Appendix J: Energy Report

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DUBLIN BOULEVARD NORTH CANYONS PARKWAY EXTENSION ENERGY REPORT

Dublin, California

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Regulatory Background

This energy analysis has been prepared pursuant to the California Environmental Quality Act (CEQA). CEQA Appendix F requires that EIRs include a discussion of the potential energy impacts of proposed projects, with particular emphasis on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy. The purpose of this analysis is to compare the energy consumption impacts associated with the new proposed roadway extension. Relative energy consumption impacts are evaluated in terms of direct energy consumption, indirect energy consumption, and total energy consumption.

Affected Environment

In 2016, total energy use per person in the State of California was 199 million British thermal units (MBTU)[1], according to the 2016 census there are approximately 59,830 residents in the City of Dublin and 89,115 residents in the city of Livermore. This would equate to approximately 29,640 billion BTU's of energy consumption per year in the Dublin/Livermore area. According to the California Energy Commission, nearly half of the energy consumed in the state is used in transportation[2]. This project should decrease the amount of energy consumed by improving traffic flow. It is expected that the amount of energy consumed by the construction of this project will be a small percentage of the total energy consumed in the Dublin/Livermore area.

Project Description

The Build Alternative would include the extension of Dublin Boulevard approximately 1.5 miles eastward through eastern Dublin and an unincorporated portion of the County. The roadway extension would start from the current terminus of Dublin Boulevard at the Dublin Boulevard/Fallon Road intersection in Dublin and would end at the Doolan Road/North Canyons Parkway intersection along the boundary of the County and Livermore. This roadway extension would provide four to six travel lanes and bicycle and pedestrian facilities (i.e., sidewalks and bike lanes). Beginning at Fallon Road, the roadway extension would have six travel lanes (three in each direction). Continuing eastward, the roadway extension would narrow to four travel lanes (two in each direction) before intersecting with Croak Road. From Croak Road to Doolan Road, the roadway extension would remain in the four lane configuration. The permanent area needed for the project, including the roadway, sidewalks, intersections, and land acquired for right-of-way is estimated at 29 acres.

Project design features and components include (from west to east):

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[1] http://www.eia.gov/state/rankings/?sid=CA#series/12
[2] http://www.consumerenergycenter.org/transportation/index.html

- Intersection improvements at Fallon Road and the elimination of the existing intersection of Croak Road and Fallon Road
- Grading and earthwork northeast of the Dublin Boulevard/Fallon Road intersection, including grading at the base of the Livermore Hills, to allow for the roadway extension, and more minor grading throughout the road alignment to meet engineering and safety requirements
- Abandonment of a north-south (frontage road) portion of Croak Road parallel to Fallon Road
- The addition of a ”T” shaped hammerhead turnaround at the new terminus of Croak Road adjacent to Fallon Road
- Removal of overhead utility lines between Fallon Road and Croak Road
- Creation of a new signalized intersection between the Dublin Boulevard extension and Croak Road
- Construction of a new bridge over Cottonwood Creek
- Construction staging and laydown between the extension and Collier Canyon Road, along Doolan Road
- Intersection improvements at Doolan Road
- The extension of underground utility lines into the project site, within the paved areas of the proposed roadway extension
- Construction of the new roadway, which would include a median, inside shoulder, vehicle travel lanes, street bicycle facilities, a parkway strip and separated sidewalk or a separated Class I bike path/MUP, lighting, and cut/fill embankments
- Retaining walls may be use in addition to, or as an alternative to, cut/fill embankments associated with roadway and hillside grading. If used, retaining walls would be placed outside of the sidewalk and path areas on either side of the roadway cross section, within the construction footprint and within the permanent right-of-way. Retaining walls would measure 3 feet to 10 feet in height and would generally require a smaller area of grading or ground disturbance in comparison to cut/fill slopes.

Methodology

Traffic information used in the energy analysis was provided by a traffic report prepared for by Kittelson and Associates, Inc. Peak and off-peak traffic data was reported for existing (2013) and future (2040) traffic volumes. Energy consumption for the different roadway alternatives was calculated using fuel consumption factors provided by the computer program EMFAC2017 and guidelines set by Caltrans[3]. Consumption factors used for this analysis are listed in Appendix A. This report compares the existing energy consumption with the future energy consumption with project implementation.

