Shoemaker Bridge Replacement Project

Energy Technical Memorandum

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EA: 27300
SCH No. 2016041007

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Memorandum

Date:	Thursday, August 08, 2019
Project:	EA 27300 Shoemaker Bridge Replacement Project
To:	John Vassiliades, Project Manager Nader Abdelmalek, Project Engineer Ronald Kosinski, Deputy District Director of Environmental Planning
From:	Jonathan Chang, Environmental Planner, HDR, Inc
Subject:	Energy Analysis Technical Memorandum

Introduction

This memorandum discusses energy impacts for the Shoemaker Bridge Replacement Project (Project) located at the southern end of State Route 710 (SR-710) in the City of Long Beach (City). It provides an overview of the energy conservation potential of the alternatives under consideration and discusses what is known at this time about the construction requirements and the vehicle operation requirements. In accordance with California Department of Transportation (Caltrans) Standard Environmental Reference Guidelines, a technical energy memorandum was conducted because, in considering the energy that would be used during Project construction and operation balanced with energy saved by relieving congestion and reducing out of direction travel, the proposed Project alternatives would not result in substantial energy impacts.[1]

Energy Planning Context

In December 2008, the California Air Resources Board (CARB) adopted its Climate Change Scoping Plan (Scoping Plan), which contains the main strategies that California will implement to achieve reduction of greenhouse gases. The Scoping Plan also includes CARB-recommended greenhouse gas reductions for each emissions sector of the State's greenhouse gas inventory. The Scoping Plan calls for the largest reductions in greenhouse gas emissions to be achieved by implementing certain measures and standards. Two of these are transportation-related: (1) improve emissions standards for light-duty vehicles; and (2) implement the Low-Carbon Fuel Standard (LCFS). The LCFS, issued January 2007 through Executive Order S-1-07, requires a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020.

CARB has not yet determined what amount of greenhouse gas reductions it recommends from local government operations; however, the Scoping Plan does state that land use planning and urban growth decisions will play an important role in the State's greenhouse gas reductions because local

[1] Per the Federal Highway Administration Technical Advisory 6640.8A, a detailed energy study, including computations, is only required for large-scale Environmental Impact Statement projects that would require extensive construction and related energy use, or where differences in energy consumption between the build and no-build alternatives are great, such as a rail system project.

governments have primary authority to plan, zone, approve, and permit how land is developed to accommodate population growth and the changing needs of their jurisdictions. CARB further acknowledges that decisions on how land is used will have large impacts on the greenhouse gas emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas emission sectors. CARB approved the First Update to the Climate Change Scoping Plan: Building on the Framework (First Update) on May 22, 2014. In 2016, the Legislature passed Senate Bill (SB) 32, which codifies a 2030 GHG emissions reduction target of 40 percent below 1990 levels. With SB 32, the Legislature passed companion legislation AB 197, which provides additional direction for developing the Scoping Plan. CARB is moving forward with a second update to the Scoping Plan to reflect the 2030 target set by Executive Order B-30-15 and codified by SB 32.

Energy Impacts Summary

The energy impacts of transportation projects are typically divided into two components: direct energy and indirect energy. Direct energy is the energy consumed in the actual propulsion (e.g., automobiles, trains, airplanes). This energy consumption is a function of traffic characteristics such as vehicle miles traveled (VMT), speed, vehicle mix, and thermal value of the fuel being used. Some projects may also include features such as new or replacement roadway lighting or other features requiring electricity which is an ongoing and permanent source of direct energy consumption. The one-time energy expenditure involved in constructing a project is also considered direct energy. Indirect energy is defined as all of the remaining energy consumed to run a transportation system, including construction energy, maintenance energy, and any substantial impacts to energy consumption related to project-induced land use changes and mode shifts, and any substantial changes in energy associated with vehicle operation, manufacturing, or maintenance due to increased automobile use.

Project Description

The City, in cooperation with Caltrans, is proposing to replace the Shoemaker Bridge (West Shoreline Drive) in Long Beach, California. The proposed Project is an Early Action Project (EAP) of the SR-710 Corridor Project and is located at the southern end of SR-710 in the City and is bisected by the Los Angeles River (LA River) in Los Angeles County (See Attachment A – Figure 1 and 2 for Regional Vicinity and Project Location, respectively). The purpose of the proposed Project is to:

- Provide a structure and highway facility that meets current structural and geometric design standards;
- Provide a facility that is compatible with planned freeway improvements and downtown development projects;
- Improve connectivity from the downtown area to surrounding communities and adjacent recreational use areas; and
- Improve safety and operations for all modes of transportation.

The proposed Project would result in improved safety operations and connectivity between downtown Long Beach and regional transportation facilities as well as accommodate future planned improvements and expansion of Cesar E. Chavez Park and Drake Park.

Project Alternatives

Three alternatives, a No-Build Alternative (Alternative 1), and two Build Alternatives (Alternatives 2 and 3) are being evaluated as part of the proposed Project. Alternatives 2 and 3 would replace the existing Shoemaker Bridge over the LA River with a new bridge constructed just south of the existing bridge. In both Alternatives 2 and 3, the Shoemaker Bridge would accommodate bicycle and pedestrian use and include the evaluation of design options for a roundabout (Design Option A) or a "Y" intersection (Design Option B) at the easterly end of the new bridge. The primary difference between Alternatives 2 and 3 is Alternative 2 includes repurposing a portion of the existing Shoemaker Bridge for nonmotorized transportation and recreational use, and Alternative 3 includes the removal of the existing Shoemaker Bridge in its entirety.

Alternatives 2 and 3 would also provide improvements to associated roadway connectors to downtown Long Beach and along West Shoreline Drive from SR-710, as well as improvements along portions of 3rd, 6th, and 7th Streets, and West Broadway from Cesar E. Chavez Park to Magnolia Avenue. The proposed improvements may include additional street lighting; restriping; turn lanes; and bicycle, pedestrian, and streetscape improvements. The proposed Project also includes the removal of the Golden Shore grade separation over West Shoreline Drive and modifications along Golden Shore to create a new controlled intersection at Golden Shore and West Shoreline Drive. Additionally, the proposed Project would evaluate street improvements on 6th and 7th Streets from Magnolia Avenue to Atlantic Avenue and on Anaheim Street between 9th and Atlantic Avenue. As an EAP of the SR-710 Corridor Project, Alternatives 2 and 3 would evaluate the impacts from the closure of the 9th and 10th Street ramp connections into downtown Long Beach (See Attachment A – Figure 3 for the Project Limits).

Regulatory Setting

Federal

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.

State

California Environmental Quality Act

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. State CEQA Guidelines Appendix F provides a list of energy-related topics that should be discussed in an Environmental Impact Report (EIR). While not described as significance thresholds for determining impacts related to energy, Appendix F provides topics2 that may be analyzed in an EIR when applicable to the proposed Project:

1. The project's energy requirements and its energy use efficiencies by amount and fuel type for each stage of the project's life cycle including construction, operation, maintenance and/or removal. If appropriate, the energy intensiveness of materials may be discussed.

2. The effects of the project on local and regional energy supplies and on requirements for additional capacity.

3. The effects of the project on peak and base period demands for electricity and other forms of energy.

4. The degree to which the project complies with existing energy standards.

5. The effects of the project on energy resources.

The project's projected transportation energy use requirements and its overall use of efficient transportation alternatives.

Based on these factors, the Project would have a significant impact with regards to energy if the Project 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.

Senate Bill (SB) 350

Signed on October 7, 2015, SB 350, also known as the Clean Energy and Pollution Reduction Act of 2015, includes objectives to: (1) increase the procurement of the state's electricity from renewable sources from 33 percent to 50 percent by December 31, 2030; and (2) to double the energy efficiency savings in electricity and natural gas final end uses of retail customers through energy efficiency and conservation by 2030[3]. SB 350 establishes annual targets for statewide energy efficiency savings and demand reduction that will achieve a cumulative doubling of statewide energy efficiency savings in electricity and natural gas final end uses by January 1, 2030.

Assembly Bill 32 and SB 32

Assembly Bill (AB) 32 (Health and Safety Code Sections 38500-38599), also known as the California Global Warming Solutions Act of 2006, establishes the statewide goal of achieving year 1990 greenhouse gas (GHG) emissions levels by 2020. As part of AB 32, the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC) are tasked to provide information,

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[2] California Environmental Quality Act. Appendix F Energy Conservation. Retrieved from http://resources.ca.gov/ceqa/guidelines/Appendix_F.html.

