

APPENDIX C– ENERGY CALCULATIONS



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:

$$\text{Fuel Used} = \text{Load Factor} \times \text{Horsepower} \times \text{Total Operational Hours} \times \text{BSFC} / \text{Unit Conversion}$$

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 30,473 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						
Concrete/Industrial Saws	1	81	0.73	8	160	543
Excavators	3	158	0.38	8	1,440	4,463
Rubber Tired Dozers	2	97	0.37	8	1,280	2,637
Grading						
Excavators	1	158	0.38	8	480	1,488
Graders	1	187	0.41	8	480	1,900
Rubber Tired Dozers	1	247	0.4	8	480	2,448
Tractors/Loaders/Backhoes	3	97	0.37	8	1,440	2,966
Park Features Construction						
Cranes	1	231	0.29	7	560	1,937
Forklifts	3	89	0.20	8	1,920	1,961
Generator Sets	1	84	0.74	8	640	2,283
Tractors/Loaders/Backhoes	3	97	0.37	7	1,680	3,460

Equipment Type	Equipment Quantity	Horse-Power	Load Factor	Operating Hours Per Day	Total Operational Hours ¹	Fuel Used (gallons)
Welders	1	46	0.45	8	640	760
Architectural Coatings						
Air Compressor	1	78	0.48	6	120	258
Paving						
Pavers	2	130	0.42	8	480	1,353
Paving Equipment	2	132	0.36	8	480	1,178
Rollers	2	80	0.38	8	480	837
Total Off-Road Equipment Fuel used during Construction (gallons)						30,473

Notes:

¹ Based on 20 days for Demolition, 60 days for Grading, 80 days for Park Features Construction, 20 days for Architectural Coatings, and 30 days for Paving.

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	24.6	179
Vendor Trips	6	6.9	41	828	7.8	106
Haul Trips	5	20	104	2,080	7.8	267
Grading						
Worker Trips	15	14.7	221	13,230	24.6	538
Vendor Trips	6	6.9	41	2,484	7.8	319
Park Features Construction						
Worker Trips	170	14.7	2,499	199,920	24.6	8,133
Vendor Trips	66	6.9	455	36,432	7.8	4,675
Architectural Coatings						
Worker Trips	34	14.7	500	9,996	24.6	407
Paving						
Worker Trips	15	14.7	221	6,615	24.6	269
Total Off-Road Equipment Fuel used during Construction (gallons)						14,893

Vehicle Trip Types	Daily Trips	Trip Length (miles)	Total per Day (miles)	Total per Phase (miles)	Fleet Average Miles per Gallon	Fuel Used (gallons)
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Notes:

¹ Based on 20 days for Demolition, 60 days for Grading, 80 days for Park Features Construction, 20 days for Architectural Coatings, and 30 days for Paving.

Source: CalEEMod Version 2016.3.2, CARB, 2018.

EMFAC2017 (v1.0.2) Emissions Inventory

Region Type: Air Basin

Region: SOUTH COAST

Calendar Year: 2020

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 Cal	Model Year	Speed	Fuel	Population VMT	Trips	Fuel Consumption	
SOUTH COAST	2020	HHDT	Aggregated	Aggregated	GAS	87.06695	7544.942081	1742.036	1.924993227
SOUTH COAST	2020	LDA	Aggregated	Aggregated	GAS	6178149	245245789.6	29171004	8365.832232
SOUTH COAST	2020	LDT1	Aggregated	Aggregated	GAS	673575	25456837.2	3092733	1009.703307
SOUTH COAST	2020	LDT2	Aggregated	Aggregated	GAS	2108550	81418834.91	9872323	3534.790518
SOUTH COAST	2020	LHDT1	Aggregated	Aggregated	GAS	173614.6	6333810.586	2586599	612.6252653
SOUTH COAST	2020	LHDT2	Aggregated	Aggregated	GAS	28771.82	1018932.099	428657.2	113.1501167
SOUTH COAST	2020	MCY	Aggregated	Aggregated	GAS	269351.1	1916380.232	538702.2	52.6214956
SOUTH COAST	2020	MDV	Aggregated	Aggregated	GAS	1509433	54618603.59	6970808	2902.923832
SOUTH COAST	2020	MH	Aggregated	Aggregated	GAS	35045.57	331213.3277	3505.959	66.05937563
SOUTH COAST	2020	MHDT	Aggregated	Aggregated	GAS	24612.45	1335068.759	492445.8	269.6494288
SOUTH COAST	2020	OBUS	Aggregated	Aggregated	GAS	5846.823	252354.2354	116983.2	51.34879326
SOUTH COAST	2020	SBUS	Aggregated	Aggregated	GAS	2268.163	93420.86198	9072.651	10.43507716
SOUTH COAST	2020	UBUS	Aggregated	Aggregated	GAS	938.2571	88202.7311	3753.029	18.36430248

vehicle miles per day (All Categories) 418,116,993 17,009 1,000 gall per day
17,009,429 gallons per day

Fleet Avg Miles per gallon 24.6

EMFAC2017 (v1.0.2) Emissions Inventory

Region Type: Air Basin

Region: SOUTH COAST

Calendar Year: 2020

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 Cal	Model Year	Speed	Fuel	Population VMT	Trips	Fuel Consumption
SOUTH COAST	2020	HHDT	Aggregated	Aggregated	DSL	94401.01	11283644	946656.7
SOUTH COAST	2020	LDA	Aggregated	Aggregated	DSL	49858.73	2047191.98	236026.5
SOUTH COAST	2020	LDT1	Aggregated	Aggregated	DSL	436.3696	10308.3494	1529.802
SOUTH COAST	2020	LDT2	Aggregated	Aggregated	DSL	11074.64	498881.676	54951.17
SOUTH COAST	2020	LHDT1	Aggregated	Aggregated	DSL	103329.4	4276352.72	1299754
SOUTH COAST	2020	LHDT2	Aggregated	Aggregated	DSL	40572.87	1644689.8	510355.6
SOUTH COAST	2020	MDV	Aggregated	Aggregated	DSL	26705.38	1126984.42	131705
SOUTH COAST	2020	MH	Aggregated	Aggregated	DSL	11453.97	113100.72	1145.397
SOUTH COAST	2020	MHDT	Aggregated	Aggregated	DSL	116761.7	7338725.15	1166319
SOUTH COAST	2020	OBUS	Aggregated	Aggregated	DSL	4066.241	300794.137	39836.27
SOUTH COAST	2020	SBUS	Aggregated	Aggregated	DSL	6271.332	198203.043	72370.31
SOUTH COAST	2020	UBUS	Aggregated	Aggregated	DSL	18.19692	1877.44623	72.78767

Diesel Truck (HHDT, MDV, MHDT) vehicle miles per day 19,749,354

2,534 1,000 gall per day
2,534,192 gallons per day

Diesel Truck Fleet Avg Miles per gallon 7.8