Santa Ana and Garden Grove Fixed Guideway Corridor

ALTERNATIVES ANALYSIS REPORT

APRIL 2014

CORDOBA CORPORATION

OCTA

DOWNTOWN ORANGE COUNTY SANTA ANA

GARDEN GROVE

Alternatives Analysis Report

in support of the

SANTA ANA AND GARDEN GROVE FIXED GUIDEWAY CORRIDOR STUDY

Santa Ana Regional Transportation Center (SARTC) to Harbor Boulevard

Prepared for
City of Santa Ana
in cooperation with
City of Garden Grove
Orange County Transportation Authority

Prepared by
Cordoba Corporation
2677 North Main Street, Suite 240
Santa Ana, CA 92705

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EXECUTIVE SUMMARY

Project Background and History

Formal planning for the Santa Ana-Garden Grove Fixed Guideway System began in 2008 when the Orange County Transportation Authority (OCTA) launched its Go Local – Transit Connections to Metrolink program. However, the concept of providing local transit connections dates back to the early 1900s when the Pacific Electric Railway linked the cities to Los Angeles.

Santa Ana Regional Transportation Center (SARTC)

The alignment alternatives evaluated in the Santa Ana-Garden Grove Fixed Guideway Study actually travel along the historic route – along the Pacific Electric Right-of-Way (PE ROW) at the west end of the Study Area, through historic Downtown Santa Ana, to the Santa Ana Regional Transportation Center (SARTC) -- the busiest multi-modal transportation hub in Orange County. Once a busy rail corridor, the PE ROW in Orange County is now a 100-feet wide strip of vacant land which OCTA has preserved for future transit use while allowing temporary interim uses along some sections.

Purpose and Need for the Project

Downtown Santa Ana, California

Santa Ana and Garden Grove are mature, densely populated, active, and ethnically diverse cities in the heart of Orange County, California, that experience significant traffic congestion and are underserved by transit.

Santa Ana is the most densely populated city in Orange County and the fifth most densely populated city with a population of 300,000 or more in the U.S., behind only New York, San Francisco, Boston and Chicago. Garden Grove is the third most densely populated city in Orange County. Population densities along the proposed fixed guideway route average

17,380 people per square mile.

With median household incomes only slightly above the U.S. poverty level, a considerably higher than average number of zero-auto households and nearly 32 percent of Study Area residents under the age of 15, there are high levels of transit dependency within the Study Area, creating a large transit market.

The Study Area is a busy hub of activity which boasts approximately 40,000 jobs and contains many significant trip generators, including:

- City, County, State and Federal government offices
- Numerous colleges and private schools
- A bustling, historic commercial core in Downtown Santa Ana
- A popular artists' village, galleries and museums
- A variety of organizations that cater to the community's needs

Figure E-1: Study Area

The Civic Center attracts more than 25,000 daily trips; the Study Area as a whole attracts hundreds of thousands of daily trips. However, few travel choices exist for people who live or work in the Study Area so most choose to drive in single-occupant vehicles. Consequently, traffic congestion is a daily challenge in the Study Area where built-out conditions significantly limit opportunities for roadway expansion. Therefore, frequent and reliable transit service is a truly viable option.

It is important to note that, unlike many other areas of Orange County, a significant number of people who live in the Study Area rely heavily on public transit. In fact, five of OCTA's most productive bus routes serve the Study Area. That bodes well for transit service expansion in the study area because new transit thrives in areas where people are accustomed to using existing systems.

In addition to meeting every Metrolink train at SARTC, the Santa Ana-Garden Grove Fixed Guideway System will connect directly with 18 OCTA bus routes. It will also attract "choice riders" and boost Metrolink ridership because it will offer travel times and convenience comparable to personal vehicles. The net result will be a significant reduction in daily vehicle miles traveled, or VMT.

VMT reduction is an important goal for the Study Area because it lies within the South Coast Air Basin whose poor air quality is attributable in large part to emissions from cars, light-duty trucks and medium-duty passenger vehicles.

Finally, a continuous effort to support the local economy and increase local jobs is needed. The Transit Zoning Code adopted by the City of Santa Ana in June 2010 provides the policy foundation for redevelopment activities specifically targeted to the Santa Ana-Garden Grove Fixed Guideway Corridor. The City of Garden Grove has a similar policy framework in place along the Harbor Boulevard corridor (InternationalWEST) and has identified the Willowick Golf Course, near the west end of the Study Area, as a potential redevelopment site. The Santa Ana-Garden Grove Fixed Guideway System will enhance access and improve connectivity to all of these areas, thereby supporting economic vitality.

Public Outreach

Meaningful public engagement was an important component of the Santa Ana-Garden Grove Fixed Guideway Project from the start. Well before any key decisions were made, the cities initiated public outreach to obtain input to the alternatives development and evaluation process and to help define the appropriate range of issues to be addressed in the Alternatives Analysis (AA), Draft Environment Impact Report (DEIR) and Environmental Assessment (EA). The public outreach effort was structured to comply with the scoping requirements of the California Environmental Quality Act (CEQA) (PRC 21000 et seq.)

Although not required by state or federal regulations, the cities continued to share information with and seek input from the community, elected officials, and key stakeholders throughout the study process through meetings, dissemination of informational materials, a project website, and a project information line.

Alternatives Development and Analysis

In 2009, the cities initiated the AA and environmental review for the Santa Ana-Garden Grove Fixed Guideway System in coordination with OCTA. The AA evaluation process included the following steps:

1. Preliminary Definition of Alternatives
    a. Develop an inventory of potential transit technologies appropriate to the study corridor;
    b. Identify system route options;

c. Conduct public outreach;
d. Conduct preliminary screening to eliminate technology options that do not satisfy criteria closely related to the Purpose and Need and project goals and objectives and route options that do not satisfy other identified criteria;
e. Identify a reduced set of technology and route options and combine these options to create a range of conceptual alternatives that could potentially further satisfy the Purpose and Need and meet the goals and objectives for the project.

2. Initial Screening:

   2A. Initial Screening (Route Options)

   a. Eliminate route options with fatal flaws and those that do not satisfy the Purpose and Need and meet the goals and objectives of the project;
   b. Identify a reduced set of feasible route options;
   c. Conduct public outreach;
   d. Define a reduced set of alternatives (routes and technologies combined).

   2B. Initial Screening (Technology Options)

   a. Eliminate technology options with fatal flaws and those that do not satisfy the Purpose and Need and meet the goals and objectives of the project;
   b. Identify a reduced set of feasible technology options;
   c. Conduct public outreach;
   d. Define a reduced set of alternatives (routes and technologies combined).

3. Detailed Evaluation and Environmental Impact Analysis:

   a. Perform conceptual engineering to provide preliminary information about the physical and operating characteristics of alternatives;
   b. Prepare environmental analysis to provide preliminary information regarding potential impacts of alternatives;
   c. Conduct detailed evaluation of the reduced set of alternatives supported by conceptual engineering and environmental analysis;
   d. Conduct public outreach;
   e. Select the Locally Preferred Alternative (LPA).

Preliminary Definition of Alternatives

General requirements for the Santa Ana-Garden Grove Fixed Guideway System, as defined by the cities and supported by the community, guided the preliminary definition of alternatives process:

- System must be surface-running;
- System must be capable of operating in mixed flow traffic within existing lane widths;
- Vehicles must be compatible with short downtown block face lengths;

- System must be compatible with pedestrian activity and pedestrian scale street frontage;
- Operating cost per potential passenger must be reasonable; and
- System must be proven to be reliable in revenue service in the U.S.

Preliminary Screening of Technologies

Technology options that were determined to be consistent with the general requirements were shared with the community during the community listening sessions. These included:

- Bus;
- Trolley Bus;
- Bus Rapid Transit (BRT);
- Modern Streetcar ;
- Light Rail Transit (LRT);
- Commuter Rail Transit;
- Subway;
- Monorail/Automated People Mover;
- Low Speed Maglev; and
- Personal Rapid Transit (PRT).

Criteria used to narrow down the technologies (see Table E-1) reflect local priorities via the Purpose and Need and project goals and objectives, but they are also based upon attributes valued by OCTA and the Federal Transit Administration (FTA) such as feasibility, cost-effectiveness, congestion relief, serving the transit-dependent, and fostering environmental stewardship.

By the close of public scoping, the technologies to be carried forward for further study had been narrowed down to the following options:

- Bus;
- Trolley Bus;
- BRT; and
- Modern Streetcar.

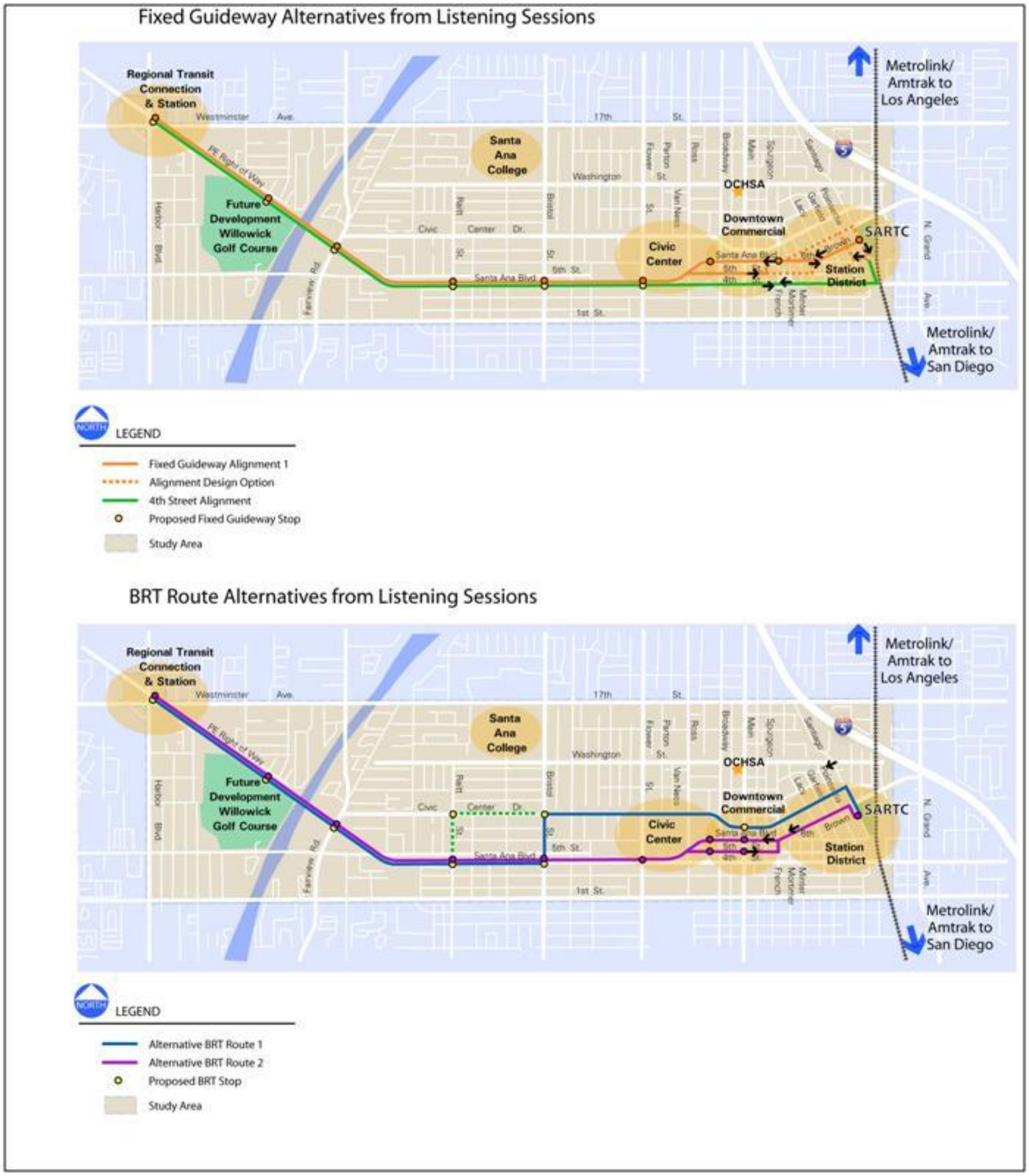
Preliminary Screening of Routes

Four different route options were also presented at the community listening sessions (see Figure E-2). These routes spanned the four-mile corridor between SARTC and Harbor Boulevard and utilized the PE ROW in the western portion of the Study Area. The route options included:

Table E-1: Technology Screening Results

GOAL-BASED CRITERIA	PERSONAL RAPID TRANSIT	LOW-SPEED MAG LEV	MONORAIL	DIESEL MULTIPLE UNITS	COMMUTER RAIL	LIGHT RAIL	BUS	TROLLEY BUS	MODERN STREETCAR
LIVABILITY/ACCESSIBILITY Does the project promote livability and walkability? Does it utilize clean fuels? Does it reduce auto dependency?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PROVEN FEASIBILITY Is the technology proven in revenue service in the US?	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AFFORDABILITY Can the project be implemented at a "reasonable" cost based on possible, known funding sources?	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
ACCESSIBILITY Does the project provide the required level of accessibility? Does it address identified travel markets and needs?	No	No	No	No	No	Yes	Yes	Yes	Yes
COMMUNITY ACCEPTANCE/ ENVIRONMENTAL STEWARDSHIP Does the project avoid significant right-of-way impacts? Can it operate in existing lanes?	No	No	No	No	No	No	Yes	Yes	Yes

Figure E-2: Conceptual Alternatives from Listening Sessions



- Civic Center Drive;
- Couplet along Santa Ana Boulevard and 5th Street;
- Extended couplet along Santa Ana Boulevard and 5th Street; and
- 4th Street.

Although the Study Area is fairly well served by transit, only two of the ten OCTA routes that serve the area operate in an east-west direction and neither of those routes directly serves the Civic Center/Downtown area. Therefore, the Santa Ana-Garden Grove Fixed Guideway Study focused on addressing unmet east-west travel demand in the Study Area. Other important considerations were:

- Serving key employment, commercial, institutional, and residential centers within the Study Area;
- Avoiding potentially negative impacts to existing transit services, such as OCTA's fixed route bus service; and
- Ensuring that the system operates in the curb lane regardless of the technology selected (except in the PE ROW, an abandoned rail corridor, where it would operate in the center of the available ROW).

Given these considerations, route concepts presented at the community listening sessions were analyzed and refined. The 4th Street bi-directional route was adjusted to operate on Santa Ana Boulevard/4th Street while a new route was added – a 3rd Street and 4th Street couplet. The remaining routes were also carried forward.

Conceptual Alternatives

Technologies and routes carried forward after the preliminary screening process were then combined to form the following conceptual alternatives:

- **BRT Civic Center Drive** – BRT transit line between SARTC and Harbor Boulevard traversing Civic Center Drive and the PE ROW with buses operating in mixed flow traffic lanes on existing city streets and in new lanes dedicated exclusively to bus use in the PE ROW.

- **BRT Santa Ana Boulevard/5th Street -** BRT transit line between SARTC and Harbor Boulevard traversing Santa Ana Boulevard and the PE ROW with a Santa Ana Boulevard and 5th Street couplet through the downtown area. Buses would operate within mixed flow traffic lanes on existing city streets and in new lanes dedicated exclusively to bus use in the PE ROW.

- **Streetcar Brown Street/Santa Ana Boulevard/5th Street -** Modern streetcar line between SARTC and Harbor Boulevard traversing Brown Street/Santa Ana Boulevard and the PE ROW with a Santa Ana Boulevard and 5th Street couplet through the downtown area. Streetcars would operate in mixed flow traffic on tracks embedded within existing city.

- **Streetcar Santa Ana Boulevard/4th Street** - Modern streetcar line between SARTC and Harbor Boulevard traversing Santa Ana Boulevard and the PE ROW with a Santa Ana Boulevard and 4th Street couplet through the downtown area. Streetcars would operate in mixed flow traffic on tracks embedded within existing city streets and on tracks dedicated exclusively for streetcar use within the PE ROW.

- **Streetcar Santa Ana Boulevard/4th Street/3rd Street** - Modern streetcar line between SARTC and Harbor Boulevard traversing 4th Street/Santa Ana Boulevard and the PE ROW with a 4th Street and 3rd Street couplet through the downtown area. Streetcars would operate in mixed flow traffic on tracks embedded within existing city streets and on tracks dedicated exclusively for streetcar use within the PE ROW.

Additionally, as mandated by federal and state regulations, a No Build Alternative and Transportation Systems Management Alternative (TSM) were included in the list of conceptual alternatives:

- No Build Alternative - Includes existing conditions as well as conditions that would be reasonably expected to occur in the foreseeable future without implementation of the proposed Project. The No Build Alternative provides the basis for comparing future conditions resulting from other alternatives proposed by the Project.
- TSM Alternative – Represents the best that can be done for mobility without construction of major new transportation facilities or physical capacity improvements in the context of the existing transportation infrastructure. The TSM Alternative provides the baseline against which the Build Alternatives (i.e., those alternatives that would entail a major investment) are compared. The TSM Alternative emphasizes low cost (*i.e.,* small physical) improvements and operational efficiencies. Included within the TSM Alternative are modifications and enhancements to selected bus routes in the Study Area; intersection/signal improvements; and bus stop amenity upgrades. The TSM Alternative includes a new bus route between SARTC and Harbor Boulevard/Westminster Avenue, which is similar to that of the Build Alternatives. While the streetcar and BRT alternatives utilize the PE ROW the TSM improvements do not since the PE ROW is unpaved and would require construction of a roadway to accommodate bus service.

At this stage of the process, bus was incorporated into the TSM Alternative while trolley bus was eliminated from further consideration as it encumbered the bus mode with both added expense and unnecessary aesthetic and technical complications associated with the overhead catenary component that were not warranted given the relatively clean fuels that would be utilized by the BRT vehicles.

Initial Screening of Alternatives

The initial screening process consisted of two stages – an early qualitative analysis of the conceptual alternatives resulting in the screening of route options and a subsequent quantitative analysis of the conceptual alternatives resulting in the screening of technology options.

Stage 1 Initial Screening

Five criteria that related directly to the Purpose and Need and the study goals and objectives were identified for use in stage 1 of the initial screening process. These included:

- Accessibility and livability;
- Economic development;
- Transit supportive land uses and community goals;
- Environmental responsibility and sustainability, travel benefits, choice and reliability; and
- Cost effectiveness and financial feasibility.

Measures of effectiveness were developed for each of the screening criteria to compare the performance of alternatives. Two conceptual alternatives were eliminated from further consideration based upon the results of the stage 1 initial screening. These routes did not best meet the Purpose and Need and the project goals and objectives:

- Streetcar Alternative Santa Ana Boulevard/4th Street/3rd Street
- BRT Alternative Civic Center Drive

Three remaining conceptual alternatives were advanced to the stage 2 initial screening:

- Streetcar Alternative Santa Ana Boulevard/4th Street;
- Streetcar Alternative Brown Street/Santa Ana Boulevard/5th Street; and
- BRT Alternative Santa Ana Boulevard/5th Street.

It should be noted that in response to comments received during public scoping, the upper couplet of the Streetcar Alternative along Brown Street/Santa Ana Boulevard/5th Street was extended to Civic Center Drive to determine if additional ridership could be gained by providing service north of the Civic Center area. The stage 1 initial screening process is shown in Table E-2.

Table E-2: Alignment Screening Results

SCREENING CRITERIA/ MEASURE OF EFFECTIVENESS	BRT 1 – CIVIC CENTER DRIVE	BRT 2 – SANTA ANA BLVD/5TH ST	STREETCAR A- SANTA ANA BLVD/5TH ST	STREETCAR B- SANTA ANA BLVD/4TH ST	STREETCAR C- 3RD ST/ 4TH ST
Serves City's adopted transit corridors	0%	29.8%	33.9%	27.0%	29.5%
Number of residents within ¼ mile (in thousands)	43	43	45	42	42
Number of employees within ¼ mile (in thousands)	26	27	27	26	25
Promotes principles of livability	Low	Low	High	High	High
Serves transit-supportive land use	Low	Med-Low	High	Med-High	Med
Significant long-term public infrastructure investment	Med	Med	High	High	High
Total estimated cost	Low	Low	Med	Med	Med

Stage 2 Initial Screening

The remaining alternatives were evaluated on the basis of the original project goals and objectives in the Stage 2 initial screening. The following alternative was eliminated from further consideration based upon the results of the Stage 2 initial screening:

- BRT Alternative Santa Ana Boulevard/5th Street.

The BRT Alternative along Santa Ana Boulevard/5th Street only met four of five project goals and objectives. The alternative did not meet the cost effectiveness objective as measured by projected capital and operations and maintenance (O&M) costs per rider. The BRT Alternative is projected to carry significantly fewer riders than the streetcar alternatives while the capital and O&M costs remain substantial.

Alternatively, the remaining streetcar alternatives satisfied all five project goals and objectives. Therefore, these two alternatives were identified as best satisfying the Purpose and Need and project goals and objectives and were recommended for further analysis:

- Streetcar Alternative Santa Ana Boulevard/4th Street; and

- Streetcar Alternative Brown Street/Santa Ana Boulevard/Civic Center/5th Street.

Detailed Evaluation and Environmental Impacts Analysis

The feedback received during public scoping combined with technical analysis, resulted in a recommendation to carry forward four options total. The reduced set of alternatives which underwent detailed engineering and environmental analysis to provide critical information to elected officials about the project's costs, impacts and benefits included the following:

- **No Build Alternative** – Depicts what would happen if only funded, committed and approved long-term projects go forward. Under this alternative, planned street improvements would be made and minor changes to some transit routes would be implemented.

- **Transportation System Management (TSM) Alternative** – Includes bus service similar to the streetcar alternative routes, bus service improvements along First Street, additional operating hours and an expanded service area for OCTA's StationLink Route 462. It also includes improvements to intersections, traffic signals and bus stops throughout the Study Area.

- **Streetcar 1** – Would operate primarily along Santa Ana Boulevard and the PE ROW. Between Mortimer and Ross Streets, it would operate westbound only on Santa Ana Boulevard and eastbound only on Fourth Street (see green line on Figure E-3.)

- **Streetcar 2** – Would operate primarily along Santa Ana Boulevard and the PE ROW. In the downtown/Civic Center area, it would operate westbound only on Civic Center Drive between Spurgeon and Flower Streets and eastbound only on Fifth Street between Ross and Minter Streets (see orange line on Figure E-3.)

Figure E-3: Streetcar Alignment Alternatives

Comparison of Alternatives

Table E-3 summarizes key details for each of the alternatives carried through detailed evaluation, including the preliminary capital and preliminary O&M cost estimates, daily ridership projections, and potential environmental issues. Streetcar system estimates are presented for potential Initial Operating System (IOS), or partial system build-out scenarios, and for full system build-out. The IOSs would operate between SARTC and Raitt Street.

Table E-3: Summary of Detailed Evaluation Results

ALTERNATIVE	CAPITAL COST ESTIMATE*	ANNUAL O&M COST ESTIMATE*	DAILY RIDERSHIP PROJECTIONS	ENVIRONMENTAL ISSUES
No Build	$0	$0	N/A	Traffic and circulation would be worse than with any of the Build scenarios
TSM	$14.5	$ 5.1 - $13.3[c]	3,085[d]	No negative impacts or adverse effects
Streetcar 1	$197.4 - $209.7[a]	$4.9	3,770 – 8,410	Potential impacts related to: - New source of light/glare - Potential need to replace Pacific Electric Santa Ana River Bridge - New source of noise and vibration - On-street parking removal - Acquisitions, displacement and relocations With mitigation, all impacts can be reduced to a level considered less than significant
Streetcar 1 IOS	$146.5 - $158.8[a]	$4.0	2,012 – 4,490	Same as Streetcar 1 except no bridge impacts
Streetcar 2	$217.0 - $228.1[b]	$6.1	3,020 – 6,425	Same as Streetcar 1
Streetcar 2 IOS	$166.2 - $177.2[b]	$4.5	1,540 – 3,280	Same as Streetcar 1 except no bridge impacts

Sources: Draft Capital Cost Methodology Report, Cordoba Corporation, August 2012; O&M Cost Estimate, Cordoba Corporation, March 2012

* All costs in millions, 2011 dollars

[a] High – low cost range is based on whether or not various design options are included for 4th Street parking scenarios or which maintenance facility site is selected.

