
Appendix D. Energy Impact Analysis

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SUBJECT: TRANSIT VILLAGES DISTRICT AND SPECIFIC PLAN ENERGY TABLES

The following Energy Tables were prepared for the proposed Transit Villages District and Specific Plan development (referred to as “Project”) which is located in the City of Redlands.

CONSTRUCTION POWER COSTS

Based on the 2022 *National Construction Estimator* (1), the typical power cost per 1,000 square feet of building construction per month is estimated to be \$2.41. Table 1 estimates the total power cost of the on-site electricity usage during the construction of the proposed Project to be approximately \$358,391.40.

TABLE 1: PROJECT CONSTRUCTION POWER COST

Area	Power Cost (per 1,000 SF)	Size (1,000 SF)	Construction Duration (months)	Project Construction Power Cost
City Center Mixed-Use	\$2.41	148.430	14	\$5,008.03
Downtown Village Future Projects	\$2.41	252.070	18	\$10,934.80
New York Street Village	\$2.41	230.000	18	\$9,977.40
State Street Village	\$2.41	1,325.322	43	\$137,343.12
The Grand Apartments	\$2.41	149.000	14	\$5,027.26
University Village	\$2.41	1,160.000	68	\$190,100.80
CONSTRUCTION POWER COST				\$358,391.40

CONSTRUCTION ELECTRICITY USAGE

The SCE’s general service rate schedule were used to determine the Project’s electrical usage. As of January 1, 2022, SCE’s general service rate is \$0.13 per kilowatt hours (kWh) of electricity for commercial uses, \$0.17 per kWh of electricity of residential uses, and \$0.13 per kWh of electricity for street and area lighting (2), the total electricity usage from on-site Project construction related activities is estimated to be approximately 2,282,064 kWh.

TABLE 2: PROJECT CONSTRUCTION ELECTRICITY USAGE

Area	Project Construction Electricity Usage (kWh)
City Center Mixed-Use	30,299
Downtown Village Future Projects	71,290
New York Street Village	74,308
State Street Village	918,450
The Grand Apartments	29,830
University Village	1,157,886
CONSTRUCTION ELECTRICITY USAGE	2,282,064

CONSTRUCTION EQUIPMENT FUEL CONSUMPTION

Fuel consumption estimates are presented in Table 3. The aggregate fuel consumption rate for all equipment is estimated at 18.5 hp-hr-gal., obtained from California Air Resources Board (CARB) 2018 Emissions Factors Tables and cited fuel consumption rate factors presented in Table D-24 of the Moyer guidelines (3). For the purposes of this analysis, the calculations are based on all construction equipment being diesel-powered which is standard practice consistent with industry standards. Diesel fuel would be supplied by existing commercial fuel providers serving the City and region. As presented in Table 3, Project construction activities would consume an estimated 661,217 gallons of diesel fuel.

TABLE 3: CONSTRUCTION EQUIPMENT FUEL CONSUMPTION ESTIMATES (1 OF 6)

Construction Activity	Duration (Days)	Equipment	HP Rating	Quantity	Usage Hours	Load Factor	HP-hrs/day	Total Fuel Consumption
City Center Mixed-Use								
Demolition	20	Concrete/Industrial Saws	81	1	8	0.73	473	511
		Excavators	158	3	8	0.38	1,441	1,558
		Rubber Tired Dozers	247	2	8	0.4	1,581	1,709
Site Preparation	10	Crawler Tractors	212	4	8	0.43	2,917	1,577
		Rubber Tired Dozers	247	3	8	0.4	2,371	1,282
Grading	20	Crawler Tractors	212	3	8	0.43	2,188	2,365
		Excavators	158	1	8	0.38	480	519
		Graders	187	1	8	0.41	613	663
		Rubber Tired Dozers	247	1	8	0.4	790	854
Building Construction	230	Cranes	231	1	8	0.29	536	6,663
		Forklifts	89	3	8	0.2	427	5,311
		Generator Sets	84	1	8	0.74	497	6,182
		Tractors/Loaders/Backhoes	97	3	8	0.37	861	10,709
		Welders	46	1	8	0.45	166	2,059
Paving	20	Pavers	130	2	8	0.42	874	944
		Paving Equipment	132	2	8	0.36	760	822
		Rollers	80	2	8	0.38	486	526
Architectural Coating	20	Air Compressors	78	1	8	0.48	300	324

