I-5 MANAGED LANES PROJECT

(RED HILL AVENUE TO ORANGE COUNTY/
LOS ANGELES COUNTY LINE)

Counties of Orange and Los Angeles, California
Cities Irvine, Tustin, Santa Ana, Orange, Anaheim, Fullerton, Buena Park, La Mirada, and Santa Fe Springs

12-Ora-5 – PM 28.9/44.4, 26.9, 27.9, 28.4
07-LA-5 – PM 0.1, 0.3, 0.6, 1.7
12-Ora-55 – PM 7.4, 8.0, 8.7, 8.9, 9.2, 9.7 9.9, 10.2
12-Ora-57 – PM 11.0, 11.3, 11.9, 12.5, 12.7, 12.9, 13.5
12-Ora-91 – PM 0.4, 0.7, 1.1, 1.3, 1.4, 1.6, 1.8, 2.0, 2.2, 2.6, 2.8, 3.4

EA 12-0Q950

DRAFT ENERGY ANALYSIS REPORT

Prepared for

Caltrans

CALTRANS DISTRICT 12 ORANGE COUNTY

April 24, 2023

Draft Energy Analysis Report

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EA 12-0Q950

April 24, 2023

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Acronyms and Abbreviations

Acronym	Definition
BMP	best management practice
BRT	bus rapid transit
CA MUTCD	California Manual on Uniform Traffic Control Devices
CAL-CET2020	Caltrans California Construction Emissions Tools 2020
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CHP	California Highway Patrol
CMS	changeable message signs
CSMP	Construction Site Monitoring Program
CT-EMFAC2017	Caltrans Emissions Factors Model
DAR	direct-access ramp
EB	eastbound
EL	Express Lane
EMFAC2017	Emission Factor Model, Version 2017
ETC	Electronic Toll Collection
FHWA	Federal Highway Administration
FTIP	Federal Transportation Improvement Program
GP	general purpose (lane)
HOV	high-occupancy vehicle
I	Interstate
LED	light-emitting diode
LOS	level of service
LRTP	Long Range Transportation Plan
ML	managed lane
mph	miles per hour
PM	Post Mile
N/A	not applicable
NB	northbound
NEPA	National Environmental Policy Act

Acronym	Definition
NPDES	National Pollutant Discharge Elimination System
OC/LA	Orange County/Los Angeles
OCTA	Orange County Transportation Authority
PacBell	Pacific Bell Telephone Company
proposed Project	I-5 Managed Lanes Project (Red Hill Ave to Orange / Los Angeles County Line)
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy
RWQCB	Regional Water Quality Control Board
SB	southbound
SCAG	Southern California Association of Governments
SCE	Southern California Edison
SIP	State Implementation Plan
SR	State Route
SWPPP	Stormwater Pollution Prevention Plan
T&R	Traffic and Revenue
TDM	Transportation Demand Management
TMP	Transportation Management Plan
TSM	Transportation System Management
USC	United States Code
VMT	vehicle miles traveled
WB	westbound

1. INTRODUCTION

1.1 Introduction

The California Department of Transportation (Caltrans) District 12 is proposing managed lanes (ML) improvements in both directions on Interstate (I-5) (proposed Project). The improvements would modify the existing high-occupancy vehicle (HOV) lanes within the proposed Project limits to address operational deficiencies. The purpose of this Energy Analysis Report is to provide quantitative and comparative analysis of the energy-related impacts of the proposed Project. The analyses consisted of calculating the energy required to construct each build alternative and the energy consumed by vehicles operating on the completed build alternatives in the Opening Year (2035) and Future Year (2055) scenarios.

The build alternatives include improvements on the I-5 corridor in the cities of Irvine, Santa Ana, Orange, Anaheim, Fullerton, Buena Park, La Mirada, and Santa Fe Springs. The build alternatives will improve the ML network operations, improve mobility and trip reliability, maximize person throughput by facilitating the efficient movement of bus and rideshare users, and apply technology to help manage traffic demand.

2. PROJECT DESCRIPTION

Caltrans District 12 is proposing ML improvements in both directions on I-5. The improvements would modify the existing HOV lanes within the proposed Project limits to address operational deficiencies. The proposed Project limits on I 5 extend from Red Hill Avenue (Post Mile [PM] 28.9) to the Orange County/Los Angeles (OC/LA) County line (12-ORA-5 PM 44.4) in the cities of Irvine, Tustin, Santa Ana, Orange, Anaheim, Fullerton, Buena Park, La Mirada, and Santa Fe Springs and include implementing associated signage (including advance signage on adjacent arterials) and tolling infrastructure.

The purpose of this Project is to improve the overall movement of people and goods along this section of I-5 by:

- Improving the ML network operations
- Improving mobility and trip reliability
- Maximizing person throughput by facilitating efficient movement of bus and rideshare users
- Applying technology to help manage traffic demand

The need, or deficiency, of the proposed Project is the existing I-5 HOV lanes between Red Hill Avenue and the OC/LA County line experience:

- HOV lane degradation (does not meet the federal performance standards)
- Demand exceeds existing capacity
- Operational deficiencies

Four preliminary alternatives, including three build alternatives and the No Build Alternative, are under consideration and are described below.

2.1 Alternative 1 – No Build Alternative

Alternative 1, the No Build Alternative, does not include improvements to the existing lane configurations for I-5. Under the No Build Alternative, no additional roadway improvements would occur. This alternative includes other projects on the financially constrained project list in the adopted Southern California Association of Governments (SCAG) 2020–2045 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) within the proposed Project limits on I-5 and the Preferred Plan in the Orange County Transportation Authority (OCTA) 2018 Long Range Transportation Plan (LRTP) within the proposed Project limits.

2.2 Alternative 2 – Build Alternative: Modify Existing HOV 2+ Lanes to HOV 3+ Lanes

Alternative 2 would maintain the existing lane configurations for I-5 with a modification of the minimum HOV lane occupancy requirement from two-plus (2+) to three-plus (3+) passengers within the current HOV system in each direction between Red Hill Avenue and the OC/LA County line. As a result of this increase in the occupancy requirement and improved trip reliability, through the Transportation Systems Management (TSM)/Transportation Demand Management (TDM) elements, it would promote and encourage public and private transit such as bus rapid

transit (BRT) and ridesharing. Under this alternative, no additional roadway improvements would occur. Additionally, two proposed park-and-ride facilities are being evaluated as part of Alternative 2 and would be constructed within the existing freeway right-of-way. Sign replacement and pavement delineation would also be implemented to meet the latest California Manual on Uniform Traffic Control Devices (CA MUTCD) standards.

2.2.1 Ramps

Physical modifications of the ramp geometry will not be required where the current HOV system is converted from 2+ to 3+ passengers; however, replacement of signage at direct-access ramps (DARs) will be required accordingly for Alternative 2.

2.2.2 Impact to Structures

Alternative 2 would not impact existing structures or create new structures (e.g., bridges) as part of its proposed design.

2.2.3 Drainage and Water Quality

Drainage management measures would be included in Alternative 2 to address the impacts to drainage patterns associated with new construction of the park-and-ride facilities. Proposed major drainage design features would include: maintaining existing drainage flow patterns and incorporating existing drainage systems to the maximum extent practicable; providing drainage facilities that would accommodate future improvements; and providing drainage facilities to prevent and/or reduce substantial erosion or siltation on or off site.

Some of the existing systems may be abandoned or removed to accommodate construction of Alternative 2. Best management practices (BMPs) would be included to address stormwater requirements and treatment of the added impervious area created by Alternative 2.

2.2.4 Tolled Components

Alternative 2 would not include the implementation of any new tolling components as part of the proposed design.

2.2.5 Transportation Management Plan

Alternative 2 may be implemented in phases and/or segments and procured under one or more contracts, including the option of using design/build. Construction-related delays are anticipated during construction of Alternative 2.

In accordance with Caltrans Deputy Directive (60-R2), a Transportation Management Plan (TMP) has been prepared for Alternative 2 which includes strategies that, when implemented, would minimize Project-related construction and circulation impacts.

It is anticipated that lane closures would be required, and it may be necessary to temporarily close on-/off-ramps and connectors during construction of Alternative 2.

Some of the key elements recommended in the TMP include the following: Public Information/ Public Awareness Campaign; Motorist Information Strategies; Incident Management; Construction Strategies; Demand Management; and Alternate Route Strategies.

Detailed detour plans, staging plans, and traffic handling plans would also be developed during the final design phase.

2.2.6 Construction Staging

As no additional construction would occur with Alternative 2, there would be no stage construction impacts associated with construction activities within the freeway mainline, which are limited to signage replacement and pavement delineators along the freeway mainline. Construction staging is anticipated for the development of the park-and-ride facilities to minimize impacts to existing traffic.

