

Appendix C

Energy Calculations

Assessment

Source: Construction Data Form, Confirmation of acreage from MB/KC on 4/2/2026, updated by MB on 5/5

[illegible][illegible]

Asphalt Paving			
Parameters	Amount	Notes/Comments	
Asphalt Site Area (acres) ¹	0.26	Asphalt/Gravel sub base and subgrade materials provided	
Site Area (ft ²)	0.1,423	Asphalt. Assume overcrossing is concrete paving	
Asphalt Depth (ft)	0.10	8" AC depth used	
Total Asphalt Volume (CY)	145		
Asphalt Truck Capacity (CY)	10		
Total Trucks Required ²	15		
Total Truck Trips (1000s)	15		
Site Area Truck (1000s) per Day	6		
Days of Hauling ³	18	TRUE	
Channel Retaining Walls - Materials			
Parameters	Amount	Notes/Comments	
Retaining Wall - Wall (CY)	415	Assume 12' average height, & 1.35 wall width channel walls for walls	
Retaining Wall Facing (CY)	400	Assume average facing cross area of 3.33 ft based on avg 12' high wall	
Retaining Wall Core (CY)	400		
Retaining Wall Capacity (CY) - Retaining Wall - Wall	10		
Retaining Wall Capacity (CY) - Retaining Wall Facing/Throat	10		
Retaining Wall Capacity - Forms, Rebar, etc.	6		
Total Trucks Required ²	41		
Total Truck Trips (1000s)	100		
Site Area Truck (1000s) per Day	18		
Days of Hauling ³	18	TRUE	
Overlapping Retaining Walls - Materials			
Parameters	Amount	Notes/Comments	
Retaining Wall - Wall (CY)	197	Assume concrete depth of 18" @ 12' ft	
Retaining Wall Facing (CY)	214	Assume average retaining wall height of 8'	
Retaining Wall Capacity (CY)	10	Assume facing cross section area of 8' @	
Retaining Wall Capacity - Forms, Rebar, etc.	6		
Total Trucks Required ²	41		
Total Truck Trips (1000s)	100		
Site Area Truck (1000s) per Day	18		
Days of Hauling ³	18	TRUE	
Concrete Wall Bridge - Materials			
Parameters	Amount	Notes/Comments	
Concrete Deck & Barrier (CY)	176		
Concrete Deck (CY)	100		
Concrete Deck Capacity (CY) - Concrete Deck & Barrier	10		
Concrete Deck Capacity (CY) - Concrete Deck	10		
Concrete Deck Capacity - Forms, Rebar, etc.	6		
Total Trucks Required ²	41		
Total Truck Trips (1000s)	100		
Site Area Truck (1000s) per Day	18		
Days of Hauling ³	18	TRUE	
Unreinforced Stone Bridge - Materials			
Parameters	Amount	Notes/Comments	
Unreinforced Stone Bridge (CY)	1		
Unreinforced Stone Bridge Capacity (CY)	1		
Total Trucks Required ²	1		
Total Truck Trips (1000s)	1		
Site Area Truck (1000s) per Day	1		
Days of Hauling ³	1	TRUE	
Reinforced Concrete Paving - Materials			
Parameters	Amount	Notes/Comments	
Reinforced Concrete Slab Thickness (ft)	0.10	Includes existing slabwork & driveway. Assumes 4" depth	
Reinforced Concrete Thickness (ft)	0.10	Assumes 4" depth	
Reinforced Concrete (CY)	10		
Reinforced Concrete Capacity (CY)	1		
Total Trucks Required ²	1		
Total Truck Trips (1000s)	1		
Site Area Truck (1000s) per Day	1		
Days of Hauling ³	1	TRUE	

Aggregate Base (AB) Material			
Parameters	Amount	Notes/Comments	
AB Site Area (acres) ¹	0.26		
AB Site Area (ft ²)	0.1,423		
AB Depth (ft)	0.10		
Total AB Volume (CY)	145		
AB Truck Capacity (CY)	10		
Total Trucks Required ²	15		
Total Truck Trips (1000s)	15		
Site Area Truck (1000s) per Day	6		
Days of Hauling ³	18	TRUE	

Notes:
1 Construction data used and data requested from client.
2 Construction materials data used and Requested from client.
3 Assuming 100% hauling to and from Project location (100% / 100%)
4 Hours of Hauling

