

## **Appendix F      Transportation and Fuel Energy Use Calculations**

## Appendices

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Operation-Related Vehicle Fuel/Energy Usage

PROPOSED COMMUTE								
Year	Gas		Diesel		CNG		Electricity	
	VMT	Gallons	VMT	Gallons	VMT	Gallons	VMT	kWh
Proposed Project	695,106	28,511	12,635	353	0	0	5,648	1,898
Total	695,106	28,511	12,635	353	0	0	5,648	1,898

## Construction-Related Fuel/Energy Usage

### CONSTRUCTION WORKER COMMUTE

Year	Gas		Diesel		Electricity	
	VMt	Gallons	VMt	Gallons	VMt	kWh
2018	20,581	837	98	3	118	40
<b>Total</b>	<b>20,581</b>	<b>837</b>	<b>98</b>	<b>3</b>	<b>118</b>	<b>40</b>

### CONSTRUCTION VENDOR TRIPS

Year	Gas		Diesel	
	VMt	Gallons	VMt	Gallons
2018	194	40	1,972	272
<b>Total</b>	<b>194</b>	<b>40</b>	<b>1,972</b>	<b>272</b>

### CONSTRUCTION TRUCK HAUL TRIPS

Year	Gas		Diesel	
	VMt	Gallons	VMt	Gallons
2018	33	9	34,067	5,626
<b>Total</b>	<b>33</b>	<b>9</b>	<b>34,067</b>	<b>5,626</b>

## Proposed Facilities

### PROPOSED CONDITIONS

Vehicle type	Fleet percent	VMT	
		Apartments Mid Rise	Total
LDA	67.24%	479,662	479,662
LDT1	5.66%	40,377	40,377
LDT2	24.46%	174,482	174,482
MDV	1.00%	7,134	7,134
LHD1	0.25%	1,813	1,813
LHD2	0.09%	610	610
MHD	0.26%	1,881	1,881
HHO	0.40%	2,830	2,830
OBUS	0.00%	0	0
UBUS	0.00%	0	0
MCY	0.64%	4,600	4,600
SBUS	0.00%	0	0
MH	0.00%	0	0
	100.00%	713,388	713,388

### PROPOSED CONDITIONS

Vehicle type	Gas percent	Diesel percent	CNG percent	Electricity percent
LDA	98.30%	0.66%	0.00%	1.04%
LDT1	99.73%	0.06%	0.00%	0.20%
LDT2	99.17%	0.49%	0.00%	0.34%
MDV	67.19%	32.81%	0.00%	0.00%
LHD1	44.52%	55.48%	0.00%	0.00%
LHD2	100.00%	0.00%	0.00%	0.00%
MHD	98.39%	1.56%	0.00%	0.06%
HHO	79.05%	20.95%	0.00%	0.00%
OBUS	0.00%	100.00%	0.00%	0.00%
UBUS	100.00%	0.00%	0.00%	0.00%
MCY	0.00%	100.00%	0.00%	0.00%
SBUS	28.37%	71.63%	0.00%	0.00%
MH	17.83%	82.17%	0.00%	0.00%

### 4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated Annual VMT	Mitigated Annual VMT
	Weekday	Saturday	Sunday		
Junior High School	182.58	235.72	235.72	713,388	713,388
Other Asphalt Surfaces	0.00	0.00	0.00		
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Total	182.58	235.72	235.72	713,388	713,388

### 4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHO	OBUS	UBUS	MCY	SBUS	MH
Junior High School	0.672372	0.056599	0.244582	0.010000	0.002542	0.000855	0.002637	0.003967	0.000000	0.000000	0.006448	0.000000	0.000000
Other Asphalt Surfaces	0.547972	0.046127	0.199330	0.125604	0.017697	0.005953	0.018360	0.027618	0.002341	0.002583	0.004804	0.000667	0.000994
Other Non-Asphalt Surfaces	0.547972	0.046127	0.199330	0.125604	0.017697	0.005953	0.018360	0.027618	0.002341	0.002583	0.004804	0.000667	0.000994

<< Equal to T6 (<https://www.arb.ca.gov/msei/downloads/emfac2014/emfac2014-vol3-technical-documentation-052015.pdf>)