[b] High – low cost range is based on which maintenance facility site is selected.

[c] Low end of cost range reflects SARTC to Harbor route only. High end of cost range reflects additional bus service beyond Study Area.

Next Steps

Concurrent with this AA, the DEIR/EA is being prepared. It is scheduled to be released for public review in Spring 2014.

Following receipt of public comments on the DEIR/EA, and based on the information provided in the AA and the DEIR/EA, an LPA for the Santa Ana-Garden Grove Fixed Guideway will be recommended, adopted by the cities of Santa Ana and Garden Grove, and presented to the OCTA Board of Directors. The LPA may be submitted to the FTA for funding consideration under the section 5309 Capital Investment Program, and if so, for permission to enter into Project Development.

Following the close of the public review period, the EIR will be finalized and certified by Santa Ana City Council (the City of Santa Ana is the lead agency under CEQA) and a Notice of Determination will be issued. Because the proposed project would not result in any adverse environmental impacts under NEPA, it is anticipated that the FTA will prepare and issue a Finding of No Significant Impact for the Project.

With the Project environmentally cleared, it is anticipated that preliminary engineering on the Santa Ana-Garden Grove Fixed Guideway would begin in early 2015. Final design would begin in mid-2016, with construction beginning in 2017. Operations would begin in 2018.

1.0 INTRODUCTION

1.1 Project Background and History

In 2008, the cities of Santa Ana and Garden Grove completed a study that identified the benefits of developing a fixed guideway corridor to link key activity and employment centers in their communities to the Santa Ana Regional Transportation Center (SARTC). In 2009, the cities initiated the Alternatives Analysis (AA) and Environmental Review for the Santa Ana-Garden Grove Fixed Guideway Corridor in coordination with the Orange County Transportation Authority (OCTA). As illustrated in Figure 1-1, the project location is in central Orange County, California and directly accesses both the Los Angeles-San Diego (LOSSAN) rail corridor and the old Pacific Electric Railway corridor.

Figure 1-1: Location Map

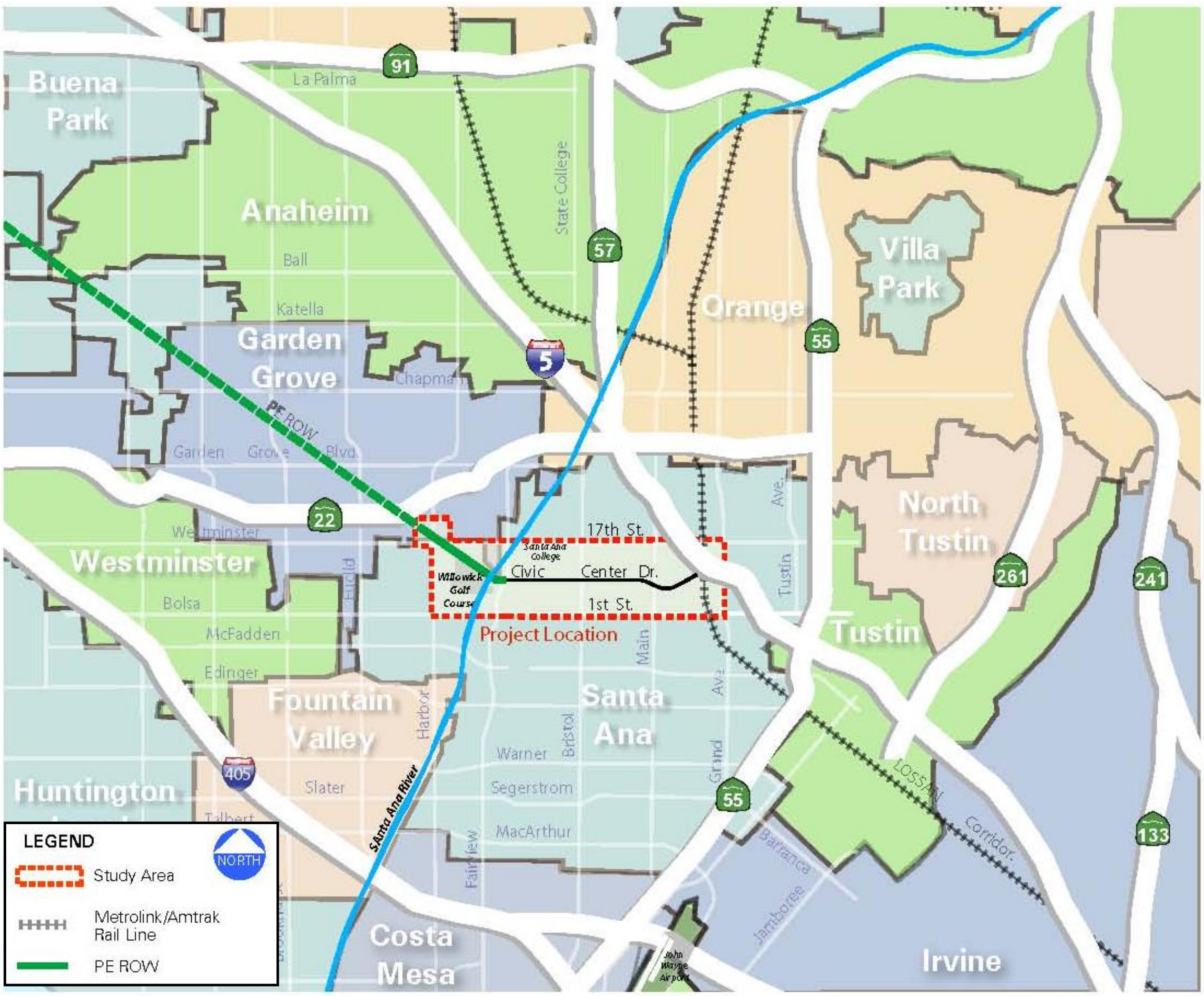


Figure 1-2 illustrates the Study Area for the Santa Ana-Garden Grove Fixed Guideway AA. The Study Area has been defined to support the development and evaluation of a broad range of modal alternatives that satisfy the goals and objectives of the study. It encompasses SARTC and existing and planned development surrounding the rail station; employment, government, commercial and cultural activity centers in the Civic Center and downtown Santa Ana; and, existing neighborhoods, businesses, and activity centers in central Santa Ana and east Garden Grove. Planned development and areas that offer future development and redevelopment opportunities were also considered, as were planned regional transportation system improvements such as OCTA's Bus Rapid Transit (BRT) program, and Metrolink service expansions.

Funding for the Santa Ana and Garden Grove Fixed Guideway study effort was awarded to the City of Santa Ana through OCTA's four-step Go Local Program, which provides competition-based grants to local jurisdictions that have an interest in initiating local transit connections to Metrolink.

1.2 Purpose and Overview of the Alternatives Analysis

An AA is a formal planning study through which all reasonable alternatives for addressing transportation needs within a travel corridor are evaluated. Pursuant to federal statute (49 USC 5339), an AA:

- Includes an assessment of a wide range of public transportation or multimodal alternatives, which will address transportation problems within a corridor or subarea,
- Provides ample information to enable the Secretary [of Transportation] to make findings of project justification and local financial commitment,
- Supports the selection of a Locally Preferred Alternative (LPA), and
- Enables the local Metropolitan Planning Organization to adopt the LPA as part of the long-range transportation plan.

The AA Report documents the process followed to define, screen and evaluate alternatives. Through the Santa Ana-Garden Grove Fixed Guideway Corridor AA:

- The purpose and need for the project were defined,
- A broad range of technology and route options were defined and screened based on the Purpose and Need and other identified criteria, with some concepts eliminated from further consideration,
- The remaining technology and route concepts were combined to form alternatives, and an additional screening was conducted in two stages; the first stage included the further analysis of route options while the second stage included the further analysis of technology options (with additional detail) to determine which options

Figure 1-2: Study Area

best meet the project's Purpose and Need and goals and objectives and which options should be eliminated from further consideration.

- The reduced set of alternatives underwent detailed evaluation and environmental impacts analysis using screening criteria that were tied to the Purpose and Need and goals and objectives, and
- The alternatives which performed best against the criteria and best addressed the Purpose and Need and goals and objectives for the project were identified for potential selection as the LPA.

1.3 Context of the Alternatives Analysis

The Santa Ana-Garden Grove Fixed Guideway Corridor AA was conducted concurrently with the environmental process for the project. This AA Report documents the process followed to define, screen and evaluate alternatives. It provides a technical assessment of the performance of the alternatives against the defined criteria, and ranks the alternatives in terms of their overall performance. It does not recommend a LPA.

Decision makers will utilize the information provided in this document, coupled with the Draft Environmental Impact Report (DEIR) /Environmental Assessment (EA), and the comments and input received through the environmental public review process to select an LPA following the close of the environmental public review period.

1.4 Organization of the Report

This AA report addresses the first step of the Federal Transit Administration (FTA) project development process. As such, it outlines the range of initial transit options considered to address the Purpose and Need for the project, and then describes the decision process to arrive at a reduced set of alternatives which were carried forward for more detailed analysis and evaluation through the AA and environmental studies. The following summarizes the content and organization of this report:

- Chapter 1 introduces the project.
- Chapter 2 states the Purpose and Need for the project.
- Chapter 3 provides an overview of the AA process from the preliminary definition of a wide range of potential alternatives through the detailed evaluation of the reduced set of alternatives.
- Chapter 4 summarizes the preliminary alternative definition process followed to identify the conceptual alternatives that best address the Project's Purpose and Need.
- Chapter 5 summarizes the two-stage initial screening process used to identify the reduced set of alternatives that would be carried forward into detailed evaluation and environmental analysis.

- Chapter 6 presents the findings of the detailed evaluation of the reduced set of alternatives, and several site-specific design options that were analyzed to minimize project impacts.
- Chapter 7 presents a comparative evaluation of the build alternatives and concludes with a ranking of the alternatives based on analysis results.
- Chapter 8 outlines the public involvement and interagency coordination efforts undertaken in support of the study process.
- Chapter 9 presents preliminary capital, and operations and maintenance costs for each alternative.
- Chapter 10 lists the "next steps" to complete this initial phase of the project development process.

1.5 Relationship to the Environmental Process

The environmental studies for the Santa Ana-Garden Grove Fixed Guideway Corridor have been prepared concurrently with the preparation of the AA, and in accordance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). The City of Santa Ana is the CEQA lead agency for the project. The FTA is the lead agency under NEPA.

The Notice of Preparation (NOP) for the Santa Ana and Garden Grove Fixed Guideway Project was issued in June 2010. The DEIR/EA document is scheduled for public release in Spring 2014. The AA Report will be released concurrently, and be available throughout the public review period for the DEIR/EA as an additional resource for the public and decision makers in evaluating the proposed alternatives.

The DEIR/EA considers the environmental effects and impacts of Project Alternatives which would operate entirely or substantially in mixed-flow traffic within the existing urban street setting. These Alternatives were advanced through the environmental review process based on the results of this Alternatives Analysis:

1. No Build Alternative represents what would happen if only funded, committed and approved long-term projects go forward. Under this alternative, planned street improvements would be made and minor changes to some transit routes would be implemented.
2. Transportation Systems Management (TSM) Alternative which would provide a bus route similar to that of the streetcar alternatives and increased transit operations and service levels along roadways within the Study Area which currently support fixed route bus transit.
3. Streetcar Alternative 1 which would utilize the Pacific Electric Right-of-Way (PE ROW) through the western half of its alignment and generally operate along Santa Ana Boulevard and Fourth Street on the way to SARTC.

4. Streetcar Alternative 2 which would utilize the PE ROW through the western half of its alignment and substantially operate along Santa Ana Boulevard, Civic Center Drive and Fifth Street along the eastern half of the alignment to SARTC.

2.0 PURPOSE AND NEED

Alternatives development begins with a solid understanding of the transportation problems in the Study Area as well as opportunities for improvement. The following discussion summarizes the key attributes of the purpose and need for the Santa Ana-Garden Grove Fixed Guideway Corridor, highlighting those factors that had a direct bearing on the development of a range of transportation investment alternatives for the corridor. The more detailed discussion of purpose and need can be found in the *Santa Ana and Garden Grove Fixed Guideway Corridor Purpose and Need Statement,* October 29, 2010.

2.1 Purpose and Need for the Project

2.1.1 Location and History

Santa Ana and Garden Grove are mature, densely populated, and ethnically diverse cities located in the heart of Orange County, California (see Figure 1-1). The City of Santa Ana was incorporated in 1886, and when Orange County was formed in 1889, Santa Ana was selected to be the county seat. Administrative activity increased, newcomers poured in, residential and commercial development surged, and public services began to expand and evolve as the 19th century came to a close. After the turn of the century, the introduction of automobiles, the rise of the oil industry, and the proliferation of utility networks combined to push Santa Ana further from its rural beginnings. It was during this period that the modern Downtown Santa Ana Historic District was first developed.

Whereas Santa Ana developed rapidly, Garden Grove, its neighbor to the west, had a far more deliberate early development and remained a quiet rural crossroads until the turn of the 20th century.

Several efforts were made to establish a streetcar system in the vicinity of Santa Ana. On November 6, 1905, the first Pacific Electric train arrived in Santa Ana as an extension of local train service in Orange County that had begun in 1904. The Santa Ana-Orange line operated between the Southern Pacific Santa Ana Station (immediately south of the present day station at the SARTC) and the PE ROW, traveling through Downtown Santa Ana along 4th Street.

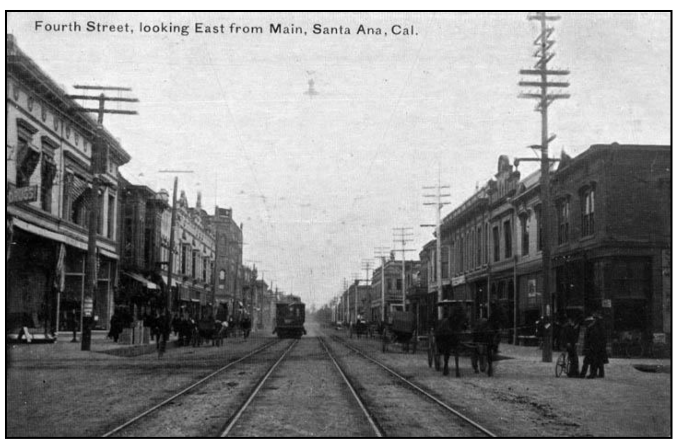


Photo of Historic Pacific Electric Rail Line Construction Project, 4th Street, Santa Ana, 1906. Source: City of Santa Ana Public Library.

1905 also brought the arrival of the Pacific Electric train to the town of Garden Grove. This development sparked a period of significant growth for the community. Soon after the arrival of the railroad, telephone, gas and electrical service also became available to downtown residents of Garden Grove, furthering the towns economic advancement. A period of agricultural prosperity followed, as residents cultivated oranges, walnuts, chili peppers, and later, strawberries. Even in the face of two major disasters (a flood in 1916 and an earthquake in1933), Garden Grove continued to gradually develop and expand.

Much of the Pacific Electric corridor that had served the communities from Santa Ana into Los Angeles has been abandoned, and is no longer available for transportation purposes. Within Orange County, the PE ROW is substantially owned by the OCTA. With the rails long since removed, the PE ROW in Orange County is a 100-feet wide strip of vacant land which OCTA has preserved for future transit use while allowing temporary interim uses along some sections. The PE ROW alignment runs through the heart of Garden Grove and leads directly into central Santa Ana. The land uses along 4th Street in Downtown Santa Ana were originally built around the Pacific Electric streetcar system.

2.1.2 Characteristics of the Study Area

Santa Ana is the most highly and densely populated city in Orange County and the fifth most densely populated city with a population of 300,000 or more in the U.S., behind only New York, San Francisco, Boston and Chicago. Garden Grove is the third most densely populated city in Orange County.

The central portion of the Study Area is a busy hub of activity. As Orange County's seat of government, Santa Ana's Civic Center houses federal, state and local government agencies, creating high levels of activity, and providing sources of employment and frequently-used services. Downtown Santa Ana, with its historic multi-story buildings housing ground level retail and restaurants with commercial office space above, is listed in the National Register of Historic Places. Downtown provides shops and services used by nearby residents and Civic Center employees, and it is a destination for visitors.

The Study Area also has a rich mosaic of neighborhoods each uniquely characterized by its history, culture, architecture, housing types, and amenities. Residents of these neighborhoods value their communities and are well organized to protect and preserve the quality of life they enjoy. The topography, block size and development patterns of these neighborhoods support walkability.

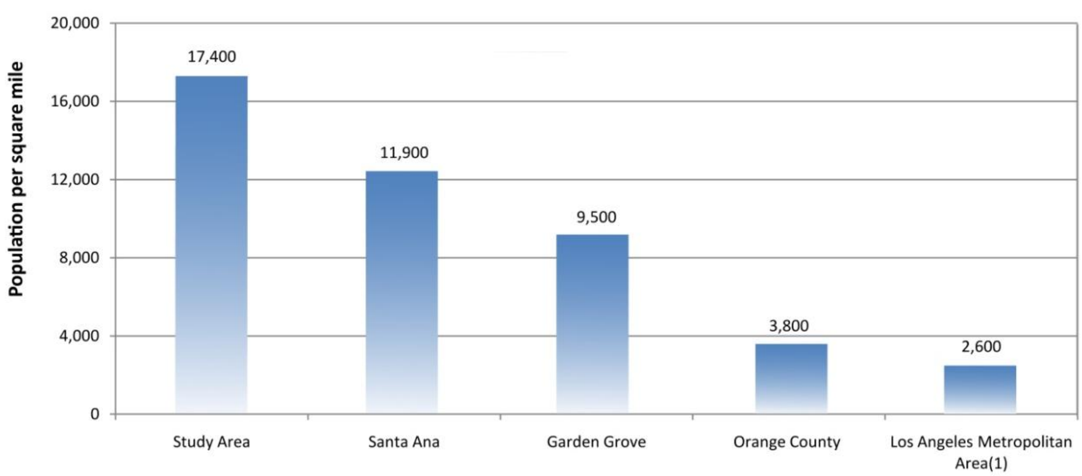
Environmental justice and transit service equity are important issues for the Study Area, where the median household income is slightly above the U.S. Census Bureau poverty level threshold and approximately 17.8 percent of households are without an automobile and therefore must rely on ridesharing, public transportation or non-motorized transportation for their travel needs. Approximately 91 percent of the Study Area population is non-white;

31.9 percent are under the age of 15 and therefore not eligible to drive an automobile.[1] More than half of Study Area residents use modes of transportation other than the single-occupant automobile for their travel to/from work including approximately 13.8 percent of Study Area residents who use public transportation.

2.1.3 Demographics in the Study Area

Santa Ana has a population of 324,528 and an average population density of 11,900 people per square mile, making it the most populous and densely populated city in Orange County.[2] Garden Grove is the third most densely populated city in Orange County with more than 170,883 residents and over 9,500 people per square mile.[3] Over the next 20 to 25 years, the population in both cities is projected to increase by approximately 10 percent[4]. The area around SARTC is expected to have the highest rate of population growth in the Study Area. Population densities along the proposed fixed guideway route are the highest in Orange County. Figure 2-1 compares Study Area population density to that of each city, Orange County, and the greater Los Angeles-Long Beach-Santa Ana Metropolitan Statistical Area (MSA).

Figure 2-1: Comparison of Study Area Population Density



[1] Los Angeles-Long Beach-Santa Ana Metropolitan Statistical Area encompasses Los Angeles and Orange Counties

Source: U.S. Census 2010

With regard to population densities, there are three distinct pockets of over 7,000[1] people per quarter square mile that are located just north and south of Downtown Santa Ana, within one mile of SARTC and within less than a half-mile walking distance of the proposed fixed guideway route. Over the next 20 to 25 years, forecast population growth in Santa Ana will result in increased density in established neighborhoods within the Study

[1] US Census 2000.
[2] US Census 2010.
[3] *Id.*
[4] Orange County Projections 2006 (OCP-2006)

Area, and developing and redeveloping areas bordering the Study Area. Population densities along the proposed fixed guideway route average 17,380[5] people per square mile.

Santa Ana has been Orange County's seat of government since 1889. Federal, state and local government agencies, which are major employers, have offices in the Civic Center and throughout Santa Ana. There are several courthouses within the Civic Center including the Orange County Courthouse, the State Courts, the 4th District Court of Appeal and the Ronald Reagan Federal Courthouse. Santa Ana is also home to the corporate headquarters of several major private employers, such as First American Corporation, The Orange County Register, and Wahoo's Fish Tacos.

In 2007, employment in the City was estimated to be approximately 149,800[6], representing roughly 10 percent of all employment in Orange County. Nearly 30 percent of employment within the City is in the Study Area[3]. Over the next 20 to 25 years, employment within the City is expected to increase by approximately seven percent[3].

More than 40,000 jobs are concentrated in the Santa Ana-Garden Grove Fixed Guideway Study Area. Forecasters predict that by the year 2030 approximately 810,000 daily trips will start, end, or occur totally within the Study Area. Although employment in the Study Area is generally focused within the Civic Center and Downtown Santa Ana where densities range from 25,001 to 100,000[1] employees per square mile, pockets of comparable employment density from 10,001 to 25,000[1] employees per square mile occur adjacent to and south of SARTC.