[3] Senate Bill 350 (2015-2016 Reg. Session) Stats 2015, Ch. 547. Signed October 7, 2015.

analysis, and recommendations to the California Air Resources Board (CARB) regarding methods to reduce GHG emissions in the electricity and natural gas utility sectors. Signed on September 8, 2016, SB 32 updates AB 32 by requiring a statewide GHG emissions reduction of 40 percent below 1990s levels by 2030. SB 32 outlines ways to achieve this emissions reduction goal, including increasing renewable energy use, improving energy efficiency, and establishing caps on emissions from key industries.

California's Renewable Portfolio Standard

Established in 2002 under Senate Bill 1078, California's Renewables Portfolio Standard (RPS) applies to all electricity retailers in the state including publicly owned utilities (POUs), investor-owned utilities, electricity service providers, and community choice aggregators. All of these entities were required to adopt the new RPS goals of 20 percent of retails sales from renewables by the end of 2013, 25 percent by the end of 2016, and the 33 percent requirement being met by the end of 2020. The CPUC and CEC jointly implement the RPS.

Senate Bill (SB) 100

Also known as the 100 Percent Clean Energy Act of 2018, SB 100 updated the goals of California's Renewable Portfolio Standard and SB 350. SB 100 requires the state to achieve a 50 percent renewable resources target by December 31, 2026 and a 60 percent target by December 31, 2030. In addition, eligible renewable energy resources and zero-carbon sources are required to supply 100 percent of retail sales of electricity to retail customers and 100 percent of electricity procured to serve all state agencies by December 31, 2045[4].

Senate Bill (SB) 1389

SB 1389 (Public Resources Code Sections 25300-25323) requires the CEC to adopt an Integrated Energy Policy Report every two years and an update every other year. The Integrated Energy Policy Report addresses electricity, natural gas, and transportation fuels. The latest completed report, the 2018 Integrated Energy Policy Report Update, addresses a variety of topics including double energy efficiency savings, integrating renewable energy, and forecasting energy demand.

Regional

The proposed Project is included in the Southern California Association of Government's (SCAG) 2016 Regional Transportation Plan (RTP) for Los Angeles County. The Project is in the 2016 RTP, which was found to be conforming by the Federal Highway Administration (FHWA)/Federal Transit Administration (FTA) on June 1, 2016. The 2016 RTP (Amendment 3) was found to conform by FHWA and FTA on December 17, 2018. The Project is also in the 2019 Federal Transportation Improvement Program (FTIP), which was found to be conforming by the FHWA/FTA on December 17, 2018[5] (HDR 2019).

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[4] Senate Bill 100 (2017-2018 Reg. Session) Stats 2018, Ch. 312. Signed September 10, 2018.

[5] Project ID: LA0G830; Description: I-710 Improvements/Shoemaker Bridge Replacement. Replace the existing Shoemaker Bridge with a new bridge. The new bridge will be reduced to have two mixed-flow lanes in the NB and

Local

City of Long Beach General Plan – Mobility Element

The City is aiming future improvements at making the existing mobility network more efficient by encouraging other modes of transportation (primarily walking, bicycling, and public transit) and by using innovation and technology to improve the flow of traffic along our corridors. The City has identified streets that have potential for new character-changing features, based on Map 16 - Opportunity for Street Character Change in the General Plan's Mobility Element (City of Long Beach 2013). These streets can be reconfigured to accommodate a variety of improvements, such as wider sidewalks with trees, bike paths or lanes, dedicated transit lanes, and landscaped medians or curb extensions that make the streets more attractive and usable. Shoemaker Bridge and Shoreline Drive are identified as having the opportunity for street character change (City of Long Beach 2013).

Port of Long Beach Master Plan

The Port of Long Beach Master Plan includes goals and policies in the Public Access, Visual Quality, and Recreational/Tourist Element. Goal No. 8 is to Enhance Public Access in the Queensway Bay Planning District, located within the Project limits.

City of Long Beach Local Coastal Program – Transportation Policy

The City's Local Coastal Program (LCP) includes Transportation goals and policies to increase pedestrian and bicycle access opportunities.

Affected Environment

Existing Conditions

The Project limits is defined as the southern terminus of SR-710 and downtown Long Beach and includes the immediate vicinity of the proposed Project, which is bounded by Anaheim Street to the north, Santa Fe Avenue to the west, Pacific Avenue to the east, and West Shoreline Drive to the south (as shown in Figure 2 in Attachment A). There is existing highway lighting on Shoemaker Bridge on both northbound (NB) and southbound (SB) sides. The existing Shoemaker Bridge was constructed in 1953 and needs to be reconstructed to bring the structure up to current structural design standards consistent with American Association of State Highway and Transportation Officials (AASHTO) Load Resistance Factor Design (LRFD) Bridge Design Specification, 2012 (Sixth Edition) with California Amendments (AASHTO-CA BDS-6), and current roadway design standards, consistent with Caltrans Highway Design Manual (HDM) design standards (December 14, 2018). The following items are assessed in the evaluation of the existing structure: the deck condition is poor, the bridge rails are nonstandard, and the deck geometry is characterized as tolerable. Additionally, local traffic entering and exiting from ramps on either end of the bridge (NB and SB), have nonstandard weaving distances. Accidents occurring on the bridge and ramps may be attributed in part to the short weaves.

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in the SB directions to tie the flow into I-710. The new bridge will also include pedestrian and bicycle access. Additionally, bicycle, pedestrian, and street enhancements will be provided on adjacent thoroughfares.

Replacement of the bridge and realignment of connectors in accordance with current Caltrans Highway Design Manual standards would reduce the potential for accidents and modernize the roadway and structural design while accommodating future planned projects, such as the I-710 Corridor Project and the Drake-Chavez Greenbelt Project.

Shoemaker Bridge provides a vital connection between SR-710 on the west side of the LA River and downtown Long Beach, on the east side of the LA River. The SR-710 mainline continues south past Shoemaker Bridge on the west side of the LA River and provides connections to the Port of Long Beach and the Port of Los Angeles via local streets and the Terminal Island Bridge. The proposed Project is needed to improve safety, operations, and connectivity between downtown Long Beach and regional transportation facilities. It is also needed to accommodate planned improvements in the area, such as the City's planned expansion of Cesar E. Chavez and Drake Parks.

If the existing Shoemaker Bridge were to continue to be used for vehicular traffic, the nonstandard features would remain and cannot be upgraded to current State highway standards. Thus, the existing bridge alignment would preclude planned improvements by other locally and regionally significant projects, specifically, the I-710 Corridor Project. Implementation of the proposed Project would provide consistency with the improvements proposed as part of the SR-710 Corridor Project and the Mobility Element of the City of Long Beach General Plan (City of Long Beach 2013), in addition to meeting the needs for traffic safety and accommodating the projected increase in demand for the City's nonmotorized transportation facilities.

Indirect energy under the Build Alternatives (Alternatives 2 and 3) under Design Options A and B would include energy used for construction activities such as excavation, backfill, dredging and material transport, and energy consumed by other elements that aid in construction, such as variable message signs and construction lighting. Indirect energy consumption would also depend on the type of equipment used for construction, vehicle efficiency, and the efficiency of haul roads. Energy used for maintaining the new bridge, auxiliary lanes, pedestrian/bicycle improvements, and other project features of the Build Alternatives under Design Options A and B would also be categorized under indirect energy. There would be no induced land use changes or any notable mode changes associated with the Build Alternatives under Design Options A and B. The No-Build Alternative would not involve any construction energy impacts, but it would not be able to accomplish any long-term reduction in energy consumption that improving the roadway operational efficiency may be able to provide.

In the long term, the direct, or operating, energy requirements of a project are usually greater and of primary importance; therefore, this discussion focuses on the direct energy requirements for ongoing Shoemaker Bridge operations with and without the proposed Build Alternatives. Since both the Build and No-Build Alternatives involve direct energy use, the analysis tries to determine which is more likely to reduce vehicle energy use by lessening congestion and related travel delays. The lessening of congestion and related traffic delay is associated with faster and less variable average travel speeds. Improved operations are likely to reduce vehicle energy use, whether in the form of petroleum fuels or alternative sources of energy (e.g., biodiesel or ethanol).

