

# Appendix ENG

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Energy Consumption Calculations

# 1919 Williams Street Warehouse Project

Last Updated: 1/24/2022

Compression-Ignition Engine Brake-Specific Fuel Consumption (BSFC) Factors [1]:

HP: 0 to 100	0.0588	HP: Greater than 100	0.0529
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Values above are expressed in gallons per horsepower-hour/BSFC.

## CONSTRUCTION EQUIPMENT

Construction Equipment	#	Hours per		Load Factor	Construction Phase	Fuel Used (gallons)
		Day	Horsepower			
Concrete/Industrial Saws	1	8	81	0.73	Demolition	1,223.10
Excavators	3	8	158	0.38	Demolition	3,275.21
Rubber Tired Dozers	2	8	247	0.4	Demolition	3,593.06
Rubber Tired Dozers	3	8	247	0.4	Site Preparation	5,389.59
Tractors/Loaders/Backhoes	4	8	97	0.37	Site Preparation	2,902.05
Excavators	1	8	158	0.38	Grading	1,117.13
Graders	1	8	187	0.41	Grading	1,426.55
Rubber Tired Dozers	1	8	247	0.4	Grading	1,838.31
Tractors/Loaders/Backhoes	3	8	97	0.37	Grading	2,227.15
Cranes	1	7	231	0.29	Building Construction	5,403.60
Forklifts	3	8	89	0.2	Building Construction	5,472.69
Generator Sets	1	8	84	0.74	Building Construction	6,370.46
Tractors/Loaders/Backhoes	3	7	97	0.37	Building Construction	9,655.22
Welders	1	8	46	0.45	Building Construction	2,121.44
Air Compressors	1	6	78	0.48	Architectural Coating	396.02
Pavers	2	8	130	0.42	Paving	1,015.91
Paving Equipment	2	8	132	0.36	Paving	884.17
Rollers	2	8	80	0.38	Paving	628.82
<b>Total Fuel Used</b>						<b>54,940.49</b>
						<b>(Gallons)</b>

Construction Phase	Days of Operation
Demolition Phase	44
Site Preparation Phase	43
Grading Phase	44
Building Construction Phase	218
Paving Phase	22
Architectural Coating Phase	30
<b>Total Days</b>	<b>401</b>

## WORKER TRIPS

Constuction Phase	MPG [2]	Trips	Trip Length (miles)	Fuel Used (gallons)
Demolition	24.4	15	10.8	292.13
Site Prep Phase	24.4	18	10.8	342.59

Grading Phase	24.4	15	10.8	292.13
Building Phase	24.4	175	10.8	16886.07
Paving Phase	24.4	15	10.8	146.07
Architectural Coating Phase	24.4	35	10.8	464.75
<b>Total</b>				<b>18,423.74</b>

**HAULING AND VENDOR TRIPS**

Trip Class	MPG [2]	Trips	Trip Length (miles)	Fuel Used (gallons)
<b>HAULING TRIPS</b>				
Demolition	7.5	1075	28.0	4013.33
Site Prep Phase	7.5	0	20.0	0.00
Grading Phase	7.5	0	20.0	0.00
Building Phase	7.5	0	20.0	0.00
Paving Phase	7.5	0	20.0	0.00
Architectural Coating Phase	7.5	0	20.0	0.00
<b>Total</b>				<b>4,013.33</b>

<b>VENDOR TRIPS</b>				
Demolition	7.5	0	7.3	0.00
Site Prep Phase	7.5	0	7.3	0.00
Grading Phase	7.5	0	7.3	0.00
Building Phase	7.5	69	7.3	14640.88
Paving Phase	7.5	0	7.3	0.00
Architectural Coating Phase	7.5	0	7.3	0.00
<b>Total</b>				<b>14,640.88</b>

<b>Total Gasoline Consumption (gallons)</b>	<b>18,423.74</b>
<b>Total Diesel Consumption (gallons)</b>	<b>73,594.70</b>

**Sources:**

[1] United States Environmental Protection Agency. 2018. *Exhaust and Crankcase Emission Factors for Nonroad Compression-Ignition Engines in MOVES2014b*. July 2018. Available at: <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockkey=P100UXEN.pdf>.

[2] United States Department of Transportation, Bureau of Transportation Statistics. 2019. *National Transportation Statistics 2019*. Available at: <https://www.bts.gov/topics/national-transportation-statistics>.

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Populate one of the following tables (Leave the other blank):

<b>Annual VMT</b>	<b>OR</b>	<b>Daily Vehicle Trips</b>
Annual VMT: 1,220,508		Daily Vehicle Trips: Average Trip Distance:

Fleet Class	Fleet Mix	Fuel Economy (MPG) [1]	
Light Duty Auto (LDA)	0.552821	Passenger Vehicles	24.4
Light Duty Truck 1 (LDT1)	0.058334	Light-Med Duty Trucks	17.9
Light Duty Truck 2 (LDT2)	0.189005	Heavy Trucks/Other	7.5
Medium Duty Vehicle (MDV)	0.121481	Motorcycles	44
Light Heavy Duty 1 (LHD1)	0.023262		
Light Heavy Duty 2 (LHD2)	0.005577		
Medium Heavy Duty (MHD)	0.010166		
Heavy Heavy Duty (HHD)	0.007476		
Other Bus (OBUS)	0.001000		
Urban Bus (UBUS)	0.000579		
Motorcycle (MCY)	0.026545		
School Bus (SBUS)	0.000826		
Motorhome (MH)	0.002928		

Fleet Mix					
Vehicle Type	Percent	Fuel Type	Annual VMT: VMT	Vehicle Trips: VMT	Fuel Consumption (Gallons)
Passenger Vehicles	55.28%	Gasoline	674722	0.00	27652.56
Light-Medium Duty Trucks	36.88%	Gasoline	450148	0.00	25147.92
Heavy Trucks/Other	5.18%	Diesel	63239	0.00	8431.92
Motorcycle	2.65%	Gasoline	32398	0.00	736.33

<b>Total Gasoline Consumption (gallons)</b>	<b>53536.81</b>
<b>Total Diesel Consumption (gallons)</b>	<b>8431.92</b>

Sources:

[1] United States Department of Transportation, Bureau of Transportation Statistics. 2019. National Transportation Statistics 2019. Available at: <https://www.bts.gov/topics/national-transportation-statistics>.

Equipment	Horsepower	Load Factor
Aerial Lifts	63	0.31
Air Compressors	78	0.48
Bore/Drill Rigs	221	0.5
Cement and Mortar Mixers	9	0.56
Concrete/Industrial Saws	81	0.73
Cranes	231	0.29
Crawler Tractors	212	0.43
Crushing/Proc. Equipment	85	0.78
Excavators	158	0.38
Forklifts	89	0.2
Generator Sets	84	0.74
Graders	187	0.41
Off-Highway Tractors	124	0.44
Off-Highway Trucks	402	0.38
Other Construction Equipment	172	0.42
Other General Industrial Equipment	88	0.34
Other Material Handling Equipment	168	0.4
Pavers	130	0.42
Paving Equipment	132	0.36
Plate Compactors	8	0.43
Pressure Washers	13	0.3
Pumps	84	0.74
Rollers	80	0.38
Rough Terrain Forklifts	100	0.4
Rubber Tired Dozers	247	0.4
Rubber Tired Loaders	203	0.36
Scrapers	367	0.48
Signal Boards	6	0.82
Skid Steer Loaders	65	0.37
Surfacing Equipment	263	0.3
Sweepers/Scrubbers	64	0.46
Tractors/Loaders/Backhoes	97	0.37
Trenchers	78	0.5
Welders	46	0.45