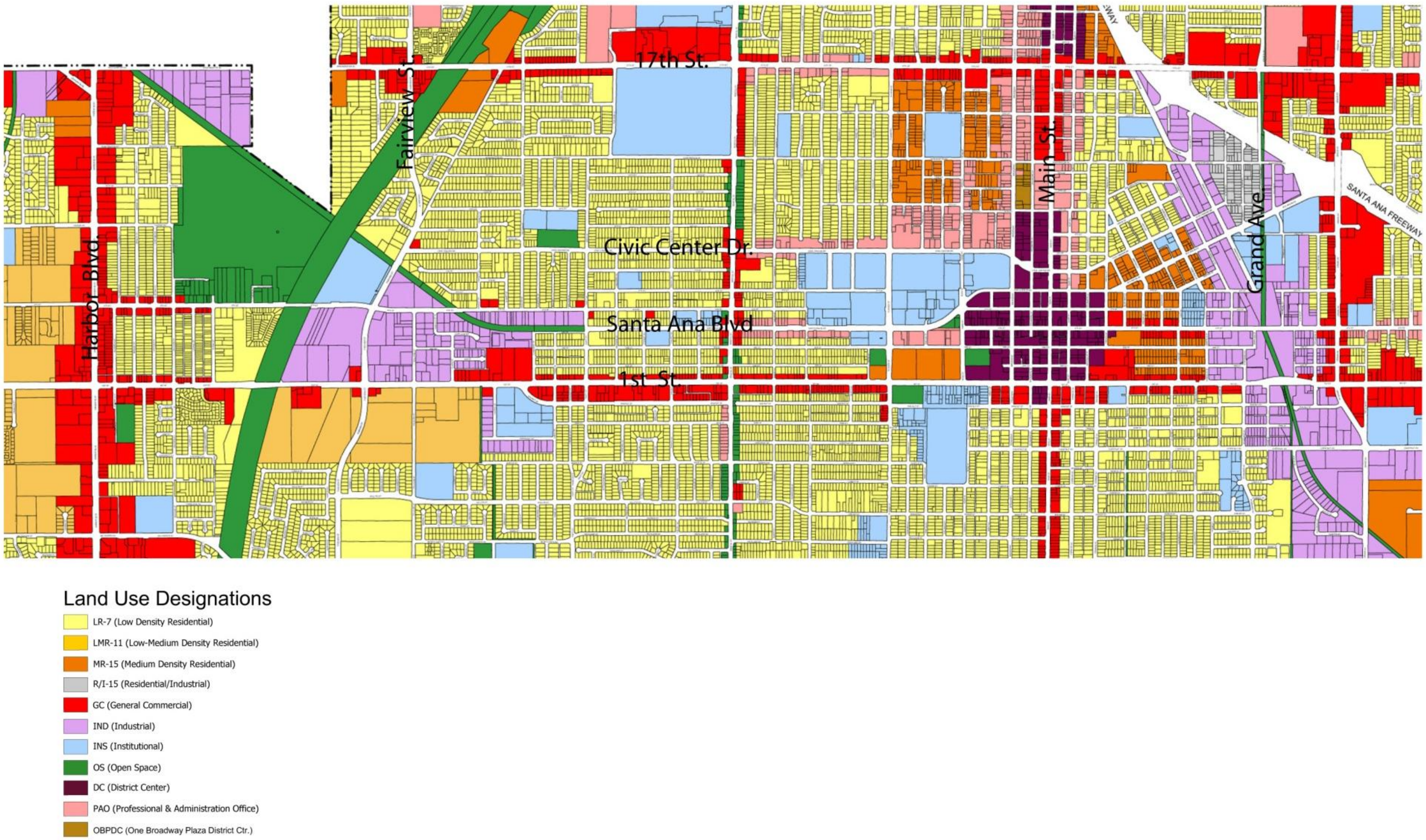
2.1.4 Land Use

The cities of Santa Ana and Garden Grove recognize that land use, economic opportunity, and transportation planning go hand in hand. Consequently, the Santa Ana and Garden Grove Fixed Guideway Corridor integrates adopted land use plans, policies, and zoning with transit design and operational characteristics for each city.

Figure 2-2 shows the portion of the Land Use Element of the City of Santa Ana's General Plan that encompasses the Study Area. In the eastern portion of the Study Area, land uses are characterized by industrial, low- and medium-density residential, and general commercial development along arterial corridors. In the central portion of the Study Area, the Civic Center is characterized by office and institutional land uses. West of the Civic Center, land uses are largely characterized by low-density residential, general commercial along arterial corridors, concentrated areas of industrial along the PE ROW, and pockets of institutional land uses. The Santa Ana River and Willowick Golf Course are also located in the western portion of the Study Area, and are classified as open space. Because the

[5] Calculated based on OCP-2006 and Orange County Traffic Analysis Model (OCTAM) traffic analysis zones.
[6] Bureau of Labor Statistics, 2007

Figure 2-2: Excerpt from City of Santa Ana General Plan Land Use Element



Study Area is urbanized and largely built out, the land uses depicted within the General Plan Land Use Element generally reflect existing land use development patterns.

Santa Ana's Transit Zoning Code, which was adopted in June 2010, encompasses 450 acres within the Study Area. The vision and intent of the Transit Zoning Code is to provide a transit-supportive, pedestrian-oriented development framework that will facilitate new infill development in existing neighborhoods, reuse of existing buildings, and mixed-use development as a means of improving livability, reducing vehicle trips and lowering greenhouse gas emissions.

Several major activity centers and key neighborhoods within the Study Area have land use characteristics that could potentially benefit from and support the implementation of the Santa Ana and Garden Grove Fixed Guideway. These include historic Downtown Santa Ana; Civic Center; three historic neighborhoods: Logan, French Park and Lacy; the Station District; Santa Ana College and Orange County High School of the Arts, among others.

2.1.5 Transportation Facilities and Services

The Study Area is served by four freeways (I-5, SR-55, SR-22 and SR-57) and a robust grid network of local streets (see Figure 2-3). In addition, OCTA serves the Study Area with ten local bus routes, one community route, three StationLink rail feeder bus routes, one intracounty route and one intercounty route (see Figure 2-4). People traveling longer distances can access the Study Area via Amtrak and Metrolink rail services or a variety of long-distance bus services that converge at the SARTC, the east gateway to the proposed fixed guideway system.

2.1.6 Performance of the Transportation System

The Study Area's central location in relation to the regional transportation network provides both opportunities and constraints to its continued growth and economic vitality. Access to and within the Study Area is constrained by congested freeways and arterials, and the lack of alternatives to the automobile.

Traffic volumes along the freeways serving the Study Area are forecast to grow by as much as 17 percent in some locations by 2035. With the exception of SR-22, all freeways are anticipated to carry peak hour traffic volumes well in excess of 90 percent of capacity (see Table 2-1). This will result in additional congestion and delay, further constraining access to the Study Area.

Figure 2-3: Freeway Network Serving the Study Area

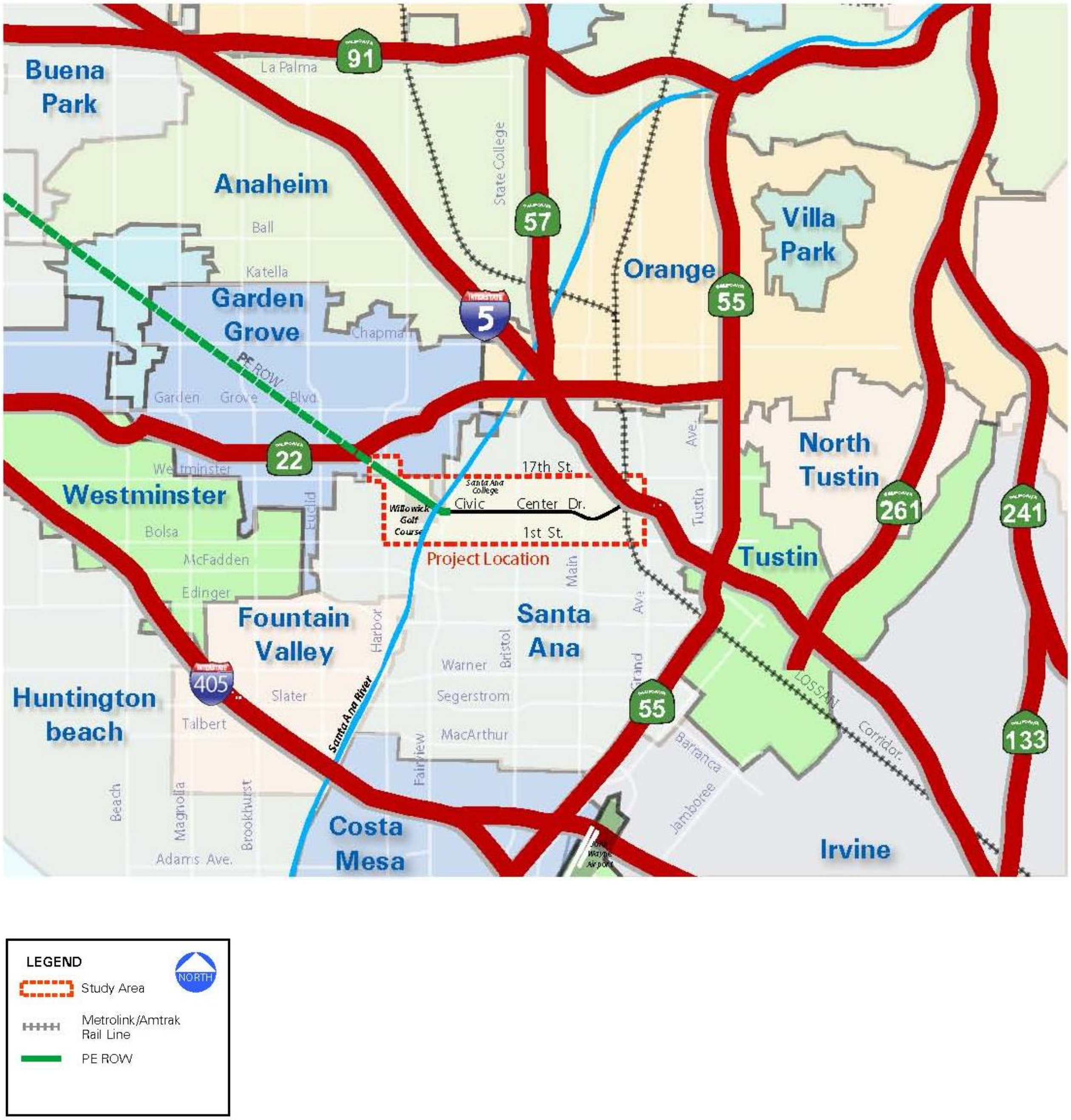
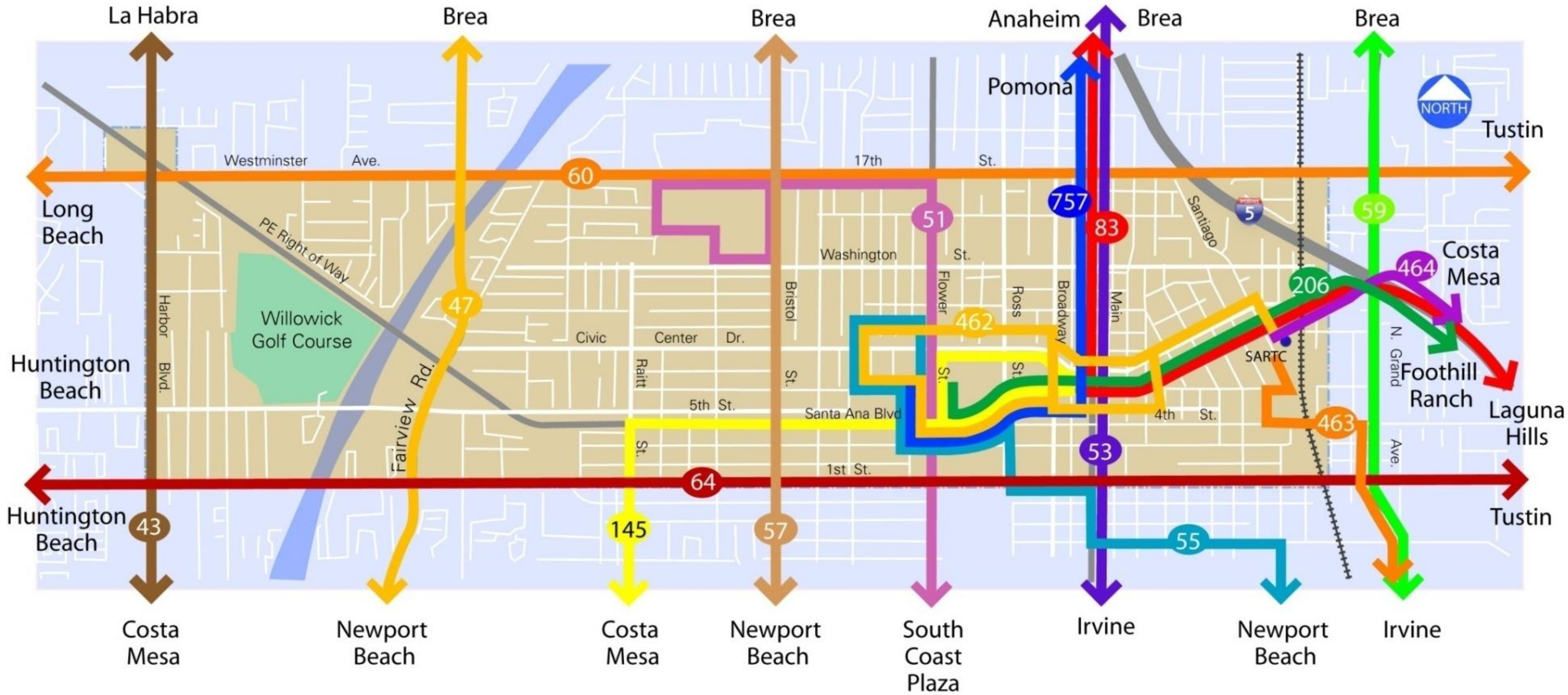


Figure 2-4: Study Area's Existing Transit Network



Bus Route and Destinations

LOCAL			
43	La Habra to Costa Mesa	64	Huntington Beach to Tustin
47	Brea to Newport Beach	83	Anaheim to Laguna Hills
51	Santa Ana College to South Coast Plaza	COMMUNITY	
53	Brea to Irvine	145	Santa Ana to Costa Mesa
55	Santa Ana Civic Center to Newport Beach	INTRA COUNTY EXPRESS	
57	Brea to Newport Beach	206	Santa Ana to Lake Forest Express
59	Brea to Irvine	STATION LINK	
60	Long Beach to Tustin	462	Civic Center to SARTC
		463	SARTC to Costa Mesa
		464	SARTC to Costa Mesa

INTRA COUNTY EXPRESS

757 Pomona to Santa Ana

Table 2-1: Study Area Freeway Volume-to-Capacity Comparison

FREEWAY	SEGMENT	PEAK HOUR CAPACITY[3]	EXISTING (2007)		2035	
			PEAK HOUR VOLUME[a]	V/C[b]	PEAK HOUR VOLUME[c]	V/C[b]
I-5	North of Grand Ave.	22,500	28,000	1.24	30,600	1.36
SR-55	North of Edinger Ave.	21,525	19,900	0.92	24,400	1.13
SR-22	East of Haster Ave.	19,575	17,200	0.88	17,500	0.89
SR-57	North of SR-22	20,550	19,500	0.95	21,500	1.05

[a]Caltrans Traffic Volumes on California State Highways 2010

[b]V/C - Volume to capacity ratio

Santa Ana's arterial roadway system is substantially built out, with little opportunity for future capacity expansion. The City's ability to further widen arterials is constrained by existing development. Traffic congestion along arterials is a common problem in the Study Area during peak commute periods, and frequently during the midday. Many of the Study Area roadways currently carry traffic volumes in excess of capacity. Table 2-2 compares daily traffic volumes along Study Area roadways for existing (2008) and future (2035) conditions.

Seven of OCTA's ten highest ridership bus routes are located within the Study Area (Routes 43, 47, 53, 55, 57, 60, and 64 in Figure 2-4). Five of OCTA's ten most productive bus routes serve the Study Area (Routes 43, 53, 57 60, and 64), based on boardings compared to revenue hours of service. Ridership along these routes ranges from 8,800 daily boardings (Route 64) to over 14,200 daily boardings (Route 43). Table 2-3 shows the average daily boardings by route, based on a rolling average from February 2009 through January 2010.

Eight of the ten OCTA local bus routes that serve the Study Area are oriented in a north-south direction and the two east-west routes completely bypass the Civic Center/Downtown Santa Ana area (a busy employment and activity center) as well as several densely populated residential neighborhoods in both cities.

Finally, the StationLink service that OCTA provides between SARTC and the Civic Center area during the morning and evening peak travel periods does not serve the residential areas east and west of the Civic Center. Furthermore, no early morning, midday, or late evening transit connection is provided between SARTC and the Civic Center Area.

Improved transit accessibility to and within the Study Area, provided by the proposed Project, will help to relieve traffic pressure on surrounding freeways and arterials. But more importantly, it will enhance access to employment, social services, education and other opportunities available within the Study Area (including those in the Civic Center and Downtown Santa Ana) to the residents of the community, where approximately 18% of households have no automobile owners within them.

Table 2-2: Existing and 2035 Baseline Average Daily Traffic on Study Area Arterials

ROADWAY	SEGMENT	EXISTING (2008) ADT[1]			2035 ADT[3]		
		VOLUME	CAPACITY	LOS[2]	VOLUME	CAPACITY	LOS
Harbor Boulevard	SR-22 to Westminster Boulevard	**53,000**	**45,000**	**F**	**60,000**	**45,000**	**F**
Fairview Street	17th Street to 9th Street	**41,000**	**30,000**	**F**	**53,000**	**45,000**	**F**
Fairview Street	9th Street to First Street	**43,000**	**45,000**	**E**	**43,000**	**45,000**	**E**
Raitt Street	N/O First Street	**14,000**	**7,500**	**F**	14,000	20,000	B
Bristol Street	N/O Civic Center Drive	**41,000**	**30,000**	**F**	**49,000**	**45,000**	**F**
Bristol Street	Civic Center Drive to First Street	**34,000**	**30,000**	**F**	39,000	45,000	D
Flower Street	17th Street to First Street	**19,000**	**20,000**	**E**	**21,100**	**20,000**	**F**
Broadway	17th Street to First Street	**24,000**	**20,000**	**F**	**26,000**	**20,000**	**F**
Main Street	17th Street to 1st Street	**33,000**	**30,000**	**F**	**37,000**	**30,000**	**F**
1st Street	Grand Avenue to Fairview Street	**41,000**	**45,000**	**E**	**45,000**	**45,000**	**F**
4th Street	Ross Street to Main Street	7,000	10,000	C	8,000	10,000	D
4th Street	Main Street to French Street	**12,000**	**10,000**	F	**14,000**	**10,000**	**F**
5th Street	Hawley Street to Raitt Street	**12,000**	**12,500**	**E**	**15,000**	**12,500**	**F**
5th Street	Ross Street to French Street	8,000	28,000	A	10,000	28,000	A
Santa Ana Boulevard	Raitt Street to Flower Street	10,000	25,000	A	12,000	25,000	A
Santa Ana Boulevard	Flower Street to Ross Street	12,000	45,000	A	14,000	45,000	A
Santa Ana Boulevard	Ross Street to French Street	10,000	22,500	B	11,000	15,000	C
Santa Ana Boulevard	French Street to Poinsettia Street	15,000	20,000	C	17,000	20,000	D
Santa Ana Boulevard	Poinsettia Street to Grand Avenue	19,000	45,000	A	28,000	45,000	B
Civic Center Drive	Fairview Street to Minter Street	18,000	30,000	B	21,000	30,000	B
Civic Center Drive	Minter Street to Santiago Street	**12,000**	**10,000**	**F**	12,000	20,000	A
17th Street	Fairview Street to Harbor Boulevard	30,000	45,000	B	35,000	45,000	C

[1] ADT – Average Daily Traffic
[2] LOS – Level of Service
[3]2035 projections assume capacity enhancements programmed for certain roadways including Fairview Street, Raitt Street, Bristol Street, 4th Street, Santa Ana Boulevard and Civic Center Drive.
Source: Orange County Traffic Flow Map (2008) and OCTAM 3.3.

Table 2-3: 2009 Average Daily Bus Boardings by Route

ROUTE #	DESCRIPTION	2009 AVERAGE DAILY BOARDINGS		
		WEEKDAY	SATURDAY	SUNDAY
LOCAL ROUTE				
43	La Habra to Costa Mesa	14,220	9,794	7,891
47	Brea Mall to Newport Pier	9,375	6,088	5,642
51	Santa Ana College to South Coast Metro	937	405	333
53	Brea Mall to Irvine	9,786	6,276	4,737
55	Santa Ana Civic Center to Fashion Island via Santa	6,148	4,373	3,655
57	Brea Mall to Newport Transportation Center	12,899	8,664	6,965
59	Brea Mall to Irvine	3,500	845	572
60	Long Beach to Tustin	11,332	7,261	5,560
64	Tustin to Huntington Beach	8,808	6,628	5,505
83	Anaheim to Laguna Hills	2,982	1,929	1,328
COMMUNITY ROUTE				
145	Santa Ana to Costa Mesa	629	274	224
INTRA-COUNTY EXPRESS ROUTE				
206	Santa Ana to Lake Forest	120	-	-
STATION LINK				
462	SARTC to Civic Center	165	-	-
463	SARTC to Hutton Center	115	-	-
464	SARTC to Costa Mesa	52	-	-
INTER-COUNTY EXPRESS ROUTE				
757	Pomona to SARTC	40	-	-

Source: OCTA

2.1.7 Travel Markets

Based on an analysis of existing and future travel conditions within central Orange County, there are three key travel markets that are underserved by the area's current and planned transportation network:

- Connecting Metrolink passengers at SARTC with their destinations in the Study Area, including:
  - Workers who commute by Metrolink
  - Visitors travelling by Metrolink to government services, educational and cultural venues, and shopping and dining opportunities in the Study Area
- Providing for frequent and reliable circulation within the Study Area to connect:
  - Residents with employment and educational opportunities, and goods and services;
  - Workers with the restaurants, retail and services they require during the workday, without the use of an automobile.
- Connecting residents to the west of the Study Area with key Study Area activity centers, and regional transportation services at SARTC.

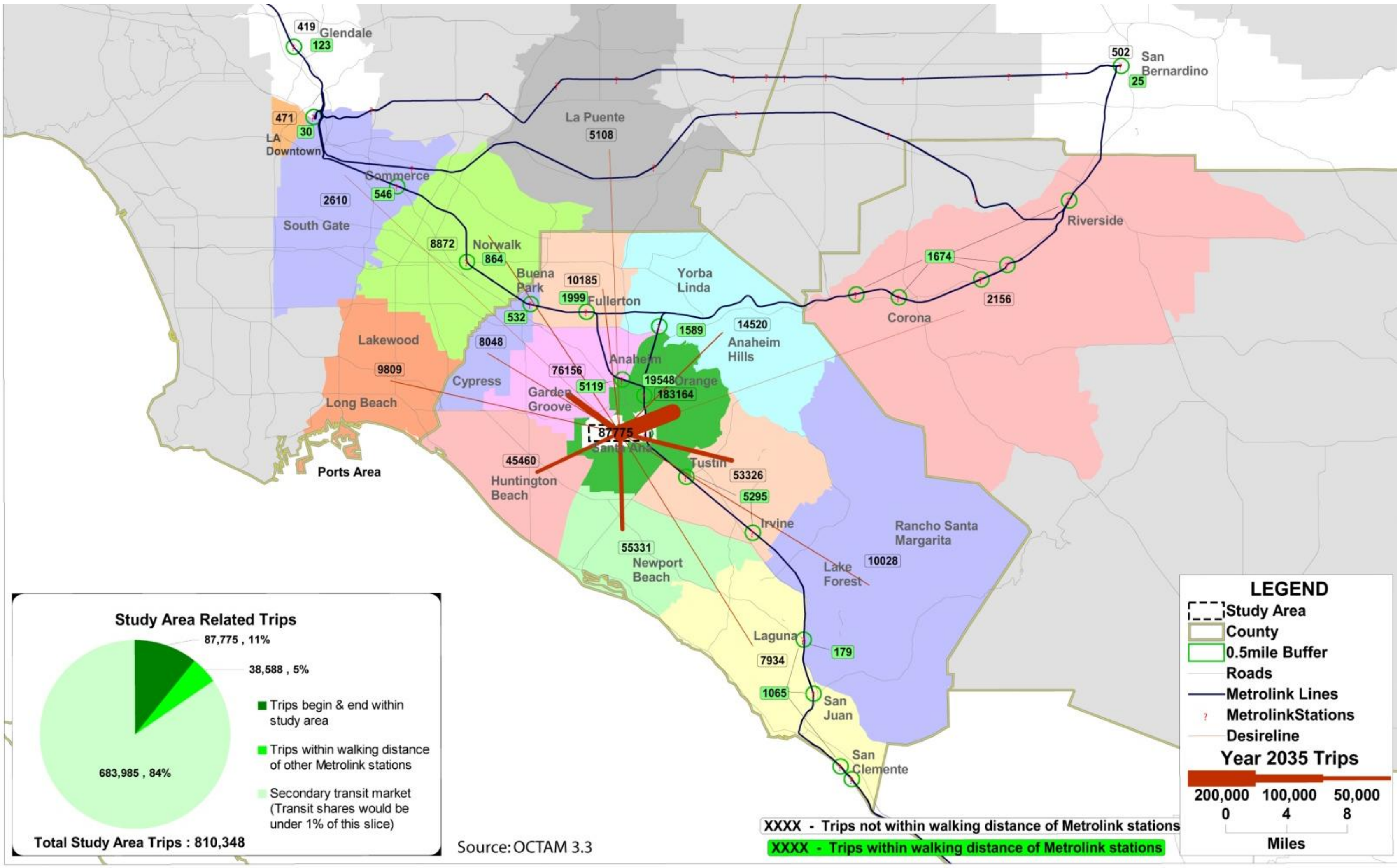
Figure 2-5 depicts projected travel patterns between the Study Area and the surrounding region in 2035, based on daily trips between the Study Area and key regional subareas forecast by the Orange County Traffic Analysis Model (OCTAM 3.3). There are estimated to be approximately 810,000 daily trips into, out of, and within the Study Area in 2035.