Stage construction concept plans are currently being developed. Should Alternative 2 be selected as the Preferred Alternative, detailed stage construction and detour plans would be developed during final design. Detailed stage construction plans and traffic handling plans would also be developed in the final design stage.

2.2.7 Right-of-Way Data

Additional right-of-way (e.g., full acquisition, partial acquisition, aerial easements, temporary construction easements) is not anticipated for the construction of Alternative 2.

2.2.8 Utility and Other Owner Involvement

Alternative 2 is not expected to have any impacts to surrounding utilities, as there are no proposed utility relocations associated with its proposed design.

2.2.9 Nonstandard Design Features (Design Standards Risk Assessment)

Alternative 2 would not impact existing nonstandard design features or create new nonstandard design features as part of the proposed design.

2.2.10 Sound Walls

Alternative 2 would not impact any existing sound walls as part of the proposed design.

2.2.11 Transportation System Management/Transportation Demand Management

Alternative 2 would not implement any new TSM/TDM measures or features beyond the ramp metering, changeable message signs (CMS), cameras, and traffic speed detection systems that already exist within the proposed Project limits.

2.2.12 Highway Planting

Existing planting and irrigation systems removed during construction of the Alternative 2 park-and-ride facilities would be replaced wherever space is available. Generally, existing vegetation in and around the park-and-ride areas would be replanted to the maximum extent practicable.

Should Alternative 2 be selected as the Preferred Alternative, planting design would be provided during the final design phase; would consider safety, maintainability, and aesthetic compatibility with adjacent urban communities; and would not deviate significantly from the existing planting theme.

2.2.13 Erosion Control

Alternative 2 would be required to comply with the terms and conditions specified in Attachment D of the *NPDES Statewide Construction General Permit* (SWRCB 2022), which includes a written site-specific Construction Site Monitoring Program (CSMP). The CSMP would include implementation of specific stormwater effluent monitoring requirements to ensure that the implemented BMPs are effective in preventing discharges from exceeding any of the water quality standards.

Erosion control measures would be implemented during construction as well as after completion of Alternative 2 construction in accordance with the requirements of the Santa Ana (Region 8) and Los Angeles (Region 4) Regional Water Quality Control Boards (RWQCBs) and the current statewide National Pollutant Discharge Elimination System (NPDES) Construction General Permit. During construction, potential construction site BMPs, such as temporary fiber rolls, temporary mulch, drainage inlet protection, concrete washout facilities, street sweeping, and hydroseeding, would be used to minimize erosion. All finished slopes would receive replacement planting or vegetative erosion control application.

Should Alternative 2 be selected as the Preferred Alternative, specific erosion control measures and construction site BMP design would be developed during final design. Preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) would be required during construction.

2.3 Alternative 3 – Build Alternative: Convert Existing HOV Lanes to Express Lanes

Alternative 3 would convert the existing HOV lane to an Express Lane (EL) in each direction between Red Hill Avenue and State Route (SR) 55; convert two existing HOV lanes to ELs in each direction between SR-55 and SR-57; and convert the existing HOV lane to an EL in each direction between SR-57 and the OC/LA County line. The typical cross-section consists of a 12-foot-wide EL, a 2- to 4-foot buffer, 12-foot-wide general-purpose (GP) lanes, 12-foot-wide auxiliary lanes, a 4- to 26-foot-wide inside shoulder, and a 10-foot-wide outside shoulder and would be provided to accommodate the EL. One 12-foot weave lane is proposed at locations of ingress or egress. Additionally, two proposed park-and-ride facilities are being evaluated as part of Alternative 3 and would be constructed within the existing freeway right-of-way. Sign replacement and pavement delineation would also be implemented to meet the latest CA MUTCD standards.

2.3.1 Ramps

Alternative 3 would impact several existing ramps. The affected ramps and the proposed improvements are summarized in Tables 2.1 and 2.2, below. In general, several existing ramps

Table 2.1: Anticipated Impacts to On-Ramps within the Proposed Project Limits—Alternative 3

Location		Post Mile (Approx.)	Ramp Improvements
1	NB SR-55 to NB I-5 Direct Connector	30.472	X
2	Grand Ave. SB Direct-Access On-Ramp	31.794	X
3	N. Main St. SB On-Ramp	32.953	X
4	SB SR-57 to SB I-5 Direct Connector	34.222	X
5	Gene Autry Wy. SB Direct-Access On-Ramp	35.949	X
6	Gene Autry Wy. NB Direct-Access On-Ramp	35.949	X
7	EB SR-91 to SB I-5 Direct Connector	41.928	X
8	WB SR-91 to NB I-5 Direct Connector	42.42	X
9	Auto Center Dr. NB On-Ramp	42.928	X
10	Artesia Blvd. SB On-Ramp	44.271	X
Total Number of On-Ramp Improvements:			**10**

Notes: * Existing ramp metering to be relocated and/or upgraded to latest equipment requirements.
**Ramps metered separately before joining.

EB = eastbound
I = Interstate
NB = northbound
SB = southbound
SR = State Route
WB = westbound

Table 2.2: Anticipated Impacts to Off-Ramps within the Proposed Project Limits—Alternative 3

Location		Post Mile (Approx.)	Ramp Improvements
1	Grand Ave. NB Direct-Access Off-Ramp	31.532	X
2	Penn Wy. SB Off-Ramp	32.521	X
3	NB I-5 to NB SR-57 Direct Connector	33.433	X
4	Gene Autry Wy. NB Direct-Access Off-Ramp	35.466	X
5	Gene Autry Wy. SB Direct-Access Off-Ramp	36.309	X
6	Anaheim Blvd. NB Direct-Access Off-Ramp	36.072	X
7	Disneyland Dr. SB Direct-Access Off-Ramp	38.439	X
8	NB I-5 to WB SR-91 Direct Connector	41.909	X
9	SB I-5 to EB SR-91 Direct Connector	42.545	X
10	Beach Blvd. SB Off-Ramp	43.680	X
11	Artesia Blvd. NB Off-Ramp	43.996	X
Total Number of Off-Ramp Improvements:			**11**

EB = eastbound
I = Interstate
NB = northbound
SB = southbound
SR = State Route
WB = westbound

would be shifted to accommodate outside widening by Alternative 3. Alternative 3 is not anticipated to impact system interchanges within the proposed Project limits. Within the proposed Project limits, ramp metering is incorporated into the existing local interchange on-ramps except at the South Anaheim Boulevard northbound on-ramp. Where ramp

improvements affect ramp metering, any ramp metering equipment would be reestablished. Existing ramp meters and equipment would be reused where possible.

For the majority of locations, physical modifications of the ramp geometry will not be required where the HOV direct connector is converted to an ELs connector; however, replacement of signage and addition of tolling equipment will be required accordingly. The incorporation of weave lanes required physical modifications of the ramp gore geometry where the HOV direct connector is converted to an ELs connector at the northbound Gene Autry Way off-ramp, northbound Disney Way off-ramp, southbound Gene Autry Way off-ramp, and southbound Disneyland Drive off-ramp.

2.3.2 Impact to Structures

Alternative 3 would not create new structures (e.g., bridges) but would impact one existing retaining wall to accommodate widening the mainline to avoid right-of-way acquisition. The affected retaining wall structure and the proposed improvements are summarized in Table 2.3.

Table 2.3: Anticipated Retaining Wall Impacts within the Proposed Project Limits—Alternative 3

Location	Post Mile	Retaining Wall Improvements		Maximum Length of Extension (Feet)
		Rebuild I / New(N)	Type	
SB I-5, North of E. 17th St.	32.521	R*	Special	793

Notes: *Retaining Wall/Sound Wall.
I = Interstate
SB = southbound

2.3.3 Drainage and Water Quality

Drainage management measures would be included in Alternative 3 to address the impacts to drainage patterns associated with new construction. Proposed major drainage design features would include: maintaining existing drainage flow patterns and incorporating existing drainage systems to the maximum extent practicable; providing drainage facilities that would accommodate future improvements; and providing drainage facilities to prevent and/or reduce substantial erosion or siltation on or off site.

Some of the existing systems may be abandoned or removed to accommodate the construction of Alternative 3. For widened sections of the pavement for Alternative 3, the existing edge drains would be replaced and reconnected to the drainage system; final connection and location details would be developed in the final design phase. BMPs would be included to address stormwater requirements and treatment of the added impervious area created by Alternative 3.

2.3.4 Tolled Components

2.3.4.1 Toll Operations Policies

The ELs would require single-occupant vehicles to pay a toll. The objective is to open the tolled ELs with some level of HOV occupancy free to encourage rideshare and transit usage. Operational adjustments to the tolled ELs may be implemented based on demand, rates of speed, traffic volumes, and to meet financial covenants, maintenance, and operational obligations. This would be determined based on the Traffic and Revenue (T&R) analysis, input from the public, and Caltrans business rules. Caltrans has the authority to set the occupancy policy on the I-5 ELs.