<< Equal to T7 (<https://www.arb.ca.gov/msei/downloads/emfac2014/emfac2014-vol3-technical-documentation-052015.pdf>)

<< Motor coach, all other buses, and OBUS (<https://www.arb.ca.gov/msei/downloads/emfac2014/emfac2014-vol3-technical-documentation-052015.pdf>)

### PROPOSED CONDITIONS

Vehicle type	VMT	Gasoline mpg	Gallons	VMT	Diesel mpg	Gallons	VMT	CNG mpg	Gallons	VMT	Electricity m/kWh	kWh
LDA	471,499	27.40	17,207	3,188	42.28	75	0	0.00	0	4,975	2.97	1,672
LDT1	40,270	23.59	1,707	25	21.01	1	0	0.00	0	82	2.97	28
LDT2	173,039	21.14	8,185	852	30.90	28	0	0.00	0	591	2.97	199
MDV	4,793	17.46	275	2,341	23.82	98	0	0.00	0	0	2.97	0
LHD1	807	10.04	80	1,006	20.41	49	0	0.00	0	0	0.00	0
LHD2	610	8.74	70	0	18.38	0	0	0.00	0	0	0.00	0
MHD	1,851	4.80	385	29	9.56	3	0	0.00	0	1	0.00	0
HHO	2,237	3.71	604	593	6.06	98	0	2.12	0	0	0.00	0
OBUS	0	4.80	0	0	8.07	0	0	0.00	0	0	0.00	0
UBUS	0	4.05	0	0	5.66	0	0	3.99	0	0	0.00	0
MCY	0	35.68	0	4,600	0.00	0	0	0.00	0	0	0.00	0
SBUS	0	8.89	0	0	7.38	0	0	0.00	0	0	0.00	0
MH	0	4.89	0	0	10.08	0	0	0.00	0	0	0.00	0
	695,106		28,511	12,635		353	0		0	5,648		1,898

Construction Worker Trips Fuel Usage Worksheet

Note: Worker vehicles are "LD\_Mix", which is 50% LDA, 25% LDT1, and 25% LDT2

Activity <sup>1</sup>	Daily trips	Trip miles	Percent in year	Trip days	Annual VMT
2018					
Asphalt Demo	15	14.7	100.00%	20	4,410
Asphalt Demo Haul	0	14.7	100.00%	20	0
Site Preparation	18	14.7	100.00%	5	1,323
Rough Grading	15	14.7	100.00%	16	3,528
Rough Grading Haul	0	14.7	100.00%	16	0
Utility Trenching	5	14.7	100.00%	6	441
Asphalt Paving	20	14.7	100.00%	18	5,292
Landscaping/Field Lighting	18	14.7	100.00%	18	4,763
Architectural Coating	4	14.7	100.00%	18	1,058

Year	LDA VMT	LDT1 VMT	LDT2 VMT	Gasoline <sup>1</sup>						Diesel <sup>1</sup>						Electricity <sup>1</sup>			
				LDA mpg	LDA gallons	LDT1 mpg	LDT1 gallons	LDT2 mpg	LDT2 gallons	LDA mpg	LDA gallons	LDT1 mpg	LDT1 gallons	LDT2 mpg	LDT2 gallons	LDA m/kWh	LDA kWh	LDT1 m/kWh	LDT1 kWh
2018	10,408	5,204	5,204	27.40	373	23.59	220	21.14	244	42.28	2	21.01	0	30.90	1	2.97	36	2.97	4

Gasoline		Diesel		Electricity	
VMT	Gallons	VMT	Gallons	VMT	kWh
20,581	837	98	3	118	40
20,581	837	98	3	118	40

<sup>1</sup> EMFAC2017 v1.0.2.