Traffic Analysis

Information for this section is taken from the Traffic Operations Analysis Report (HDR 2019) which presents traffic analysis and results for the proposed Project. The Traffic Study Area is consists of 30 intersections and 29 arterials within the vicinity of the Project limits.

No-Build Alternative (Alternative 1)

By 2035, without improvements to facilities including freeway segments, weaving segments, and ramp junction areas, congested traffic conditions would prevail in the Traffic Study Area, as traffic congestion increases on SR-710. Due to insufficient capacity for the forecast volumes, bottlenecks and queues would develop at certain intersections in the Traffic Study Area. Low travel speeds and long delays would be prevalent during peak hours. Such congested traffic conditions contribute to inefficient energy consumption as vehicles use extra fuel while idling in stop-and-go traffic or moving at slow speeds on a congested roadway.

Alternatives 2 and 3 (Design Options A and B)

As shown in Figure 2, the Build Alternatives under Design Options A and B include modifications to nine local streets, including West Shoreline Drive, Ocean Boulevard, Golden Shore/Golden Avenue, West Broadway, 3rd Street, 6th Street, 7th Street, 9th Street, 10th Street, and Anaheim Street. Alternative 2 includes the replacement of the ramp structures that connect to the downtown Long Beach roadway system and will evaluate both the roundabout Design Option (Design Option A) and the “Y” interchange design option (Design Option B) at the east end of the proposed bridge.

The deck of the new bridge would accommodate two through ramp lanes in each direction, shoulders, barriers, and a bicycle and pedestrian path on the south side of the bridge. Under Design Option B, the bridge would also include two turn lanes in the SB direction. On the west side of the LA River, the ramps would connect on the left side of the freeway, at approximately the same merge and diverge existing ramp locations. On the east side of the river, a roundabout or controlled intersection would be provided at the ramp termini. The ramp termini would be located at or near the eastern abutment of the river-spanning section of the new Shoemaker Bridge.

Similar to Alternative 2, Alternative 3 includes the replacement of the ramp structures that connect to the downtown Long Beach roadway system. It would also evaluate both Design Options A and B at the east end of the proposed bridge. Local street improvements described under Alternative 2 would also apply under Alternative 3. These improvements include:

- Improvements along portions of 3rd, 6th, and 7th Streets, and West Broadway from Cesar E. Chavez Park to Magnolia Avenue;
- Additional street lighting, restriping, turn lanes, and bicycle, pedestrian, and streetscape improvements, as may be needed; and
- Removal of the Golden Shore Bridge over Shoreline Drive and modifications to Golden Shore to create a new controlled intersection at Golden Shore and Shoreline Drive.

The primary difference between Alternatives 2 and 3 is that Alternative 2 includes repurposing a portion of the existing bridge for non-motorized transportation and recreational use, and Alternative 3 includes the removal of the existing bridge. The same ramp/connectors proposed under Alternative

2 would apply under Alternative 3. Thus, Alternatives 2 and 3 would reduce traffic delay in ramp junction areas, interchanges, and surrounding intersections within the Project limits to the same extent. The following discusses the traffic analysis results and the effect on energy consumption with regards to Alternative 2, as this Build Alternative includes pedestrian and bicycle uses as part of repurposing a portion of the existing bridge.

Traffic Conditions and Effects on Energy Consumption

Traffic diversions near bottlenecks are common and can cause considerable delay, which would increase vehicle energy consumption. Existing conditions traffic analysis shows that traffic congestion exists on parts of local roads and near major off-ramps. Project Build Conditions do not affect physical configuration or traffic volumes along SR-710. However, by 2035, as congestion on SR-710 increases, traffic diversion to local streets would also increase. This increase in "cut-through" traffic would deteriorate conditions on local streets, increasing delay and energy consumption.

Traffic analysis results that would influence energy consumption in the Project limits are presented in this section. To analyze the differences in traffic on local streets, intersection level of service (LOS) values were compared. Based on the Highway Capacity Manual (2010), LOS E and F[6] values are considered unsatisfactory. According to the Traffic Operations Report (HDR 2019), all Traffic Study Area intersections currently operate at acceptable LOS D[7] or better under existing conditions with the exception of the intersection of Pier B Street/Pico Avenue at 9th Street/SR-710 Ramps which operates at LOS F during the AM peak hour.

No-Build Alternative (Alternative 1)

By 2035, due to the population and job growth in the region, traffic on freeway mainline and ramps would increase. According to the TOAR (HDR 2019), under No-Build Conditions in 2035, four freeway off-ramps will operate at unsatisfactory LOS E:

- WB Anaheim St On-Ramp to SB Pacific Coast Highway (PCH) Off-Ramp, during AM Peak Hour
- North of WB Anaheim St Off-Ramp, during AM and Midday Peak Hours
- WB Anaheim St Off-Ramp, during Midday Peak Hour
- 7th St On-Ramp / 10th St Off-Ramp, during AM Peak Hour

Under the No-Build Alternative, these freeway ramp junction areas would not be able to accommodate the future travel demand, leading to severe traffic congestion during peak hours. Intersection queuing

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[6] *LOS F* describes a condition of excessively high delay, considered unacceptable to most drivers. This condition often occurs when arrival flow rates exceed the LOS D capacity of the intersection. Poor progression and long cycle lengths may also be major contributing causes to such delay. Source: Highway Capacity Manual 2010

[7] *LOS D* describes operations with high delay, resulting from some combination of unfavorable progression; long cycle lengths, or high volumes. The influence of congestion becomes more noticeable, and individual cycle failures are noticeable. Source: Highway Capacity Manual 2010

at key study intersections was also analyzed in the traffic study. In 2035, two intersections do not provide adequate storage under No-Build Conditions, these include:

- Maine Avenue and Broadway – northbound right-turn lane
- Magnolia Avenue and 6th Street – southbound through lane

Thus, under No-Build Conditions in 2035, no anticipated energy savings are associated with the No-Build Alternative.

Alternatives 2 and 3 (Design Options A and B)

Proposed Project improvements would result in physical changes to Shoemaker Bridge, itself. The removal of the local connector from 9th and 10th Streets eliminates a weave taking place at the northern end of the bridge structure. Under Alternatives 2 and 3 (Design Options A and B) in 2035, freeway operations at the 7th St on-Ramp would improve to LOS D during the AM Peak Hour, thus substantially reducing congestion and delay at this ramp junction. Vehicles that took circuitous routes to circumvent congestion under the No-Build Alternative at the 7th St on-Ramp would come back to this on-ramp, reducing vehicle miles traveled in the corridor. As energy consumed is directly proportional to the vehicle miles traveled, Alternatives 2 and 3 (Design Options A and B) would lead to energy savings.

Environmental Consequences

Construction Energy Impacts

The No-Build Alternative would not involve any construction energy impacts as no construction activities would occur under this alternative.

Construction Direct Energy Use

Construction of the proposed Project's Build Alternatives under Design Options A and B would involve temporary fuel usage associated with construction vehicles and equipment. Project construction will involve the following: grubbing/land clearing, grading/excavation, drainage/utilities/sub-grade, paving, and striping. The Project's construction emissions were estimated under Alternatives 2 and 3 (Design Options A and B) using the Sacramento Metropolitan Air Quality Management District's Road Construction Emissions Model, Version 8.1.0. Default equipment assumptions for the Road Construction Emissions Model were used in developing the emissions estimates. The emissions presented below assume that the schedule for all improvements is anticipated to begin in 2022 and end in 2024. Table 1 provides the peak daily constructions emissions that would be generated by Alternative 2. Table 2 provides the peak daily constructions emissions that would be generated by Alternative 3. The fuel consumptions listed in Table 1 and Table 2 were calculated using the 22.2 pounds of CO_2 per gallon emission rate for diesel fuel (EPA 2005).