Connecting Metrolink Passengers at SARTC with Key Destinations

Approximately 25,000 employees travel to the Civic Center to work every day. To avoid peak hour congestion, many employees in the Study Area who live outside the area commute to work using Metrolink to/from SARTC. Some people use Metrolink to travel to government and judicial services in the Civic Center, or to work, school, shopping or dining opportunities in the Study Area. Once at SARTC, their options to reach their destinations are limited. OCTA's StationLink Route 462 provides service between SARTC and the Civic Center between 6:00 a.m. and 9:00 a.m. in the morning and between 3:44 p.m. and 5:30 p.m. in the afternoon. StationLink buses are scheduled to meet selected Metrolink and Amtrak trains and Greyhound buses. There is no midday or weekend service. This is the only currently available east-west transit service through the Study Area.

Based on forecast information from OCTAM, in 2035 approximately 53 percent of trips (approximately 432,000 daily trips) to/from the Study Area will be within convenient reach of Metrolink service (see Figure 2-5). For example, approximately five percent of Study Area trips (38,588 daily trips) are projected to be within walking distance of a Metrolink station other than SARTC (see Figure 2-5). These trips represent a strong potential source of ridership for the fixed guideway corridor, as well as an opportunity to attract additional

Figure 2-5: 2035 Daily Study Area Trips To/From Key Regional Subareas



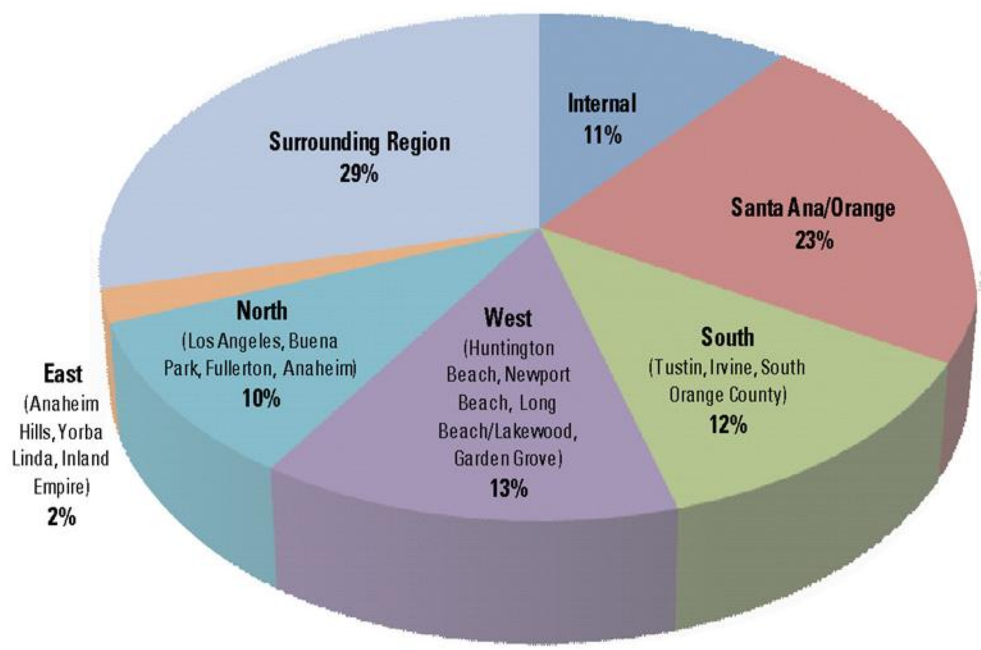
NOTE: All Trips Summary (HBW + Other trips purposes combined) riders to Metrolink by providing connectivity for Metrolink riders who walk to a station and ride the train to the Study Area. A reliable and user friendly transit connection between SARTC and key activity centers within the Study Area, including downtown and the Civic Center would serve this potential travel market and further encourage the use of Metrolink by regional commuters to/from Santa Ana. The fixed guideway would provide the linkage between SARTC (Metrolink station) and Metrolink riders' destination in the Study Area.

Frequent and Reliable Circulation within the Study Area

The existing transportation system lacks alternatives to the automobile to connect Study Area neighborhoods with activity centers that provide employment and educational opportunities, goods and services. There is also a need to connect employees who commute to work in the Study Area with restaurants, retail, and services they require during the workday without the use of an automobile.

Based on forecast information from OCTAM, in 2035, approximately 11 percent of Study Area trips (87,775 daily trips) begin and end in the Study Area. An additional 23 percent, or 183,164 daily trips, begin or end in the immediately surrounding area (the balance of Santa Ana south and east of the Study Area, and the city of Orange) (see Figure 2-6). These trips represent both work and non-work related travel.

Figure 2-6: 2035 Daily Trips To/From the Study Area



Source: OCTAM 3.3

The neighborhoods to the east of downtown Santa Ana are well-covered by transit routes; although, not necessarily well served. West of Downtown, transit service is limited to local bus service along the major arterials, on a one-mile grid. Neighborhoods to the west of downtown are not directly served by transit. There are currently no east-west transit routes through the Study Area (Route 60 serves 17th Street on the north and Route 64 serves First Street on the south.) Frequency of service is considerably reduced during off-peak periods; and with recent cutbacks in transit service, night time service on many routes has been substantially reduced or eliminated. For non-work related travel, stepping onto and off of traditional buses with strollers, packages or personal shopping carts is challenging. Accessibility and livability for Santa Ana residents would be greatly enhanced with reliable, high capacity transit service (in compliance with the Americans with Disabilities Act (ADA)) to connect surrounding residential neighborhoods with jobs, shopping, and other necessary services.

There are few convenient travel choices for employees within the Civic Center. Employees that need to go to lunch or run errands must use an automobile. The need for automobile use during work hours is a deterrent to using transit for the work commute, and typically results in employees traveling to areas outside the Civic Center/Downtown area when eating or conducting personal business during the work day. Employees within the Civic Center could take advantage of the goods and services available within Downtown Santa Ana without the use of their cars.

Connecting Non-Study Area Residents with SARTC and Other Study Area Activity Centers

For many residents of central Orange County, SARTC provides the closest and most convenient access to regional, interregional, and interstate rail and bus services. Their options to access SARTC are limited to either personal autos or local bus service.

For residents of the communities west of the Civic Center, access to the Civic Center, Downtown, or SARTC requires travel along SR-22 or SR-55, and negotiating the I-5/SR-55 interchange or the Orange Crush (SR-22/I-5/SR-57 interchange); the two most congested interchanges in the county. The alternate routes involve lengthy travel on congested arterials, or negotiating multiple transfers on local buses. There is a need to provide more direct access to the Civic Center, Downtown, and SARTC, as well as more travel choices for travelers originating west of the Civic Center. Based on forecast information from OCTAM, in 2035, approximately 13 percent (108,320 daily trips) of trips to/from the Study Area will come from cities west of the Study Area (see Figure 2-6), including Garden Grove, and represent a potential travel market which would be served by the fixed guideway at its western terminus at Harbor Boulevard.

Similar to many of Orange County's historic downtowns, Downtown Santa Ana is not directly accessible by freeways or regional arterials. First Street and Main Street, providing direct continuous regional arterial access to the Downtown Santa Ana and Civic Center areas, are four-lane arterials that carry traffic in excess of their capacity and are frequently congested with peak period commute traffic and midday traffic. Downtown Santa Ana's economic vitality has been inhibited by its constrained regional accessibility.

2.1.8 Statement of Need

The following describes the need for the Project:

Missing Transit Links – Everyday, people travel to jobs or to government and judicial services in the Civic Center; or they travel to employment, educational opportunities, and goods and services available in the Study Area. Many people commute from the surrounding region via Metrolink to SARTC. Once at SARTC, their options to reach their destinations are limited. There is a need for a local collector-distributor transit line that connects rail travelers to their destinations

Congested Freeways and Arterials - All of the freeways serving the Study Area (SR-22, I-5, SR-55, and SR-57) are subject to congestion during peak periods; the segments of I-5 and SR-55 adjacent to the Study Area carry peak hour volumes in excess of 110 percent of capacity. Likewise, the major arterials that serve the Study Area carry traffic in excess of their capacity with daily levels of service of E or worse, and are frequently congested with peak period and midday traffic.

Limited Transportation Improvement Options - Due to its built-out condition and the potential environmental impacts that would result from freeway and arterial widening projects, few options are available to increase roadway capacity in the Study Area. Opportunities to improve mobility are limited to Transportation Systems Management (TSM) and Transportation Demand Management (TDM) strategies, and increased/enhanced transit service.

Limited Travel Choices - Travel choices for people who live or work in the Study Area are confined to automobiles and limited bus service. With churches and schools intermingled within the Study Area neighborhoods, there is also considerable pedestrian activity for the very short trips. However, while residents are able to walk to many key destinations within their neighborhoods, opportunities for employment, education, shopping and/or personal services are just out of reach for walking. The same applies to those who work within the Study Area or travel there for other purposes, such as jury duty; many restaurants and retail opportunities cannot be conveniently accessed during lunch hour. A new fixed guideway system would reinforce the viability of transit for people living within the Study Area as well as workers commuting to the Civic Center via Metrolink.

Significant Level of Transit Dependence - The median household income of the Study Area is $28,167, which is slightly above the U.S. poverty level ($25,596 for a 5-person household). Approximately 17.8 percent of Study Area households do not have any residents who own a car. Approximately 31.9 percent of the residents in the Study Area are under the age of 15 and therefore not yet eligible to drive a car. These characteristics contribute to high levels of transit dependency within the Study Area, creating a potentially large transit market.

Automobile Emissions Contribute to Unhealthy Air Quality -In addition to congestion, the predominance of the automobile as the primary mode of travel within the Study Area and the surrounding region contributes to reduced air quality. The Study Area lies within the South Coast Air Basin. Air quality within the basin is governed by the standards established by the United States Environmental Protection Agency (EPA) and the more stringent requirements of the California Air Resources Board (CARB), and managed by the South Coast Air Quality Management District (SCAQMD). Based on the standards established by CARB, the South Coast Air Basin is currently designated as a non-attainment area for ozone and total suspended particulates (including PM2.5 and PM 10). Mobile source emissions are identified by SCAQMD as the single largest contributor to the region's air quality problems. This includes greenhouse gases associated with cars, light-duty trucks and medium-duty passenger vehicles. On January 10, 2010, the Administrator of the US EPA enacted a rule finding that greenhouse gases in the atmosphere may reasonably be anticipated to endanger both public health and public welfare.

2.1.9 Statement of Purpose

The purpose of the Santa Ana-Garden Grove Fixed Guideway Project is to:

Improve Transit Connectivity – Currently access to the Study Area is constrained by congested freeways and arterials, and the lack of alternatives to the automobile. Improved transit accessibility to and within the Study Area will help to relieve traffic pressure on surrounding freeways and arterials. But more importantly, it will enhance access to employment, social services, education and other opportunities available within the Study Area (including those in the Civic Center and Downtown) to the residents of the community; it will reinforce the viability of transit for workers commuting to the Civic Center via Metrolink from the surrounding region; and, it will foster economic vitality and redevelopment opportunities in Downtown Santa Ana and along the corridor.

Relieve Congestion - A local collector distributor transit line connecting SARTC with Downtown Santa Ana, the Civic Center, and the Harbor Boulevard corridor to the west will reinforce the viability of transit for workers and residents in central Santa Ana. Increased transit use in this area has the potential to reduce travel along the I-5, SR-22 and through the congested "Orange Crush" interchange area. It will also provide potential benefit to the Study Area arterial system that links the key activity centers.

Be Sensitive to the Character of the Community – The unique character of the Study Area is an asset to the cities of Santa Ana and Garden Grove, and is highly valued by the people who live and work within the Study Area. Many of the roadways that serve the Study Area are narrow, and historic buildings line the sidewalks of many streets. As a result, the cities' are committed to identifying transit improvements that can be accommodated within the existing street system and rights-of-way without extensive street widening to avoid impacts to adjacent land uses and to the existing character of the community.

Transportation solutions will need to be good neighbors to residents (quiet), pedestrian-friendly and operate substantially within the existing street system using available rights-of-way. The scale, fit and operating characteristics of the transportation investment will need to be compatible with the established urban setting, and incorporate principles of context sensitive design.

Increase Transportation Options - Providing a transit alternative for short, local trips within the Study Area will provide residents a practical means to complete necessary trips related to daily living while reinforcing the walkable character of this community.

The fixed guideway system will be a frequent, convenient and reliable urban circulator that will open up access to the full range of opportunities and services available within the study area to its residents, workers and visitors, and that will also encourage walking. The topography and development patterns within the study area provide for walkability. Reduction in automobile trips will further enhance the pedestrian experience within the study area. Communities with successful transit systems have higher pedestrian activity and more positive body weight trends. The fixed guideway will help foster and support healthy travel choices within the study area. It will benefit employees and visitors to the Downtown and Civic Center areas and also the businesses located there by efficiently connecting potential customers with shops, restaurants and services that are not quite accessible by walking or without an automobile.

Improve Transit Accessibility - Improved transit accessibility to and within the Study Area will enhance the quality of life for the large number of transit-dependent individuals who live in the Study Area by providing them greater access to employment, social services, shopping, education, and other opportunities within the Study Area. It will also enable transit-dependent people who live in other parts of Orange County to more easily access federal, state and county social service agencies which are concentrated in the Civic Center area.

Provide Benefits for the Environmental through Improved Air Quality –An important goal of the Santa Ana-Garden Grove Fixed Guideway Project is to help reduce reliance on the automobile and to take active steps to improve air quality in the Study Area. This calls for transit solutions that allow those who commute to the Study Area via Metrolink and Amtrak to complete their trips without the use of a car. This also calls for transit options that would serve the circulation needs of residents, employees, and visitors so that they do not have to rely on their private automobiles to complete these trips within the Study Area. An additional criterion for alternatives development is that clean fuel technologies such as electricity, liquefied natural gas or clean diesel would need to be used to power the transit vehicles.

Be Financially Feasible and Cost Efficient to Construct, Operate and Maintain – A practical consideration in the development of alternatives for the Santa Ana-Garden Grove Fixed Guideway Project is that potential transit solutions should be affordable. While at this early stage in the study there is no set, minimum threshold for affordability, the capital costs needed to construct the project as well as the expense of operating and maintaining the system need to be reasonable and achievable based on known, potential revenue sources for project funding. At present, this is envisioned to be a mix of local, state, and federal transportation funds. Opportunities for public-private partnerships and for private involvement/profit sharing within the vicinity of station stop areas are also being explored as additional potential funding sources.

Santa Ana's overall vision for the Study Area includes a transit system that integrates seamlessly with the community and is compatible with the established urban character. As such, the system is envisioned to be street-running rather than elevated or subterranean. This will result in lower capital costs for right-of-way and construction than grade-separated designs. Throughout the alternatives analysis, there will be a need to balance system amenities against cost, while optimizing system efficiency and maximizing safety. A system that is technically dependable and cost-efficient to operate and maintain is an objective.

Support Economic Vitality and Foster Redevelopment Opportunities – The cities of Santa Ana and Garden Grove recognize the importance of public investment in infrastructure as a catalyst for economic development. In the competitive Orange County marketplace, transportation infrastructure projects that improve access and mobility enhance the attractiveness of neighborhoods and provide a competitive edge for nearby businesses. Therefore, an important element of the cities' integrated transportation-land use vision is the provision of transit service that is continuous and reliable, as well as a permanent and visible fixture for transit users and the community. Such service would improve visibility and access to existing economic activity centers and areas targeted for redevelopment. Connectivity to these key existing and future development areas is one of the most critical aspects of the Santa Ana-Garden Grove Fixed Guideway Corridor Project.

In recent years, the City of Santa Ana has taken active steps to revitalize its downtown area to attract new businesses, customers, and visitors, utilizing a design scheme that fosters walkability and transit use. The Artist's Village and the East End Promenade in downtown Santa Ana are prime examples of this effort. Moreover, the recent adoption of the Transit Zoning Code by the City of Santa Ana provides the policy foundation for redevelopment activities specifically targeted to the Fixed Guideway Corridor. However, constrained access continues to be a challenge for the area.

To the west, the City of Garden Grove continues to promote economic development along the Harbor Boulevard corridor (InternationalWEST). The proposed transportation investment is intended to support economic vitality and foster redevelopment opportunities within the Study Area by improving access and connectivity within the Study Area, and between the Study Area and the surrounding region. This, in turn, will improve visibility and enhance access to Study Area land uses, and promote businesses. It will strengthen existing development and foster new opportunities for mixed-use development and transit-supportive residential products, and regionally significant resort and entertainment venues in areas such as the Willowick Golf Course and the southern end of Garden Grove's Harbor Boulevard Corridor.

Support Local Plans for Transit-Oriented Development – The cities of Santa Ana and Garden Grove recognize that land use, economic opportunity, and transportation planning go hand in hand. Over the last several years, the City of Santa Ana has implemented transit-oriented development in the area adjacent to SARTC. Santa Ana's Transit Zoning Code, which encompasses 450 acres within the Study Area, supports mixed-use development and provides a transit-supportive, pedestrian–oriented development framework to reduce vehicle trips and greenhouse gas emissions.

3.0 ALTERNATIVES DEVELOPMENT PROCESS

The development of a set of conceptual alternatives for the Santa Ana-Garden Grove Fixed Guideway Corridor was a process that occurred in stages beginning with public listening sessions and community outreach early in the study and continued during development of the project Purpose and Need. The *Evaluation Methodology* (May 2010) that was prepared for the project was also consulted and used as a guide.

Further, in keeping with federal and regional transportation planning guidelines, the following "rules of thumb" were applied in the development of a set of conceptual alternatives:

- *The set of alternatives must include the necessary baseline options: No Build Alternative and Transportation Systems Management (TSM) Alternative.* Both state and federal environmental regulations require the inclusion of a "do-nothing" alternative as the environmental baseline. In addition, the regulations require that any build alternatives (i.e., those that would involve a major investment of public funds) be evaluated in comparison to a TSM Alternative which is comprised of lower cost improvements, including traffic engineering programs, transit service improvements, and travel demand management strategies.
- *The set of alternatives should include all reasonable routes and technologies, but only those that are reasonable.* Consistent with the Orange County Transportation Authority (OCTA) policy, only service-proven technologies should be considered. By the same token, alternatives that do not make technical sense in addressing the transportation problems should be dropped. Alternatives may fail this test on a number of grounds, such as their inappropriateness for the travel markets in the corridor, significant rights-of-way requirements, extremely high costs, and/or risk of adverse environmental impacts.
- *The set of alternatives should include options designed to address differing goals and objectives.* In circumstances where there is a wide range of goals and objectives for transportation improvements, it is logical to infer that substantial trade-offs will exist among some of the objectives. Consequently, it is important that an appropriate range of alternatives be included to illustrate these trade-offs. In a corridor that is relatively well-defined and contained, such as the Santa Ana-Garden Grove Fixed Guideway Corridor, this may mean developing potential alignments that are only a few blocks apart in order to test for specific benefits such as accessibility, ridership, and economic development, and to avoid adverse impacts.
- *The initial set of alternatives should include all options that have a reasonable chance of being included in the Locally Preferred Alternative (LPA).* This entails careful assessment of the purpose and need as well as scrutiny of public inputs received

through public participation to identify the values and viewpoints that will ultimately lead to a decision in regard to the locally preferred alternative.

- *The set of alternatives should encompass an appropriate range of options, without major gaps in the likely costs of the alternatives.* In most cases, it is not desirable to structure the set of alternatives to include, for example, several relatively low-cost options and several high-cost options with no intermediate-cost alternatives.

- *Where questions remain on the feasibility of specific alternatives, other alternatives should provide related fall-back options.* This principle suggests that if a segment of an existing alternative has substantial technical or environmental concerns that may lead to its rejection, an alignment variation be included as another option.

- *The number of alternatives should be manageable.* It is important that decision-makers and the public understand the major implications of each alternative. An iterative, multi-step process of analysis allows the broadest range of alternatives to be reasonably and effectively considered. The analysis progresses from many alternatives being evaluated with less detail, focusing on key critical criteria and differentiators, to a few of the most promising alternatives being evaluated in great detail. In this way, decision-makers and the public are provided understandable information on the advantages, disadvantages and tradeoffs among the alternatives with which they are presented at each step in the decision-making process.

3.1 Goals and Objectives

The goals and objectives for the Santa Ana-Garden Grove Fixed Guideway Corridor Study address the issues, opportunities and constraints discussed previously and reflect local, community goals established early in the project. Along with the Purpose and Need, these goals and objectives shaped the development of transportation alternatives and established the framework for evaluating transportation alternatives.

Goal 1: Increase accessibility and livability in the heart of Orange County through transit options that enhance the quality of life within the community.

- Support planned growth in regional rail and bus service.
- Enhance connections to regional, interstate, and international bus, rail and air service.
- Provide convenient, efficient regional access between Santa Ana Regional Transportation Center (SARTC), and employment and activity centers, and residential neighborhoods in central Santa Ana and Garden Grove.
- Enhance connectivity between neighborhoods, businesses, and activity centers in central Santa Ana.
- Provide employees with improved access to job sites.

- Provide additional travel options for students and transit-dependent individuals.

Goal 2: Actively foster economic development opportunities, transit supportive land uses, and community goals.

- Stimulate land development opportunities in undeveloped and underdeveloped areas along the corridor.
- Provide a transportation system that supports pedestrian activity, and serves higher density development.
- Integrate well with surrounding neighborhoods by providing frequent stops with shorter travel distances between stops.
- Reinforce transit-oriented development near SARTC and in appropriate locations along the corridor.

Goal 3: Promote sustainable and environmentally responsible transportation investments that respond to the needs of the people who live and work within the community.

- Reduce automobile trips by providing high quality transit access and promoting walkability.
- Improve air quality, reduce energy consumption, carbon footprint, and greenhouse gas emissions.
- Support reduced parking requirements along the corridor where appropriate.
- Limit environmental impacts by implementing a system that operates primarily within existing rights-of-way.

Goal 4: Deliver travel benefits, reliability, and choice to transportation system users.

- Provide transit service that is user-friendly.
- Attract new transit riders.
- Provide service that is travel time competitive with personal automobiles.
- Use a service-proven technology.
- Provide for the safety of the system users and individuals who live in the corridor.
- Provide for a reasonable, integrated fare structure.