Key Caltrans business rules may include, but are not limited to:

- Toll-free travel for vehicles that meet minimum vehicle occupancy requirements, motorcycles, and buses.
- Qualifying carpools would continue to be able to access the lanes without a charge; trucks, other than two-axle light-duty trucks, would not be allowed.
- Toll/transit credits would be available to frequent ELs transit riders.
- Emergency vehicles may use the ELs toll-free when responding to incidents.
- Qualifying Clean Air Vehicles would be given a toll discount.
- Equity Assistance Plan.

2.3.4.2 Toll Operations and Maintenance

At this time, a process is in place to develop a formal maintenance plan as part of the Caltrans and Federal Highway Administration (FHWA) systems engineering process. It is anticipated that Caltrans would maintain the physical infrastructure, such as pavement, striping, and median barriers, as well as perform general maintenance, such as trash and graffiti removal, paid for from toll revenues. It is anticipated that Caltrans would also manage the tolling infrastructure, while the customer service centers and other back-office support facilities would be contracted to others. However, final agreements and decisions on such responsibilities will be decided in the future phases of the Project.

2.3.4.3 Toll Revenue/Pricing Structure

Time-of-day pricing and dynamic pricing methods are being analyzed for their application as part of the proposed Project. Toll rates would be set in response to vehicle demand and would be adjusted as necessary to regulate volume in the ELs to maintain traffic flow at a pre-determined level of service (LOS).

The pricing structure and details would be evaluated further during final design. No tolling amount or pricing decisions have been made at this time.

2.3.4.4 Toll Collection

The I-5 ELs facility is expected to use an all-electronic toll collection (ETC) system and would not accept cash or credit card payment on the facility. This would eliminate the need for customers

to stop and pay tolls at traditional tollbooths. The ETC system would require customers to have pre-paid accounts with a tolling agency and mount a nonstop automated vehicle identification transponder or toll tag on the windshield of a registered vehicle. Tolls would be collected electronically by reading the transponder at highway speeds.

2.3.4.5 Toll Enforcement

Toll enforcement is an essential element of any successful EL system, ensuring that traffic laws are enforced, customers are charged the appropriate toll based on vehicle occupancy, and toll evasion is minimized. Toll enforcement would be accomplished through California Highway Patrol (CHP) patrols, electronic systems, and facility design. The CHP is anticipated to be contracted to conduct routine and supplemental enforcement services on the I-5 ELs facility, including toll infractions, HOV eligibility occupancy infractions, buffer crossing infractions, speeding, and other moving violations. The ETC system is intended to identify both vehicles that do not have a transponder as well as the declared transponder switch setting. Caltrans would incorporate an infrared occupancy detection system into the EL enforcement. The CHP currently provides enforcement on all of the toll roads in southern California under several different institutional arrangements.

2.3.5 Transportation Management Plan

The same TMP described under Alternative 2 would be utilized as part of Alternative 3. This infrastructure is detailed in Section 2.1.2.5, above.

2.3.6 Construction Staging

It is anticipated that Alternative 3 would be designed and constructed in separate phases to facilitate Project delivery based on available funding. Each phase would include construction staging to minimize impacts to existing traffic. The same number of existing mainline lanes would be kept open to traffic during construction whenever feasible.

Stage construction concept plans are currently being developed. However, Alternative 3 would require ramp closures of less than 10 days to accommodate reconstruction of pavement at or near on- and off-ramps. Closures of successive on- or off-ramps would be avoided. Should Alternative 3 be selected as the Preferred Alternative, detailed stage construction and detour plans would be developed during final design. Detailed stage construction plans and traffic handling plans would also be developed in the final design stage.

2.3.7 Right-of-Way Data

Additional right-of-way (e.g., full acquisition, partial acquisition, aerial easements, temporary construction easements) is not anticipated for the construction of Alternative 3.

2.3.8 Utility and Other Owner Involvement

Underground and above-ground utility conflicts are anticipated within the proposed Project limits. The anticipated utility impacts within the proposed Project limits are summarized in Table 2.4.

Table 2.4: Anticipated Impacts to Utilities within the Proposed Project Limits—Alternative 3

No.	Location	Utility Owner and/or Contact Name	Wet (W) / Dry (D)	Utility Type(s)	Utility Conflict Description	H*
1	N. Main St. SB On-Ramp	AT&T	D	Telecom	Roadway Conflict	N/A
2	North of N. State College Blvd.	PacBell	D	Telecom	Overhead Sign Conflict	N/A
3	North of N. State College Blvd.	SCE	W	Electric	Overhead Sign Conflict	N/A

Notes: H* denotes high-priority utilities based on Chapter 600 of the Caltrans Encroachment Permits Manual.
AT&T = American Telephone and Telegraph Company
Caltrans = California Department of Transportation
N/A = Not Applicable
PacBell = Pacific Bell Telephone Company
SB = southbound
SCE = Southern California Edison

Should Alternative 3 be selected as the Preferred Alternative, a "positive location" verification would be performed during the final design phase, which would include surveying and boring the area in order to verify the depth and specific locations of underground utilities in the proposed Project vicinity that may be in close proximity to or conflict with proposed improvements as determined from as-built plans and utility company records. Relocation or addition of towers are not anticipated for the existing overhead electrical lines.

2.3.9 Nonstandard Design Features (Design Standards Risk Assessment)

A listing of major existing nonstandard design features for Alternative 3 is included in Table 2.5, below.

Table 2.5: Design Standards Risk Assessment—Alternative 3

No.	Design Standard	Probability of Design Exception Approval (None, Low, Medium, High)
1	201.1 (Stopping Sight Distance Standards)*	Medium/High
2	301.1 (Lane Width)*	Medium
3	302.1 (Shoulder Width)*	Medium/High
4	305.1 (Median Width Freeways and Expressways-Urban)**	High
5	305.1(3)(a) (Median Width)*	High
6	309.1(3)(a) (Horizontal Clearances for Highways)*	Medium /High
7	504.7 (Minimum Weave Length)*	High

Notes: *Boldface
**Underline

2.3.10 Sound Walls

Alternative 3 would impact one existing sound wall. The affected sound wall and the proposed improvements are summarized in Table 2.6.

Table 2.6: Anticipated Sound Wall Impacts within the Proposed Project Limits—Alternative 3

Location	Post Mile	Sound Wall Improvements			Maximum Length of Extension (Feet)
		Rebuild I / New (N)	Extension	Removal	
SB I-5, North of E. 17th St.	32.521	R*			793

Notes: *Retaining Wall/Sound Wall.
I = Interstate
SB = southbound

2.3.11 Transportation System Management/Transportation Demand Management

TSM/TDM aims to improve traffic flow, promote travel safety, and increase transit usage and rideshare participation. The TSM/TDM measures included as part of Alternative 3 would add TSM/TDM techniques to existing features within the proposed Project limits.

The following TSM features would be incorporated into Alternative 3's proposed design:

- Ramp metering
- Intelligent Transportation Systems
- CHP observation and enforcement areas

The following TDM measures have been incorporated into Alternative 3:

- The EL use would be incentivized for carpool, transit users, and electric and clean-emissions vehicles (e.g., discounted fare, partial or full subsidized fare).
- Potential excess toll revenue would be allocated to fund projects and programs to reduce vehicle miles traveled (VMT), such as:
  - Outreach and education regarding ridesharing, transit travel, and multimodal opportunities;
  - Outreach and education regarding alternative work schedule programs and telecommuting;
  - Construction two park-and-ride facilities; and
  - Generating sustainable funding to support ongoing operations and promoting transit equity programs.
- Alternative 3 would facilitate travel for commercial buses and tourist buses to and from tourist destinations within the proposed Project area.

2.3.12 Highway Planting

The same erosion control features described under Alternative 2 would be included as part of Alternative 3. These are detailed in Section 2.1.2.12, above. Generally, existing vegetation in and

around the interchange areas would be replanted; however, due to limited space between the freeway improvements and right-of-way, planting replacement would not always be possible along the mainline.

2.3.13 Erosion Control

The same erosion control features described under Alternative 2 would be included as part of Alternative 3. These are detailed in Section 2.1.2.13, above.