Table 1. Construction Emissions for Alternative 2 (Design Options A and B)

Project Phase	CO_2e (lbs/day)	Fuel Consumption (gallons/day)
Grubbing/Land Clearing	7,246.39	326.4
Grading/Excavation	20,711.04	932.9
Drainage/Utilities/Sub-Grade	15,582.23	701.9
Paving	7,173.12	323.1
Maximum daily or average daily	20,711.04	932.9
Project Total (tons or gallons)	4,169.94	375,670

CO_2e = carbon dioxide equivalent
Source: Air Quality Report. Shoemaker Bridge Replacement. (HDR 2019)

Table 2. Construction Emissions for Alternative 3 (Design Options A and B)

Project Phase	CO_2e (lbs/day)	Fuel Consumption (gallons/day)
Grubbing/Land Clearing	7,972.81	359.1
Grading/Excavation	20,711.04	932.9
Drainage/Utilities/Sub-Grade	15,582.23	701.9
Paving	7,173.12	323.1
Maximum daily or average daily	20,711.04	932.9
Project Total (tons or gallons)	4,189.12	377,398

CO_2e = carbon dioxide equivalent
Source: Air Quality Report. Shoemaker Bridge Replacement. (HDR 2019)

The grading and excavation phase during construction activities would result in maximum daily construction emissions and thus would be the most energy intensive. As indicated above, energy use associated with proposed Project construction is estimated to result in the short-term consumption of 359,045 gallons from construction equipment. This represents 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.

Energy minimization measures would minimize energy use during construction activities. In addition, construction traffic would be scheduled and would reduce congestion caused by idling vehicles along local roads during peak travel times (HDR 2019), as provided by Project Feature PF E-1. This project feature would reduce construction-related energy consumption by idling vehicles. The Project would comply with all SCAQMD regulations regarding use of construction vehicles and equipment. 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 energy resources. With implementation of Project Feature PF E-1 and minimization measures to reduce construction-related vehicle and equipment energy consumption, the Project would not result in wasteful, inefficient, or unnecessary consumption of energy resources during construction.

Construction Indirect Energy Use

Construction indirect energy consumption would also result from traffic delays due to construction. The Project's Transportation Management Plan (TMP), implemented as Project Feature PF E-2, would minimize any construction related traffic impacts. The TMP would assist in managing traffic congestion, and provide signage to affected residents and businesses in the event temporary closures or detours are warranted during construction activities. Compared to direct energy use by construction vehicles and equipment, indirect energy use due to construction-related traffic delays would be minimal and would be minimized with implementation of the TMP.

Operational Energy Impacts

For purposes of this analysis, it is assumed that the operational energy impacts of the Build Alternatives (Alternatives 2 and 3) under Design Options A and B would be equal.

Vehicle Energy Consumption

The Project's Build Alternatives under Design Options A and B would not generate new vehicular traffic trips since it would not construct new homes or businesses. Based on the TOAR (HDR 2019), Alternative 2 - Design Option A yields superior LOS results compared to Alternative 2 - Design Option B under 2035 Build Conditions. As a result, energy savings are associated with the Alternative 2 (Design Option A) compared to the No-Build Alternative.

The regional VMT data for the existing, No-Build, and Build Alternatives under Design Options A and B, along with the CT-EMFAC2017 emission rates, were used to calculate the CO_2e emissions for the Existing (2015), 2025, and 2035 conditions. The fuel consumptions were calculated using the 22.2 pounds of CO_2 per gallon emission rate for diesel fuel (EPA 2005). As shown in Table 3, there is a possibility that some traffic currently utilizing other routes would use the new facilities, thus resulting in increased VMT, CO_2e emissions, and fuel consumption within the Project limits.

Table 3. Modeled Annual CO_2e Emissions and Fuel Consumption, by Alternative

Alternative	Annual Vehicle Miles Traveled[1]	CO_2e Emissions (Metric Tons/Year)	Annual Fuel Consumption (gallons)
Existing/Baseline (2015)	17,785,832	10,662	1,049,350
Open to Traffic (2025)			
No-Build	18,548,538	9,468	931,837
Alternative 2 and 3	19,620,768	9,475	932,526
Horizon/Design-Year (2035)			

Table 3. Modeled Annual CO_2e Emissions and Fuel Consumption, by Alternative

Alternative	Annual Vehicle Miles Traveled[1]	CO_2e Emissions (Metric Tons/Year)	Annual Fuel Consumption (gallons)
No-Build	19,502,094	9,010	886,761
Alternative 2 and 3	20,579,529	9,082	893,847

CO_2e = carbon dioxide equivalent
Source: CT-EMFAC2017
Air Quality Report. Shoemaker Bridge Replacement. (HDR 2019)
[1] Annual VMT values derived from Daily VMT values multiplied by 347, per ARB methodology (CARB 2008).

As shown in Table 3, all of the future No-Build and Build Alternative conditions emissions are lower than the existing baseline. When compared to the No-Build Conditions, the Build Alternatives under Design Options A and B would result in a minimal increase in emissions. Although there is a modeled increase in VMT, during operation of the Project over the long term, newer and more fuel-efficient vehicles will enter the fleet, resulting in an overall lower potential for an increase in energy consumption due to vehicle traffic.

Projects that improve traffic flow during peak travel demand periods or reduce stop-and-go conditions would improve vehicles' fuel economies, and thus affect project energy consumption. Compared to the No-Build Conditions, the Project's proposed improvements under the Build Alternatives under Design Options A and B would improve roadway operations and reduce traffic delay in ramp junction areas, interchanges, and intersections within the Project limits. Thus, vehicle delay and congestion within the Project limits would decrease compared to No-Build Conditions. Due to all of the above-mentioned advantages, the Build Alternatives under Design Options A and B would not result in long-term energy impacts with regards to vehicular traffic energy use. Therefore, the Project's Build Alternatives under Design Options A and B would not result in wasteful, inefficient, or unnecessary consumption of energy resources during Project operation.

Pedestrian and Bicycle Access and Reduction in Vehicle Fuel Usage

As part of the Alternatives 2 and 3 under Design Options A and B, the new replacement bridge will include pedestrian and bicycle access. In addition, bicycle, pedestrian, and street enhancements will be provided on adjacent thoroughfares. A new bicycle path would extend from the new 6th Street terminus, providing connections to the LARIO Trail and the new Shoemaker Bridge. Implementation of the proposed Project would provide consistency with the improvements proposed as part of the I-710 Corridor Project and the Mobility Element of the City of Long Beach General Plan. In particular, Shoemaker Bridge and Shoreline Drive are identified as having the opportunity for street character change in the City's General Plan Mobility Element, as these streets have the potential to be reconfigured to accommodate a variety of improvements (City of Long Beach 2013). The Project Build Alternatives under Design Options A and B proposes to build a replacement bridge within the Queensway Bay District. Under Alternatives 2 and 3, the deck of the new bridge would accommodate two through ramp lanes in each direction, shoulders, barriers, and a bicycle and pedestrian path on the south side of the bridge. Thus, as the Project's Build Alternatives under Design Options A and B would increase pedestrian and bicycle access, the Project would be consistent with the following goal in the City's Mobility Element:

Strategy No. 1 – Establish a network of complete streets that complements the related street type.
Policy 1-1: To improve the performance and visual appearance of Long Beach's streets, design streets holistically using the "complete streets approach" which considers walking, those with mobility constraints, bicyclists, public transit users, and various other modes of mobility in parallel.

The Project's Build Alternatives under Design Options A and B would improve overall connectivity from the downtown area to surrounding communities and adjacent recreational uses as well as increase pedestrian and bicycle access opportunities compared to No-Build Conditions. Therefore, the Build Alternatives under Design Options A and B would decrease reliance on automobile use and reduce consumption of transportation-related energy within the Project limits.

Energy Use during Operation

Indirect energy-use involving maintenance activities on roadways would result in long-term indirect energy consumption by equipment required to operate and maintain the roadway. However, this long-term indirect energy use would be minimal compared to the direct energy use by vehicles on roadways within the Project limits.

Southern California Edison provides electricity service to the City. Project operational direct energy-use would include electricity usage associated with highway and street lighting as part of proposed Project improvements. The Project would incorporate energy-efficient lighting, such as light-emitting diode (LED) traffic signals and street lights, as provided in Project Feature PF E-3. Thus, the Build Alternatives under Design Options A and B would not result in wasteful, inefficient, or unnecessary consumption of energy resources with regards to electricity consumption during Project operation.

Project Consistency with Local Plans for Renewable Energy or Energy Efficiency

As mentioned previously, the proposed Project is included in the 2019 FTIP and SCAG 2016 RTP. The Project limits does not currently contain any generators of renewable energy. The Project would not obstruct or conflict with a state or local plan for renewable energy.