TABLE 3: CONSTRUCTION EQUIPMENT FUEL CONSUMPTION ESTIMATES (2 OF 6)

Construction Activity	Duration (Days)	Equipment	HP Rating	Quantity	Usage Hours	Load Factor	HP-hrs/day	Total Fuel Consumption
Downtown Village								
Demolition	20	Concrete/Industrial Saws	81	1	8	0.73	473	511
		Excavators	158	3	8	0.38	1,441	1,558
		Rubber Tired Dozers	247	2	8	0.4	1,581	1,709
Site Preparation	10	Crawler Tractors	212	4	8	0.43	2,917	1,577
		Rubber Tired Dozers	247	3	8	0.4	2,371	1,282
Grading	30	Crawler Tractors	212	2	8	0.43	1,459	2,365
		Excavators	158	2	8	0.38	961	1,558
		Graders	187	1	8	0.41	613	995
		Rubber Tired Dozers	247	1	8	0.4	790	1,282
		Scrapers	367	2	8	0.48	2,819	4,571
Building Construction	300	Cranes	231	1	8	0.29	536	8,691
		Forklifts	89	3	8	0.2	427	6,928
		Generator Sets	84	1	8	0.74	497	8,064
		Tractors/Loaders/Backhoes	97	3	8	0.37	861	13,968
		Welders	46	1	8	0.45	166	2,685
Paving	20	Pavers	130	2	8	0.42	874	944
		Paving Equipment	132	2	8	0.36	760	822
		Rollers	80	2	8	0.38	486	526
Architectural Coating	20	Air Compressors	78	1	8	0.48	300	324

TABLE 3: CONSTRUCTION EQUIPMENT FUEL CONSUMPTION ESTIMATES (3 OF 6)

Construction Activity	Duration (Days)	Equipment	HP Rating	Quantity	Usage Hours	Load Factor	HP-hrs/day	Total Fuel Consumption
New York Street Village								
Demolition	20	Concrete/Industrial Saws	81	1	8	0.73	473	511
		Excavators	158	3	8	0.38	1,441	1,558
		Rubber Tired Dozers	247	2	8	0.4	1,581	1,709
Site Preparation	10	Crawler Tractors	212	4	8	0.43	2,917	1,577
		Rubber Tired Dozers	247	3	8	0.4	2,371	1,282
Grading	30	Crawler Tractors	212	2	8	0.43	1,459	2,365
		Excavators	158	2	8	0.38	961	1,558
		Graders	187	1	8	0.41	613	995
		Rubber Tired Dozers	247	1	8	0.4	790	1,282
		Scrapers	367	2	8	0.48	2,819	4,571
Building Construction	300	Cranes	231	1	8	0.29	536	8,691
		Forklifts	89	3	8	0.2	427	6,928
		Generator Sets	84	1	8	0.74	497	8,064
		Tractors/Loaders/Backhoes	97	3	8	0.37	861	13,968
		Welders	46	1	8	0.45	166	2,685
Paving	20	Pavers	130	2	8	0.42	874	944
		Paving Equipment	132	2	8	0.36	760	822
		Rollers	80	2	8	0.38	486	526
Architectural Coating	20	Air Compressors	78	1	8	0.48	300	324

TABLE 3: CONSTRUCTION EQUIPMENT FUEL CONSUMPTION ESTIMATES (4 OF 6)