2.4 Alternative 4 – Build Alternative: Convert Existing HOV Lanes to Express Lanes and Construct Additional Express Lanes

Alternative 4 would convert the existing HOV lane to an EL in each direction between Red Hill Avenue and SR-55; convert two existing HOV lanes to ELs in each direction between SR-55 and SR-57; convert the existing HOV lane to an EL in each direction between SR-57 and the OC/LA County line; and construct an additional EL in each direction between SR-57 and SR-91. The typical cross-section consists of 12-foot-wide ELs, a 2- to 4-foot buffer, 12-foot-wide GP lanes, 12-foot-wide auxiliary lanes, a 4- to 14-foot-wide inside shoulder, and a 10-foot-wide outside shoulder and would be provided to accommodate the ELs. One 12-foot weave lane is proposed at locations of ingress or egress. Additionally, two proposed park-and-ride facilities are being evaluated as part of Alternative 4 and would be constructed within the existing freeway right-of-way. Sign replacement and pavement delineation would also be implemented to meet the latest CA MUTCD standards.

2.4.1 Ramps

Alternative 4 would impact some existing ramps within the proposed Project limits. The affected ramps and the proposed improvements are summarized in Tables 2.7 and 2.8, below. In general, some existing ramps would be shifted to accommodate outside widening by Alternative 4. Alternative 4 is not anticipated to impact system interchanges within the proposed Project limits. Within the proposed Project limits, ramp metering is incorporated into the existing local interchange on-ramps, except at the South Anaheim Boulevard northbound on-ramp. Where ramp improvements affect ramp metering, any ramp metering equipment would be re-established. Existing ramp meters and equipment would be reused where possible.

For the majority of locations, physical modifications of the ramp geometry would not be required where the HOV direct connector is converted to an ELs connector; however, replacement of signage and addition of tolling equipment would be required accordingly. The incorporation of weave lanes would require physical modifications at the ramp gore where the HOV direct connector is converted to an ELs connector at the following locations:

- Southbound SR-57 connector
- Northbound SR-57 connector
- Southbound Gene Autry Way on-ramp
- Northbound Gene Autry Way off-ramp
- Northbound Disney Way off-ramp

Table 2.7: Anticipated Impacts to On-Ramps within the Proposed Project Limits—Alternative 4

Location		Post Mile (Approx.)	Ramp Improvements
1	NB SR-55 to NB I-5 Direct Connector	30.472	X
2	Grand Ave. SB Direct-Access On-Ramp	31.794	X
3	N. Main St. SB On-Ramp	32.953	X
4	SB SR-57 to SB I-5 Direct Connector	34.222	X
5	Gene Autry Wy. SB Direct-Access On-Ramp	35.949	X
6	Gene Autry Wy. NB Direct-Access On-Ramp	35.949	X
7	W. Lincoln Ave. NB On-Ramp	38.913	X
8	EB SR-91 to SB I-5 Direct Connector	41.928	X
9	WB SR-91 to NB I-5 Direct Connector	42.42	X
10	Auto Center Dr. NB On-Ramp	42.928	X
11	Artesia Blvd. SB On-Ramp	44.271	X
Total Number of Off-Ramp Improvements:			**11**

Notes: * Existing ramp metering to be relocated and/or upgraded to latest equipment requirements.
**Ramps metered separately before joining.

EB = eastbound
I = Interstate
NB = northbound
SB = southbound
SR = State Route
WB = westbound

Table 2.8: Anticipated Impacts to Off-Ramps within the Proposed Project Limits—Alternative 4

Location		Post Mile (Approx.)	Ramp Improvements
1	Grand Ave. NB Direct-Access Off-Ramp	31.532	X
2	Penn Wy. SB Off-Ramp	32.521	X
3	NB I-5 to NB SR-57 Direct Connector	33.433	X
4	Gene Autry Wy. NB Direct-Access Off-Ramp	35.466	X
5	Gene Autry Wy. SB Direct-Access Off-Ramp	36.309	X
6	Anaheim Blvd. NB Direct-Access Off-Ramp	36.072	X
7	Disneyland Dr. SB Direct-Access Off-Ramp	38.439	X
8	Lincoln Ave. SB Off-Ramp	39.471	X
9	N. Euclid St. NB Off-Ramp	39.263	X
10	NB I-5 to WB SR-91 Direct Connector	41.909	X
11	SB I-5 to EB SR-91 Direct Connector	42.545	X
12	Beach Blvd. SB Off-Ramp	43.680	X
13	Artesia Blvd. NB Off-Ramp	43.996	X
Total Number of Off-Ramp Improvements:			**13**

EB = eastbound
I = Interstate
NB = northbound
SB = southbound
SR = State Route

- Southbound Gene Autry Way off-ramp
- Northbound Gene Autry Way on-ramp
- Southbound Disneyland Drive off-ramp

2.4.2 Impact to Structures

Alternative 4 would not create new structures (e.g., bridges) but would impact existing retaining walls and create a new retaining wall. Retaining walls would be provided, where required, to minimize and avoid right-of-way acquisition. The affected retaining wall structures and the proposed improvements are summarized in Table 2.9.

Table 2.9: Anticipated Retaining Wall Impacts within the Proposed Project Limits—Alternative 4

Location	Post Mile	Retaining Wall Improvements		Maximum Length of Extension (Feet)
		Rebuild I / New(N)	Type	
SB I-5, South of E. 17th St.	32.521	R*	Special	793
Along NB I-5 to NB SR-57 Direct Connector	34.117	R	Special	479
Along SB SR-57 to SB I-5 Direct Connector	34.124	R	Special	446

Notes: *Retaining Wall/Sound Wall.
I = Interstate SB = southbound
NB = northbound SR = State Route

2.4.3 Drainage and Water Quality

The same drainage and water quality features described under Alternative 3 would be constructed as part of Alternative 4. These features are detailed in Section 2.1.3.3, above.

2.4.4 Tolled Components

The same tolling infrastructure described under Alternative 3 would be constructed as part of Alternative 4. This infrastructure is detailed in Section 2.1.3.4, above.

2.4.5 Transportation Management Plan

The same TMP described under Alternative 2 would be utilized as part of Alternative 4. This infrastructure is detailed in Section 2.1.2.5, above.

2.4.6 Construction Staging

Stage construction concept plans are currently being developed. However, Alternative 4 would require several 55-hour weekend closures of the SR-57 HOV connectors to accommodate construction of retaining walls, the median barrier, and concrete pavement. Should Alternative 4 be selected as the Preferred Alternative, detailed stage construction and detour plans would be developed during final design. Detailed stage construction plans and traffic handling plans would also be developed in the final design stage.

2.4.7 Right-of-Way Data

Additional right-of-way (e.g., full acquisition, partial acquisition, aerial easements, temporary construction easements) is not anticipated for the construction of Alternative 4.

2.4.8 Utility and Other Owner Involvement

Underground and above-ground utility conflicts are anticipated within the proposed Project limits. The anticipated utility impacts within the proposed Project limits are summarized in Table 2.10.

Table 2.10: Anticipated Impacts to Utilities within the Proposed Project Limits—Alternative 4

No.	Location	Utility Owner and/or Contact Name	Wet (W) / Dry (D)	Utility Type(s)	Utility Conflict Description	H*
1	N. Main St. SB On-Ramp	AT&T	D	Telecom	Roadway Conflict	N/A
2	North of N. State College Blvd.	PacBell	D	Telecom	Overhead Sign Conflict	N/A
3	North of N State College Blvd.	SCE	W	Electric	Overhead Sign Conflict	N/A
4	N. Euclid St. NB Off-Ramp	City of Anaheim	W	Water	Roadway Conflict	N/A
5	N. Euclid St. SB	City of Anaheim	W	Water	Roadway Conflict	N/A
6	N. Euclid St. SB	Sprint	D	Telecom	Roadway Conflict	N/A
7	North of N. Euclid St. SB	Sprint	D	Telecom	Roadway Conflict	N/A

Notes: H* denotes high-priority utilities based on Chapter 600 of the Caltrans Encroachment Permits Manual.
AT&T = American Telephone and Telegraph Company
Caltrans = California Department of Transportation
N/A = Not Applicable
NB = northbound
PacBell = Pacific Bell Telephone Company
SB = southbound
SCE = Southern California Edison

Positive location would be performed for underground utilities in the proposed Project vicinity that may be in close proximity to or conflict with proposed improvements, as determined from as-built plans and utility company records.

Relocation or addition of towers are not anticipated for the existing overhead electrical lines.

2.4.9 Nonstandard Design Features (Design Standards Risk Assessment)

A listing of major existing nonstandard design features for Alternative 4 is included in Table 2.11, below.

