APPENDIX G

ENERGY CALCULATIONS

Construction Off-Road Equipment										
Phase	**Off-Road Equipment Type**	**Amount**	**Usage Hour/Day**	**Total Usage Days**	**Total Usage Hours/Equipment**	**Horsepower**	**Load Factor**	**Total Usage Hours/ Equipment**	**Horsepower-Hour**	**Fuel Usage (gallons)**
Demolition	Concrete/Industrial Saws	1	8	20	160	33	0.73	160	3854.4	197.34528
	Excavators	3	8	20	480	36	0.38	480	6566.4	336.19968
	Rubber Tired Dozers	2	8	20	320	367	0.4	320	46976	2405.1712
Site Preparation	Rubber Tired Dozers	3	8	160	3840	367	0.4	3840	563712	28862.0544
	Tractors/Loaders/Backhoes	4	8	160	5120	84	0.37	5120	159129.6	8147.43552
Grading	Excavators	2	8	160	2560	36	0.38	2560	35020.8	1793.06496
	Graders	1	8	160	1280	148	0.41	1280	77670.4	3976.72448
	Rubber Tired Dozers	1	8	160	1280	367	0.4	1280	187904	9620.6848
	Scrapers	2	8	160	2560	423	0.48	2560	519782.4	26612.85888
	Tractors/Loaders/Backhoes	2	8	160	2560	84	0.37	2560	79564.8	4073.71776
Building Construction	Cranes	1	7	300	2100	367	0.29	2100	223503	11443.3536
	Forklifts	3	8	300	7200	82	0.2	7200	118080	6045.696
	Generator Sets	1	8	300	2400	14	0.74	2400	24864	1273.0368
	Tractors/Loaders/Backhoes	3	7	300	6300	84	0.37	6300	195804	10025.1648
	Welders	1	8	300	2400	46	0.45	2400	49680	2543.616
Paving	Pavers	2	8	60	960	81	0.42	960	32659.2	1672.15104
	Paving Equipment	2	8	60	960	89	0.36	960	30758.4	1574.83008
	Rollers	2	8	60	960	36	0.38	960	13132.8	672.39936
Architectural Coating	Air Compressors	1	6	90	540	37	0.48	540	9590.4	491.02848
									Total	**121766.5331** Diesel

Construction Truck and Construction Worker Vehicle Fuel Efficiency				
		EMFAC 2021 Outputs		
Vehicle Type	Vehicle Class	Fuel Consumption (1,000 gallons/day)	VMT (miles/ day)	Fuel Efficency (miles/gallon)
Construction Truck	MHDT	125.3	1,142,312.2	9.1
	HHDT	199.0	1,283,903.0	6.5
	HHDT/MHDT	-	-	7.8
Construction Worker Vehicle	LDA	1,241.0	41,149,375.5	33.2
	LDT1	119.6	3,277,866.3	27.4
	LDT2	826.0	22,415,240.2	27.1
	Worker Mix	-	-	30.2

Notes:

[1] For construction trucks assumes 50 percent HHDT and 50 percent MHDT vehicles, consistent with assumptions in CalEEMod for hauling trucks. For construction worker vehicles assumes 50 percent LDA, 25 percent LDT1, and 25 percent LDT2 vehicles, consistent with assumptions in CalEEMod for worker vehicles.

[2] EMFAC2021 was run for Orange County for the construction year 2029. Data was aggregated over all vehicle model years and speed bins.

[3] The fuel efficiency was calculated by dividing the VMT (miles/day) by the fuel consumption (gallons/day).

Construction Vehicle Fuel Use - Diesel Vehicles						
Phase	Trip Type	Total Trips	Trip Length (miles)	Total VMT	Diesel Fuel Effiency (miles/gallon)	Fuel Usage (gallons/year)
Demolition	Hauling	40	20	800	6.5	123.1
Building Construction	Vendor	17400	10.2	177480	7.8	22753.8
					Total	**22876.9**

Diesel

[1] Assumes 100 percent HHDT vehicles for haul trucks and 50 percent HHDT/50 percent MHDT vehicles for MHDT, consistent with assumptions in CalEEMod.

[2] EMFAC2021 was run for Orange County for the construction year 2029. Data was aggregated over all vehicle model years and speed bins.

[3] The fuel efficiency was calculated by dividing the VMT (miles/day) by the fuel consumption (gallons/day).