Goal 5: Make cost-effective and financially feasible transportation choices.

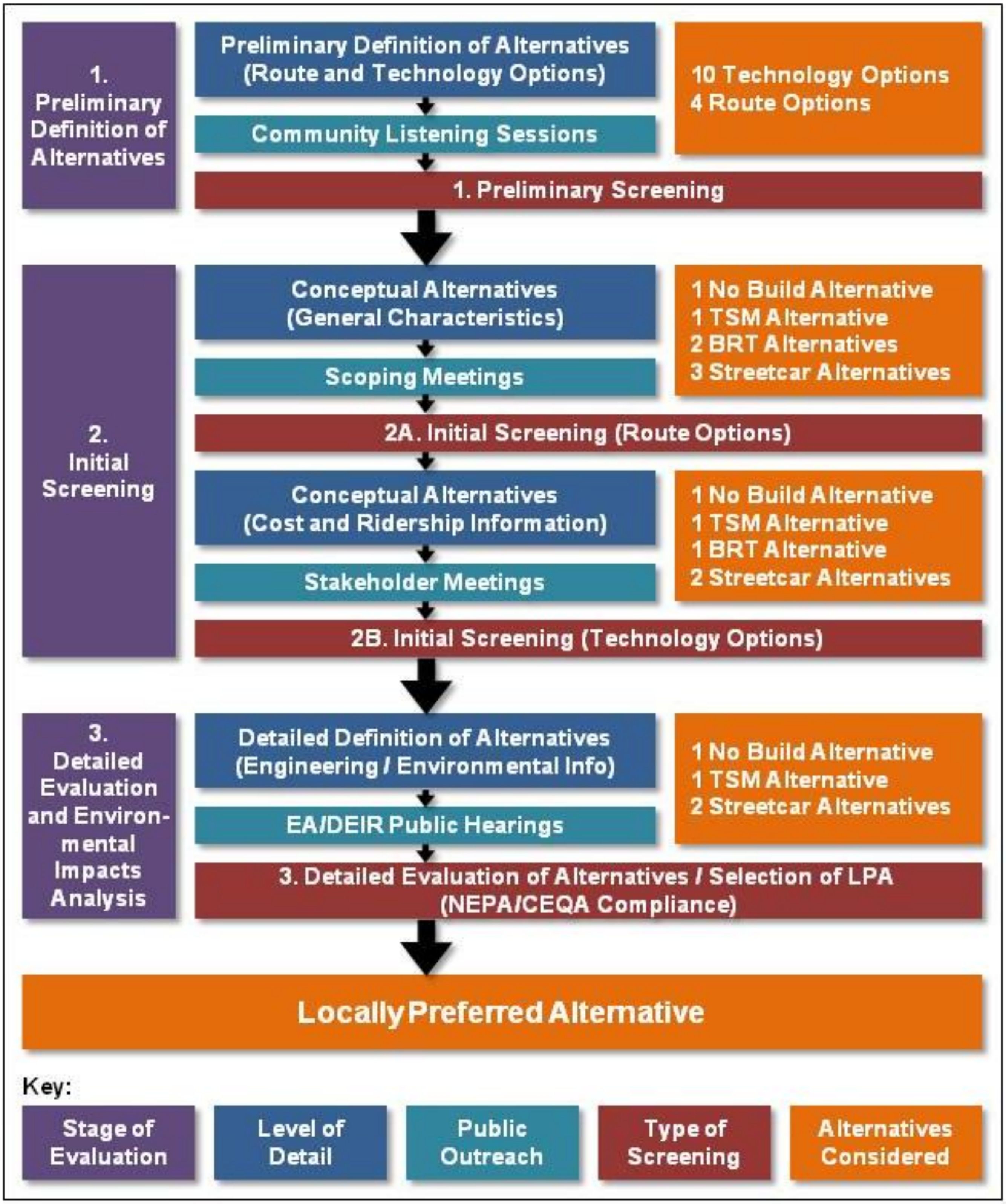
- Attract long-term, sustainable public and private investment.
- Explore opportunities to reduce or minimize capital costs.
- Provide for efficient and cost-effective system operations and maintenance.
- Maximize overall system cost-effectiveness.
- Maximize ridership.
- Minimize cost per rider for long term operations.

3.2 Evaluation Process

The Santa Ana-Garden Grove Fixed Guideway Corridor Study evaluation process was structured to give project stakeholders and decision makers several opportunities to share their input and to provide information required to select an LPA. The analytical steps in the process are shown in Figure 3-1 and include:

1. Preliminary Definition of Alternatives
    a. Develop an inventory of potential transit technologies appropriate to the study corridor;
    b. Identify system route options;
    c. Conduct public outreach;
    d. Conduct preliminary screening to eliminate technology options that do not satisfy criteria closely related to the Purpose and Need and project goals and objectives and route options that do not satisfy other identified criteria;
    e. Identify a reduced set of technology and route options and combine these options to create a range of conceptual alternatives that could potentially further satisfy the Purpose and Need and meet the goals and objectives for the project.
2. Initial Screening:
    2A. Initial Screening (Route Options)
    a. Eliminate route options with fatal flaws and those that do not satisfy the Purpose and Need and meet the goals and objectives of the project;
    b. Identify a reduced set of feasible route options;
    c. Conduct public outreach;
    d. Define a reduced set of alternatives (routes and technologies combined).
    2B. Initial Screening (Technology Options)
    e. Eliminate technology options with fatal flaws and those that do not satisfy the Purpose and Need and meet the goals and objectives of the project;
    f. Identify a reduced set of feasible technology options;
    g. Conduct public outreach;
    h. Define a reduced set of alternatives (routes and technologies combined).
3. Detailed Evaluation and Environmental Impact Analysis:
    a. Perform conceptual engineering to provide preliminary information about the physical and operating characteristics of alternatives;
    b. Prepare environmental analysis to provide preliminary information regarding potential impacts of alternatives;
    c. Conduct detailed evaluation of the reduced set of alternatives supported by conceptual engineering and environmental analysis;
    d. Conduct public outreach;
    e. Select the LPA.

Figure 3-1: Alternatives Development and Analysis Process



4.0 PRELIMINARY DEFINITION OF ALTERNATIVES

4.1 Community Listening Sessions

As an initial step in the consideration and development of potential transportation alternatives, the cities of Santa Ana and Garden Grove hosted a series of community listening sessions in early February 2010. The project team also met with a diverse group of community representatives – the Stakeholders Working Group – in late January 2010 to discuss the Santa Ana-Garden Grove Fixed Guideway Corridor Project in some depth including how it relates to other transportation, land use and economic development initiatives taking place in Central Orange County. The purpose of these meetings was to get a sense of community issues and priorities very early in the study process so that the cities' early decisions could be guided, in part, by public feedback.

A wide variety of transit technologies and routes were presented and discussed to help ensure that the study process was open-ended and that it allowed a broad range of ideas to be considered.

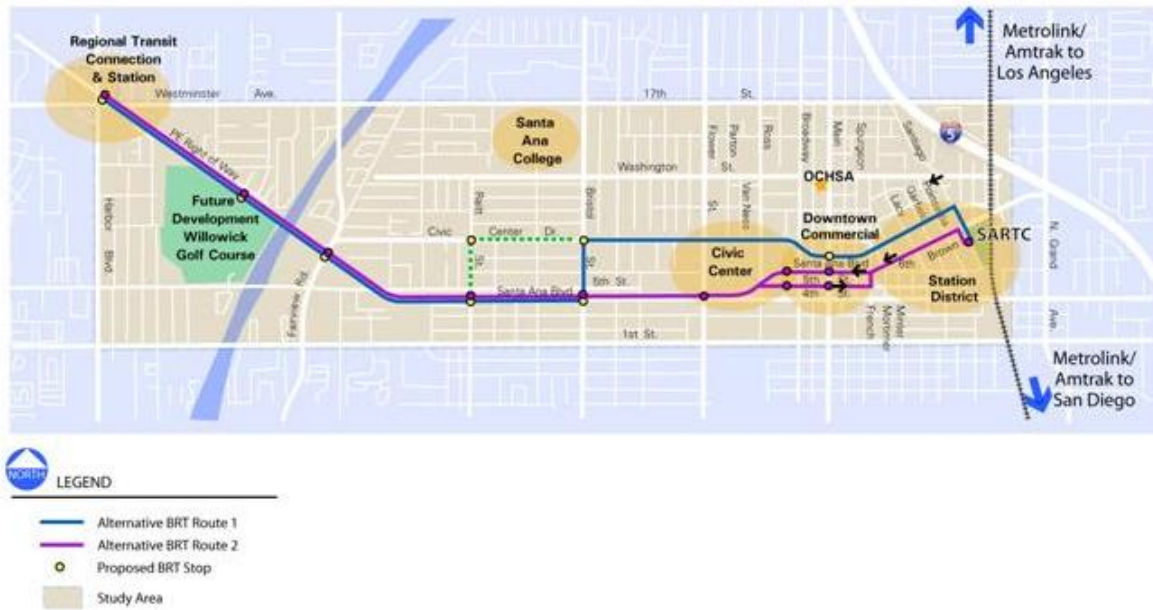
4.1.1 Technology and Route Alternatives Options Presented

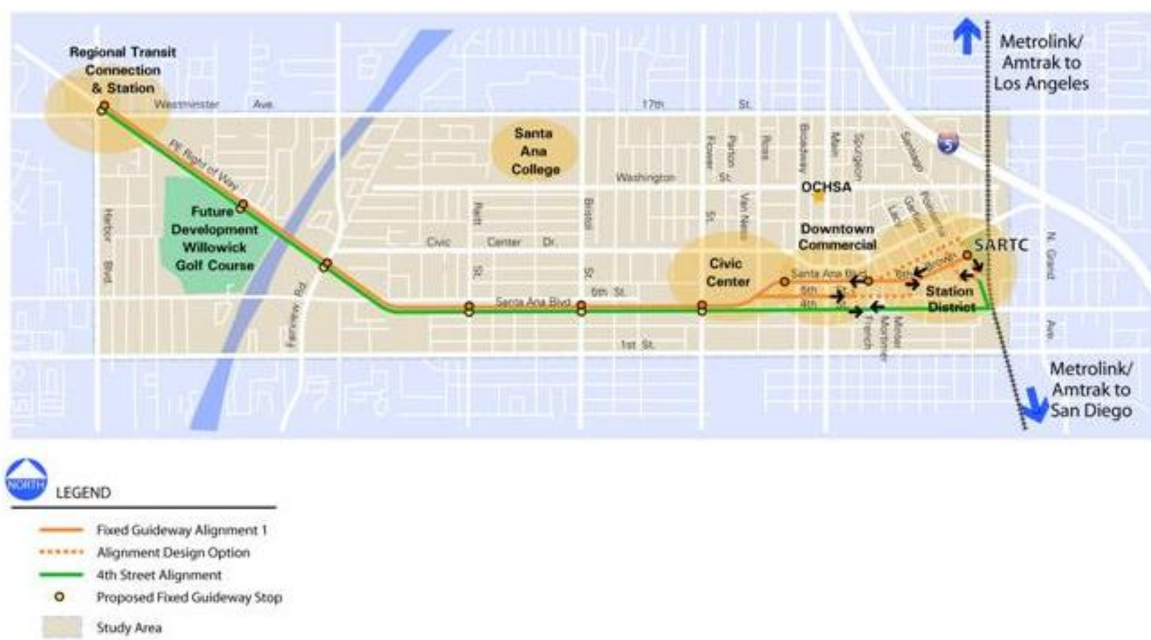
The transit modes and technologies that were put forward to the public at the community listening sessions included: bus, trolley bus, bus rapid transit (BRT), modern streetcar, light rail transit (LRT), commuter rail, heavy rail transit (subway), monorail, low speed maglev and personal rapid transit (PRT). These modes were defined with general requirements for the Santa Ana-Garden Grove Fixed Guideway System in mind, as defined by the cities and supported by the community. These included:

- System must be surface-running
- System must be capable of operating in mixed flow traffic within existing lane widths
- Vehicles compatible with short downtown block face lengths
- System must be compatible with pedestrian activity and pedestrian scale street frontage
- Operating cost per potential passenger must be reasonable
- System must be provide to be reliable in revenue service in the US

Four different route options were presented at the community listening sessions as it was important to provide tangible "lines on maps" to which members of the community could respond. Some of the routes originated with the previous work that was completed in the corridor under Step One of the Go Local Program *(Santa Ana and Garden Grove Transit Vision and Go Local Project Concept, Final Study Report, May 2008)*. Others were developed to more directly serve the City of Santa Ana's downtown core. All four of these draft routes spanned the full breadth of the four-mile corridor between Santa Ana Regional Transportation Center (SARTC) and Harbor Boulevard and all utilized the Pacific Electric Right-of-Way (PE ROW) in the western portion of the Study Area. The following four routes were explored as travel paths through the eastern portion of the Study Area: (1) Civic Center Drive; (2) a couplet along Santa Ana Boulevard and 5th Street; (3) an extended couplet along Santa Ana Boulevard and 5th Street; and (4) 4th Street.

Figure 4-1: Listening Session Route Options





4.1.2 Feedback Received

In general, most of the individuals who attended the community listening sessions indicated that proven technologies that operated at grade and were able to provide frequent and reliable service would best address travel needs in the corridor. This included the family of bus technologies, streetcar, and light rail as opposed to technologies such as commuter rail or heavy rail transit. When asked for their opinions, many of the participants said they favored the surface rail technologies (streetcar, LRT) over the bus technologies, citing reasons such as trip reliability and development potential. A few evinced skepticism for some of the transit technologies (e.g., monorail, maglev, PRT) that they viewed to be speculative or too costly to build and to operate. Yet others – particularly those who lived within neighborhoods near a potential alignment - voiced concerns about the impacts associated with the construction of an elevated guideway or with street widening.

The range of draft routes appeared to be well received and no firm pattern of public opinion emerged on any one of the draft routes as it was generally understood that these would be studied further and then brought back again for the public to review. Some questions and comments were received related to routing in the vicinity of SARTC.

4.2 Preliminary Screening

4.2.1 Technology Criteria

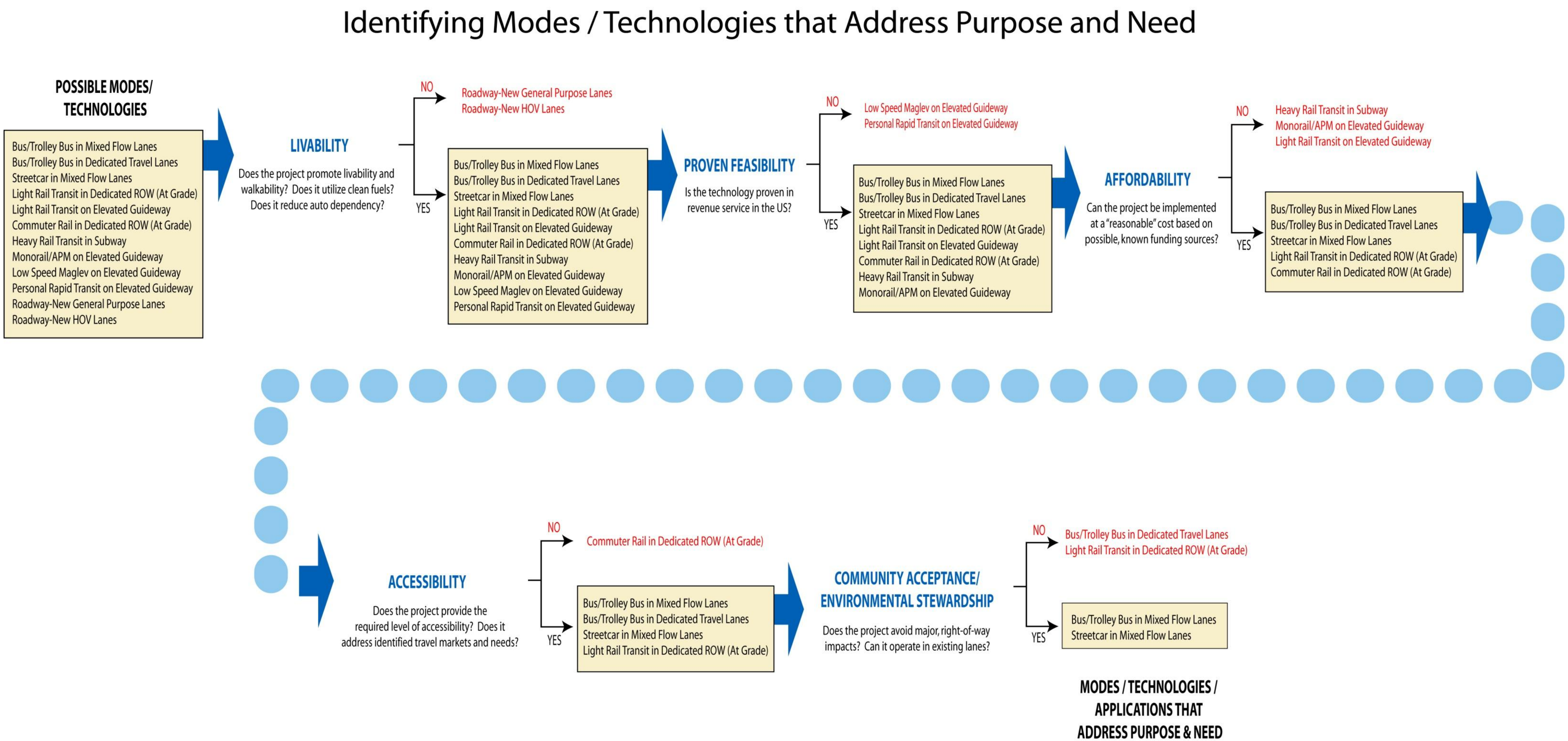
Upon the conclusion of the community listening sessions, preliminary screening was conducted to determine which transit modes and technologies were particularly well-suited to address the key factors related to the Purpose and Need for the project as described in Section 2 of this report, specifically: (a) Livability; (b) Proven Feasibility; (c) Affordability; (d) Accessibility; and (e) Community Acceptance / Environmental Stewardship.

These core criteria tied back to the goals and objectives established early in the project. They were also identified and briefly described in the *Santa Ana and Garden Grove Fixed Guideway Evaluation Methodology Technical Report* (May 2010). Source material on transit technologies was also drawn from a technical memorandum entitled *Transit Technology Review (January 2010)* that was prepared early in the study effort.

4.2.2 Technology Preliminary Screening Results

Figure 4-2 provides a graphical depiction of the analytical framework utilized to assess the possible modes, transit technologies, and applications according to the core criteria

Figure 4-2: Analytical Framework to Screen Modes, Transit Technologies and Applications



established for the project. The analytical framework is in the form of a flowchart and each major criterion represents a step on the flowchart. A key question (or related series of questions) was asked and answered for each of the core criteria. If the answer to the question was "yes," then the transit mode or technology was carried forward to the next step on the decision ladder. If the answer was "no" then it was dropped from further consideration at that stage because it failed to meet an important success criterion for the project.

Through the preliminary screening process, only those transit modes and technologies which were able to meet all of the criteria were carried forward. As illustrated in Figure 4-2, those technologies that were determined most suitable for the Study Area were bus, trolley bus, BRT, and modern streetcar.

4.2.3 Route Criteria

In preparation for the Public Scoping Meetings held in June 2010, the city continued with the outreach effort and conducted one-on-one briefings with community leaders and key stakeholders. In addition, city staff and the project technical team worked on the draft alignments, particularly through Downtown Santa Ana and in the neighborhoods, to test for streets where turns could be made with the streetcar technology with minimal disruption to existing land uses. Moreover, since two of the principal east-west streets through Downtown Santa Ana are one-way – Santa Ana Boulevard operates in the westbound direction and 5th Street operates in an eastbound direction – the draft routes were further examined for compatibility with existing traffic operations as well as accessibility to existing and future land uses.

Although the Study Area is fairly well served by transit, only two of the ten OCTA routes that serve the area operate in an east-west direction and neither of those routes directly serves the Civic Center/Downtown area. Therefore, it was deemed fundamentally important that the Santa Ana-Garden Grove Fixed Guideway System serve key employment, commercial, institutional, and residential centers within the Study Area. Additionally, by providing a connection between SARTC and the City of Garden Grove at the intersection of Harbor Boulevard and Westminster Avenue, the Fixed Guideway System would greatly enhance the Study Area's regional transit connectivity by providing direct connections to Metrolink, OCTA fixed route bus service and their emerging BRT network (Route 543 on Harbor Boulevard began service in Summer 2013 with service along Westminster Avenue/17th Street planned). Furthermore, it was determined that potentially negative impacts to OCTA's other existing fixed route bus service should be avoided. Therefore, all of the route options evaluated were concentrated in a fairly compact area bounded by Civic Center Drive on the north and 3rd Street on the south through the Downtown Santa Ana/Civic Center area.

Figure 4-3: Results of Preliminary Screening Process for Transit Modes and Technologies

GOAL-BASED CRITERIA	PERSONAL RAPID TRANSIT	LOW-SPEED MAG LEV	MONORAIL	DIESEL MULTIPLE UNITS	COMMUTER RAIL	LIGHT RAIL	BUS	TROLLEY BUS	MODERN STREETCAR
LIVABILITY/ACCESSIBILITY Does the project promote livability and walkability? Does it utilize clean fuels? Does it reduce auto dependency?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PROVEN FEASIBILITY Is the technology proven in revenue service in the US?	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AFFORDABILITY Can the project be implemented at a “reasonable” cost based on possible, known funding sources?	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
ACCESSIBILITY Does the project provide the required level of accessibility? Does it address identified travel markets and needs?	No	No	No	No	No	Yes	Yes	Yes	Yes
COMMUNITY ACCEPTANCE/ ENVIRONMENTAL STEWARDSHIP Does the project avoid significant right-of-way impacts? Can it operate in existing lanes?	No	No	No	No	No	No	Yes	Yes	Yes

The cities also decided early in the study process that, regardless of the technology selected, the Fixed Guideway System should operate in the curb lane (except in the PE ROW where it would operate in the center of the available ROW). Based on careful consideration of the local context, review of the safety records of existing streetcar systems, and consultation with the Fixed Guideway technical consultant team, a curb-running system was determined to be the best solution for the segments of the streetcar that would operate in mixed-flow traffic on existing streets for several reasons:

1. The only form of public transportation currently operating on roadways within the Santa Ana- Garden Grove Study Area is OCTA bus service. All of OCTA's bus stops are curbside. Transit users and motorists are accustomed to transit vehicles traveling in the curb lane and stopping in the curb lane for passengers to board and alight. The fact that no new learning will be required if the streetcar travels curbside should enhance safety.

2. Center platforms that accompany center-running streetcars result in passengers boarding and unloading in the middle of a roadway. Passengers must cross one or more lanes of traffic, and possibly one set of tracks, on their way to and from the platforms. The potential conflicts with automobile traffic create safety issues for passengers. In an area where rail transit is unfamiliar to most people, the need for passengers to cross tracks also raises safety concerns. Curb-running streetcar with curbside platforms minimizes potential conflicts between streetcar passengers and vehicular traffic. The Santa Ana-Garden Grove streetcar will operate near five public school sites between Raitt Street and Flower Street. Having the streetcar stop curbside, where school children are accustomed to being dropped off and picked up, should enhance safety.