Implementation of the proposed Project would provide consistency with the improvements proposed as part of the SR-710 Corridor Project and the City's General Plan Mobility Element (City of Long Beach 2013). The Build Alternatives under Design Options A and B would accommodate the projected increase in demand for the City's nonmotorized transportation facilities, thus promoting transportation energy efficiency.

With regards to highway and street lighting, the Project would install high efficiency LEDs, which consume about 75 percent less electricity than typical incandescent bulbs (U.S. Department of Energy). These energy conservation features are consistent with State and local policies with regards to energy efficiency (California Public Utilities Commission). Therefore, the Build Alternatives under Design Options A and B would not obstruct or conflict with a state or local plan for renewable energy or energy efficiency.

Project Features

The following Project Features will be implemented during construction activities:

PF E-1 To the extent feasible, construction traffic will be scheduled and reduce congestion and related air quality impacts caused by idling vehicles along local roads during peak travel times.

PF E-2 The Transportation Management Plan (TMP) would include, but is not limited to, the following measures:

A Maintenance of Traffic (MOT) Plan will be established that provides at least one lane of traffic in each direction on roads during construction.

Local access will be maintained to businesses and residential properties at all times.

Pedestrian access points to businesses, parks, schools within the construction area will be maintained throughout the construction period where feasible. If usual access points are lost, provisions for alternative access to the affected parcels will be made. Appropriate signage will be placed to inform pedestrians and bicyclists of the alternative access to local businesses. Disabled access will be maintained during construction where feasible.

PF E-3 The Project will incorporate the use of energy-efficient lighting, such as light-emitting diode (LED) traffic signals and street lights, to the extent feasible. LED lights consume 10 percent of the electricity of traditional lights.

Avoidance, Minimization, and/or Mitigation Measures

The following minimization measure will be implemented during construction activities.

E-1 **Construction Energy Efficiency Plan.** As part of the Plans, Specifications, and Estimates (PS&E), the City's Resident Engineer will prepare a construction efficiency plan, which may include the following:

- Reuse of existing rail, steel, and lumber wherever possible, such as for falsework, shoring, and other applications during the construction process.
- Recycling of asphalt taken up from roadways, if practicable and cost-effective.
- Use of newer, more energy-efficient equipment where feasible and maintenance of older construction equipment to keep in good working order.
- Promoting of scheduling of construction operations to efficiently use construction equipment, i.e., only haul waste when haul trucks are full and combine smaller dozer operations into a single comprehensive operation, where possible.
- Promotion of construction employee carpooling.

Conclusion

With inclusion of PF E-1 through PF E-3, which includes a TMP, and the implementation of Minimization Measure E-1, the Project's Build Alternatives under Design Options A and B would minimize temporary construction energy impacts related to construction vehicle and equipment use.

Under No-Build Conditions, low travel speeds and long delays would be prevalent during peak hours at certain intersections and interchanges. Such congested traffic conditions contribute to inefficient energy consumption as vehicles use extra fuel while idling in stop-and-go traffic or moving at slow speeds on a congested roadway.

The Project's proposed improvements as part of the Build Alternatives under Design Options A and B would improve roadway operations and reduce traffic delay in ramp junction areas, interchanges, and intersections within the Project limits. Although there is a modeled increase in VMT during operation of the Project over the long term, newer and more fuel-efficient vehicles will enter the fleet, resulting in an overall lower potential for an increase in energy consumption due to vehicle traffic. Therefore, the Build Alternatives under Design Options A and B would not result in long-term energy impacts with regards to vehicular traffic energy use.

Furthermore, the Project's Build Alternatives under Design Options A and B would improve overall connectivity from the downtown area to surrounding communities and adjacent recreational uses as well as increase pedestrian and bicycle access opportunities. Therefore, the Build Alternatives under Design Options A and B would decrease reliance on automobile use and reduce consumption of transportation-related energy within the Project limits compared to the No-Build Alternative.

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ATTACHMENT A:

FIGURES

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EA No. 27300

Shoemaker Bridge Replacement Project

Figure 1. Regional Vicinity

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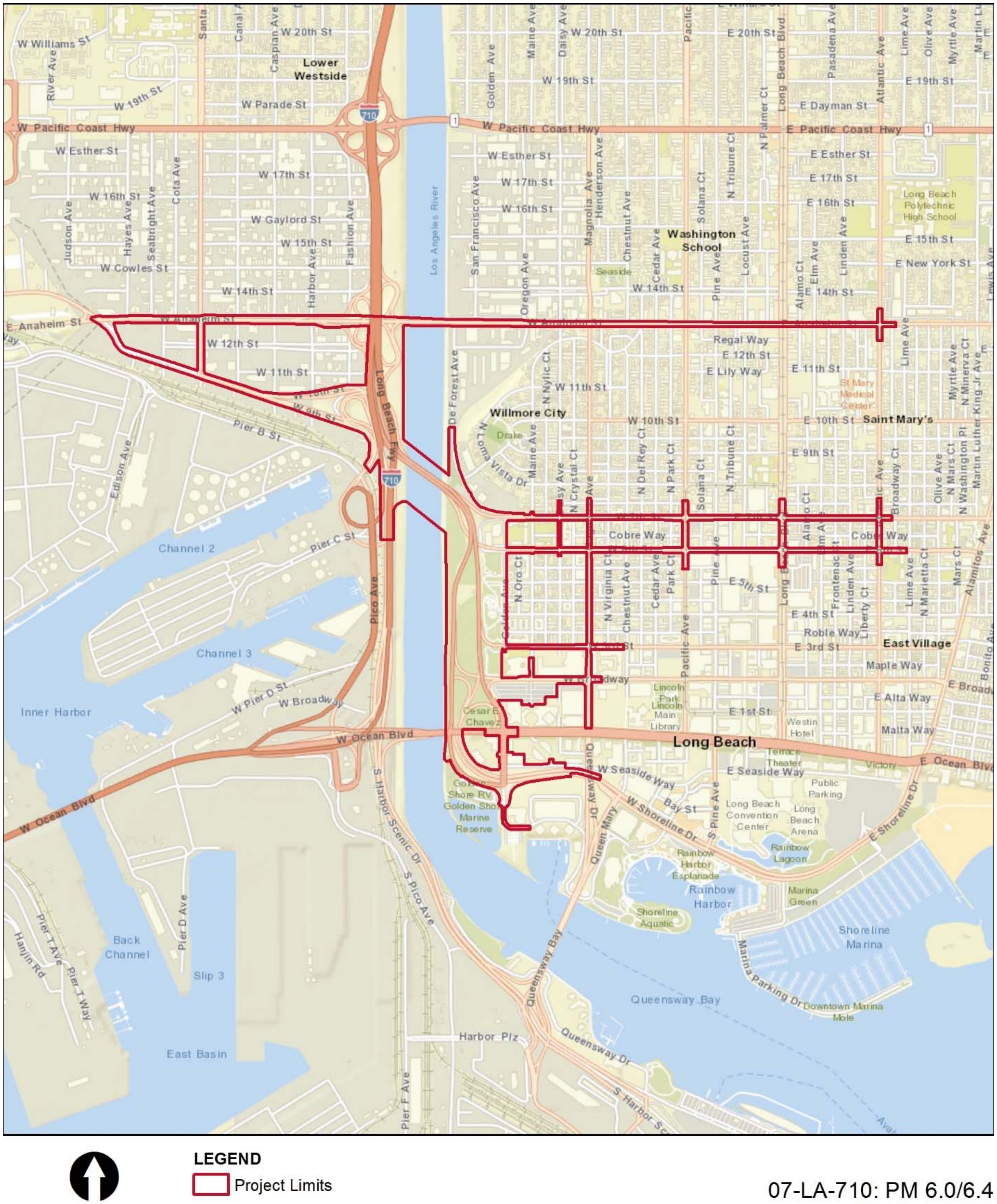

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Shoemaker Bridge Replacement Project