Year	VMT from gasoline			VMT from diesel			VMT from electricity	
	LDA	LDT1	LDT2	LDA	LDT1	LDT2	LDA	LDT1
2018	98.30%	99.73%	99.17%	0.66%	0.06%	0.49%	1.04%	0.20%

Appendix C: Evidence Used to Define the Average Number of KWH Required to Displace a Gallong of Gasoline

Table A 3: Evidence from U.S. Department of Energy and U.S. Environmental Protection Agency’s fuel economy website<sup>[32]</sup>

Vehicle	Model year	Electric consumption	Gasoline fuel economy	Number of kWh that are equivalent to 1 gallon
Ford Fusion Energi & Ford C-Max Energi	2013	0.34 kWh per mile	43 mpg	14.6
Chevrolet Volt	2013	0.35 kWh per mile	37 mpg	12.9
Chevrolet Volt	2012	0.36 kWh per mile	37 mpg	13.3
Fisker Karma	2012	0.62 kWh per mile	20 mpg	12.4
Toyota Prius	2013	0.29 kWh per mile & 0.2 gal	50 mpg	13.1
Average for five models	-	-	-	13.3 +/- 0.8

Table A 5: Average power consumption per mile traveled over time for different PEV categories

Year range	2012- 2020	2020-2030	2030-2040	2040-2050	2050
Efficiency improvement per year	0.3%	0.8%	0.9%	0.9%	
Year	2012	2020	2030	2040	2050
Relative energy efficiency	1.000	0.976	0.901	0.823	0.752

[https://www.fhwa.dot.gov/environment/climate\\_change/mitigation/publications\\_and\\_tools/ev\\_deployment/page08.cfm](https://www.fhwa.dot.gov/environment/climate_change/mitigation/publications_and_tools/ev_deployment/page08.cfm)

0.34	14.6	2013	0.34
0.35	12.9	2014	0.34
0.36	13.3	2015	0.34
0.34	13.3	2016	0.34
		2017	0.34
		2018	0.34
		2019	0.34
		2020	0.33
		2021	0.33
		2022	0.33
		2023	0.33
		2024	0.32
		2025	0.32
		2026	0.32
		2027	0.32
		2028	0.31
		2029	0.31
		2030	0.31
		2031	0.31
		2032	0.30
		2033	0.30
		2034	0.30
		2035	0.29

Vendor Trips Fuel Usage Worksheet

Note: Hauling vehicles are "HDT\_Mix", which is 50% HHDT (T7), and 50% MHDt (T6)

Activity <sup>1</sup>	Daily trips <sup>1,2</sup>	Trip miles <sup>2</sup>	Percent in year	Trip days <sup>1</sup>	Annual VMT
2018					
Asphalt Demo	4	6.9	100.00%	20	552
Asphalt Demo Haul	0	6.9	100.00%	20	0
Site Preparation	4	6.9	100.00%	5	138
Rough Grading	4	6.9	100.00%	16	442
Rough Grading Haul	0	6.9	100.00%	16	0
Utility Trenching	4	6.9	100.00%	6	166
Asphalt Paving	0	6.9	100.00%	18	0
Landscaping/Field Lighting	7	6.9	100.00%	18	869
Architectural Coating	0	6.9	100.00%	18	0

Year	HHDT (T7) VMT		MHDT (T6) VMT		Gasoline <sup>1</sup>				Diesel <sup>2</sup>			
			HHDT (T7) mpg	HHDT (T7) gallons	MHDT (T6) mpg	MHDT (T6) gallons	HHDT (T7) mpg	HHDT (T7) gallons	MHDT (T6) mpg	MHDT (T6) gallons		
2018	1,083	1,083	3.71	0	4.80	40	6.06	179	9.56	93		

<sup>1</sup> EMFAC2017 v1.0.2.

Year	VMT from gasoline		VMT from diesel	
	HHDT (T7)	MHDt (T6)	HHDT (T7)	MHDt (T6)
2018	0.10%	17.83%	99.90%	82.17%

VENDOR			
Gasoline		Diesel	
VMT	Gallons	VMT	Gallons
194	40	1,972	272
194	40	1,972	272

VENDOR AND HAULING COMBINED			
Gasoline		Diesel	
VMT	Gallons	VMT	Gallons
227	49	36,040	5,898
227	49	36,040	5,898

Truck Haul Trips Fuel Usage Worksheet

Note: Hauling vehicles are HHDT (T7)

Activity	Total Trips <sup>1</sup>
Asphalt Demo	0
Asphalt Demo Haul	32
Site Preparation	0
Rough Grading	0
Rough Grading Haul	1,673
Utility Trenching	0
Asphalt Paving	0
Landscaping/Field Lighting	0
Architectural Coating	0

<sup>1</sup> Based on information provided.