3. The existing streetcar systems in Portland, Seattle and Tacoma are predominantly curb-running systems that, in many areas, operate immediately adjacent to the curb with no buffer. All have excellent safety records. The Portland streetcar system, which has been in operation since 2001, has not had a single reported safety incident in more than ten years of operation. The built environment in Portland, Seattle and Tacoma is similar to the built environment in Santa Ana and Garden Grove -- with a mix of residential, commercial, industrial, and institutional uses. Moreover, the streetcar systems in all three cities were preceded by curb-running bus systems. The positive safety records of these systems demonstrate that curb-running systems do not jeopardize public safety.

4. The Santa Ana-Garden Grove Fixed Guideway must fully comply with the requirements of the California Public Utilities Commission (CPUC), which oversees the safety and security of all rail transit projects in California. Based on initial coordination with the CPUC, the curb-running alignment best addressed their requirements and concerns.

5. Within the Santa Ana-Garden Grove Study Area, the center lane of roadways tends to be less obstructed by side-friction. Consequently, motorists travel at somewhat higher travel speeds in the center lane than in the curb lanes. Given historic traffic patterns in the Study Area, motorists would not expect a transit vehicle traveling in the center lane to stop. Therefore, a center-running system could increase the risk of accidents. The continuation of familiar traffic patterns should enhance safety.

6. The segment of Santa Ana Boulevard between Shelton Street and Raitt Street, west of the Civic Center, is narrow (approximately 55 feet wide curb-to-curb within 80 feet of ROW). The streetcar is proposed to run in the curb lane with stops located within the existing sidewalk and parkway. There is inadequate width to accommodate center platforms through this segment without additional ROW acquisition within this substantially residential segment. It should be noted that one segment of the Portland Streetcar system runs immediately adjacent to sidewalk along 4th Street (opened to service in 2005), and there are three locations where the streetcar operates within pedestrian corridors. No incidents have been reported in these areas.

7. Curb-running rather than center-running is the general design practice for streetcars that are intended to serve as circulators, operating at fairly low travel speeds with frequent stops.

8. The visual impacts of a curb-running system would be less significant for a curb-running system in the Santa Ana-Garden Grove Study Area, where power lines can be shielded by existing curbside trees, than in the center of the roadway. This is an important local consideration.

4.2.4 Route Preliminary Screening Results

The route concepts presented at the community listening sessions were refined based on the above criteria, subsequent technical analysis and public input. The 4th Street bi-directional alignment was adjusted to operate on Santa Ana Boulevard/4th Street. A new alignment was added – a 3rd Street and 4th Street couplet – which would more thoroughly penetrate the southern portion of Santa Ana's downtown, retail section and which would also provide an additional scenario to test transit operation on 4th Street in a different direction. The other route options were carried forward including Civic Center Drive and Santa Ana Boulevard and 5th Street.

4.2.5 Combining Technologies and Routes

Three streetcar build scenarios were formed utilizing three different alignment options through the downtown Santa Ana area: (a) Brown Street/Santa Ana Boulevard/5th Street; (b) Santa Ana Boulevard/4th Street; and (c) Santa Ana Boulevard/4th Street/3rd Street. All of these routes differed in their approach to the SARTC station. However, in the western half of the Study Area, all of these routes kept the same alignment: Santa Ana Boulevard and the PE ROW. While the Build Alternatives utilize the PE ROW the TSM improvements do not since the PE ROW is unpaved and would require construction of a roadway to accommodate bus service

The bus family of technologies were also further defined and enhanced to optimize the bus transit mode. First, the transit operational description of the Transportation Systems Management Alternative (TSM) for the Santa Ana-Garden Grove Fixed Guideway Corridor Study Area was further articulated based on a more detailed examination of existing bus routes (OCTA's March 2010 Service Plan) as well as an examination of future transit service improvements planned for central Orange County that are funded and committed. Key among these future transit routes that transect the Study Area are three of OCTA's planned BRT routes: (1) Harbor Boulevard, (2) Bristol Street; and (3) Westminster Avenue /17th Street.

Next, two build BRT scenarios were crafted for the bus technology from two of the draft routes presented in the community listening sessions to take full advantage of the flexibility, speeds, and turning capabilities of this transit mode: (a) Civic Center Drive, and (b) Santa Ana Boulevard/5th Street. Within the PE ROW between Harbor Boulevard and Raitt Street, a dedicated bus guideway would be built in the exclusive right-of-way. East of Raitt Street, similar to the streetcar alternatives, the buses would transition into mixed flow operation.

At this stage in the alternatives development process, the concept of trolley bus was generally dropped from further consideration as it encumbered the bus mode with both added expense and unnecessary aesthetic and technical complications associated with the overhead catenary component that were not warranted given the relatively clean fuels that would be utilized by the BRT vehicles. However, it was determined that special branding would be applied to the BRT vehicles to help distinguish this transit application from ordinary buses. It was also decided that station stop design treatments would include all of the support features and amenities afforded to the streetcar alternatives.

4.3 Conceptual Alternatives

In summary, based on preliminary screening, the comments received at the community listening sessions, and further input received from the cities, the most suitable technologies were coupled with potential corridor route options to arrive at an initial set of seven conceptual alternatives, which are described in greater detail below:

- No Build Alternative;
- TSM Alternative;
- BRT Alternative on Civic Center Drive;
- BRT Alternative on Santa Ana Boulevard/5th Street;

- Streetcar Alternative on Brown Street/Santa Ana Boulevard/5th Street;
- Streetcar Alternative on Santa Ana Boulevard/4th Street; and
- Streetcar Alternative on Santa Ana Boulevard/4th Street/3rd Street.

4.3.1 No Build Alternative

The No Build Alternative includes existing conditions as well as conditions that would be reasonably expected to occur in the foreseeable future without implementation of the proposed Project. Conditions in the foreseeable future (through planning horizon year 2035) include other projects that (1) have environmental analysis approved by an implementing agency and (2) have a funding source identified for implementation. The No Build Alternative provides the basis for comparing future conditions resulting from other alternatives proposed by the Project. Table 4-1 lists the projects that were included in the No Build Alternative.

Table 4-1: No Build Alternative - Planned and Committed Future Projects within the Study Area

	PROJECT NAME AND DESCRIPTION	TYPE	SOURCE
1.	Transit Zoning Code (SD 84A and SD 84B), both project-level and program-level components [anticipated Build-Out by 2028]	Policy, Land Use	Santa Ana Transit Zoning Code DEIR
2.	Station District Development Projects	Land Use	Station District Plan
3.	Year 2035 OCTA Transit Service in Study Area	Transit	OCTAM 3.3 (2035)
4.	Year 2035 Metrolink/Amtrak Service	Transit	OCTAM 3.3 (2035), 2008 RTP #ITR1015
5.	Bristol Street Widening [Warner Avenue to Memory Lane, from 4 to 6 lanes]	Roadway	2008 RTIP
6.	Grand Avenue Widening [First Street to 4th Street, from 4 to 6 lanes]	Roadway	2008 RTIP
7.	First Street Widening [Susan St. to Fairview St., from 4 to 6 Lanes]	Roadway	2008 RTIP
8.	Harbor Boulevard Bus Rapid Transit Corridor [Costa Mesa to Fullerton, 10-minute headways, peak period]	Transit	2008 RTIP, #ORA120531
9.	Westminster/17th Street Bus Rapid Transit Corridor [Santa Ana to Long Beach, 10-minute headways, peak period]	Transit	2008 RTIP
10.	Bristol Street Bus Rapid Transit Corridor [Irvine Transportation Center to Brea Mall, 10-minute headways, peak period]	Transit	2008 RTIP

4.3.2 TSM Alternative

The TSM Alternative represents the best that can be done for mobility without construction of major new transportation facilities or physical capacity improvements in the context of the existing transportation infrastructure. As such, the TSM Alternative provides the baseline against which the Build Alternatives (i.e., those alternatives that would entail a major investment) are compared. The TSM Alternative emphasizes low cost (*i.e.,* small physical) improvements and operational efficiencies such as focused traffic engineering actions, expanded bus service, and improved access to transit services. Included within the TSM Alternative are modifications and enhancements to selected bus routes in the Study Area; intersection/signal improvements; and bus stop amenity upgrades. **Error! Reference source not found.** lists the improvements included in the TSM Alternative and Figure 4-4 shows the bus routes selected for enhancement as part of the TSM Alternative. As listed in **Error! Reference source not found.**, the TSM Alternative includes a new bus route between SARTC and Harbor Boulevard/Westminster Avenue, which is similar to that of the Build Alternatives.

Table 4-2: Improvements Included in the TSM Alternative

• All projects included in the No Build Alternative
• Improvements to the frequency and span of service for bus routes along key east-west arterials above and beyond the No Build Alternative, including but not limited to (see Figure 4-4). – Skip-stop overly service on 1st Street (Route 64) which includes access to SARTC – A new route between SARTC and Harbor Boulevard/Westminster Avenue via Civic Center Drive, Bristol Street and 17th Street/Westminster Avenue, providing 10-minute peak and 20-minute off-peak service – Expanded service span for StationLink service (Route 462) between SARTC and the Civic Center, providing 15-minute peak and 15-minute off-peak service
• Travel demand management strategies
• Traffic signal timing improvements at select congested locations along Santa Ana Boulevard and Civic Center Drive to provide preferential treatments for enhanced east-west bus flow, potentially including but not limited to: ○ Main Street at Civic Center Drive ○ Broadway at Civic Center Drive ○ Flower Street at Civic Center Drive ○ Fairview at Civic Center Drive ○ Santa Ana Boulevard at Santiago Street ○ Santa Ana Boulevard at Lacy Street (install traffic signal)
• Real-time bus schedule information at high-volume transit stops (e.g. Flower Street and 6th Street area, Santa Ana Boulevard, and Main Street)
• Improvements to transit stop amenities (benches, shelters, kiosks, sidewalk connections, etc.) along Santa Ana Boulevard and Main Street corridors
• Timed-transfer operations along 1st Street, Santa Ana Boulevard and Civic Center Drive to enhance connections to north-south service, including future BRT routes along Harbor Boulevard and Bristol Street.

Figure 4-4: Transportation Systems Management (TSM) Alternative - Selected Elements

4.3.3 BRT Alternative on Civic Center Drive

This alternative envisions construction of a new BRT[7] line between SARTC and Harbor Boulevard with buses traveling in an east-west alignment along Civic Center Drive and within the PE ROW. Buses would operate in mixed flow traffic lanes on city streets and in dedicated bus lanes within the PE ROW. This alternative is depicted as Alternative 3A in Figure 4-5 and Figure 4-6.

4.3.4 BRT on Santa Ana Boulevard with 5th Street Couplet

This alternative would result in construction of a new BRT line between SARTC and Harbor Boulevard with buses following an east-west alignment along Santa Ana Boulevard and the PE ROW, with a Santa Ana Boulevard and 5th Street couplet through the downtown Santa Ana area. Buses would operate within mixed flow traffic lanes on existing city streets, except for the PE ROW segment where buses would operate in new lanes dedicated exclusively to bus use. This alternative is depicted as Alternative 3B in Figure 4-5 and

4.3.5 Streetcar Alternative on Brown Street/Santa Ana Boulevard with 5th Street Couplet

Streetcars would follow an east-west alignment along Brown Street / Santa Ana Boulevard and within the PE ROW, with a couplet in downtown Santa Ana along Santa Ana Boulevard/5th Street, as illustrated in Figure 4-7. Streetcars would operate on tracks embedded within existing city streets in mixed flow traffic, and in a dedicated guideway within the PE ROW along the alignment shown in Figure 4-5.

4.3.6 Streetcar Alternative on Santa Ana Boulevard with 4th Street Couplet

Streetcars would follow an east-west alignment along Santa Ana Boulevard and within the PE ROW, with a Santa Ana Boulevard and 4th Street couplet through downtown Santa Ana, as illustrated in Figure 4-8. Streetcars would operate on tracks embedded within existing city streets in mixed flow traffic and in a dedicated guideway within the PE ROW along the alignment shown in Figure 4-5.

4.3.7 Streetcar Alternative on Santa Ana Boulevard with 4th Street/3rd Street Couplet

Streetcars would follow an east-west alignment within the PE ROW and along 4th Street/Santa Ana Boulevard, with a 4th Street/3rd Street couplet through downtown Santa Ana, as illustrated in Figure 4-9. Streetcars would operate on tracks embedded within existing city streets in mixed flow traffic and in a dedicated guideway within the PE ROW along the alignment shown in Figure 4-5.

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[7] BRT is a form of public transit in which buses operate in mixed flow travel lanes with transit priority signal treatments, or in travel lanes that are restricted to bus use only.

Figure 4-5: All Build Alternatives (Western Portion)

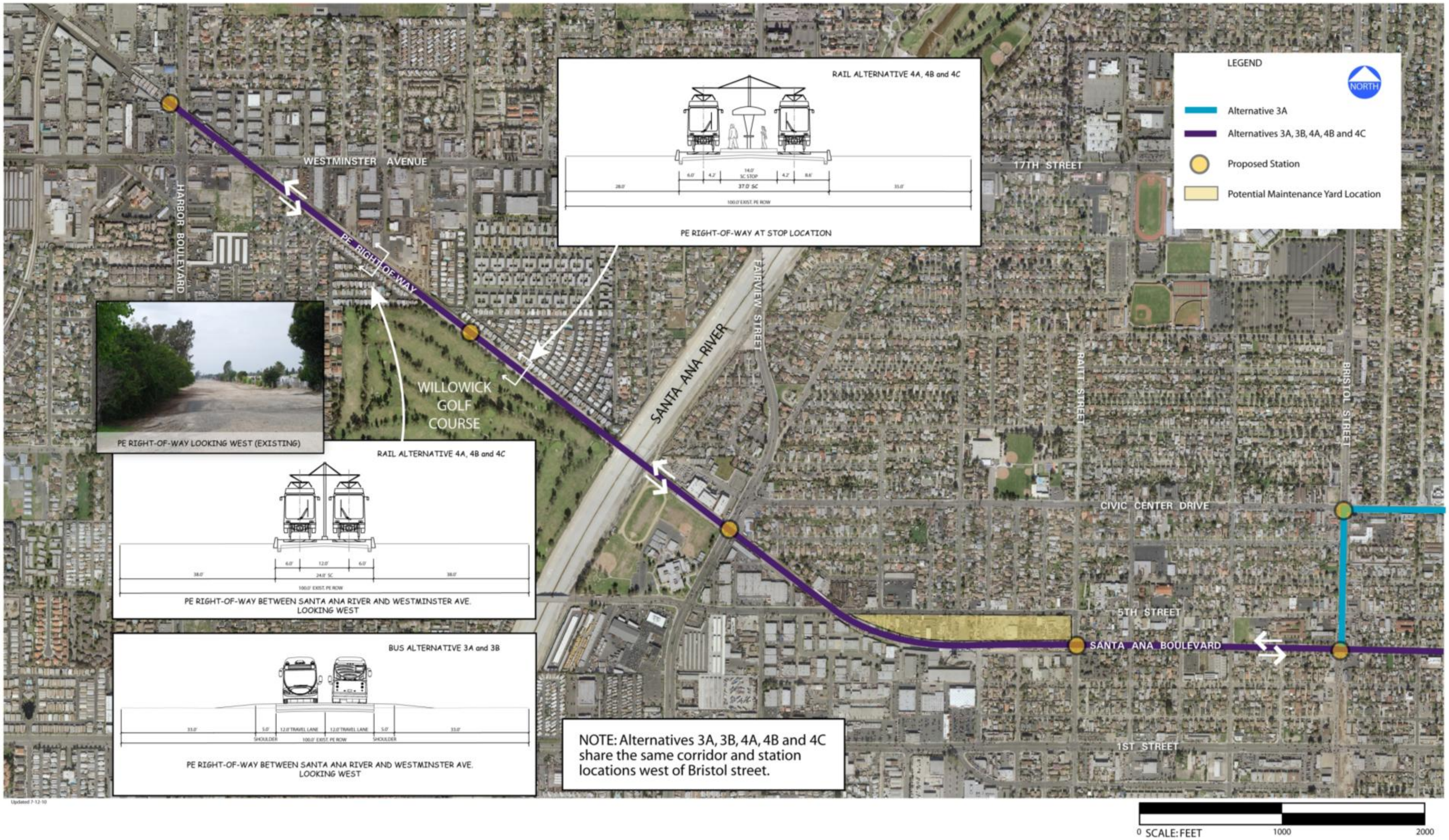

Figure 4-6: BRT Alternatives (Eastern Portion)

Figure 4-7: Modern Streetcar (Brown Street/Santa Ana Boulevard/5th Street)

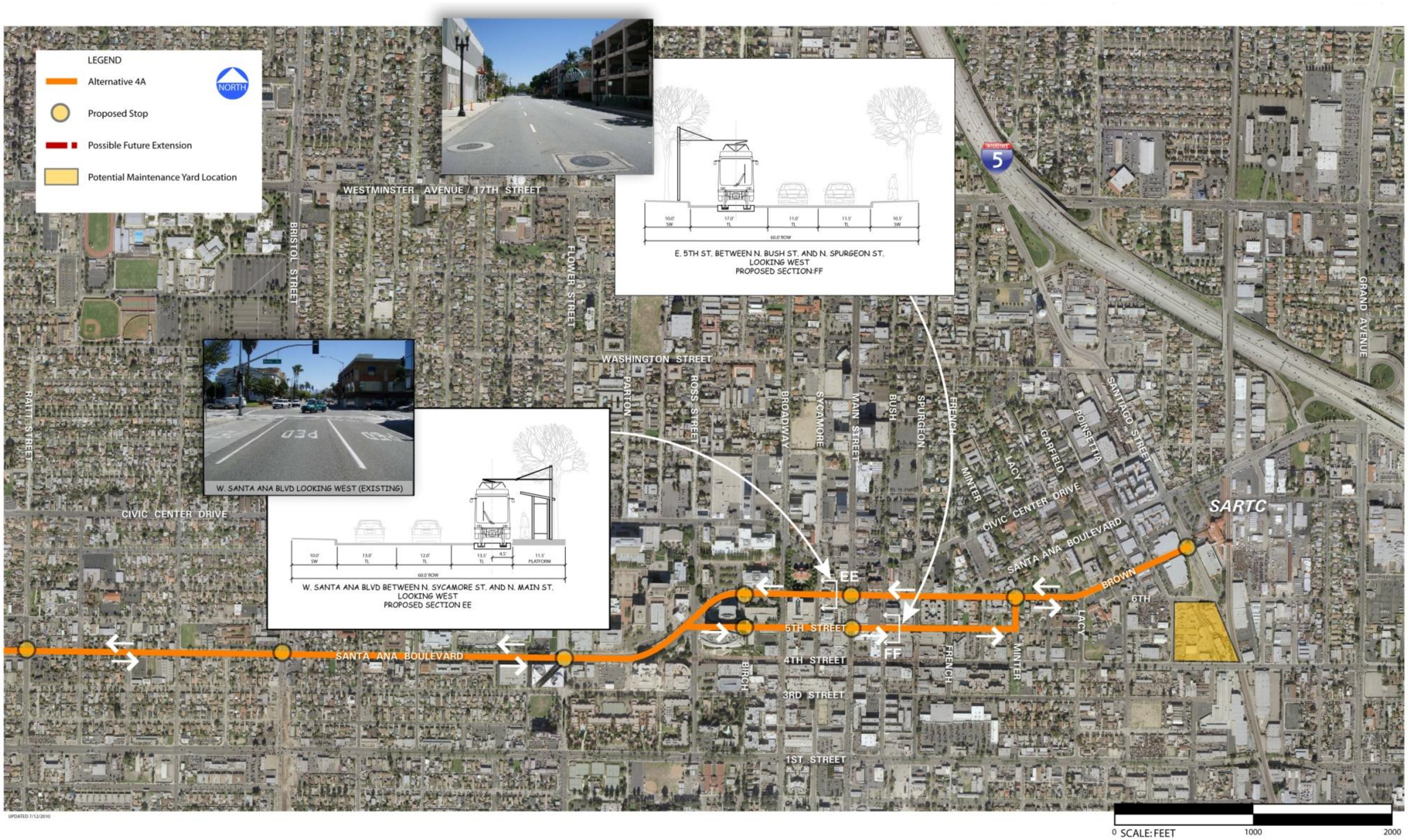

Figure 4-8: Modern Streetcar (Santa Ana Boulevard/4th Street)

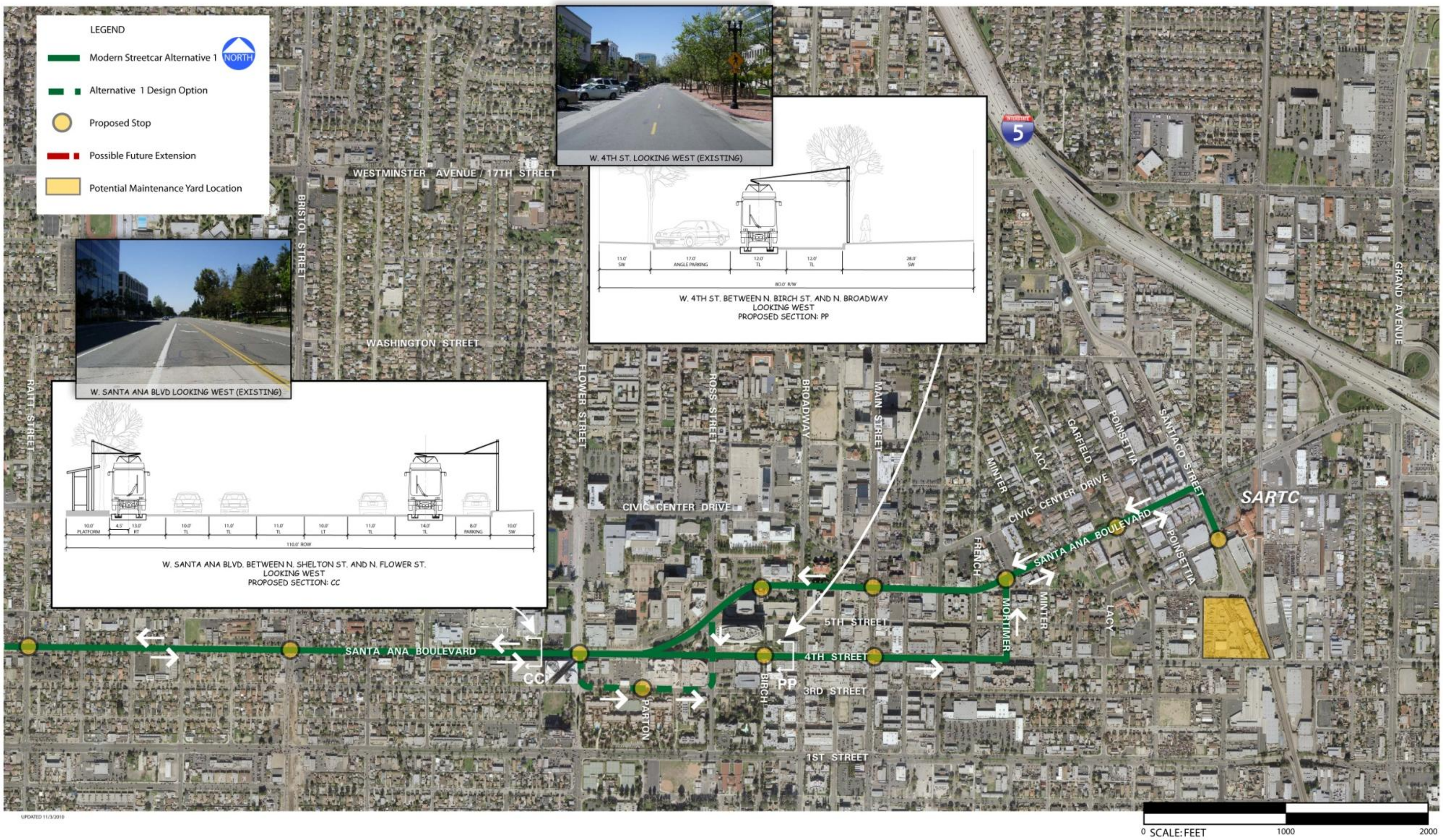

Figure 4-9: Modern Streetcar (Santa Ana Boulevard/4th Street/3rd Street)

5.0 INITIAL SCREENING OF ALTERNATIVES

5.1 Public Scoping Meetings

The draft set of conceptual alternatives were presented first to the Stakeholders Working Group and then at a series of four Public Scoping Meetings that were held for the project in early June 2010 in order to obtain additional feedback from the general public. In addition, a Notice of Preparation for the project was distributed on May 18, 2010, and a separate Scoping Meeting was also conducted with interested transportation and resource agencies on June 9, 2010, in order to discuss the project.