Off-Road Heavy-Duty Construction Equipment - Maximum Day

Construction Phase	CalEEMod Equipment Category	No. of Heavy-Duty Equipment	No. of hours/day	Hours of Operation/Week Per Equipment	Emissions Tier Rating or Fuel (After Mitigation if needed)	Notes/Comments
Demolition	Crushing/Processing Equip.	1	8	40	Average	*Diesel Equip used, Load, HP, and emission factor taken from CalEEMod 2020 Appendix D. Modeled separately due to caleemod error where it did not calculate the emissions.
	Excavators	1	8	40	Average	
	Skid Steer Loader	1	8	40	Average	
	Concrete/Industrial Saws	2	8	40	Average	
		5				
Asphalt Paving	Cement/Mortar Mixers	2	8	40	Average	
	Pavers	1	8	40	Average	
	Paving Equipment	1	8	40	Average	
	Rollers	1	8	40	Average	
	Graders	1	8	40	Average	
	Scrapers	1	8	40	Average	
	Excavators	1	8	40	Average	
	Skid Steer Loader	1	8	40	Average	
	Plate Compactors	2	8	40	Average	
	Rubber Tired Dozers	1	8	40	Average	
	Tractors/Loaders/Backhoes	2	8	40	Average	
		14				
Channel Retaining Walls	Cement/Mortar Mixers	2	8	40	Average	
	Pumps	2	8	40	Average	
	Trenchers	2	8	40	Average	
	Plate Compactors	2	8	40	Average	
	Excavators	1	8	40	Average	
	Skid Steer Loader	1	8	40	Average	
	Tractors/Loaders/Backhoes	2	8	40	Average	
		12				
Overcrossing Retaining Wall	Cement/Mortar Mixers	2	8	40	Average	
	Pumps	2	8	40	Average	
	Trenchers	2	8	40	Average	
	Plate Compactors	2	8	40	Average	
	Excavators	1	8	40	Average	
	Skid Steer Loader	1	8	40	Average	
	Tractors/Loaders/Backhoes	2	8	40	Average	
		12				
Concrete Slab Bridge	Cement/Mortar Mixers	2	8	40	Average	
	Pumps	1	8	40	Average	
	Bore/Drill Rig	1	8	40	Average	
	Excavators	1	8	40	Average	
	Skid Steer Loader	1	8	40	Average	
	Plate Compactors	2	8	40	Average	
	Tractors/Loaders/Backhoes	2	8	40	Average	
		10				
Prefabricated Truss Bridge	Crane	1	8	40	Average	
	Welder	2	8	40	Average	
Roadway Concrete Paving	Cement/Mortar Mixers	2	8	40	Average	
	Pumps	1	8	40	Average	
	Sweepers/Scrubbers	1	8	40	Average	

IBC Multi-Use Trail Barranca Trail
Construction Energy Analysis

Annual Fuel Summary

Heavy-Duty Construction Equipment	
32,666	Total Project Consumption
23,517	Annual Consumption
Haul Trucks	
10,174	Total Project Consumption
7,324	Annual Consumption
Vendor Trucks	
788	Total Project Consumption
568	Annual Consumption
Workers	
5,733	Total Project Consumption
4,127	Annual Consumption
10,962	Project Consumption of diesel for Haul Trucks and Vendors
7,892	Annual Consumption
43,629	Total Gallons Diesel
5,733	Total Gallons Gasoline

1.39 Estimated Project Construction Duration (years)

31,409 Annual Average Gallons Diesel
4,127 Annual Average Gallons Gasoline

Orange County			Percent of Annual Project Compared to Orange County
Source	Fuel Type	Gallons	
Workers	Gasoline	32,000,000	0.013%
Off-Road/Vendor/Haul Trucks	Diesel	7,000,000	0.449%

Notes:

1 Gasoline and diesel amounts from CEC, 2025. Available: <https://www.energy.ca.gov/data-reports/energy-almanac/transportation-energy/california-retail-fuel-outlet-annual-reporting>

Annual Electricity Summary

Temporary Construction Trailer - Electricity	40,936 kWh/year
Water Conveyance for Dust Control	1,463 kWh/year
Total	42,399 kWh/year