Activity	Daily trips	Mi/Trip <sup>1</sup>	Percent in year	Trip Days <sup>2</sup>	Annual VMT
2018					
Asphalt Demo	0	20	100.00%	20	0
Asphalt Demo Haul	2	20	100.00%	20	640
Site Preparation	0	20	100.00%	5	0
Rough Grading	0	20	100.00%	16	0
Rough Grading Haul	105	20	100.00%	16	33,460
Utility Trenching	0	20	100.00%	6	0
Asphalt Paving	0	20	100.00%	18	0
Landscaping/Field Lighting	0	20	100.00%	18	0
Architectural Coating	0	20	100.00%	18	0

<sup>1</sup> Based on CalEEMod defaults.

<sup>2</sup> Based on information provided.

Year	VMT	Gasoline <sup>1</sup>		Diesel <sup>1</sup>	
		HHDT (T7) mpg	HHDT (T7) gallons	HHDT (T7) mpg	HHDT (T7) gallons
2018	34,100	3.71	9	6.06	5,626

<sup>1</sup> EMFAC2017 v1.0.2.

Year	VMT from gasoline	VMT from diesel
2018	0.10%	99.90%

Gasoline		Diesel	
VMT	Gallons	VMT	Gallons
33	9	34,067	5,626
33	9	34,067	5,626



EMFAC Fuel Usage: Year 2018

Vehicle type	Gasoline			Diesel			Natural Gas			Electricity
	VMT/day	Gallons/day	Miles/gallon	VMT/day	Gallons/day	Miles/gallon	VMT/day	Gallons/day	Miles/gallon	VMT/day
All other buses	0	0	0.00	126,199	13,338	9.46	0	0	0.00	0
LDA	152,352,408	5,559,825	27.40	1,030,227	24,364	42.28	0	0	0.00	1,607,386
LDT1	15,417,611	653,474	23.59	9,679	461	21.01	0	0	0.00	31,333
LDT2	50,345,386	2,381,272	21.14	247,932	8,024	30.90	0	0	0.00	171,905
LHD1	4,057,202	404,071	10.04	1,981,420	97,083	20.41	0	0	0.00	0
LHD2	620,061	70,945	8.74	772,852	42,049	18.38	0	0	0.00	0
MCY	1,074,479	30,114	35.68	0	0	0.00	0	0	0.00	0
MDV	32,040,666	1,835,250	17.46	506,721	21,274	23.82	0	0	0.00	18,850
MH	186,778	38,206	4.89	49,488	4,911	10.08	0	0	0.00	0
Motor coach	0	0	0.00	83,912	14,015	5.99	0	0	0.00	0
OBUS	184,430	38,453	4.80	0	0	0.00	0	0	0.00	0
PTO	0	0	0.00	72,939	15,653	4.66	0	0	0.00	0
SBUS	42,036	4,730	8.89	106,132	14,383	7.38	0	0	0.00	0
T6	791,158	164,686	4.80	3,646,766	381,589	9.56	0	0	0.00	0
T7	5,895	1,590	3.71	6,149,059	1,015,445	6.06	77,453	36,450	2.12	0
UBUS	32,230	7,960	4.05	3,221	569	5.66	424,964	106,408	3.99	1,070
<b>Total</b>	<b>257,150,338</b>	<b>11,190,576</b>	<b>22.98</b>	<b>14,786,547</b>	<b>1,653,158</b>	<b>8.94</b>	<b>502,417</b>	<b>142,858</b>	<b>3.52</b>	<b>1,830,544</b>



EMFAC2017 (v1.0.2) Emissions Inventory

Region Type: Sub-Area

Region: Los Angeles (SC)