At the close of the Public Scoping period in July 2010, the technical team and the cities reviewed and discussed the comments that had been received before settling on a final description for the initial set of conceptual alternatives. Small adjustments were made to the conceptual locations of the station stops to optimize accessibility and to help ensure parity across all of the alternatives, both bus and streetcar, with the understanding that these alternatives will be subjected to additional comparative analysis in the upcoming alternatives screening phase of the project study.

5.1.1 Summary of Comments Received

On the whole, the conceptual alternatives were generally well received, although some members of the public voiced initial concerns for how the alternatives might impact their immediate neighborhoods (e.g., noise). Others were reassured to hear that major street widening was not being contemplated to accommodate the fixed guideway. Some expressed a need to provide additional connections to areas such as Santa Ana College or along First Street that are located near the periphery of the Study Area. A few members of the public expressed a preference for the rail technologies as opposed to the bus technologies. See Chapter 8 for a detailed summary of the public outreach process, including public scoping.

5.2 Initial Screening

Initial screening was performed to identify which of the conceptual alternatives best satisfied the Purpose and Need and project goals and objectives and appeared to be most feasible. Initial screening was designed to eliminate those alternative concepts determined to have "fatal flaws" – that is, impacts that outweigh benefits or that would be prohibitively expensive to mitigate. The initial screening process consisted of two stages – an early qualitative analysis of the conceptual alternatives resulting in the screening of route options and a subsequent quantitative analysis of the conceptual alternatives resulting in the screening of technology options.

5.2.1 Stage 1 Criteria

Five screening criteria that relate directly to the Purpose and Need and the study goals and objectives were identified for use in stage 1 of the initial screening process:

1. **Accessibility and livability** - This criterion focuses on the degree to which an alternative promotes livability within the Study Area by enhancing connectivity and improving accessibility for residents and employees, particularly those who are transit-dependent.

2. **Economic development, transit supportive land uses and community goals** - This criterion addresses the potential of an alternative to stimulate economic development, foster redevelopment opportunities and reinforce transit-supportive land uses and land use plans.

3. **Environmental responsibility and sustainability** - This criterion is intended to measure the potential environmental impacts and benefits of an alternative.

4. **Travel benefits, choice and reliability** - This criterion addresses the ease and convenience of system use, as represented in each alternative, for both transit-dependent and discretionary riders.

5. **Cost effectiveness and financial feasibility** - This criterion addresses the degree to which an alternative will be perceived by potential private investors/developers as a significant and long-term public investment in the community. In addition, it provides a preliminary indication of cost effectiveness, as measured by capital cost.

Measures of effectiveness were developed for each of the screening criteria to help differentiate among alternatives (see Table 5-1) and to measure and compare their performance at this earlier, less-detailed stage of study. The performance measures also included evaluation criteria adopted by the OCTA Board of Directors for the Go Local program and criteria from FTA's New Starts/Small Starts program. In addition, community support was also considered at this stage of analysis.

5.2.2 Stage 1 Initial Screening Results

Table 5-2 summarizes the first stage of the initial screening of conceptual alternatives and shows how well each alternative responded to the measures of effectiveness and thus the Purpose and Need and project goals and objectives. Community support is also included in Table 5-2. As previously mentioned, the analysis was largely qualitative and was only suitable to screen route options.

As indicated in Table 5-2, the streetcar alternatives along Santa Ana Boulevard/4th Street and Brown Street/Santa Ana Boulevard/5th Street performed best overall due in large part

Table 5-1: Initial Screening Criteria and Measures of Effectiveness

SCREENING CRITERIA	MEASURES OF EFFECTIVENESS
1. Accessibility/Livability	Number of direct connections (within one block) to designated transfer points/transit nodes
	Number of new transit connections[1]
	Number of residents within 1/2 mile walking distance of proposed alignment
	Number of employees within 1/2 mile walking distance of proposed alignment
	Percentage of designated activity centers or medium-to-high density residential areas within 3 blocks of proposed station
	Degree to which alternative promotes the U.S. Livable Communities Committee’s Principals of Livability
2. Economic Development, Transit Supportive Land Use and Community Goals	Number of "high opportunity areas" for development/ redevelopment within 1/2 mile of alignment
	Qualitative assessment of the transit supportiveness of land uses served by the proposed project[1]
	Potential impacts to physical character of community including physical scale, visual fit
3. Environmental Responsibility and Sustainability	Number of environmental issue areas with potentially significant impacts
	Amount of additional ROW required
4. Travel Benefits, Choice and Reliability	Service-proven technology[1]
	Station/stop spacing
	Transit vehicle capacity
	Qualitative assessment of ease of use and “understandability”
5. Cost Effectiveness and Financial Feasibility	Will be perceived by potential investors/developers as significant long-term public investment
	Capital cost estimate
	Capital cost estimate per mile

[1] The performance measure is included in the OCTA Board-approved Go Local Program Evaluation Criteria.

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Table 5-2: Initial Screening of Alternatives - Summary Matrix

	SCREENING CRITERIA / MEASURES OF EFFECTIVENESS	TSM[a]	ALT. 3A BRT - Civic Center Dr.	ALT. 3B BRT - Brown St./Santa Ana Blvd./ 5th St.	ALT. 4A STREETCAR - Brown St./ Santa Ana Blvd./ 5th St.	ALT. 4B STREETCAR – Santa Ana Blvd./ 4th St.	ALT. 4C STREETCAR – Santa Ana Blvd./ 4th St./3rd St.
A.	***ACCESSIBILITY AND LIVABILITY***						
A-1	Number of new connections to the existing and planned transit network provided by the alternative at station/stop locations.	21	21	21	21	21	21
A-2	% of alignment length that lies within City's adopted transit corridors.	0%	**0%**	15%	14%	18%	17%
A-3	Number of residents within 1/4 mile walking distance of proposed alignment	**37,174 (2008) 38,013 (2015)**	39,414 (2008) 40,219 (2015)	39,532 (2008) 40,353 (2015	**39,172 (2008) 39,939 (2015)**	41,619 (2008) 42,478 (2015)	41,530 (2008) 42,344 (2015)
	Number of employees within 1/4 mile walking distance of proposed alignment	25,242 (2008) 25,273 (2015)	25,631 (2008) 25,658 (2015)	26,618 (2008) 26,550 (2015)	26,500 (2008) 26,433 (2015)	27,273 (2008) 27,203 (2015)	**24,559 (2008) 24,504 (2015)**
A-4	Percentage of designated activity centers or medium-to high-density residential areas within 1/4 mile of proposed stations	83% Civic Center	83% Civic Center	86% Civic Center	86% Civic Center	94% Civic Center	**77% Civic Center**
		66% Downtown District	**66% Downtown District**	79% Downtown District	79% Downtown District	74% Downtown District	80% Downtown District
		26% Med. To High Density Residential	**44% Med. to High Density Residential**	45% Med. to High Density Residential	49% Med. to High Density Residential	47% Med. to High Density Residential	51% Med. to High Density Residential
		71% High Intensity Office	71% High Intensity Office	51% High Intensity Office	51% High Intensity Office	39% High Intensity Office	27% High Intensity Office
A-5	Qualitative assessment of the ability of the alternative to promote Principles of Livability	**Low-Medium**	**Low-Medium**	**Low-Medium**	High	High	High
B.	***ECONOMIC DEVELOPMENT, TRANSIT SUPPORTIVE LAND USES AND COMMUNITY GOALS***						
B-1	Number of "high opportunity areas" for development/ redevelopment within 1/4 mile of alignment.	**257 acres**	323 acres	347 acres	339 acres	346 acres	353 acres
B-2	Total developed/developable frontage	71,602 feet	**45,040 feet**	47,460 feet	48,480 feet	49,300 feet	53,500 feet
B-3	Percentage of transit supportive land uses within 3 blocks of proposed stations	61% SARTC/Transit Village	61% SARTC/Transit Village	61% SARTC/Transit Village	61% SARTC/Transit Village	61% SARTC/Transit Village	61% SARTC/Transit Village
		100% City-Owned Parcels	100% City-Owned Parcels	100% City-Owned Parcels	100% City-Owned Parcels	100% City-Owned Parcels	100% City-Owned Parcels
		74% Urban Center	**74% Urban Center**	76% Urban Center	81% Urban Center	80% Urban Center	100% Urban Center
B-4	Assessment of the transit supportiveness of land uses served by the proposed project (block by block favorability index – see description in Section 7.3.2).	2,180	**1,360**	11,220	10,401	14,020	7,270
B-5	Potential impacts to the physical character of the community including physical scale and visual fit	Minor	Minor	Minor	Minor	Minor	Minor

Table 5-2: Initial Screening of Alternatives - Summary Matrix – continued

	SCREENING CRITERIA / MEASURES OF EFFECTIVENESS	TSM[a]	ALT. 3A BRT - Civic Center Dr.	ALT. 3B BRT - Brown St./Santa Ana Blvd./ 5th St.	ALT. 4A STREETCAR - Brown St./ Santa Ana Blvd./ 5th St.	ALT. 4B STREETCAR – Santa Ana Blvd./4th St.	ALT. 4C STREETCAR – Santa Ana Blvd./4th St./3rd St.
C.	***ENVIRONMENTAL RESPONSIBILITY AND SUSTAINABILITY***						
C-1	Number of environmental issue areas with potentially significant impacts (before mitigation)	–	– PE Bridge – Santa Ana River Crossing – Noise & Vibration (PE ROW section) – Maintenance Facility – Mid-block, at-grade crossings (Westminster Ave., Fairview St., 5th St.)	– PE Bridge – Santa Ana River Crossing – Noise & Vibration (PE ROW section) – Maintenance Facility – Mid-block, at-grade crossings (Westminster Ave., Fairview St., 5th St.)	– PE Bridge – Santa Ana River Crossing – Noise & Vibration (PE ROW section) – Maintenance Facility – Mid-block, at-grade crossings (Westminster Ave., Fairview St., 5th St., **Brown St.**)	– PE Bridge – Santa Ana River Crossing – Noise & Vibration (PE ROW section) – Maintenance Facility – Mid-block, at-grade crossings (Westminster Ave., Fairview St., 5th St.) – **Sasscer Park**	– PE Bridge – Santa Ana River Crossing – Noise & Vibration (PE ROW section) – Maintenance Facility – Mid-block, at-grade crossings (Westminster Ave., Fairview St., 5th St., **Minter, Santiago Extension)** – **4th & Minter Planned Park**
C-2	Percent of roadway capacity shared by new transit service (Transit lane miles as % of total lane miles)	47.1%	46.9%	46.0%	**45.3%**	**47.7%**	45.1%
C-3	Additional right-of-way required (in thousand sq. ft.)	0	178	178	186	184	**205**
D.	***TRAVEL BENEFITS, CHOICE AND RELIABILITY***						
D-1	Service-proven technology	Yes	Yes	Yes	Yes	Yes	Yes
D-2	Station/stop spacing (Level of fit to existing and planned urban context)	Good	Good	Good	Good	Good	Good
D-3	Transit vehicle capacity (as measured by passengers per hour) Note: All Build Alternatives assume 10-minute peak and off-peak headways	840 pph	1200 pph	1200 pph	1800 pph	1800 pph	1800 pph
D-4	Qualitative assessment of ease of use and "understandability"	Low-Medium	Low Medium	**Low**	**Medium-High**	Medium	Medium
D-5	Quality of ride	**Low-Medium**	**Low-Medium**	**Low-Medium**	**High**	**High**	**High**
E.	***COST EFFECTIVENESS AND FINANCIAL FEASIBILITY***						
E-1	Will be perceived as significant long-term public investment in infrastructure by potential investors/developers?	**Low**	Low-Medium	Low-Medium	**Medium-High**	**Medium-High**	**Medium-High**
E-2	Total estimated capital cost	Low	Low-Medium	Low-Medium	**Medium**	**Medium**	**Medium**
F.	***COMMUNITY SUPPORT***	Low	**Low**	**Low**	Medium	High	High

Best Performing   Worst Performing

to how well they addressed accessibility and livability and supported economic development, transit supportive land use and community goals. Of the BRT options, the alternative along Santa Ana Boulevard/5th Street also performed well in terms of accessibility and livability and economic development, transit supportive land use and community goals. The performance of these routing options is described in more detail below:

Streetcar Alternative Santa Ana Boulevard/4th Street – This route is most compatible with the City of Santa Ana's adopted plans and policies with the highest percent of its alignment within adopted transit corridors. The route is also accessible to transit supportive land use areas and within a ¼-mile walking distance for the greatest number of residents and employees. This option received the greatest level of community support during community outreach activities.

Streetcar Alternative Brown Street/Santa Ana Boulevard/5th Street – Although this routing option is somewhat less accessible to residents and employees than the streetcar on Santa Ana Boulevard/4th Street, the land uses along the alignment are highly transit supportive (ranking second only to the streetcar on Santa Ana Boulevard/4th Street). It also has the lowest percentage of total lane miles shared by the new fixed guideway system, suggesting a somewhat lower potential to impact corridor traffic. It should be noted that, in response to comments received during public scoping, the upper couplet of the Brown Street/Santa Ana Boulevard/5th Street route was extended to Civic Center Drive to determine if additional ridership could be gained by providing service north of the Civic Center area.

BRT Alternative Santa Ana Boulevard/5th Street – This routing option performed better than the BRT option along Civic Center Drive. This route would operate within the City's adopted transit corridors, serve more residents and employees within a ¼-mile walking distance and serve more destinations/activity centers within ¼-mile of proposed stations. The Santa Ana Boulevard/5th Street route has more developable frontage and high opportunity areas for development. Surrounding land uses are significantly more transit supportive.

Stage I: Eliminated Alternatives

After careful review and consideration of the stage 1 initial screening results, it was determined that the following alternatives would be eliminated from further consideration because their route options did not best meet the Purpose and Need and project goals and objectives:

Streetcar Alternative Santa Ana Boulevard/4th Street/3rd Street – Although this route option is the most effective of the alternatives at serving the Downtown area, it is the least effective at serving the Civic Center. As a result, it is also the least effective in serving employment centers. Additionally, the route has a low transit favorability rating in terms of the land uses which front the alignment, with many parking garages, surface parking lots and low-density commercial and industrial areas along the alignment. For these reasons, it was recommended for elimination.

BRT Alternative Civic Center Drive – This alternative was recommended for elimination from further consideration because its route did not perform as well as the BRT Alternative along Santa Ana Boulevard/5th Street. The Civic Center route does not run within the City's adopted transit corridors and the route displays slightly fewer residents and employees within a ¼-mile walking distance and fewer destinations/activity centers within a ¼-mile of proposed stations. The Civic Center route also has less total developed/developable frontage with fewer high opportunity areas for development while surrounding land uses are thought to be significantly less transit supportive.

Stage I: Alternatives Carried Forward

Therefore, the remaining conceptual alternatives included:

- Streetcar Alternative – Santa Ana Boulevard/4th Street;
- Streetcar Alternative – Brown Street/Santa Ana Boulevard/Civic Center Drive/5th Street; and
- BRT Alternative – Santa Ana Boulevard/5th Street.

5.2.3 Stage 2 Criteria

The stage 2 initial screening used the five original project goals and objectives to directly compare the remaining three conceptual alternatives. The project goals and objectives are described in full in Section 3.1. Community supportiveness was also considered. Valuable quantitative data that was not available at the time of the stage 1 initial screening was incorporated into the analysis and used to screen technology options.

5.2.4 Stage 2 Initial Screening Results

This section summarizes the results of second stage of the initial screening of conceptual alternatives. The remaining two streetcar alternatives and BRT Alternative are discussed in terms of the five project goals below:

Goal 1: Increase accessibility and livability in the heart of Orange County through transit options that enhance the quality of life within the community. Both the streetcar alternatives and the BRT Alternative would increase accessibility and livability by providing a new, convenient and efficient transit service/travel option between SARTC and employment and activity centers and residential neighborhoods in central Santa Ana and Garden Grove. Each conceptual alternative would also equally enhance transit connections to regional, interstate, and international bus, rail and air service.

Goal 2: Actively foster economic development opportunities, transit supportive land uses, and community goals. Both the streetcar alternatives and the BRT Alternative would integrate well with the surrounding neighborhood by providing frequent service with short distances between stops and fostering an active pedestrian environment. Each alternative has potential to foster economic development opportunities and supportive land uses by stimulating high-density land development/TOD in underdeveloped and appropriate areas.

However, there is a body of research that asserts streetcar systems, under certain circumstances, can stimulate greater economic development opportunities and transit supportive land uses than other types of transit service lacking physical guideway or tracks, such as buses. This research typically contains case studies from areas such as Portland, Oregon, where the streetcar system has been credited with revitalizing the community. Although these case studies are informative, it is important to be cautious about attributing all positive change to streetcar implementation. Streetcars are just one part of the urban fabric that can contribute value in terms of walkable and vibrant communities. Additionally, many of these analyses often consider streetcar systems exclusively without a direct comparison to BRT specifically. Despite this, such research provides some insight that should be noted for the purposes of presenting a comprehensive analysis. These arguments are described in detail below:

Although BRT can include highly visible vehicles, shelters, stations and branding that can raise the profile of the service; the inherent flexibility of BRT routes and service levels dilutes its ability to spark real estate investment, as most real estate investment decisions require predictability over longer periods of time – up to 30 years. Additionally, the BRT lines that attract the most investment tend to operate in exclusive guideways and not in mixed traffic as much of the proposed BRT service would in Santa Ana[8]. It is estimated that the streetcar system in Portland has helped spark over $3.5 billion in new development, 55 percent of which has taken place within one block of the streetcar alignment. Additionally, it is estimated that the streetcar system in Tampa, Florida has stimulated over $600 million in public investment and $700 million in private projects[9].

Another potential benefit of the modern streetcar which is not necessarily observed for BRT is the relationship between density of development and proximity to the streetcar line. Greater levels of density are typically observed closer to streetcar lines[10]. For example, development intensities have increased substantially with the implementation of the streetcar system in Portland; since 1997, density has doubled within three blocks of the streetcar line[11]. This attribute can be especially attractive to cities looking to increase transit ridership in their communities.

Implementation of a streetcar system may also contribute to increases in property values within close proximity (approximately a quarter mile) of the line. This trend has been

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[8] *District of Colombia Land Use Study*, Goody Clancy, May 2011.

[9] *An Economic Impact Analysis from a Downtown Streetcar System in the City of Columbus, Ohio,* The Danter Company, June 2007.

[10] *District of Colombia Land Use Study*, Goody Clancy, May 2011.

[11] *Ibid.*

especially prominent in underdeveloped areas where streetcar service has encouraged the expansion of existing commercial districts and transit nodes and where it increases accessibility and improves connectivity to areas with existing amenities. Thus, streetcars may be able to boost property tax revenues collected by the local government[12]. The area in close proximity to the Portland streetcar has experienced land valuation gains three-times the city-wide average while the area within close proximity to the Seattle streetcar has experienced increases in land values at more than double the rate experienced city-wide[13].

In recognition of the economic development potential of the modern streetcar, the City of Santa Ana adopted a Transit Zoning Code -- which encompasses the eastern half of the Study Area -- in June 2010. The Transit Zoning Code allows higher density development in Downtown Santa Ana and the Station Area, both of which would be served by the streetcar alternatives. New high quality affordable housing is already being developed in the area in anticipation of future streetcar service. Several investors have also indicated a strong interest in further development in the Study Area if a streetcar system is approved. Investors and developers do not consider BRT service as compelling of a reason to invest in the community.

To infer potential land use benefits from streetcar implementation in Santa Ana specifically, a land use and economic assessment of the proposed Santa Ana-Garden Grove Fixed Guideway Project was performed. The analysis reviewed existing land use conditions and quantified potential development in proximity to the proposed streetcar from 2017 to 2035. The study found that approximately 3.2 million square feet of added commercial space and residential building space, representing a 21 percent increase in the corridor's 2010 building inventory, is anticipated with streetcar implementation[14]. In contrast, approximately 757,000 square feet of new development, representing a 5 percent increase in the area's existing commercial and residential building stock, is anticipated in absence of streetcar implementation.

Based in part on research that asserts streetcars can stimulate greater economic development and transit supportive land uses in addition to actual and predicted investment in the Study Area in anticipation of streetcar implementation, it can be argued that the streetcar alternatives are more effective than the BRT Alternative in responding to the Livable Communities Initiative. The Livable Communities Initiative was jointly developed by U.S. Department of Transportation, U.S. Department of Housing and Urban Development and U.S. Environmental Protections Agency and includes 6 Principles of Livability to "stimulate America's neighborhoods to become safer, healthier and more vibrant":

> Provide more transportation choices. Develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce our nation's

[12] *Ibid.*
[13] *The Economic Impact of Streetcar in San Antonio*, E.D. Hovee, LLC, April 2011.
[14] Santa Ana-Garden Grove Fixed Guideway Project, E.D. Hovee, LLC, February 24, 2012.

dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health.

Promote equitable, affordable housing. Expand location and energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to increase mobility and lower the combined cost of housing and transportation.

Enhance economic competitiveness. Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services, and other basic needs by workers, as well as expanded business access to markets.

Support existing communities. Target federal funding towards existing communities – through strategies like transit-oriented, mixed-use development, and land recycling – to increase community revitalization and the efficiency of public works investments, and safeguard rural landscapes.

Coordinate and leverage federal policies and investment. Align federal policies and funding to remove barriers to collaboration, leverage funding, and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.

Value communities and neighborhoods. Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods – rural, urban, or suburban.

The following section describes the relative performance of the streetcar alternatives and BRT Alternative in terms of the 6 Principles of Livability.

In terms of Livability Principle #1, both the streetcar alternatives and BRT Alternative would offer safe, reliable and economical transportation choices. However, the streetcar alternatives would provide somewhat more benefit in terms of improving local air quality compared even to clean bus technology. Additionally, streetcar systems have been shown to foster and encourage pedestrian activity to a far greater degree than buses, helping to promote healthier communities[15].

Livability Principles #2 through #4 address the interaction between transportation and land use, and the ability of transportation to influence land use and development patterns in ways that affect the livability of communities (location and distribution of affordable housing; accessibility of employment and educational opportunities and services; expanded access to business markets; and community revitalization towards transit-oriented, mixed-use development). Based on the existing characteristics of the Study Area and experience in other cities throughout the nation, a streetcar system would more effectively serve as a catalyst for economic vitality, fostering development and redevelopment opportunities.

[15] *The Economic Impact of Streetcar in San Antonio*, E.D. Hovee, LLC, April 2011.

This is supported in the previous section and has already been observed in Santa Ana where the Station District development team is building 420 new affordable housing units based, in part, on the understanding that the area would be served by a high capacity transit system (Livability Principle #2). As previously mentioned, studies have inferred that while BRT costs less to build and can be implemented more quickly, it does not attract the same degree of real estate investment as the modern streetcar, limiting the potential for housing, transit-oriented and mixed-use development[16].