Table 2.11: Design Standards Risk Assessment—Alternative 4

No.	Design Standard	Probability of Design Exception Approval (None, Low, Medium, High)
1	201.1 (Stopping Sight Distance Standards)*	Medium/High
2	201.7 (Decision Sight Distance)**	High
3	301.1 (Lane Width)*	Medium
4	302.1 (Shoulder Width)*	Medium/High
5	305.1 (Median Width Freeways and Expressways-Urban)**	High
6	305.1(3)(a) (Median Width)*	High
7	309.1(3)(a) (Horizontal Clearances for Highways)*	Medium/High
8	504.2(2) (Design of Freeways Entrances and Exits)**	Medium
9	504.7 (Minimum Weave Length)*	High

Notes: *Boldface
**Underline

2.4.10 Sound Walls

The same impacts to sound walls described under Alternative 3 would occur as part of Alternative 4. These are detailed in Section 2.1.3.10, above.

2.4.11 Transportation System Management/Transportation Demand Management

The same TSM/TDM measures described under Alternative 3 would also be included as part of Alternative 4. These are detailed in Section 2.1.3.11, above.

2.4.12 Highway Planting

The same highway planting impacts described under Alternative 3 would occur as part of Alternative 4. These are detailed in Section 2.1.3.12, above.

2.4.13 Erosion Control

The same erosion control impacts described under Alternative 2 would occur as part of Alternative 4. These are detailed in Section 2.1.2.13, above.

3. AFFECTED ENVIRONMENT

3.1 Regulatory Setting

The National Environmental Policy Act (NEPA) (42 United States Code [USC] Part 4332) requires the identification of all potentially significant impacts to the environment, including energy impacts.

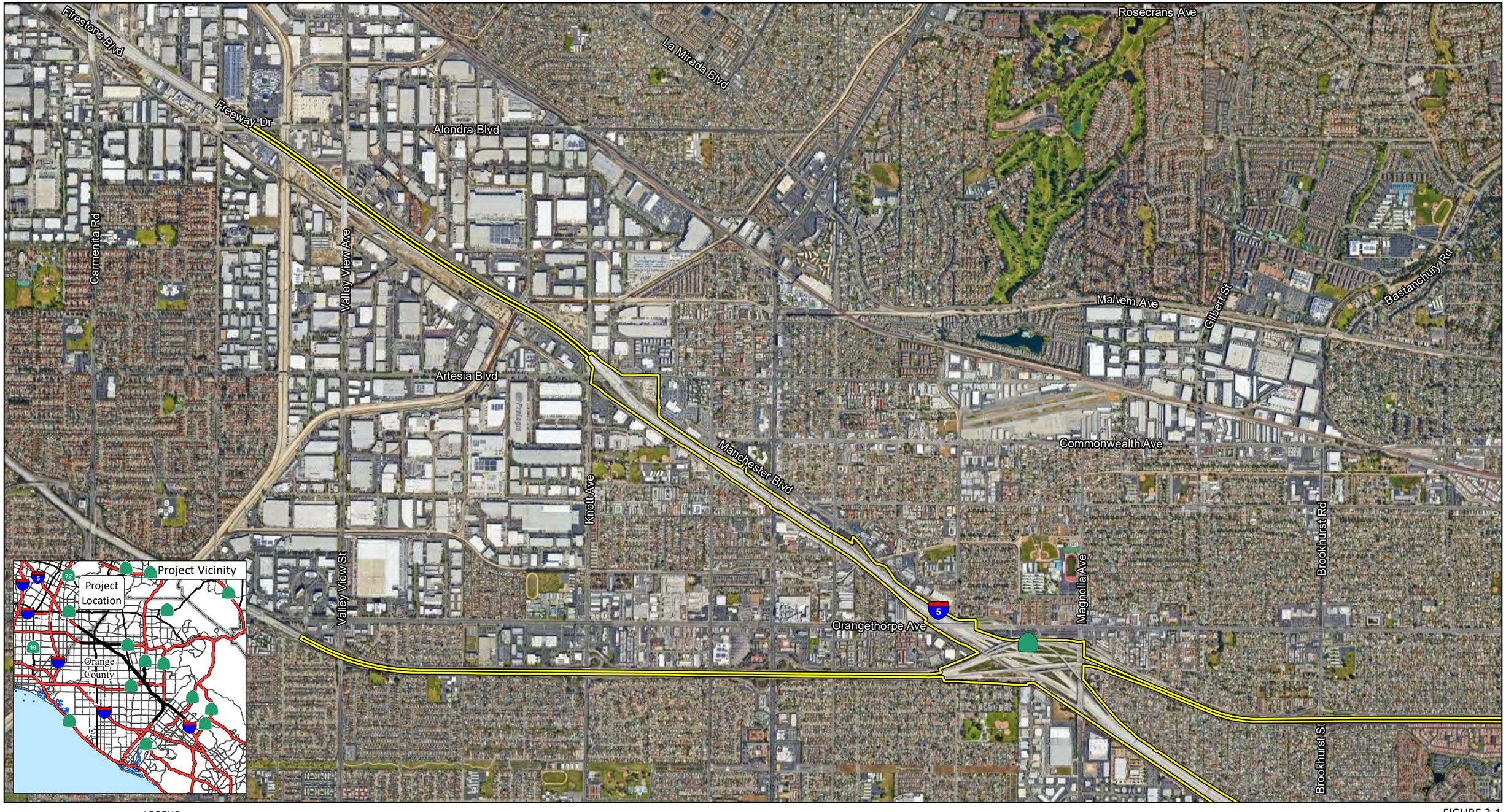
The California Environmental Quality Act (CEQA) Guidelines, Section 15126.2(b) and Appendix F, Energy Conservation, require an analysis of a project's energy use to determine if the project may result in significant environmental effects due to wasteful, inefficient, or unnecessary use of energy, or wasteful use of energy resources.

3.2 Existing Energy Use

3.2.1 Existing Roadways and Traffic Conditions

The southern Project limit is the section of I-5 that intersects with Red Hill Avenue south of SR-55 in Tustin. I-5 continues north through the cities of Santa Ana, Orange, Anaheim, Fullerton, Buena Park, La Mirada, and Santa Fe Springs, and includes three major freeway-to-freeway interchanges at SR-55, SR-22/SR-57, and SR-91, as shown on Figure 3-1. The northern Project limit is 0.5 mile north of the OC/LA County line in La Mirada. The existing HOV direct connectors link the I-5 HOV facility with the SR-55, SR-57, and SR-91 HOV facilities. The first HOV lanes on I-5 opened in 1992 with HOV 2+ requirements and have been highly utilized. There are several HOV DARs within the proposed Project limits at Grand Avenue, Gene Autry Way, Disney Way, and Disneyland Drive.

I-5 currently has at least one HOV lane in each direction within the proposed Project limits that is separated with limited ingress/egress buffer openings. In mid-2021, the construction of an additional HOV lane in each direction and removal of the existing northbound and southbound DARs at Main Street was completed within the section of I-5 south of SR-55 at Red Hill Avenue and SR-57. Table 3.1 shows the existing traffic conditions for northbound and southbound I-5 traffic.



LEGEND

Project Location

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FEET

SOURCE: Google (2022)