[3] Energy and Transportation Systems, Caltrans Transportation Laboratory, Sacramento, CA, July 1983

Direct Energy

Direct energy is the amount of fuel consumed by vehicles over a given period of time. Factors that influence fuel consumption include: speed, grade, intersection delay time, traffic density (free flowing or congested) and changing fuel economy due to newer more fuel efficient vehicles on the road. The traffic report did not differentiate between truck and auto traffic, for the purpose of this report the same energy consumption factors were applied to all vehicles for all of the alternatives.

Indirect Energy

Indirect energy is the remaining energy consumed to construct, operate and maintain the proposed project alternative. Indirect energy also includes the manufacture and maintenance of vehicles using the roadway. Indirect energy consumption for construction was determined using the input-output method. This method uses construction cost to estimate energy consumption by multiplying the cost of the project by a MBTU/1977 ratio provided by Caltrans[3]. This ratio was based on the cost of construction in 1977. In order to apply this ratio, the Caltrans construction cost index[4] was used to relate current construction cost to 1977 construction cost. Other sources of indirect energy consumption were determined by multiplying the roadway length by a MBTU/mile ratio which was provided by Caltrans.

Energy Impacts

Direct Energy Consumption

Direct energy consumption is based on travel forecasts. These projections show that for the region, there would be an increase in VMT between existing and future conditions without the project. Regional VMT under the proposed project would be similar to no-build conditions. Projected direct energy consumption is reported in Table 1, direct energy expenditures range from 7,403,643 billion BTU under existing conditions to 5,575,127 billion for project conditions in 2040. When focusing on the project area, the travel forecasts show a decrease in VMT with the project in 2040. This equates to a decrease of approximately 1.2 billion BTUs per day and 436 billion BTUs annually (see Table 2).

[4] http://www.dot.ca.gov/hq/esc/oe/cost_index/historical_reports/CCI_1QTR_2014.pdf

Table 1: Annual Projected Direct Energy Consumption - Regional

	Annual VMT				
	Existing 2013	**2025**	**2040**	**2025 Build**	**2040 Build**
	1,197,741,358	1,349,057,818	1,528,944,016	1,348,999,732	1,529,387,024
	Percentage of Travel				
Gas Travel	94%	90%	90%	90%	90%
Diesel Travel	6%	7%	7%	7%	7%
Electric Travel	0%	3%	3%	3%	3%
	Fuel Efficiency (gal/mi, kW/mi)				
Gas Travel	21.5	29.1	36.6	29.1	36.6
Diesel Travel	7.8	10.6	13.1	10.6	13.1
Electric Travel	3.3	3.3	3.3	3.3	3.3
	Energy Usage (mmBtu)				
Gas Travel	6,270,877,784	5,038,561,125	4,528,133,577	5,038,344,182	4,529,445,594
Diesel Travel	1,132,765,714	1,089,512,157	1,001,364,985	1,089,465,247	1,001,655,129
Electric Travel		38,835,098	44,013,451	38,833,426	44,026,204
Total	**7,403,643,498**	**6,166,908,379**	**5,573,512,014**	**6,166,642,855**	**5,575,126,927**
Total over 2013		(1,236,735,119)	(1,830,131,485)	(1,237,000,644)	(1,828,516,571)
Percentage Change		-16.70%	-24.72%	-16.71%	-24.70%
Project vs No Project				(265,525)	1,614,914
Percentage Change				-0.0048%	0.029%
	Fuel efficiency and travel fraction based on EMFAC2017 for Bay Area				
	1 gallon of gasoline = 120,476 Btu				
	1 gallon of diesel fuel = 137,452 Btu				
	Source:	U.S. Energy Information Administration			
		https://www.eia.gov/Energyexplained/?page=about_energy_units			
	30 kW·h/100 mi = 3.3 mi/kW				
	1 kW = 3,412 Btu				
	Source:	Wikipedia from US EPA:			
		https://en.wikipedia.org/wiki/Miles_per_gallon_gasoline_equivalent			

