	0.48	6	120	258
Tractors/Loaders/Backhoes	1	97	0.37	8	160	330
Total Off-Road Equipment Fuel used during Construction (gallons)						47,069

Notes:

¹ Based on 20 days for Demolition, 42 days for Grading, 199 days for Bridge Construction, 21 days for Paving, and 20 days for Painting/Landscaping.

Source: CalEEMod Version 2016.3.2, CARB, 2018.

The on-road construction-related vehicle trips fuel usage was calculated through use of the default construction vehicle trip assumptions from the CalEEMod model run, plus the 6 daily vendor trips added to the Demolition and Grading phases to account for water truck emissions. The fleet average miles per gallon rates have been calculated through use of the EMFAC2017 model (<https://www.arb.ca.gov/emfac/2017/>) and the EMFAC2017 model printouts are attached. The following Table shows the on-road construction vehicle trips modeled in CalEEMod and the fuel usage calculations, which shows that the on-road construction-related vehicle trips would consume 54,033 gallons of fuel.

On-Road Construction Vehicle Trips Modeled in CalEEMod and Fuel Used

Vehicle Trip Types	Daily Trips	Trip Length (miles)	Total per Day (miles)	Total per Phase (miles)	Fleet Average Miles per Gallon	Fuel Used (gallons)
Demolition of Existing Parking Lot						
Worker Trips	15	14.7	221	4,410	23.9	184
Vendor Trips	6	6.9	41	828	7.6	108
Haul Trips	5	50	99	1,980	7.6	259
Grading (Excavation)						
Worker Trips	18	14.7	265	11,113	23.9	465
Vendor Trips	6	6.9	41	1,739	7.6	228
Haul Trips	74	20	1,488	29,762	7.6	3,896
Bridge Construction						
Worker Trips	38	14.7	559	11,161	23.9	4,646
Vendor Trips	15	6.9	104	20,597	7.6	2,696
Paving						
Worker Trips	20	14.7	294	6,174	23.9	258
Painting/Landscaping						
Worker Trips	8	14.7	118	2,352	23.9	98
Total Off-Road Equipment Fuel used during Construction (gallons)						12,839

Notes:

¹ Based on 20 days for Demolition, 42 days for Grading, 199 days for Bridge Construction, 21 days for Paving, and 20 days for Painting/Landscaping.

Source: CalEEMod Version 2016.3.2, CARB, 2018.

EMFAC2017 (v1.0.2) Emissions Inventory

Region Type: Air Basin

Region: SOUTH COAST

Calendar Year: 2019

Season: Annual

Vehicle Classification: EMFAC2007 Categories

Units: miles/day for VMT, trips/day for Trips, tons/day for Emissions, 1000 gallons/day for Fuel Consumption

Region	Calendar Y	Vehicle Ca	Model Year	Speed	Fuel	Populator VMT	Trips	Fuel Consumption
SOUTH COAST	2019	HHD1	Aggregated	Aggregated	GAS	101.2689	7,659	2,026
SOUTH COAST	2019	LDA	Aggregated	Aggregated	GAS	6081048	244,446,391	28,695,373
SOUTH COAST	2019	LDT1	Aggregated	Aggregated	GAS	651943.4	24,807,246	2,983,370
SOUTH COAST	2019	LDT2	Aggregated	Aggregated	GAS	2073197	80,872,282	9,694,322
SOUTH COAST	2019	LHDT1	Aggregated	Aggregated	GAS	175207.5	6,463,196	2,610,330
SOUTH COAST	2019	LHDT2	Aggregated	Aggregated	GAS	28634.65	1,024,337	426,614
SOUTH COAST	2019	MCY	Aggregated	Aggregated	GAS	259354.2	1,869,286	518,708
SOUTH COAST	2019	MDV	Aggregated	Aggregated	GAS	1497221	54,845,361	6,911,949
SOUTH COAST	2019	MH	Aggregated	Aggregated	GAS	35590.49	335,289	3,560
SOUTH COAST	2019	MHDT	Aggregated	Aggregated	GAS	24590.83	1,348,347	492,013
SOUTH COAST	2019	OBUS	Aggregated	Aggregated	GAS	5873.334	259,979	117,514
SOUTH COAST	2019	SBUS	Aggregated	Aggregated	GAS	2127.585	88,942	8,510
SOUTH COAST	2019	UBUS	Aggregated	Aggregated	GAS	931.1469	87,702	3,725
vehicle miles per day (All Categories)						416,456,016		17407
								1,000 gall per day
								17407182 gallons per day

Fleet Avg Miles per gallon

23.9

EMFAC2017 (v1.0.2) Emissions Inventory

Region Type: Air Basin

Region: SOUTH COAST

Calendar Year: 2019

Season: Annual

Vehicle Classification: EMFAC2007 Categories

Units: miles/day for VMT, trips/day for Trips, tons/day for Emissions, 1000 gallons/day for Fuel Consumption

Region	Calendar Y	Vehicle Ca	Model	Year	Speed	Fuel	Population	VMT	Trips	Fuel Consumption
SOUTH COAST	2019	HHDT	Aggregated	Aggregated	Aggregated	DSL	92086.456	11035509.7	918238.1	1756.357
SOUTH COAST	2019	LDA	Aggregated	Aggregated	Aggregated	DSL	45875.256	1896328.9	216399.5	42.11914
SOUTH COAST	2019	LDT1	Aggregated	Aggregated	Aggregated	DSL	482.355	11462.4	1688.987	0.524598
SOUTH COAST	2019	LDT2	Aggregated	Aggregated	Aggregated	DSL	9664.5065	445809.6	48035.03	13.63116
SOUTH COAST	2019	LHDT1	Aggregated	Aggregated	Aggregated	DSL	97012.581	4044994.9	1220296	195.5523
SOUTH COAST	2019	LHDT2	Aggregated	Aggregated	Aggregated	DSL	37899.954	1552333.1	476733.7	83.01222
SOUTH COAST	2019	MDV	Aggregated	Aggregated	Aggregated	DSL	23710.3	1023300.7	117204.2	40.71306
SOUTH COAST	2019	MH	Aggregated	Aggregated	Aggregated	DSL	11071.442	110800.3	1107.144	10.75767
SOUTH COAST	2019	MHDT	Aggregated	Aggregated	Aggregated	DSL	114050.54	7128971.3	1136926	714.723
SOUTH COAST	2019	OBUS	Aggregated	Aggregated	Aggregated	DSL	4003.9331	293204.8	39272.79	37.05915
SOUTH COAST	2019	SBUS	Aggregated	Aggregated	Aggregated	DSL	6232.5511	197082.4	71922.78	26.67112
SOUTH COAST	2019	UBUS	Aggregated	Aggregated	Aggregated	DSL	18.196918	1877.4	72.78767	0.296796

Diesel Truck (HHDT, MDV, MHDT) vehicle miles per day 19,187,782 2,512 1,000 gall per day
2511793 gallons per day

Diesel Truck Fleet Avg Miles per gallon 7.6