Construction Activity	Duration (Days)	Equipment	HP Rating	Quantity	Usage Hours	Load Factor	HP-hrs/day	Total Fuel Consumption
State Street Village								
Demolition	84	Concrete/Industrial Saws	81	2	8	0.73	946	4,296
		Excavators	158	5	8	0.38	2,402	10,905
		Rubber Tired Dozers	247	3	8	0.4	2,371	10,767
Site Preparation	125	Crawler Tractors	97	4	8	0.43	1,335	9,018
		Rubber Tired Dozers	247	3	8	0.4	2,371	16,022
Grading	130	Crawler Tractors	97	2	8	0.43	667	4,690
		Excavators	158	3	8	0.38	1,441	10,126
		Graders	187	1	8	0.41	613	4,310
		Rubber Tired Dozers	247	1	8	0.4	790	5,554
		Scrapers	367	2	8	0.48	2,819	19,806
Building Construction	865	Cranes	231	1	8	0.29	536	25,058
		Forklifts	89	3	8	0.2	427	19,974
		Generator Sets	84	1	8	0.74	497	23,251
		Tractors/Loaders/Backhoes	97	3	8	0.37	861	40,274
		Welders	46	1	8	0.45	166	7,743
Paving	125	Pavers	130	2	8	0.42	874	5,903
		Paving Equipment	132	2	8	0.36	760	5,137
		Rollers	80	2	8	0.38	486	3,286
Architectural Coating	125	Air Compressors	78	1	8	0.48	300	2,024

TABLE 3: CONSTRUCTION EQUIPMENT FUEL CONSUMPTION ESTIMATES (5 OF 6)

Construction Activity	Duration (Days)	Equipment	HP Rating	Quantity	Usage Hours	Load Factor	HP-hrs/day	Total Fuel Consumption
The Grand Apartments								
Demolition	20	Concrete/Industrial Saws	81	1	8	0.73	473	511
		Excavators	158	3	8	0.38	1,441	1,558
		Rubber Tired Dozers	247	2	8	0.4	1,581	1,709
Site Preparation	10	Crawler Tractors	212	4	8	0.43	2,917	1,577
		Rubber Tired Dozers	247	3	8	0.4	2,371	1,282
Grading	20	Crawler Tractors	212	3	8	0.43	2,188	2,365
		Excavators	158	1	8	0.38	480	519
		Graders	187	1	8	0.41	613	663
		Rubber Tired Dozers	247	1	8	0.4	790	854
Building Construction	230	Cranes	231	1	8	0.29	536	6,663
		Forklifts	89	3	8	0.2	427	5,311
		Generator Sets	84	1	8	0.74	497	6,182
		Tractors/Loaders/Backhoes	97	3	8	0.37	861	10,709
		Welders	46	1	8	0.45	166	2,059
Paving	20	Pavers	130	2	8	0.42	874	944
		Paving Equipment	132	2	8	0.36	760	822
		Rollers	80	2	8	0.38	486	526
Architectural Coating	20	Air Compressors	78	1	8	0.48	300	324

TABLE 3: CONSTRUCTION EQUIPMENT FUEL CONSUMPTION ESTIMATES (6 OF 6)

Construction Activity	Duration (Days)	Equipment	HP Rating	Quantity	Usage Hours	Load Factor	HP-hrs/day	Total Fuel Consumption
University Village								
Demolition	70	Concrete/Industrial Saws	81	1	8	0.73	473	1,790
		Excavators	158	3	8	0.38	1,441	5,452
		Rubber Tired Dozers	247	2	8	0.4	1,581	5,981
Site Preparation	40	Crawler Tractors	212	4	8	0.43	2,917	6,307
		Rubber Tired Dozers	247	3	8	0.4	2,371	5,127
Grading	110	Crawler Tractors	212	2	8	0.43	1,459	8,673
		Excavators	158	2	8	0.38	961	5,712
		Graders	187	1	8	0.41	613	3,647
		Rubber Tired Dozers	247	1	8	0.4	790	4,700
		Scrapers	367	2	8	0.48	2,819	16,759
Building Construction	1110	Cranes	231	1	8	0.29	536	32,155
		Forklifts	89	3	8	0.2	427	25,632
		Generator Sets	84	1	8	0.74	497	29,837
		Tractors/Loaders/Backhoes	97	3	8	0.37	861	51,682
		Welders	46	1	8	0.45	166	9,936
Paving	75	Pavers	130	2	8	0.42	874	3,542
		Paving Equipment	132	2	8	0.36	760	3,082
		Rollers	80	2	8	0.38	486	1,972
Architectural Coating	75	Air Compressors	78	1	8	0.48	300	1,214
CONSTRUCTION FUEL DEMAND (GALLONS DIESEL FUEL)								661,217