Calendar Year: 2018

Season: Annual

Vehicle Classification: EMFAC2011 Categories

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

Region	CalYr	VehClass	MdlYr	Speed	Fuel	Population	VMT	Trips	Fuel_Consumption
Los Angeles (SC)	2018	All Other Buses	Aggregated	Aggregated	DSL	2203.841823	126198.5154	18512.27131	13.33769024
Los Angeles (SC)	2018	LDA	Aggregated	Aggregated	GAS	3787140.552	152352408.3	17836906.86	5559.824824
Los Angeles (SC)	2018	LDA	Aggregated	Aggregated	DSL	25490.99936	1030226.731	118708.8221	24.36423964
Los Angeles (SC)	2018	LDA	Aggregated	Aggregated	ELEC	41946.83649	1607385.571	211903.9032	0
Los Angeles (SC)	2018	LDT1	Aggregated	Aggregated	GAS	399738.3858	15417610.87	1824084.367	653.4742189
Los Angeles (SC)	2018	LDT1	Aggregated	Aggregated	DSL	375.8082074	9678.848446	1349.673014	0.460778536
Los Angeles (SC)	2018	LDT1	Aggregated	Aggregated	ELEC	980.9928755	31333.39808	4658.79438	0
Los Angeles (SC)	2018	LDT2	Aggregated	Aggregated	GAS	1276816.328	50345385.82	5957553.211	2381.271962
Los Angeles (SC)	2018	LDT2	Aggregated	Aggregated	DSL	5287.651852	247931.814	26272.04647	8.023941154
Los Angeles (SC)	2018	LDT2	Aggregated	Aggregated	ELEC	4752.691838	171904.9306	24329.14215	0
Los Angeles (SC)	2018	LHD1	Aggregated	Aggregated	GAS	107338.7882	4057201.89	1599188.009	404.070611
Los Angeles (SC)	2018	LHD1	Aggregated	Aggregated	DSL	44862.62848	1981420.14	564315.4291	97.08286984
Los Angeles (SC)	2018	LHD2	Aggregated	Aggregated	GAS	17154.32044	620060.9911	255573.8147	70.94515861
Los Angeles (SC)	2018	LHD2	Aggregated	Aggregated	DSL	18097.2275	772852.4144	227640.3556	42.04905885
Los Angeles (SC)	2018	MCY	Aggregated	Aggregated	GAS	147201.2937	1074478.73	294402.5874	30.11391925
Los Angeles (SC)	2018	MDV	Aggregated	Aggregated	GAS	876188.8226	32040665.85	4042546.609	1835.25006
Los Angeles (SC)	2018	MDV	Aggregated	Aggregated	DSL	11707.10339	506720.8207	58056.4086	21.274123
Los Angeles (SC)	2018	MDV	Aggregated	Aggregated	ELEC	545.0052675	18850.11602	2739.180271	0
Los Angeles (SC)	2018	MH	Aggregated	Aggregated	GAS	18915.51119	186777.7259	1892.30774	38.2060069
Los Angeles (SC)	2018	MH	Aggregated	Aggregated	DSL	4631.581386	49488.17588	463.1581386	4.910961438
Los Angeles (SC)	2018	Motor Coach	Aggregated	Aggregated	DSL	669.4656384	83912.40557	9774.19832	14.01546199
Los Angeles (SC)	2018	OBUS	Aggregated	Aggregated	GAS	4043.618232	184429.6522	80904.71359	38.4531154
Los Angeles (SC)	2018	PTO	Aggregated	Aggregated	DSL	0	72938.83324	0	15.65251738
Los Angeles (SC)	2018	SBUS	Aggregated	Aggregated	GAS	975.8986724	42036.02377	3903.59469	4.729517218
Los Angeles (SC)	2018	SBUS	Aggregated	Aggregated	DSL	3336.476364	106131.8697	38502.47466	14.38269341
Los Angeles (SC)	2018	T6 Ag	Aggregated	Aggregated	DSL	12.17663633	113.4299469	53.57719986	0.013550547
Los Angeles (SC)	2018	T6 CAIRP heavy	Aggregated	Aggregated	DSL	243.3649548	49140.86553	3553.128341	4.738022474
Los Angeles (SC)	2018	T6 CAIRP small	Aggregated	Aggregated	DSL	127.8605024	6842.302406	1866.763335	0.697090223
Los Angeles (SC)	2018	T6 instate construction heavy	Aggregated	Aggregated	DSL	2308.68074	153308.3632	10437.45586	16.37231967
Los Angeles (SC)	2018	T6 instate construction small	Aggregated	Aggregated	DSL	7945.850142	394667.3121	35922.87956	41.87394506
Los Angeles (SC)	2018	T6 instate heavy	Aggregated	Aggregated	DSL	8993.72683	1218914.862	103786.3607	123.4671959
Los Angeles (SC)	2018	T6 instate small	Aggregated	Aggregated	DSL	34935.24515	1709145.941	403147.8855	180.7063566
Los Angeles (SC)	2018	T6 OOS heavy	Aggregated	Aggregated	DSL	139.255167	28226.69154	2033.125439	2.720343488
Los Angeles (SC)	2018	T6 OOS small	Aggregated	Aggregated	DSL	73.55971787	3923.08972	1073.971881	0.399847658
Los Angeles (SC)	2018	T6 Public	Aggregated	Aggregated	DSL	4361.38266	66249.53074	13229.52739	8.75547011