Figure 2. Project Location

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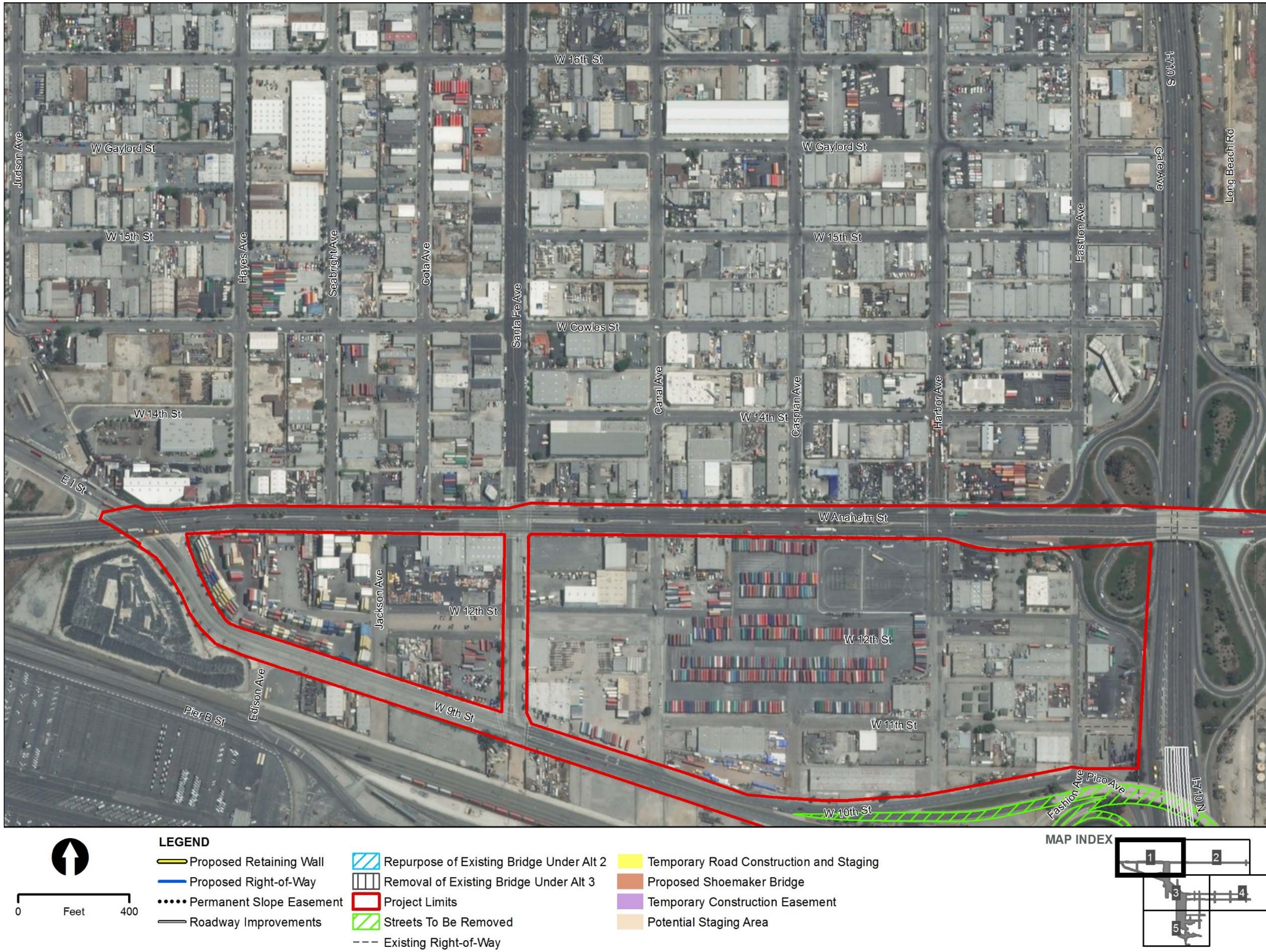

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Shoemaker Bridge Replacement Project

Figure 3. Project Limits
Sheet 1 of 5

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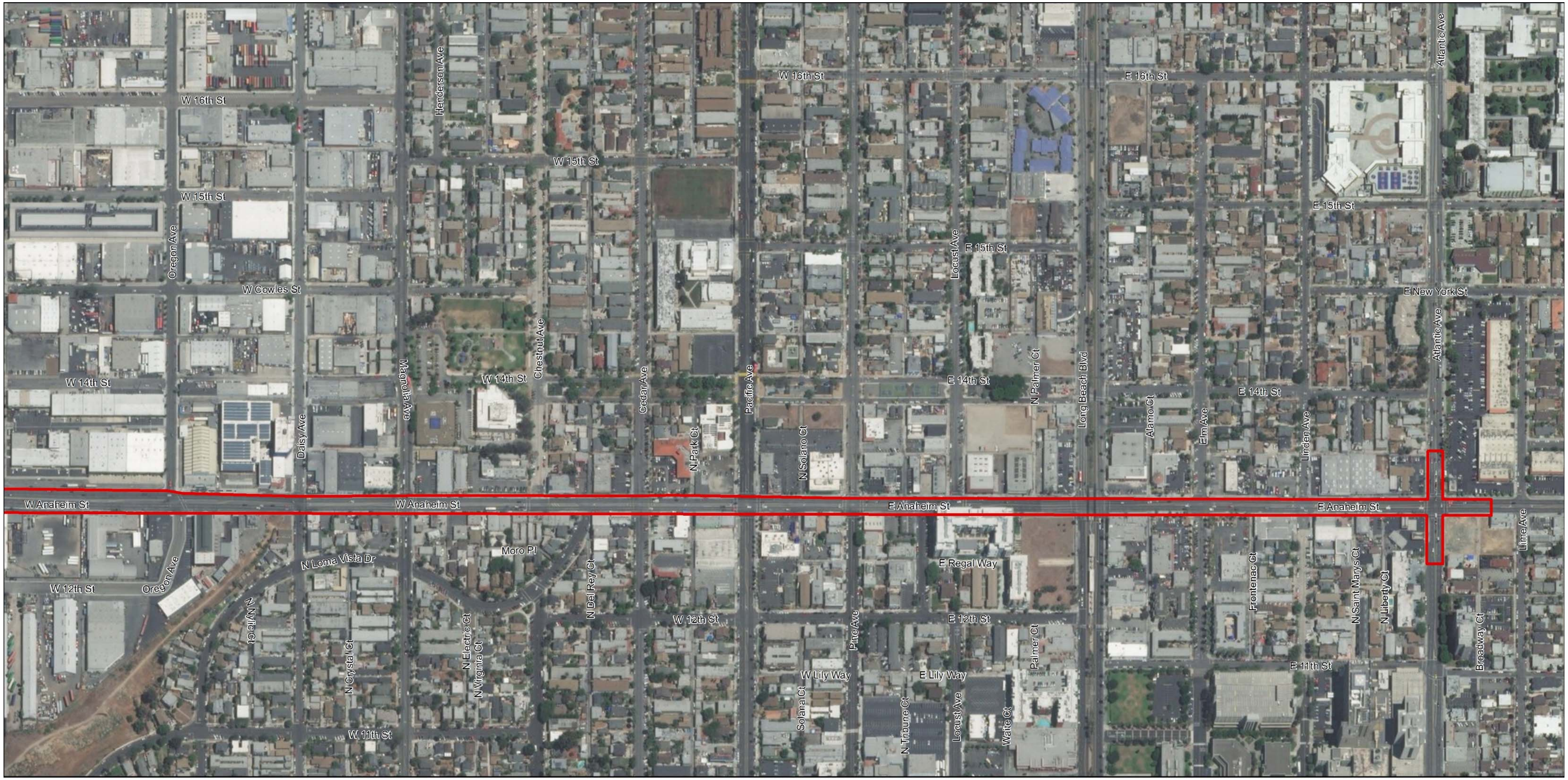

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LEGEND

- Proposed Retaining Wall
- Proposed Right-of-Way
- Permanent Slope Easement
- Roadway Improvements
- Repurpose of Existing Bridge Under Alt 2
- Removal of Existing Bridge Under Alt 3
- Project Limits
- Streets To Be Removed
- Existing Right-of-Way
- Temporary Road Construction and Staging
- Proposed Shoemaker Bridge
- Temporary Construction Easement
- Potential Staging Area

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Shoemaker Bridge Replacement Project