CONSTRUCTION WORKER FUEL ESTIMATES

For purposes of analysis, it is assumed that 50% of all worker trips are from light-duty-auto vehicles (LDA), 25% are from light-duty-trucks with a gross vehicle weight rating (GVWR) of less than 6,000 lbs. and equivalent test weight (ETW) of less than or equal to 3,750 lbs (LDT1), and 25% are from light-duty-trucks with a GVWR of less than 6,000 lbs. and ETW between 3,751 lbs. and 5,750 lbs (LDT2). Data regarding Project related construction worker trips were based on CalEEMod 2020.4.0 model defaults utilized within the AQIA. Vehicle fuel efficiencies for LDAs, LDT1s, and LDT2s were estimated using information generated within the 2017 version of the EMFAC developed by the CARB.

Table 4 provides an estimated annual fuel consumption resulting from the Project generated by LDAs, LDT1s, and LDT2s related to construction worker trips. Based on Table 4, it is estimated that 864,212 gallons of fuel will be consumed related to construction worker trips during full construction of the proposed Project.

TABLE 4: CONSTRUCTION WORKER FUEL CONSUMPTION ESTIMATES (1 OF 2)

Area	Duration (Days)	Worker Trips/Day	Trip Length (miles)	VMT	Estimated Fuel Consumption (gallons)
LDA					
City Center Mixed-Use	320	115	14.7	187,425	5,753
Downtown Village	400	206	14.7	336,777	10,279
New York Street Village	400	278	14.7	484,071	14,773
State Street Village	1,454	1,681	14.7	5,096,931	149,865
The Grand Apartments	582	193	14.7	454,406	13,943
University Village	1,480	2,110	14.7	6,587,144	188,263
LDT1					
City Center Mixed-Use	320	59	14.7	93,933	3,423
Downtown Village	400	105	14.7	170,814	6,193
New York Street Village	400	140	14.7	242,256	8,782
State Street Village	1,454	843	14.7	2,550,920	89,499
The Grand Apartments	582	141	14.7	393,872	14,345
University Village	1,480	1,056	14.7	3,294,417	112,719

TABLE 4: CONSTRUCTION WORKER FUEL CONSUMPTION ESTIMATES (2 OF 2)

Area	Duration (Days)	Worker Trips/Day	Trip Length (miles)	VMT	Estimated Fuel Consumption (gallons)
LDT2					
City Center Mixed-Use	320	59	14.7	93,933	3,633
Downtown Village	400	105	14.7	170,814	6,563
New York Street Village	400	140	14.7	242,256	9,307
State Street Village	1,454	843	14.7	2,550,920	94,017
The Grand Apartments	582	141	14.7	393,872	15,225
University Village	1,480	1,056	14.7	3,294,417	117,631
TOTAL CONSTRUCTION WORKER FUEL CONSUMPTION					864,212

CONSTRUCTION VENDOR/HAULING FUEL ESTIMATES

It is assumed that 50% of all vendor trips are from Medium-Heavy-Duty-Trucks (MHDT), 50% are from Heavy-Heavy-Duty Trucks (HHDT), and 100% of hauling trips are from HHDTs. These assumptions are consistent with the CalEEMod 2020.4.0 defaults utilized within the within the AQIA. Vehicle fuel efficiencies for MHDTs and HHDTs were estimated using information generated within EMFAC2017.