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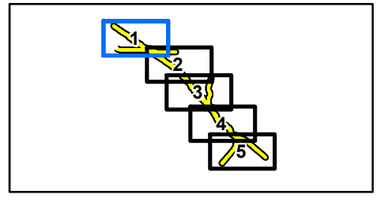
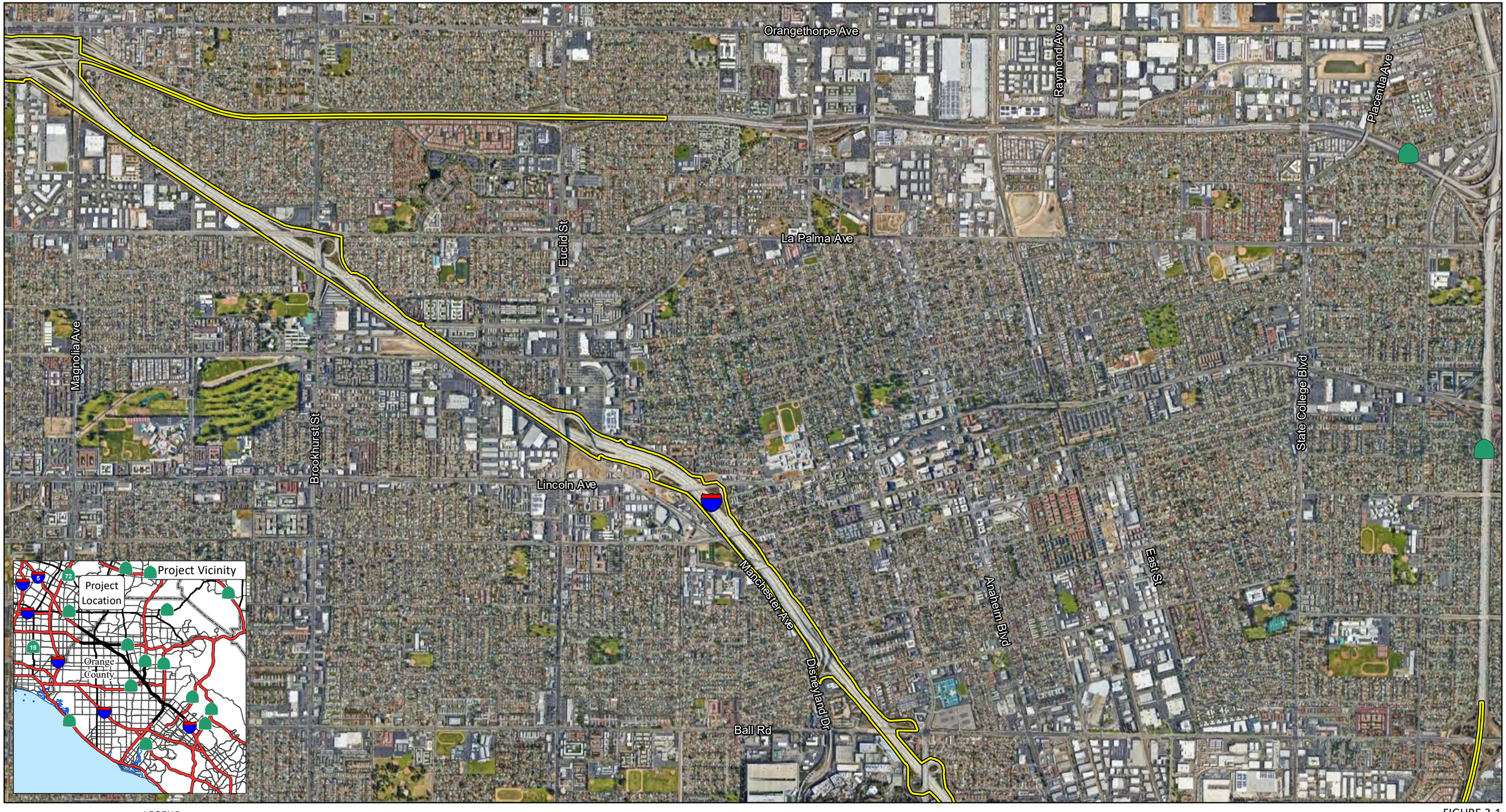


FIGURE 3-1
Sheet 1 of 5

I-5 Managed Lanes Project
(Red Hill Avenue to Orange County/Los Angeles County Line)

Project Location and Vicinity

EA No. 0Q950



LEGEND

Project Location

0 1000 2000
FEET

SOURCE: Google (2022)

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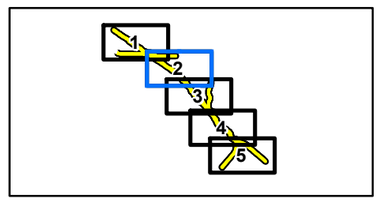

FIGURE 3-1
Sheet 2 of 5

I-5 Managed Lanes Project
(Red Hill Avenue to Orange County/Los Angeles County Line)

Project Location and Vicinity

EA No. 0Q950

Disneyland Dr
Ball Rd
East St
Anaheim Blvd
State College Blvd
Taft Ave
Glassell St
Ketella Ave
Katella Ave
Collins Ave
Harbor Blvd
Chapman Ave
The City Dr
Main St
La Veta Ave
Parker St

Project Vicinity
Project Location
Orange County

LEGEND

Project Location

0 1000 2000
FEET

SOURCE: Google (2022)

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1 2 3 4 5

FIGURE 3-1
Sheet 3 of 5

I-5 Managed Lanes Project
(Red Hill Avenue to Orange County/Los Angeles County Line)
Project Location and Vicinity
EA No. 0Q950

La Veta Ave
Garden Grove Blvd
The City Dr
Main Place Dr
Parker St
Glassell St
Tustin St
Hewes St
Memory Ln
Hewes Ave
17th St
Main St
Bristol St
Fairview St
Santa Ana Blvd
Grand Ave
Tustin Ave
5th St
4th St
Irvine Blvd
Newport Ave
1st St
Red Hill Ave
5
72
19
Project Vicinity
Project Location
Orange County

LEGEND

Project Location

N

0 1000 2000

FEET

SOURCE: Google (2022)

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1 2 3 4 5

FIGURE 3-1

Sheet 4 of 5

I-5 Managed Lanes Project

(Red Hill Avenue to Orange County/Los Angeles County Line)

Project Location and Vicinity

EA No. 0Q950

Edinger Ave
Grand Ave
Main St
Warner Ave
Newport Ave
Sycamore Ave
Red Hill Ave
Tustin Ranch Rd
Irvine Blvd
Jamboree Rd
5
Dyer Rd
Barranca Pkwy
Alton Pkwy
Walnut Ave
Harvard Ave
Culver Dr
Trabuco Rd
Yale Ave

Project Vicinity
Project Location
Orange County
MacArthur Blvd
5
72
19

LEGEND

Project Location

0 1000 2000
FEET

SOURCE: Google (2022)

I:\WSP2203.07\GIS\MXD\ProjLocation_Aerial.mxd (3/6/2023)

1 2 3 4 5

FIGURE 3-1
Sheet 5 of 5

I-5 Managed Lanes Project
(Red Hill Avenue to Orange County/Los Angeles County Line)
Project Location and Vicinity
EA No. 0Q950

Table 3.1: Summary of Existing Traffic Conditions

Scenario/ Analysis Year	Location	AADT		% Truck	VMT (mi/day)	Average Speed During Peak Travel (mph)	Average Speed During Off-Peak Travel (mph)
		Total	Truck				
Existing/Baseline Year 2022	Northbound I-5 Mainline	173,358	14,447	7.0%–9.5%	2,123,880	42	59
	Northbound I-5 HOV	22,923	0	0%	450,953	52	60
Existing/Baseline Year 2022	Southbound I-5 Mainline	170,445	14,204	7.0% –9.5%	2,063,228	42	59
	Southbound I-5 HOV	22,662	0	0%	384,967	52	60

Source: Jacobs (December 2022).
Note: AADT shown is the peak rate throughout the Project Study Area, truck percentages from Caltrans census traffic data for 2019.
AADT = average annual daily traffic
HOV = high-occupancy vehicle
I = Interstate
mi = miles
mph = miles per hour
VMT = vehicle miles traveled

3.2.2 Alternative 1 – No Build Alternative

The No Build Alternative consists of those transportation projects that are already planned for construction by or before 2035. Consequently, the No Build Alternative represents future travel conditions in the Study Area without any of the build alternatives and is the baseline against which each of the build alternatives will be assessed to meet National Environmental Policy Act (NEPA) requirements. Table 3.2 shows the I-5 traffic conditions for the 2035 and 2055 No Build conditions.

Table 3.2: No Build I-5 Traffic Conditions

Scenario/ Analysis Year	Location	AADT		% Truck	VMT (mi/day)	Average Speed During Peak Travel (mph)	Average Speed During Off-Peak Travel (mph)
		Total	Truck				
No Build 2035	Northbound I-5 Mainline	177,419	14,785	7.0% - 9.5%	2,173,356	41	59
	Northbound I-5 HOV	26,673	0	0%	526,377	54	60
	Southbound I-5 Mainline	174,810	14,568	7.0% - 9.5%	2,126,776	41	59
	Southbound I-5 HOV	26,251	0	0%	447,917	54	60
No Build 2055	Northbound I-5 Mainline	183,667	15,306	7.0% - 9.5%	2,249,480	40	59
	Northbound I-5 HOV	32,440	0	0%	642,400	50	60
	Southbound I-5 Mainline	181,522	15,127	7.0% - 9.5%	2,224,545	38	59
	Southbound I-5 HOV	31,773	0	0%	544,779	49	60

Source: Jacobs (2023), AADT shown is the peak rate throughout the Project Study Area, truck percentages from Caltrans census traffic data for 2019, assumed to apply to 2035 and 2055.

AADT = annual average daily traffic
HOV = high-occupancy vehicle
I = Interstate
mi = miles/miles
mph = miles per hour
VMT = vehicle miles traveled

3.2.3 Alternatives 2, 3, and 4 – Build Alternatives

Table 3.3 shows the I-5 traffic conditions for the 2035 and 2055 build alternatives.