Figure 3. Project Limits
Sheet 2 of 5

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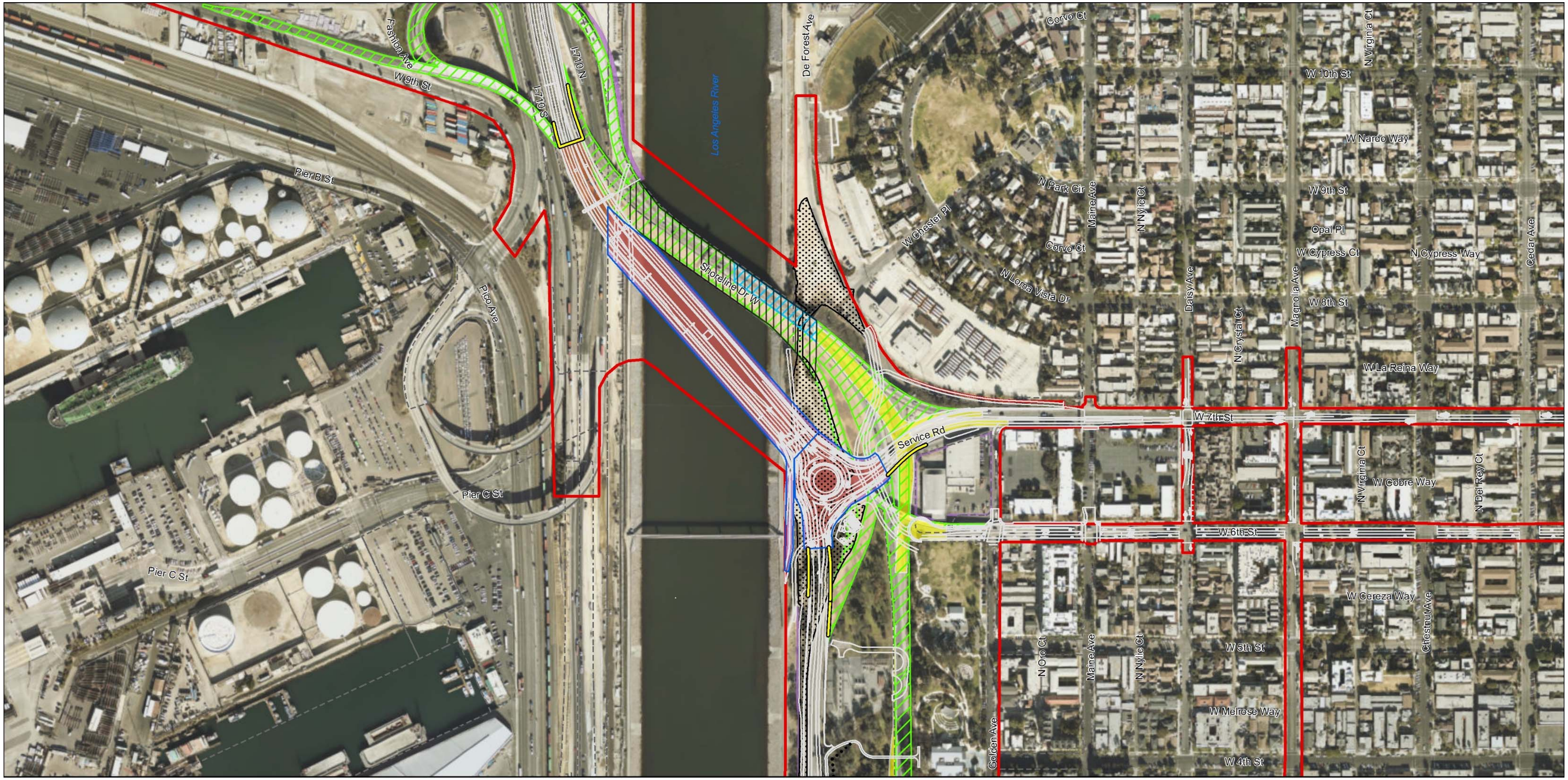

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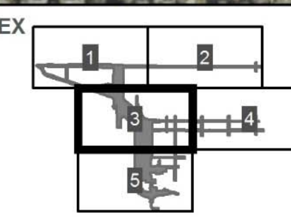

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Shoemaker Bridge Replacement Project

Figure 3. Project Limits
Sheet 3A of 5

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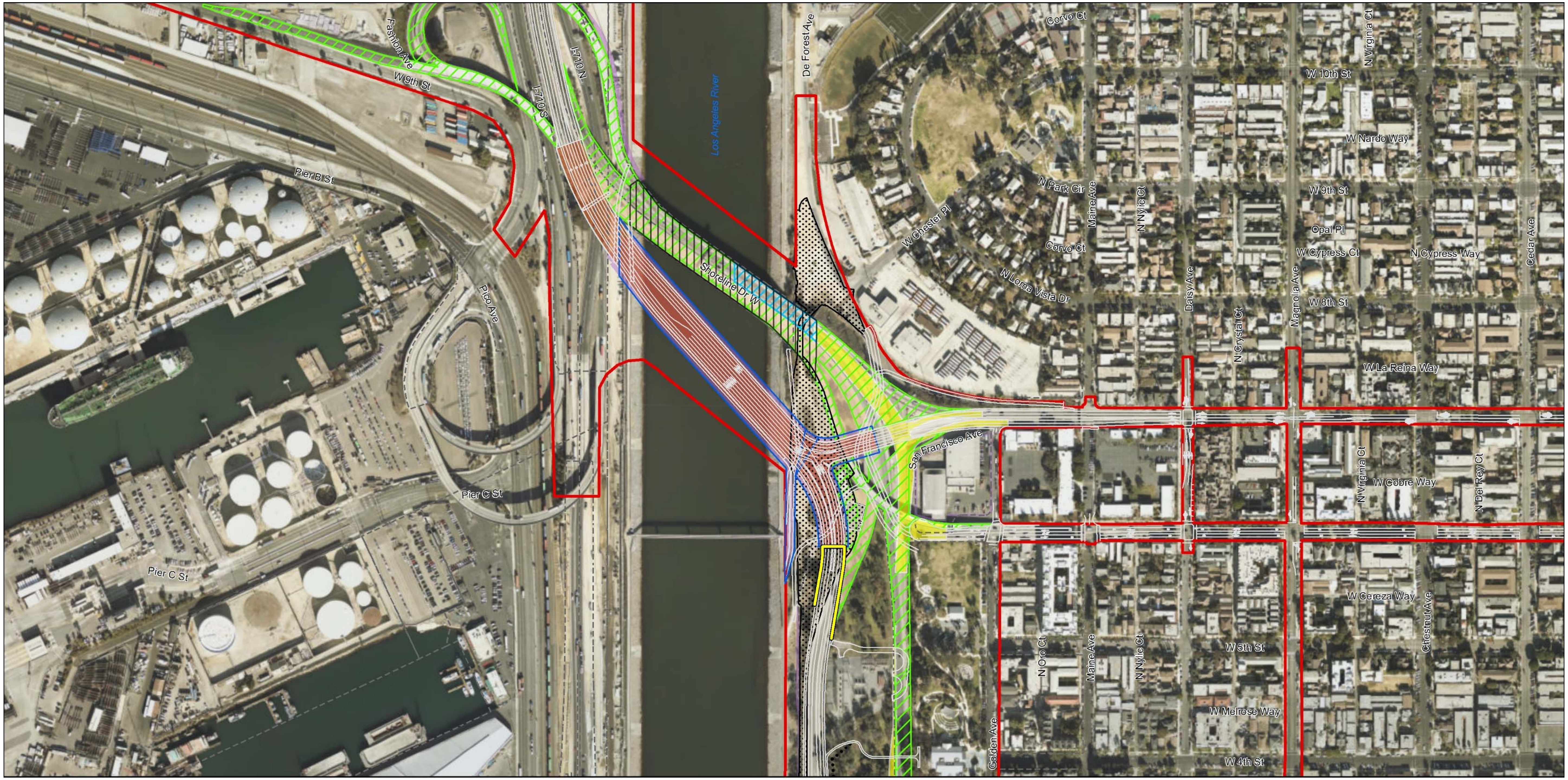

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- Temporary Construction Easement
- Potential Staging Area
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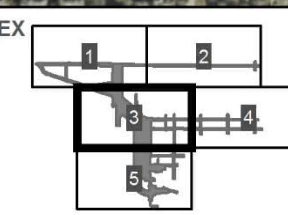

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Shoemaker Bridge Replacement Project