Table 5 shows the estimated fuel economy of MHDTs and HHDTs accessing the Project site. Based on Table 5, fuel consumption from construction trips will total approximately 291,668 gallons.

TABLE 5: CONSTRUCTION VENDOR/HAULING FUEL CONSUMPTION ESTIMATES (1 OF 2)

Area	Duration (Days)	Vendor/Hauling Trips/Day	Trip Length (miles)	VMT	Average Vehicle Fuel Economy (mpg)
MHDT					
City Center Mixed-Use	320	8	6.9	12,696	1,333
Downtown Village	386	16	6.9	6,182	639
New York Street Village	400	28	6.9	10,819	1,118
State Street Village	865	352	6.9	525,228	53,893
The Grand Apartments	346	28	6.9	44,436	4,666
University Village	1,110	455	6.9	497,835	50,213

TABLE 5: CONSTRUCTION VENDOR/HAULING FUEL CONSUMPTION ESTIMATES (2 OF 2)

Area	Duration (Days)	Vendor/ Hauling Trips/Day	Trip Length (miles)	VMT	Average Vehicle Fuel Economy (mpg)
HHDT (Vendor)					
City Center Mixed-Use	320	8	6.9	12,696	1,839
Downtown Village	386	16	6.9	6,182	884
New York Street Village	400	28	6.9	10,819	1,547
State Street Village	865	352	6.9	525,228	74,538
The Grand Apartments	346	28	6.9	44,436	6,436
University Village	1,110	455	6.9	497,835	69,478
HHDT (Hauling)					
City Center Mixed-Use	320	0	20	0	0
Downtown Village	386	0	20	0	0
New York Street Village	400	0	20	0	0
State Street Village	865	104	20	171,840	25,085
The Grand Apartments	346	0	20	0	0
University Village	1,110	0	20	0	0
TOTAL CONSTRUCTION VENDOR/HAULING FUEL CONSUMPTION					291,668

TRANSPORTATION ENERGY DEMANDS

Energy that would be consumed by Project-generated traffic is a function of total VMT and estimated vehicle fuel economies of vehicles accessing the Project site. Table 6 presents the estimated annual fuel consumption from project-generated traffic.

TABLE 6: PROJECT-GENERATED TRAFFIC ANNUAL FUEL CONSUMPTION

Area	Annual VMT	Estimated Annual Fuel Consumption (gallons)
City Center Mixed-Use	2,729,821	102,440
Downtown Village	8,226,402	308,706
New York Street Village	8,446,360	316,960
State Street Village	4,191,505	145,892
The Grand Apartments	2,324,950	87,247
University Village	17,171,689	574,733
TOTAL FUEL CONSUMPTION	43,090,727	1,535,977

FACILITY ENERGY DEMANDS

Project building operations and Project site maintenance activities would result in the consumption of natural gas and electricity. Natural gas would be supplied to the Project by Southern California Gas (SoCalGas) and electricity would be supplied to the Project by SCE. Annual natural gas and electricity demands of the Project are summarized in Table 7.

TABLE 7: PROJECT ANNUAL OPERATIONAL NATURAL GAS AND ELECTRICITY DEMAND SUMMARY

Area	Natural Gas Demand (kBtu/year)	Electricity Demand (kWh/year)
City Center Mixed-Use	2,207,321	693,553
Downtown Village	2,931,934	1,809,216
New York Street Village	5,035,670	3,452,534
State Street Village	17,537,640	7,847,988
The Grand Apartments	2,364,910	601,650
University Village	17,105,100	5,660,420
TOTAL PROJECT ENERGY DEMAND	47,182,575	20,065,361

REFERENCES

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<https://www.sce.com/regulatory/tariff-books/rates-pricing-choices>.
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