78,612,000,000 | Total SCE, 2025
0.00000005% Project percentage of SCE

Site	Source	Acreage/Day	Number of Days	Total Construction Water Use (Mgal)	Electricity Demand from Water Conveyance (MWh)	Annual Electricity Demand from Water Conveyance (MWh)
Project Site	Demolition	0.815	16	0.039	0.3	0.2
Project Site	Asphalt Paving	0.815	26	0.064	0.4	0.3
Maintenance Access Road Improvements	Channel Retaining Walls	0.262	84	0.066	0.4	0.3
Overcrossing - Concrete Bridge, Truss Bridge	Overcrossing Retaining Wall	0.267	88	0.070	0.5	0.3
Overcrossing - Concrete Bridge, Truss Bridge	Concrete Slab Bridge	0.267	74	0.059	0.4	0.3
Total				0.298	2.0	1.5
CalEEMod Water Electricity Factors		Electricity Intensity Factor To Supply (kWh/Mgal)	Electricity Intensity Factor To Treat (kWh/Mgal)	Electricity Intensity Factor To Distribute (kWh/Mgal)	Electricity Intensity Factor For Wastewater Treatment (kWh/Mgal)	
		3044	725	1537	1501	

Sources and Assumptions:

CalEEMod Appendix G, Table G-32

-Electricity Intensity Factors - California Emissions Estimator Model (CalEEMod).

-Estimated construction water use assumed to be generally equivalent to landscape irrigation, based on a factor of 20.94 gallons per year per square foot of landscaped area within the Los Angeles area (Mediterranean climate), which assumes high water demand landscaping materials and an irrigation system efficiency of 85%. Factor is therefore $(20.94 \text{ GAL/SF/year}) \times (43,560 \text{ SF/acre}) / (365 \text{ days/year}) / (0.85) = 2,940 \text{ gallons/acre/day}$, rounded up to 3,000 gallons/acre/day.

(U.S. Department of Energy, Energy Efficiency & Renewable Energy, Federal Energy Management Program. "Guidelines for Estimating Unmetered Landscaping Water Use." July 2010. Page 12, Table 4 - Annual Irrigation Factor – Landscaped Areas with High Water Requirements).

IBC Multi-Use Trail Barranca Trail
Construction Energy Analysis

Temporary Construction Trailer - Electricity

Land Use	Square Feet	Energy Use per year (kWh)	Total Energy Use (kWh)	Energy Use per SF
General Office	2,000	40,936	56,862.06	20.5
Note: Energy use per sf is derived from CalEEMod User Guide, Appendix G, Table G-28 for the Statewide average for General Office Building land use				

**IBC Multi-Use Trail Barranca Trail
Construction Energy Analysis
Off-Road Equipment**

Equipment ≤ 100 hp

pounds diesel fuel/hp-hr (lb/hp-hr): ¹	0.408 lb/hp-hr
diesel density (lb/gal): ¹	7.11 lb/gal
diesel gallons/hp-hr:	0.0574 gal/hp-hr
Total hp-hr:	450,110 hp-hr
Total diesel gallons:	25,833 gal

Equipment > 100 hp

pounds diesel fuel/hp-hr (lb/hp-hr): ¹	0.367 lb/hp-hr
diesel density (lb/gal): ¹	7.11 lb/gal
diesel gallons/hp-hr:	0.0516 gal/hp-hr
Total hp-hr:	132,364 hp-hr
Total diesel gallons:	6,833 gal

Total diesel gallons (off-road equipment): 32,666 gal

[1. OFFROAD2017 Emission Factor Documentation](#)