Table 3.3: I-5 Traffic Conditions for the Build Alternatives

Scenario/ Analysis Year	Location	AADT		% Truck	VMT (mi)	Average Speed During Peak Travel (mph)	Average Speed During Off-Peak Travel (mph)
		Total	Truck				
Alternative 2 2035	Northbound I-5 Mainline	181,919	15,160	7.0% - 9.5%	2,226,468	40	59
	Northbound I-5 HOV	15,980	0	0%	267,755	59	60
	Southbound I-5 Mainline	177,384	14,782	7.0% - 9.5%	2,177,990	40	59
	Southbound I-5 HOV	15,520	0	0%	198,492	59	60
Alternative 3 2035	Northbound I-5 Mainline	181,493	15,124	7.0% - 9.5%	2,219,082	41	59
	Northbound I-5 HOV	18,425	0	0%	342,148	58	60
	Southbound I-5 Mainline	178,082	14,840	7.0% - 9.5%	2,166,467	41	59
	Southbound I-5 HOV	18,196	0	0%	279,946	57	60
Alternative 4 2035	Northbound I-5 Mainline	181,472	15,123	7.0% - 9.5%	2,217,174	41	59
	Northbound I-5 HOV	22,027	0	0%	436,325	58	60
	Southbound I-5 Mainline	177,840	14,820	7.0% - 9.5%	2,162,982	41	59
	Southbound I-5 HOV	19,096	0	0%	335,220	58	60
Alternative 2 2055	Northbound I-5 Mainline	188,394	15,700	7.0% - 9.5%	2,310,549	39	59
	Northbound I-5 HOV	17,082	0	0%	311,604	58	60
	Southbound I-5 Mainline	185,675	15,473	7.0% - 9.5%	2,281,966	37	59
	Southbound I-5 HOV	16,773	0	0%	239,241	58	60
Alternative 3 2055	Northbound I-5 Mainline	188,109	15,676	7.0% - 9.5%	2,306,115	39	59
	Northbound I-5 HOV	22,355	0	0%	410,127	57	60
	Southbound I-5 Mainline	187,218	15,602	7.0% - 9.5%	2,287,109	37	59
	Southbound I-5 HOV	22,003	0	0%	336,083	55	60
Alternative 4 2055	Northbound I-5 Mainline	187,831	15,653	7.0% - 9.5%	2,297,071	39	59
	Northbound I-5 HOV	25,590	0	0%	518,658	56	60
	Southbound I-5 Mainline	187,047	15,587	7.0% - 9.5%	2,282,754	38	59
	Southbound I-5 HOV	23,051	0	0%	398,739	55	60

Source: Jacobs (2023), AADT shown is the peak rate throughout the Project Study Area, truck percentage from Caltrans census traffic data for 2019, assumed to apply to 2035 and 2055.
AADT = annual average daily traffic
HOV = high-occupancy vehicle
I = Interstate
mi = mile/miles
mph = miles per hour
VMT = vehicle miles traveled

4. STUDY METHODS

The energy analysis is based on the methodology described in the *Caltrans Standard Environmental Reference*, Volume 1, Chapter 13 – Energy (Caltrans 2023). The energy analysis addresses both direct and indirect energy consumption, which are defined as follows:

Direct Energy. In the context of transportation, direct energy involves all energy consumed by vehicle propulsion (e.g., automobiles, trains, airplanes). This energy consumption is a function of traffic characteristics, such as VMT, speed, vehicle mix, and thermal value of fuel being used. Additionally, direct energy also includes the one-time energy expenditure involved in construction of the build alternatives. Therefore, analysis of direct energy use includes the following factors:

- **Direct Energy (Mobile Sources):** The energy consumed by vehicle propulsion within the facility during operation of the build alternatives.
- **Direct Energy (Construction):** The energy consumed by construction vehicles and equipment during construction of the build alternatives.
- **Indirect Energy**: Indirect energy includes maintenance activities that would result in long-term indirect energy consumption by equipment required to operate and maintain the roadway.

Direct energy consumption from mobile sources associated with the build alternatives was estimated using traffic model forecasts for VMT from the Traffic Operations Analysis Report (March 2023) and the Caltrans Emissions Factors Model (CT-EMFAC2017) version 1.0.3.0, which uses emission factors developed by the California Air Resources Board (CARB) in its Emission Factor Model, Version 2017 (EMFAC2017). The emission factor data for scenario years 2022, 2035, and 2050 were utilized with the corresponding traffic data for the 2022 No Build condition (Existing condition), 2035 Opening Year, and 2055 Future Year scenarios.

The construction emissions were estimated for the build alternatives using the Caltrans California Construction Emissions Tools 2020 (CAL-CET2020), Version 1.0, which is consistent with the guidance provided by Caltrans for evaluating construction impacts from roadway projects. The CAL-CET2020 results were used to quantify construction-related energy usage generated by construction of the build alternatives. The energy usage presented below is based on the best information available at the time of calculations and specifies the following build schedules for the build alternatives:

- **Alternative 2:** Anticipated to take approximately 11 months beginning in 2026.
- **Alternative 3:** Anticipated to take approximately 36 months beginning in 2026.
- **Alternative 4:** Anticipated to take approximately 36 months beginning in 2026.

5. ENVIRONMENTAL CONSEQUENCES

5.1 Impact Thresholds

5.1.1 National Environmental Policy Act Guidance

According to the Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] §§ 1500-1508) (CEQ 1969), the determination of a significant impact is a function of both context and intensity. Context means that the significance of an action must be analyzed in several contexts, such as society as a whole (i.e., human, national), the affected region, the affected interests, and the locality. Both short- and long-term effects are relevant. Intensity refers to the severity of impact. To determine significance, the severity of the impact must be examined in terms of the type, quality and sensitivity of the resource involved; the location of the proposed Project; the duration of the effect (short- or long-term) and other consideration of context. Adverse impacts will vary with the setting of the proposed action and the surrounding area.

5.1.2 California Environmental Quality Act Guidance

In accordance with Appendix G of the CEQA Guidelines, the proposed Project would result in impacts related to energy if it would:

- Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation; or
- Conflict with or obstruct a state or local plan for renewable energy or energy efficiency.

5.2 Impacts

The purpose of the build alternatives is to improve the overall movement of people and goods along this section of I-5 by improving the ML network operations, improving mobility and trip reliability, maximizing person throughput by facilitating the efficient movement of bus and rideshare users, and applying technology to help manage traffic demand. The build alternatives would result in direct but temporary fuel usage during construction as well as direct operational fuel consumption (i.e., vehicles using the facility).

5.2.1 Direct Energy Use (Construction)

5.2.1.1 No Build Alternatives (Alternative 1)

The No Build Alternative would not result in the construction of any improvements to I-5 in the Project Area except for ongoing and planned projects and, therefore, would not result in temporary impacts to energy.

5.2.1.2 Build Alternatives (Alternatives 2, 3, and 4)

Construction of the build alternatives would primarily consume diesel and gasoline through operation of heavy-duty construction equipment, material deliveries, and debris hauling.

As stated previously in Section 4, the construction impacts were estimated for the build alternatives using CAL-CET2020, Version 1.0, which is consistent with the guidance provided by Caltrans for evaluating construction impacts from roadway projects. This evaluation includes the two proposed park-and-ride facilities that would be constructed within the existing freeway right-of-way. There are no changes planned to the existing park and ride facilities. The CAL-CET2020 results were used to quantify construction-related energy usage generated by construction of the build alternatives and are presented in Tables 5.1, 5.2, and 5.3. The energy usage presented below is based on the best information available at the time of calculations and specifies the following build schedules for the build alternatives:

Table 5.1: Annual Construction Fuel Consumption for Alternative 2

Construction Year	Fuel Consumption (gallons)	
	Diesel Equipment	Gasoline Equipment
2026	4,969	1,187
2027	2,103	550
Total	**7,072**	**1,737**

Source: Compiled by LSA using CAL-CET2020 v1.0 (February 2023).
CAL-CET2020 = Caltrans California Construction Emissions Tools 2020

Table 5.2: Annual Construction Fuel Consumption for Alternative 3

Construction Year	Fuel Consumption (gallons)	
	Diesel Equipment	Gasoline Equipment
2026	130,133	38,016
2027	173,813	42,509
2028	95,070	17,355
2029	35,696	12,949
Total	**434,712**	**110,830**

Source: Compiled by LSA using CAL-CET2020 v1.0 (February 2023).
CAL-CET2020 = Caltrans California Construction Emissions Tools 2020

Table 5.3: Annual Construction Fuel Consumption for Alternative 4

Construction Year	Fuel Consumption (gallons)	
	Diesel Equipment	Gasoline Equipment
2026	145,277	42,453
2027	194,036	47,466
2028	106,120	19,367
2029	39,852	14,461
Total	**485,284**	**123,747**

Source: Compiled by LSA using CAL-CET2020 v1.0 (February 2023).
CAL-CET2020 = Caltrans California Construction Emissions Tools 2020

- **Alternative 2:** Anticipated to take approximately 11 months beginning in 2026.
- **Alternative 3:** Anticipated to take approximately 36 months beginning in 2026.
- **Alternative 4:** Anticipated to take approximately 36 months beginning in 2026.