Construction Worker Vehicle Fuel Use - Gasoline Vehicles							
Phase	Total One-Way Trips/Day	Total Days	Total Trips	Trip Length (miles)	Total VMT	Gasoline Fuel Effiency (miles/gallon)	Fuel Usage (gallons/year)
Demolition	15	20	600	18.5	11100	30.2	367.5
Site Preparation	18	160	5760	18.5	106560	30.2	3528.5
Grading	20	160	6400	18.5	118400	30.2	3920.5
Building Construction	67	300	40200	18.5	743700	30.2	24625.8
Paving	15	60	1800	18.5	33300	30.2	1102.6
Architectural Coating	13	90	2340	18.5	43290	30.2	1433.4
						Total	**34978.5**

Gas

Total Construction Gasoline Usage	**34,978**
Total Construction Diesel Usage	**144,643**

Proposed Project Operational Trips			
Vehicle Class	CalEEMod	Total Project Trips	Total Trips per Vehicle Class
LDA	0.4848	1149	557.0
LDT1	0.037	1149	42.5
LDT2	0.2441	1149	280.5
MDV	0.1468	1149	168.7
LHD1	0.02903	1149	33.4
LHD2	0.007924	1149	9.1
MHD	0.01593	1149	18.3
HHD	0.00625	1149	7.2
OBUS	0.0005834	1149	0.7
UBUS	0.0003477	1149	0.4
MCY	0.002292	1149	2.6
SBUS	0.0009511	1149	1.1
MH	0.00322	1149	3.7

Proposed Project Operational Trips – Fuel Efficiency						
Fuel	Vehicle Class	EMFAC2021 Outputs1				
		Fleet Mix (%)2	Fuel Consumption (1,000 gallons/day)	VMT (miles/day)	Fuel Efficiency3 (miles/gallon)	
Gas	LDA	50%	1,183.4	40,978,810.7	34.6	17.3
	LDT1	4%	111.2	3,190,141.6	28.7	1.1
	LDT2	28%	804.9	22,862,952.0	28.4	7.9
	MDV	16%	561.4	13,000,009.1	23.2	3.7
	LHD1	2%	95.2	1,510,431.7	15.9	0.3
	MCY	0%	8.2	350,810.6	43.0	0.2
	MH	0%	10.3	50,222.6	4.9	0.0
	Fleet Mix	–	–	–	30.5	30.5
Diesel	LHD2	16%	24.6	448,148.0	18.2	2.8
	MHDT	38%	117.1	1,085,975.6	9.3	3.5
	HHDT	47%	1,085,975.6	1,335,001.0	0.0	0.0
	Fleet Mix	–	–	–	6.4	6.4

Notes:

[1] EMFAC2021 was run for Orange County for the operational year 2032. Data was aggregated over all vehicle model years and speed bins.

[2] Fleet mix is based on assumptions made in CalEEMod for the proposed project.

[3] The fuel efficiency was calculated by dividing the VMT (miles/day) by the fuel consumption (gallons/day).

Proposed Project Operational Trips – Fuel Usage						
Land Use	Total Annual VMT2 (miles/year)	Fuel Type	Portion of Fleet3 (%)	VMT by Fuel Type (miles/year)	Fleet Mix Efficiency4 (miles/gallon)	Fuel Usage (gallons/ year)
Proposed Project	3,556,579.00	Gas	95%	3373560	30.5	110,565.39
		Diesel	3%	107067	6.4	16,831.89
					Total Gasoline/year	**110,565.39**
					Total Diesel/year	**16,831.89**

Notes:

[1] Calculated for operational year 2032 only. Future years will likely use less fuel due to more efficient cars.

[2] Total VMT is based on project's trip generation and trip lengths.

[3] Fleet distribution is based on EMFAC2021 output and CalEEMod assumptions.

[4] Fuel efficiency is based on fuel consumption and VMT data from EMFAC2021 for Orange County and total VMT.

Electricity Usage	
Electricity by Land Use	**kWh/year**
Proposed Project	1,618,159
Total	**1,618,159**

Natural Gas Usage			
Natural Gas by Land Use	**kBTU/year**	**BTU/year**	**therms/year**
Proposed project	1,367,764	1,367,764,000	13,680
Total	**1,367,764**	**1,367,764,000**	**13,680**