Los Angeles (SC)	2018 T6 utility	Aggregated	Aggregated	DSL	969.7029462	16233.44127	11151.58388	1.844838912
Los Angeles (SC)	2018 T6TS	Aggregated	Aggregated	GAS	14396.12617	791158.0454	288037.6924	164.6862854
Los Angeles (SC)	2018 T7 Ag	Aggregated	Aggregated	DSL	4.476059052	132.8750216	19.69465983	0.024549724
Los Angeles (SC)	2018 T7 CAIRP	Aggregated	Aggregated	DSL	5038.353534	983516.1275	73559.9616	154.5333457
Los Angeles (SC)	2018 T7 CAIRP construction	Aggregated	Aggregated	DSL	561.2130513	110122.729	2537.222385	16.56184689
Los Angeles (SC)	2018 T7 NNOOS	Aggregated	Aggregated	DSL	5807.274037	1198958.303	84786.20095	182.2089288
Los Angeles (SC)	2018 T7 NOOS	Aggregated	Aggregated	DSL	1982.793403	386423.8259	28948.78368	62.0059478
Los Angeles (SC)	2018 T7 POLA	Aggregated	Aggregated	DSL	7420.321085	866877.3689	56394.44025	158.8841722
Los Angeles (SC)	2018 T7 Public	Aggregated	Aggregated	DSL	5241.142731	106203.7548	15898.13294	19.34850793
Los Angeles (SC)	2018 T7 Single	Aggregated	Aggregated	DSL	5505.705073	367334.5435	63535.07321	60.47853432
Los Angeles (SC)	2018 T7 single construction	Aggregated	Aggregated	DSL	3993.918596	273194.2358	18056.35069	44.10897393
Los Angeles (SC)	2018 T7 SWCV	Aggregated	Aggregated	DSL	2051.637213	83826.57238	8001.385132	41.46870509
Los Angeles (SC)	2018 T7 SWCV	Aggregated	Aggregated	NG	1900.523466	77453.03375	7412.041519	36.44976972
Los Angeles (SC)	2018 T7 tractor	Aggregated	Aggregated	DSL	10823.37144	1539152.798	137456.8172	237.8204874
Los Angeles (SC)	2018 T7 tractor construction	Aggregated	Aggregated	DSL	3219.187705	225361.1923	14553.82245	36.64821244
Los Angeles (SC)	2018 T7 utility	Aggregated	Aggregated	DSL	391.760251	7955.141759	4505.242887	1.353019232
Los Angeles (SC)	2018 T7IS	Aggregated	Aggregated	GAS	79.23283967	5894.676941	1585.290656	1.590190551
Los Angeles (SC)	2018 UBUS	Aggregated	Aggregated	GAS	445.5711954	32229.7446	1782.284782	7.960241864
Los Angeles (SC)	2018 UBUS	Aggregated	Aggregated	DSL	31.4305	3221.377108	125.722	0.569277383
Los Angeles (SC)	2018 UBUS	Aggregated	Aggregated	ELEC		12	1070.403311	48
Los Angeles (SC)	2018 UBUS	Aggregated	Aggregated	NG	4012.38417	424964.4125	16049.53668	106.4080125