Construction Phase	Equipment	Fuel Type	Number	Hours/Day	HP	Load	Days	Total hp-hr	
Demolition	Excavators	Diesel	1	8	36	0.38	23	2,517	
Demolition	Skid Steer Loaders	Diesel	1	8	71	0.37	23	4,834	
Demolition	Concrete/Industrial Saws	Diesel	2	8	33	0.73	23	8,865	
Demolition	Crushing/Proc. Equipment	Diesel	1	8	85	0.78	23	12,199	
Asphalt Paving	Cement and Mortar Mixers	Diesel	2	8	10	0.56	19	1,702	
Asphalt Paving	Pavers	Diesel	1	8	81	0.42	19	5,171	
Asphalt Paving	Paving Equipment	Diesel	1	8	89	0.36	19	4,870	
Asphalt Paving	Rollers	Diesel	1	8	36	0.38	19	2,079	
Asphalt Paving	Graders	Diesel	1	8	148	0.41	19	9,223	
Asphalt Paving	Scrapers	Diesel	1	8	423	0.48	19	30,862	
Asphalt Paving	Excavators	Diesel	1	8	36	0.38	19	2,079	
Asphalt Paving	Skid Steer Loaders	Diesel	1	8	71	0.37	19	3,993	
Asphalt Paving	Plate Compactors	Diesel	2	8	8	0.43	19	1,046	
Asphalt Paving	Rubber Tired Dozers	Diesel	1	8	367	0.4	19	22,314	
Asphalt Paving	Tractors/Loaders/Backhoes	Diesel	2	8	84	0.37	19	9,448	
Channel Retaining Walls	Cement and Mortar Mixers	Diesel	2	8	10	0.56	84	7,526	
Channel Retaining Walls	Pumps	Diesel	2	8	11	0.74	84	10,940	
Channel Retaining Walls	Trenchers	Diesel	2	8	40	0.5	84	26,880	
Channel Retaining Walls	Plate Compactors	Diesel	2	8	8	0.43	84	4,623	
Channel Retaining Walls	Excavators	Diesel	1	8	36	0.38	84	9,193	
Channel Retaining Walls	Skid Steer Loaders	Diesel	1	8	71	0.37	84	17,653	
Channel Retaining Walls	Tractors/Loaders/Backhoes	Diesel	2	8	84	0.37	84	41,772	
Prefab Truss Bridge	Cranes	Diesel	1	8	367	0.29	32	27,246	
Prefab Truss Bridge	Welders	Diesel	2	8	46	0.45	32	10,598	
Overcrossing Retaining Wall	Cement and Mortar Mixers	Diesel	2	8	10	0.56	88	7,885	
Overcrossing Retaining Wall	Pumps	Diesel	2	8	11	0.74	88	11,461	
Overcrossing Retaining Wall	Trenchers	Diesel	2	8	40	0.5	88	28,160	
Overcrossing Retaining Wall	Plate Compactors	Diesel	2	8	8	0.43	88	4,844	
Overcrossing Retaining Wall	Excavators	Diesel	1	8	36	0.38	88	9,631	
Overcrossing Retaining Wall	Skid Steer Loaders	Diesel	1	8	71	0.37	88	18,494	
Overcrossing Retaining Wall	Tractors/Loaders/Backhoes	Diesel	2	8	84	0.37	88	43,761	
Overcrossing Retaining Wall	Graders	Diesel	1	8	148	0.41	88	42,719	
Concrete Slab Bridge	Cement and Mortar Mixers	Diesel	2	8	10	0.56	74	6,630	
Concrete Slab Bridge	Pumps	Diesel	1	8	11	0.74	74	4,819	
Concrete Slab Bridge	Bore/Drill Rigs	Diesel	1	8	83	0.5	74	24,568	
Concrete Slab Bridge	Excavators	Diesel	1	8	36	0.38	74	8,099	
Concrete Slab Bridge	Skid Steer Loaders	Diesel	1	8	71	0.37	74	15,552	
Concrete Slab Bridge	Plate Compactors	Diesel	2	8	8	0.43	74	4,073	
Concrete Slab Bridge	Tractors/Loaders/Backhoes	Diesel	2	8	84	0.37	74	36,799	
Concrete Slab Bridge	Pavers	Diesel	1	7	81	0.42	74	17,622	
Concrete Slab Bridge	Rollers	Diesel	1	7	36	0.38	74	7,086	
Roadway Concrete Paving	Cement and Mortar Mixers	Diesel	2	8	10	0.56	44	3,942	
Roadway Concrete Paving	Pumps	Diesel	1	8	11	0.74	44	2,865	
Roadway Concrete Paving	Sweepers/Scrubbers	Diesel	1	8	36	0.46	44	5,829	
								-	
								Total - >100 hp	132,364
								Total - <100 hp	450,110

IBC Multi-Use Trail Barranca Creek
Total On-Road Fuel Consumption

gal/mile		
2028Hauling	Hauling	0.15847566
2028Vendor	Vendor	0.13432209
2028Worker	Worker	0.03400426
2029Hauling	Hauling	0.15620441
2029Vendor	Vendor	0.13292736
2029Worker	Worker	0.0334204