Table 2 Projected Direct Energy Consumption – Focused Area

	Focused Daily VMT				
	Existing 2013	2025	2040	2025 Build	2040 Build
	Percentage of Travel				
Gas Travel	94%	90%	90%	90%	90%
Diesel Travel	6%	7%	7%	7%	7%
Electric Travel	0%	3%	3%	3%	3%
	Fuel Efficiency (gal/mi, kW/mi)				
Gas Travel	21.5	29.1	36.6	29.1	36.6
Diesel Travel	7.8	10.6	13.1	10.6	13.1
Electric Travel	3.3	3.3	3.3	3.3	3.3
	Energy Usage (mmBtu)				
Gas Travel	-	-	-	-	(971)
Diesel Travel	-	-	-	-	(215)
Electric Travel		-	-	-	(9)
Daily Total	-	-	-	-	(1,196)
Annual Total					(436,419)

Fuel efficiency and travel fraction based on EMFAC2017 for Bay Area

1 gallon of gasoline = 120,476 Btu
1 gallon of diesel fuel = 137,452 Btu
Source: U.S. Energy Information Administration
https://www.eia.gov/Energyexplained/?page=about_energy_units

30 kW·h/100 mi = 3.3 mi/kW
1 kW = 3,412 Btu
Source: Wikipedia from US EPA:
https://en.wikipedia.org/wiki/Miles_per_gallon_gasoline_equivalent

Indirect Energy Consumption

Projected indirect energy consumption is reported in Table 3. To capture the net increase in energy consumption attributable to the project, existing conditions are compared with projected energy consumption in 2040 without the project (no build) and against 2040 energy consumption with project implementation (build). Indirect energy consumption for the 2040 no build alternative compared to existing conditions will be 68 MBTUs of energy. Implementation of the project would result in consumption of an additional 308 MBTUs of energy over the 2040 no build scenario. The indirect energy consumed in road construction and vehicle manufacturing is a one-time non-recoverable consumption of energy, the other sources are reported as a per year expenditure.

Table 3: Projected Indirect Energy Consumption (in Billion BTU)

Description	Existing	2040 No Build	2040 Build
Vehicles Maintenance	1,977	2,141	2,141
Road Maintenance	40	40	40
Road Construction	--	--	308
Vehicle Manufacturing	1,676	2,139	2,139
Total Indirect Energy	3,393	4,320	4,628

Table 4 shows the annual energy consumption in the Dublin/Livermore area compared to the indirect energy consumed by one-time non-recoverable energy expenditures. The energy consumed in the construction of the project would make up 1% of the typical the energy consumed by the Cities of Dublin and Livermore; therefore, the energy impacts associated with the construction of the project will have minimal impact on the surrounding area.

Table 4: Annual Energy Consumption Dublin/Livermore area Compared to the Indirect Non-Recoverable Energy Consumption Associated with the Proposed Alternatives.

Description	BTUs
Annual Energy Consumed in the Dublin/Livermore area (2017)	29,640,055,000,000
Indirect Energy Consumed by the Construction of the Alternative	307,694,691,935
%Of the Cities Energy Demands Used in Construction	1%

Conservation Measures

Energy consumption for the build alternatives will have a minimal impact on the surrounding area, but implementing the following conservation measures would help further reduce impacts to the area.

- Use energy efficient lighting at the new intersections; for example, install light emitting diode traffic signals.
- Use of energy efficient construction equipment.
- Limit idle time for construction equipment.
- Promote carpooling for construction crews.
- Recycle construction waste when feasible and select disposal sites in the vicinity of the project area.

Summary and Conclusion

When comparing the no build to the build alternative, the build alternative will consume less than 0.03% more direct energy than the no build alternative. As stated above, the difference between the build and no build alternatives is due to increased VMT in the region, while VMT in the local area decreases. In terms of indirect energy consumption the build alternative would use more energy than the no build alternative due to the amount of energy needed for construction. But when considering the annual energy consumption by the Cities Dublin and Livermore, the energy used in construction of the project is quite small.

Appendix A

Indirect Energy Consumption Factors

Road Maintenance	80.3 MBTU/lane-mile
Vehicle Maintenance	0.0014 MBTU/VMT
Road Construction	0.0246 MBTU/1977$
Vehicle Manufacturing	0.001399 MBTU/mile

Note: Energy and Transportation Systems, Caltrans Transportation Laboratory, Sacramento, CA, July 1983