Figure 3. Project Limits
Sheet 3B of 5

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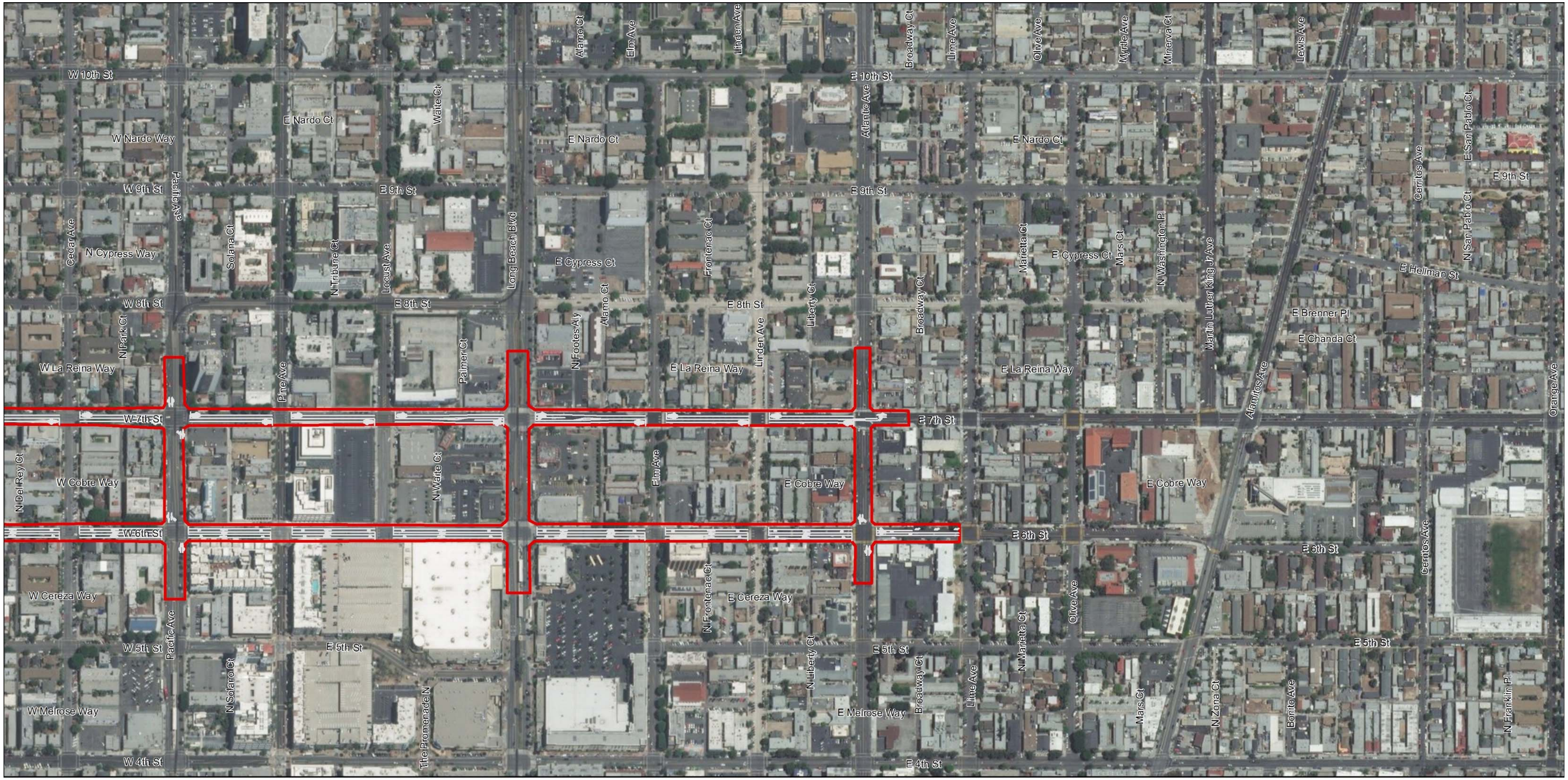

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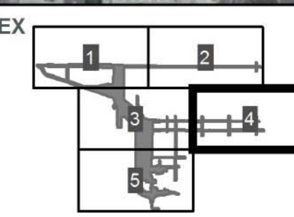

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Shoemaker Bridge Replacement Project

Figure 3. Project Limits
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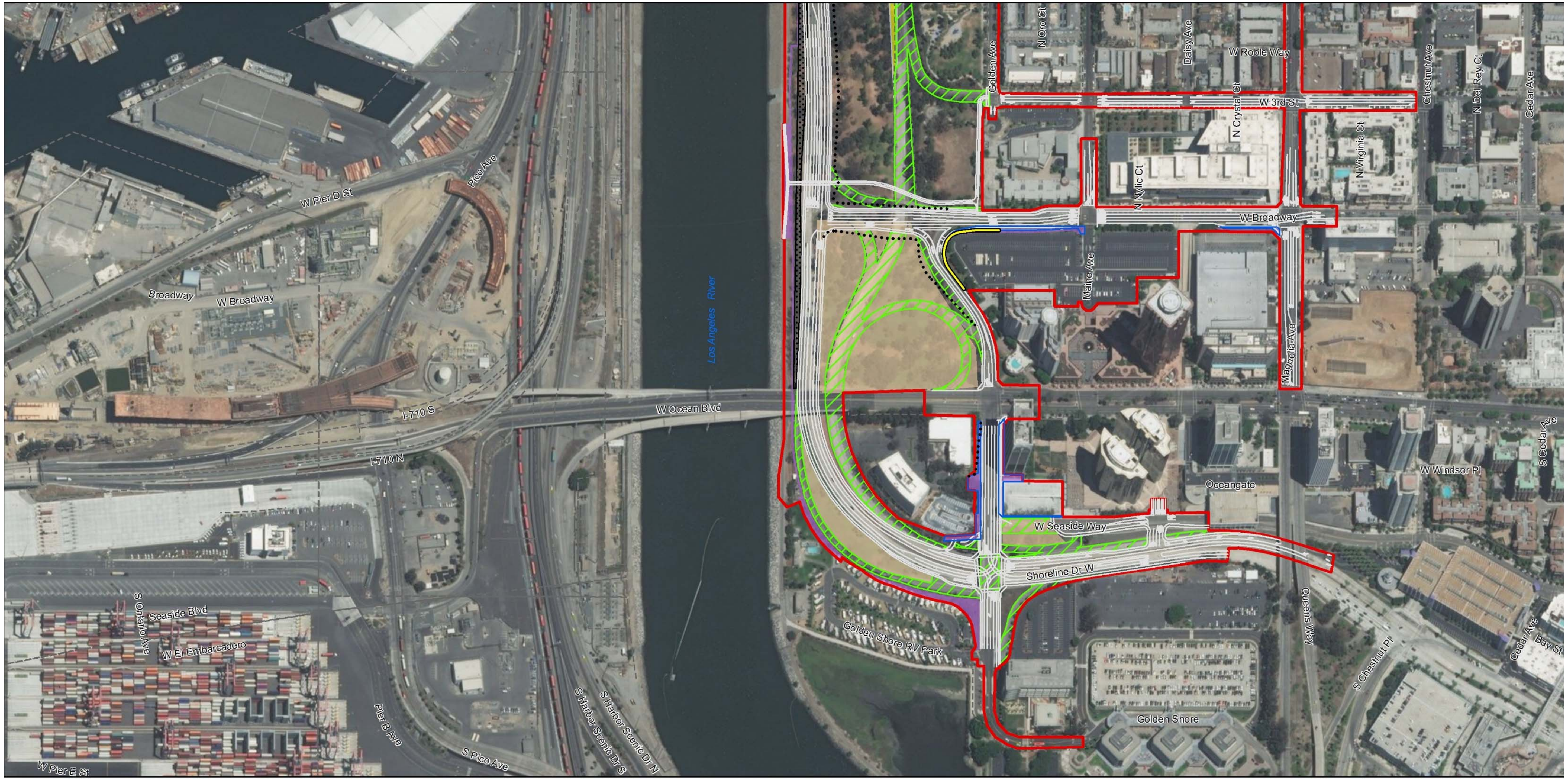

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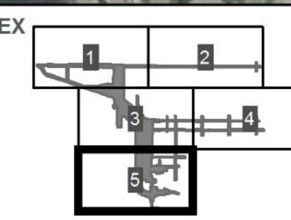

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Shoemaker Bridge Replacement Project

Figure 3. Project Limits
Sheet 5 of 5

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