Construction Phase	Daily One-Way Trips	Haul Days per Phase (days)	Work Hours per Day (hours/day)	One-Way Trip Distance per Day (miles)	Idling per Day (minutes)	Regional Emissions (gallons)		
						gal/mile	gal/day	Total Gallons/yr
Barranca Trail								
<u>Demolition</u>	2028							
Hauling	6	23	8	25	15	0.16	24	547
Vendor	2	23	8	10.2	15	0.13	3	63
Worker	14	23	8	18.5	0	0.03	9	203
<u>Asphalt Paving - Material Trucks Asphalt</u>	2028							
Hauling	4	10	8	25	15	0.16	16	158
Vendor	0	10	8	10.2	15	0.13	0	0
Worker	0	10	8	18.5	0	0.03	0	0
<u>Asphalt Paving - Material Trucks AE</u>	2028							
Hauling	22	2	8	25	15	0.16	87	174
Vendor	0	2	8	10.2	15	0.13	0	0
Worker	0	2	8	18.5	0	0.03	0	0
<u>Asphalt Paving - Grading Trucks</u>	2028							
Hauling	10	10	8	25	15	0.16	40	396
Vendor	0	10	8	10.2	15	0.13	0	0
Worker	0	10	8	18.5	0	0.03	0	0
<u>Asphalt Paving</u>	2028							
Hauling	0	19	8	25	15	0.16	0	0
Vendor	2	19	8	10.2	15	0.13	3	52
Worker	36	19	8	18.5	0	0.03	23	430
Maintenance Access Road								
<u>Channel Retaining Walls - Material Trucks</u>	2028							
Hauling	10	20	8	25	15	0.16	40	792
Vendor	0	20	8	10.2	15	0.13	0	0
Worker	0	20	8	18.5	0	0.03	0	0
<u>Channel Retaining Walls - Grading Trucks</u>	2028							
Hauling	66	20	8	25	15	0.16	261	5,230
Vendor	0	20	8	10.2	15	0.13	0	0
Worker	0	20	8	18.5	0	0.03	0	0
<u>Channel Retaining Walls</u>	2028							
Hauling	0	84	8	25	15	0.16	0	0
Vendor	2	84	8	10.2	15	0.13	3	230
Worker	30	84	8	18.5	0	0.03	19	1,585
Overcrossing								
<u>Overcrossing Retaining Wall - Material Trucks</u>	2028							
Hauling	6	25	8	25	15	0.16	24	594
Vendor	0	25	8	10.2	15	0.13	0	0
Worker	0	25	8	18.5	0	0.03	0	0
<u>Concrete Slab Bridge - Material Trucks</u>	2028							
Hauling	14	15	8	25	15	0.16	55	832
Vendor	0	15	8	10.2	15	0.13	0	0
Worker	0	15	8	18.5	0	0.03	0	0
<u>Prefab Truss Bridge</u>	2029							
Hauling	0	32	8	25	15	0.16	0	0
Vendor	0	32	8	10.2	15	0.13	0	0
Worker	8	32	8	18.5	0	0.03	5	158
<u>Overcrossing Retaining Wall</u>	2028							
Hauling	0	88	8	25	15	0.16	0	0
Vendor	2	88	8	10.2	15	0.13	3	241
Worker	34	88	8	18.5	0	0.03	21	1,882
<u>Prefab Truss Bridge - Material Trucks</u>	2029							
Hauling	2	1	8	25	15	0.16	8	8
Vendor	0	1	8	10.2	15	0.13	0	0
Worker	0	1	8	18.5	0	0.03	0	0
<u>Overcrossing Retaining Wall - Grading Trucks</u>	2028							
Hauling	12	25	8	25	15	0.16	48	1,189
Vendor	0	25	8	10.2	15	0.13	0	0
Worker	0	25	8	18.5	0	0.03	0	0
<u>Concrete Slab Bridge - Grading Trucks</u>	2028							
Hauling	4	15	8	25	15	0.16	16	238
Vendor	0	15	8	10.2	15	0.13	0	0
Worker	0	15	8	18.5	0	0.03	0	0
<u>Concrete Slab Bridge</u>	2028							
Hauling	0	46	8	25	15	0.16	0	0
Vendor	2	46	8	10.2	15	0.13	3	126
Worker	26	46	8	18.5	0	0.03	16	752
<u>Concrete Slab Bridge</u>	2029							
Hauling	0	28	8	25	15	0.16	0	0
Vendor	2	28	8	10.2	15	0.13	3	76
Worker	26	28	8	18.5	0	0.03	16	450
Jamboree Road								
<u>Roadway Concrete Paving - Material Trucks</u>	2029							
Hauling	2	2	8	25	15	0.16	8	16
Vendor	0	2	8	10.2	15	0.13	0	0
Worker	0	2	8	18.5	0	0.03	0	0
<u>Roadway Concrete Paving</u>	2029							
Hauling	0	44	8	25	15	0.16	0	0
Vendor	0	44	8	10.2	15	0.13	0	0
Worker	10	44	8	18.5	0	0.03	6	272

Source	Fuel Type	Total Fuel Use (gal)
Hauling	Diesel	10,174
Vendor	Diesel	788
Worker	Gasoline	5,733
Fuel Type	Total Fuel Use	Annual Fuel Use
Diesel	10,962	7,892
Gasoline	5,733	4,127

Duration of Construction	
Start	1/3/2028
End	5/24/2029
1.4	years