As indicated above, energy use associated with Alternative 2 is estimated to result in the short-term consumption of 7,072 gallons from diesel-powered equipment and 1,737 gallons from gasoline-powered equipment. Alternative 3 is estimated to result in the short-term consumption of 434,712 gallons from diesel-powered equipment and 110,830 gallons from gasoline-powered equipment. Alternative 4 is estimated to result in the short-term consumption of 485,284 gallons from diesel-powered equipment and 123,747 gallons from gasoline-powered equipment. These energy use estimates represent a small demand on local and regional fuel supplies that would be easily accommodated, and this demand would cease once construction is complete. Moreover, construction-related energy consumption would be temporary and not a permanent new source of energy demand, and demand for fuel would have no noticeable effect on peak or baseline demands for energy. In addition, implementation of the following Project Feature, will reduce energy impacts resulting from construction activities.

PF-AQ-1 The Contractor shall comply with the California Department of Transportation (Caltrans) Standard Specifications in Section 14-9 (2022) for reducing impacts from construction activities. Section 14-9.02 specifically requires compliance by the contractor with all applicable air-pollution-control rules, regulations, ordinances related to air quality, including air quality management district rules and regulations.

Therefore, the build alternatives would not result in an inefficient, wasteful, and unnecessary consumption of energy.

5.2.2 Permanent Impacts – Direct Energy (Mobile Sources)

5.2.2.1 No Build Alternatives (Alternative 1)

As shown in Table 5.4, below, annual diesel fuel consumption for the No Build Alternative would be higher than existing conditions and would result in an increase in diesel fuel consumption compared to the build alternatives. Gasoline fuel consumption would decrease compared to the Existing (2022) condition, but would be higher than the build alternatives in both the Opening Year (2035) and Future Year (2055).

Fuel consumption would decrease under the No Build Alternative; therefore, the No Build Alternative would not result in permanent adverse energy impacts.

5.2.2.2 Build Alternatives (Alternatives 2, 3, and 4)

The primary purpose of the proposed Project is to improve the overall movement of people and goods along the section of I-5 from Red Hill Avenue to the OC/LA County line. Annual fuel consumption was estimated using traffic data for the proposed Project region and rates from CT-EMFAC2017 version 1.0.3.0, which uses factors developed by CARB in its EMFAC2017. The data for scenario years 2022, 2035, and 2055 were utilized with the corresponding traffic data for the 2022 No Build Condition (Existing Condition), 2035 Opening Year, and 2055 Future Year scenarios.

The regional VMT for Existing (2022) conditions, the No Build Alternative, and the build alternatives were estimated using the daily traffic volumes included in the *I-5 Managed Lanes Project (Red Hill Ave to Orange / Los Angeles County Line) Draft Traffic Operations Analysis Report* (Jacobs 2023). The VMT data, along with the CT-EMFAC2017 data, were used to calculate and compare the annual diesel and gasoline fuel consumption for the 2022, 2035, and 2055 regional conditions.

Table 5.4: Annual VMT, Vehicle Percentages, and Operational Fuel Consumption

Analysis Year	Annual VMT[1]	Truck Percentage[2]	Annual Fuel Consumption (gallons)[3]	
			Diesel	Gasoline
Opening Year (2035)				
Existing (2022)	1,742,990,490	7.0%	399,494	53,369,695
No Build Alternative	1,830,225,725	7.0%	448,950	38,660,007
Change from Existing	*87,235,235*	7.0%	*49,456*	*-14,709,687*
Alternative 2	1,690,134,558	7.0%	417,108	35,970,069
Change from Existing	*-52,855,932*	7.0%	*17,614*	*-17,399,626*
Change from No Build	*-140,091,167*	7.0%	*-31,842*	*-2,689,938*
Alternative 3	1,737,652,373	7.0%	428,835	36,704,573
Change from Existing	*-5,338,117*	7.0%	*29,341*	*-16,665,122*
Change from No Build	*-92,573,352*	7.0%	*-20,115*	*-1,955,434*
Alternative 4	1,787,640,305	7.0%	441,172	38,045,223
Change from Existing	*44,649,815*	7.0%	*41,677*	*-15,324,472*
Change from No Build	*-42,585,420*	7.0%	*-7,779*	*-614,785*
Future Year (2055)				
Existing (2022)	1,742,990,490	7.0%	372,292	35,061,353
No Build Alternative	1,964,437,696	7.0%	536,133	35,846,723
Change from Existing	*221,447,206*	7.0%	*163,841*	*785,370*
Alternative 2	1,784,746,094	7.0%	496,156	33,321,292
Change from Existing	*41,755,604*	7.0%	*123,864*	*-1,740,061*
Change from No Build	*-179,691,601*	7.0%	*-39,977*	*-2,525,431*
Alternative 3	1,852,783,427	7.0%	515,070	34,591,552
Change from Existing	*109,792,937*	7.0%	*142,778*	*-469,801*
Change from No Build	*-111,654,269*	7.0%	*-21,063*	*-1,255,171*
Alternative 4	1,907,536,046	7.0%	530,291	35,613,786
Change from Existing	*164,545,556*	7.0%	*157,999*	*552,433*
Change from No Build	*-56,901,650*	7.0%	*-5,841*	*-232,937*

Source: Compiled by LSA using CT-EMFAC2017 (2022).

[1] Annual VMT values derived from daily VMT values multiplied by 347, per CARB methodology (CARB 2008).

[2] Truck volume is 7%, based on Caltrans Truck AADT (2019).

[3] The fuel consumption is based on speeds during peak travel and during off-peak travel as shown in Table 3.1, Table 3.2, and Table 3.3.

AADT = annual average daily traffic
Caltrans = California Department of Transportation
CARB = California Air Resources Board
CT-EMFAC2017 = Caltrans Emissions Factors Model
mph = miles per hour
VMT = vehicle miles traveled

The results of the modeling were used to calculate the annual fuel consumption listed in Table 5.4, which shows that the future No Build scenario would result in an increase in fuel consumption in 2035 and 2055 compared to the Existing (2022) condition. In addition, all build alternatives would result in an increase in diesel fuel consumption when compared to the Existing (2022) condition, but would also result in a decrease in diesel fuel consumption when compared to the future No Build scenario and also a decrease in gasoline fuel consumption compared to the No Build and Existing (2022) condition in both the Opening Year (2035) and Future Year (2055).

Although annual diesel fuel consumption for the build alternatives is higher than existing conditions, the build alternatives would result in a decrease in diesel fuel consumption when compared to the No Build Alternative. Similarly, annual gas fuel consumption for the build alternatives is higher than existing conditions, the build alternatives would result in a decrease in diesel fuel consumption when compared to the No Build Alternative. The build alternatives are expected to improve the overall movement of people and goods along this section of I-5 by improving the ML network operations, improving mobility and trip reliability, maximizing person throughput by facilitating the efficient movement of bus and rideshare users, and applying technology to help manage traffic demand and reduce energy consumption.

The changes to the traffic on I-5 ramps and connectors will be very minor and the addition of the park-and-ride facilities would only result in fewer vehicles on I-5. Thus, these were not included in the energy analysis.

As such, the build alternatives would not result in a wasteful, inefficient, or unnecessary consumption of energy.

The build alternatives are included in the 2023 Federal Transportation Improvement Program (FTIP) under ID No. ORA210604 and are proposed for funding from the COVID Relief Funds – State Transportation Improvement Program (STIP), State Highway Operation and Protection Program (SHOPP) Advance Construction (AC) - Mobility, and STIP AC Interregional Improvement Program (IIP) programs. The proposed Project is currently included in the future commitments section of SCAG's *2020–2045 Regional Transportation Plan/Sustainable Communities Strategy: A Plan for Mobility, Accessibility, Sustainability, and High Quality of Life* (2020–2045 RTP/SCS). However, the proposed Project is not captured in future regional models and efforts to incorporate the build alternatives into such models are being taken. Once updated later in 2023 the 2020–2045 RTP/SCS and the FTIP will capture the build alternatives in regional models.

The build alternatives would be consistent with regional, State, and local energy conservation plans. The Connect SoCal 2020 RTP/SCS includes information about efforts to encourage energy efficiency and renewable energy use. Regional plans for renewable energy and energy efficiency would not be impacted by the construction and operation of the build alternatives. Energy-efficient building development is not applicable to this Project, and renewable energy policies are encouraged for all Caltrans projects where applicable and feasible.

The result of the build alternatives will not conflict with or obstruct regional plans for renewable energy or energy efficiency.

6. REFERENCES

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Appendix materials to be provided upon request