Additionally, streetcar systems have been credited with improving communities by:

- Enhancing the sustainability of established neighborhoods;
- Revitalizing blighted areas;
- Serving as an amenity to attract residents/consumers;
- Reducing automobile use/increased mobility; and
- Providing effective linkages to bus/light rail/conventional rail systems[17].

The streetcar alternatives would most likely enhance the economic competitiveness of the Study Area (Livability Principle #3). The alternatives would improve the attractiveness and value of Study Area neighborhoods, endowing them with a fixed asset that provides easy, reliable access to educational, employment, shopping, recreational and regional transportation opportunities. As previously discussed, this has been demonstrated in communities where streetcars have been implemented and property values in close proximity to the alignment have increased.

Additionally, compared to BRT, the streetcar alternatives would more likely enhance the economic competitiveness of Study Area businesses, particularly in the Downtown area. Public investment in a unique mode of transportation in Orange County will create interest in and focus attention on the area in a way that BRT service would not because it lacks highly visible and permanent infrastructure. Streetcar implementation will reinforce Santa Ana and Garden Grove's goals in that the investment in public transportation will be cost-efficient, it will support planned mixed-use and transit oriented development and it will provide a livable alternative to automobile-oriented communities (Livability Principle #4).

In regard to Livability Principle #5, both the streetcar alternatives and BRT Alternative would coordinate and leverage federal policies and investment, although the streetcar alternatives would perform better than the BRT Alternative in terms of smart energy choices due to the use of electric vehicles over diesel, gas or compressed natural gas buses.

Consistent with the intent of Livability Principal #6, the streetcar alternatives would "enhance the unique characteristics of all communities by investing in healthy, safe, and

[16] *The Economic Impact of Streetcar in San Antonio*, E.D. Hovee, LLC, April 2011.
Why has this been struck out?

walkable neighborhoods". The land use mix, topography and scale of the neighborhoods within the Study Area make them very walkable already. As previously mentioned, streetcar systems encourage pedestrian activity more so than buses[18]. For this reason, business owners in the historic Downtown have opposed buses operating along the 4th Street and 5th Street commercial corridors, but have expressed considerable interest and support for the implementation of a streetcar line.

Table 5-3 summarizes the results of the qualitative assessment of each alternative's potential to promote the Principles of Livability. The streetcar alternatives received ratings of "high" for six of the six Principles of Livability (or 100 percent) compared to the BRT Alternative which received "medium" ratings for three of the principles, and "low" ratings for three. Within the Santa Ana and Garden Grove Fixed Guideway Corridor, the streetcar alternatives provide far greater potential to support application of the Principles of Livability than the BRT.

Table 5-3: Potential of Alternatives to Promote Principles of Livability

PRINCIPLES OF LIVABILITY		BRT	MODERN STREETCAR
1.	Provide more transportation choices	Medium	High
2.	Promote equitable, affordable housing	Low	High
3.	Enhance economic competitiveness	Low	High
4.	Support existing communities	Medium	High
5.	Coordinate and leverage federal policies and investment	Medium	High
6.	Value communities and neighborhoods	Low	High

Goal 3: Promote sustainable and environmentally responsible transportation investments that respond to the needs of the people who live and work within the community. Both the streetcar alternatives and the BRT Alternative would potentially reduce automobile trips, although it has been argued that the streetcar alternatives may be better than the BRT Alternative at fostering an active pedestrian environment[19]. Both the streetcar alternatives and the BRT Alternatives would potentially reduce energy consumption and greenhouse gas emissions while improving air quality. Each of the alternatives would operate within existing rights-of-way, limiting potential environmental impacts.

Goal 4: Deliver travel benefits, reliability, and choice to transportation system users. Both streetcar and BRT service is service-proven and would provide user-friendly and safe service that would attract riders.

[18] Bureau of Labor Statistics, 2007.
[19] Bureau of Labor Statistics, 2007.

However, the BRT Alternative is limited in terms of providing travel benefits, reliability and choice because the alternative is subject to mixed traffic operations and frequent stops outside the PE ROW, when the mode carries the greatest benefit when it operates in dedicated lanes and makes less frequent stops. When operating in dedicated lanes with infrequent stops, BRT can reach higher speeds and incur travel time savings while improving reliability and convenience.

All potential transit improvements in the Study Area were envisioned as mixed use operations outside the PE ROW (to ensure integration with the character of the corridor and reduce potential environmental impacts) with frequent stops (to enhance accessibility). While this configuration and station spacing is appropriate for the study area and consistent with the stated purpose and need for the project, it eliminates the travel time advantage that might typically be realized by a traditional BRT system. Whereas the streetcar alternatives are intended to operate in mixed traffic with frequent stops and would therefore perform well under these conditions, the BRT Alternative would not perform as effectively. The BRT Alternative would not provide significant travel time benefits over the streetcar alternatives nor would it be able to provide extensive benefits beyond the TSM Alternative, while costing much more than the TSM Alternative to construct due to the need to pave a dedicated lane in the PE ROW.

Additionally, it should be noted that the BRT Alternative does not perform as well as the streetcar alternatives with regard to transit vehicle capacity. The streetcar alternatives would provide approximately 50 percent greater passenger carrying capacity than the BRT Alternative assuming the same service spans and frequencies for both systems. Table 5-4 summarizes the assumptions and the resulting number of passengers per hour that could be served by the BRT and streetcar alternatives. The TSM Alternative is also included in Table 5-4 for the purposes of comparison.

While it is possible to decrease headways for the BRT Alternative to provide additional capacity, doing so would significantly increase operating costs. The operations and maintenance (O&M) cost for the BRT Alternative is estimated to be $4.5 million annually (assuming 10-minute peak and 15-minute off-peak headways). The operations cost would escalate to $5.9 million if headways were adjusted (to 7-minute peak and 10-minute off-peak) to compensate for the lower capacity of the BRT vehicles compared with the streetcar vehicles. This escalated operations and maintenance cost estimate is greater than the projected operations cost for the Streetcar Alternative 1 ($4.5 million annually) and on par with the projected operations cost for the Streetcar Alternative 2 ($5.6 million annually).

Table 5-4: Transit Vehicle Capacity

CHARACTERISTICS	TSM	BRT*	STREETCAR**
Transit Vehicle Crush Load Capacity	70	100	150
Seated	45	60	50
Standing	25	40	100
Headways - Peak Hour	10-min	10-min	10-min
Number of Vehicles per Peak Hour	12	12	12
Number of Passengers per Peak Hour	840	1,200	1,800
Headways - Off-Peak Hour	15-min	15-min	15-min
Number of Vehicles per Off-Peak Hour	8	8	8
Number of Passengers per Off-Peak Hour	560	800	1,200

Source: LTK, Los Angeles Metro, 2011

* For the BRT mode, the Los Angeles Metro Orange Line transit vehicle capacity was assumed.

** For the streetcar mode, a Portland-type transit vehicle was assumed.

Goal 5: Make cost-effective and financially feasible transportation choices. Both the streetcar and BRT services have the potential to attract private investment. However, the streetcar alternatives and the BRT Alternative are differentiated in terms of cost effectiveness. The BRT Alternative did not meet the cost effectiveness objective as measured by projected capital and O&M cost per rider. The BRT Alternative is projected to carry significantly fewer riders than the streetcar alternatives while the capital and O&M costs remain substantial. Projected ridership and cost is discussed in more detail below:

As shown in Table 5-5, the streetcar alternatives would carry approximately 25 percent to 75 percent more passengers than the BRT Alternative. Whereas the streetcar alternatives would carry an estimated 4,700 to 6,100 daily riders, the BRT alternatives would only carry an estimated 3,800 daily riders. In fact, the BRT Alternative would only attract slightly more transit patrons than the TSM Alternative, illustrating that investment in BRT rather than traditional bus service does not necessarily yield significantly higher ridership. The streetcar alternatives would likely attract more choice riders (people who own cars but choose to take transit).

Table 5-5: Ridership Estimates

ALTERNATIVE	PROJECTED DAILY RIDERSHIP (2035)
TSM	3,100
BRT	3,800
Streetcar 1	6,100
Streetcar 2	4,700

Source: Cambridge Systematics, 2013

As discussed above, projected ridership for the BRT Alternative is only slightly higher than the projected ridership for the TSM Alternative (the BRT Alternative would only carry 700 additional daily riders). However, a significant amount of capital investment would be required to prepare the PE ROW for use by the BRT Alternative as the facility is not currently paved. When the small amount of additional ridership between the BRT Alternative and the TSM Alternative is considered with the high capital cost for the BRT Alternative ($116 million) compared to the TSM Alternative ($14.5 million), it becomes clear that the BRT Alternative is less cost effective.

Capital cost effectiveness is measured in Table 5-4 by dividing the cost differential of the TSM and BRT Alternatives by the ridership differential of the TSM and BRT Alternatives (additional cost per additional rider). From this calculation, it is evident that both streetcar alternatives are more cost effective than the BRT Alternative. Streetcar 1 exhibits an additional cost per rider of $60,967 to $65,067, Streetcar 2 exhibits an additional cost per rider of $126,562 to $133,500 while the additional cost per rider for the BRT Alternative is higher at $145,285.

Table 5-6: Cost Effectiveness - Capital Costs

ALTERNATIVE	PROJECTED CAPITAL COST (2010 MILLIONS)	COST DIFFERENTIAL (MILLIONS)	PROJECTED DAILY RIDERSHIP (2035)	RIDERSHIP DIFFERENCE	ADDITIONAL COST PER ADDITIONAL RIDERS (COMPARED TO THE TSM ALTERNATIVE)
TSM	$14.5	Baseline	3,100	Baseline	-
BRT	$116.2	$101.7	3,800	700	$145,285
Streetcar 1	$197.4-$209.7	$182.9-$195.2	6,100	3,000	$60,967 - $65,067
Streetcar 2	$217.0-$228.1 $219.6	$202.5-213.6	4,700	1,600	$126,562 - $133,500

Source: Cordoba Corporation, Cambridge Systematics, STV, 2012-13

Cost effectiveness is also shown in terms of annual O&M cost per daily rider in Table 5-7 below. The annual O&M cost per rider is lower for the streetcar alternatives ($744 per rider for Streetcar Alternative 1 and $1,201 per rider for Streetcar Alternative 2) than for the BRT Alternative ($1,507). However, the TSM Alternative exhibits the highest annual O&M cost per rider at $4,680.

Table 5-7: Cost Effectiveness - O&M Costs

ALTERNATIVE	PROJECTED ANNUAL O&M	PROJECTED DAILY RIDERSHIP (2035)/b/	ANNUAL COST PER DAILY RIDER
TSM/a/	$13,282,258	3,100	$4,285
BRT	$5,059,776	3,800	$1,332
Streetcar 1	$4,933,284	6,100	$809
Streetcar 2	$6,110,656	4,700	$1,300

Source: Cordoba Corporation, Cambridge Systematics, STV, 2012-13

/a/ Cost based on all elements of TSM including transit service enhancements that extend beyond the study area. The SARTC to Harbor Route accounts for approximately $5.1 million of the projected annual O&M Cost.

/b/ Represents the average ridership based on the ridership range (low and high) forecast for each alternative (see Table 7-3).

The streetcar alternatives along Santa Ana Boulevard/4th Street and Brown Street/Santa Ana Boulevard/Civic Center/5th Street performed best overall because they satisfied all five project goals used as criteria to compare alternatives. Alternatively, the BRT alternative along Santa Ana Boulevard/5th Street only met four of five project goals and objectives. In addition, project stakeholders and the general public were not as supportive of the BRT mode as they were of the modern streetcar.

After careful review and consideration of the Stage 2 initial screening results, it was determined that the BRT Alternative would be eliminated from further consideration because the technology option did not best meet the Purpose and Need and project goals and objectives, as summarized below:

Stage II: Eliminated Alternatives

BRT Alternative Santa Ana Boulevard/5thStreet – This BRT Alternative was recommended for elimination because it was projected to carry significantly fewer riders than the streetcar alternatives and have less economic development potential, which coupled with a substantial capital and annual O&M costs, would make the alternative less cost effective in terms of both capital and O&M costs per rider.

Stage II: Alternatives Carried Forward

Therefore, the remaining conceptual alternatives include:

- Streetcar Alternative Brown Street/Santa Ana Boulevard/Civic Center/5th Street; and
- Streetcar Alternative Santa Ana Boulevard/4th Street.

The detailed definition for each of these alternatives is provided in the following section.

6.0 DETAILED DEFINITION OF ALTERNATIVES

6.1 Reduced Set of Alternatives

The reduced set of alternatives (or alternatives carried forward for detailed evaluation) consists of a No Build Alternative, which is used as a basis for comparing the costs and benefits of the other alternatives, a TSM Alternative, and two Build Alternatives that were assembled after public scoping and initial screening to respond to purpose and need, study goals, and community input.

Through detailed evaluation, an in-depth examination of each of the potential alternatives is conducted so that decision makers can be well-informed when they select a Locally Preferred Alternative (LPA) at the end of the study process. Important issues such as cost, potential community impacts and potential community benefits are thoroughly investigated during the detailed evaluation process.

6.1.1 No Build Alternative

The No Build Alternative assumes no further transportation improvements within the Study Area beyond what has already been funded and committed through the year 2035 (see Section 4.3.1 for additional detail about the transportation improvement projects included in the No Build Alternative).

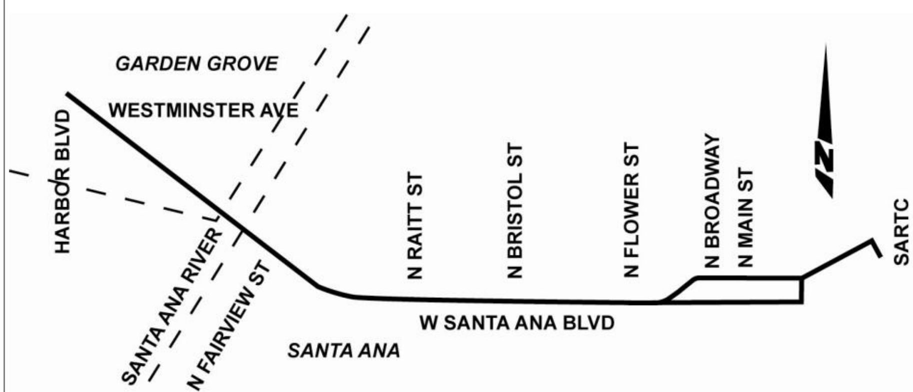
6.1.2 TSM Alternative

The TSM Alternative represents the best that can be done for mobility without construction of major new transportation facilities or physical capacity improvements to the existing transportation infrastructure. As such, the TSM Alternative consists of relatively inexpensive projects, operational improvements, or policy actions such as increases in existing bus service, improved signal timing, and incentives to carpooling (see Section 4.3.2 for a more detailed description of the improvements included in the TSM Alternative). Figure 4-4, presented previously, is a map of the proposed routes for the TSM bus network enhancements. The TSM Alternative includes a new bus route between SARTC and Harbor Boulevard/Westminster Avenue, which is similar to that of the Build Alternatives.

6.1.3 Streetcar Alternative 1 (Santa Ana Boulevard and 4th Street Couplet)

Table 6-1 provides a summary description of the key physical and operational attributes of Streetcar Alternative 1 (Santa Ana Boulevard and 4th-Street Couplet). Figure 6-1provides a conceptual illustration of the alignment for Streetcar Alternative 1 relative to the existing street network within the Study Area.

Table 6-1: Key Physical and Operational Attributes of Streetcar Alternative 1

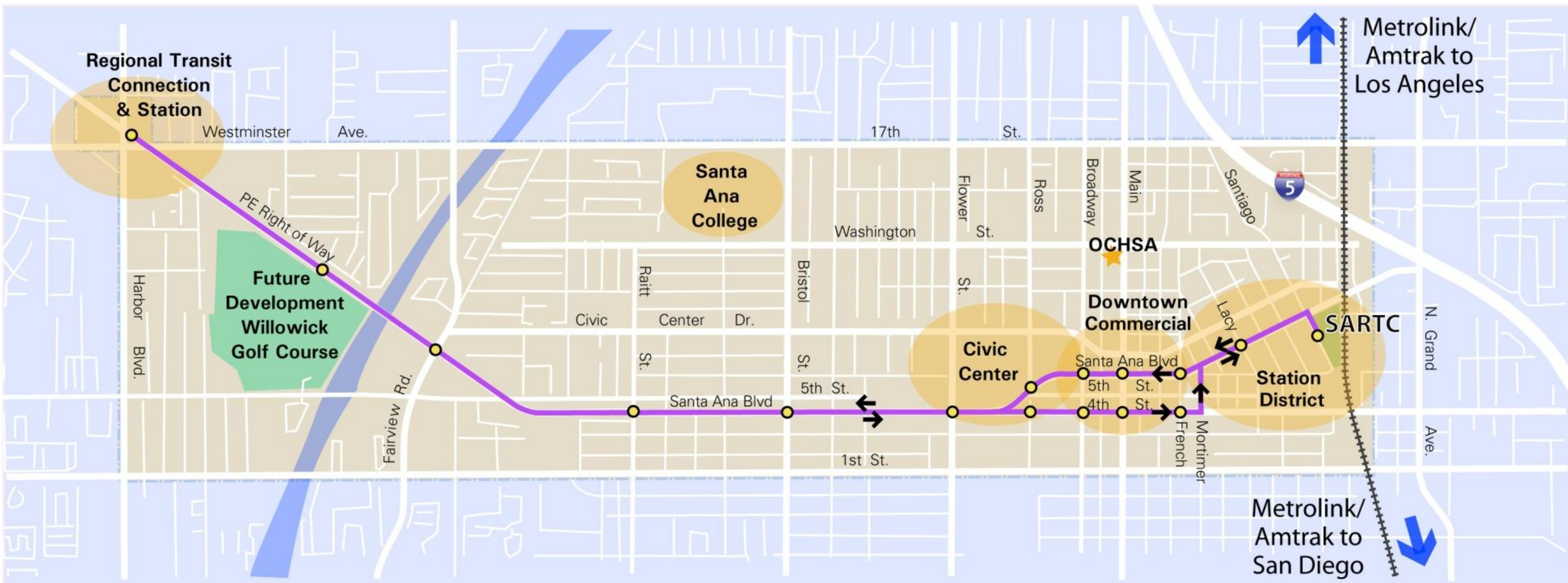
<table>
<tr><th>KEY ATTRIBUTES</th><th colspan="2">DESCRIPTIONS</th></tr>
<tr><td>Transit Mode</td><td colspan="2">Streetcar</td></tr>
<tr><td>Termini</td><td colspan="2">Western Terminus: Harbor Blvd.
Eastern Terminus: SARTC</td></tr>
<tr><td>Alignment Description</td><td colspan="2"><u>Routing by Segment:</u>
PE ROW, from Harbor Blvd. to Raitt St.: streetcars operate at-grade, bi-directionally, in exclusive ROW.
Santa Ana Blvd., from Raitt St. to Ross St: streetcars operate in the street, at grade, bi-directionally, along with mixed-flow traffic.
4^{th} St./Santa Ana Blvd. Couplet, from Ross St. to Mortimer St.: streetcars operate in the street, at grade, one-way, along with mixed-flow traffic.
Santa Ana Blvd., from Mortimer St. to SARTC: streetcars operate in the street, at grade, bi-directionally, along with mixed-flow traffic.


</td></tr>
<tr><td>Length of Alignment.</td><td colspan="2">4.1 miles (Harbor Blvd. to SARTC)</td></tr>
<tr><td rowspan="3">Stations
(12 Stations)</td><td colspan="2">1. Harbor Blvd. and Westminster Ave.
2. Willowick
3. Fairview St. and PE ROW
4. Raitt St. and Santa Ana Blvd.
5. Bristol St. and Santa Ana Blvd.
6. Flower St. and Santa Ana Blvd.</td></tr>
<tr><td>Couplet Section (Eastbound)
7. Sasscer Park
8. Broadway and 4^{th} St.
9. Main St. and 4^{th} St.
10. French St. and 4^{th} St.</td><td>Couplet Section (Westbound)
7. Ross St. and Santa Ana Blvd.
8. Broadway and Santa Ana Blvd.
9. Main St. and Santa Ana Blvd.
10. French St. and Santa Ana Blvd.</td></tr>
<tr><td colspan="2">11. Lacy St. and Santa Ana Blvd.
12. SARTC</td></tr>
</table>

KEY ATTRIBUTES	DESCRIPTIONS
Alignment Design Options	Western Terminus (Harbor Blvd. and Westminster Ave.): • At Grade Option • Elevated Option • Truncated At-Grade Option
	Santa Ana River Crossing: • Bridge Replacement Option • Bridge Avoidance Option A • Bridge Relocation Option • Bridge Avoidance Option B
	Sasscer Park: • Option 1A (Direct Route) • Option 1B (Curved Route)
	4th Street Parking Scenarios: • Scenario A: South Side Parallel • Scenario B: South Side Removal • Scenario C: South Side and North Side Removal
Headways	Peak: 10 minutes (6:00 a.m. to 6:00 p.m.) Off-Peak: 15 minutes (after 6:00 p.m.)
Hours of Operation (in revenue service)	Monday – Thursday: 6:00 a.m. to 11:00 p.m. (17 hours) Friday and Saturday: 6:00 a.m. to 1:00 a.m. (19 hours) Sunday: 7:00 a.m. to 10:00 p.m. (15 hours)
Transit Vehicle	Streetcar – Vehicle type selection has yet to be determined. The two classifications under consideration include: • Classic Modern Streetcar (e.g., United Streetcar Portland vehicle) • CPUC Compliant Streetcar (e.g., Siemens S70)
Power Source	Electric, Overhead Contact System, Traction Power Substations
Operations and Maintenance Facility Sites	Two Candidate Sites: • Site A: South of SARTC, bordered by 4th St., 6th St., Poinsettia St. and Metrolink tracks. • Site B: West of Raitt St., between the PE ROW and 5th St.
Major Bicycle and Pedestrian Features	• Sidewalk and pedestrian improvements in the vicinity of proposed station platforms. • 4th St.: In conjunction with on-street parking modifications, widen sidewalks on 4th St. between Ross St. and French St.: – Scenario A: On south side by 8 ft. for a total width of 20 ft. – Scenario B: On south side by 16 ft. for a total width of 28 ft. – Scenario C: On both sides by 16 ft. for a total width of 28 ft.

Source: Cordoba Corporation, Conceptual Design Plan Set, October 2012

Figure 6-1: Streetcar Alternative 1 Alignment



NORTH

LEGEND

- Streetcar 1
- Proposed Stop
- Future Extension to Metro East Mixed-Use Development
- Study Area

6.1.4 Streetcar Alternative 2 (Santa Ana Boulevard and Civic Center Drive/5th Street Couplet)

Table 6-2 provides a summary description of the key physical and operational attributes of Streetcar Alternative 2. Figure 6-2provides a conceptual illustration of the alignment for Streetcar Alternative 2 relative to the existing street network within the Study Area.

Table 6-2: Key Physical and Operational Attributes of Streetcar Alternative 2

<table>
<tr><th>KEY ATTRIBUTES</th><th>DESCRIPTIONS</th></tr>
<tr><td>Transit Mode</td><td>Streetcar</td></tr>
<tr><td>Termini</td><td>Western Terminus: Harbor Blvd.
Eastern Terminus: SARTC</td></tr>
<tr><td>Alignment Description</td><td>

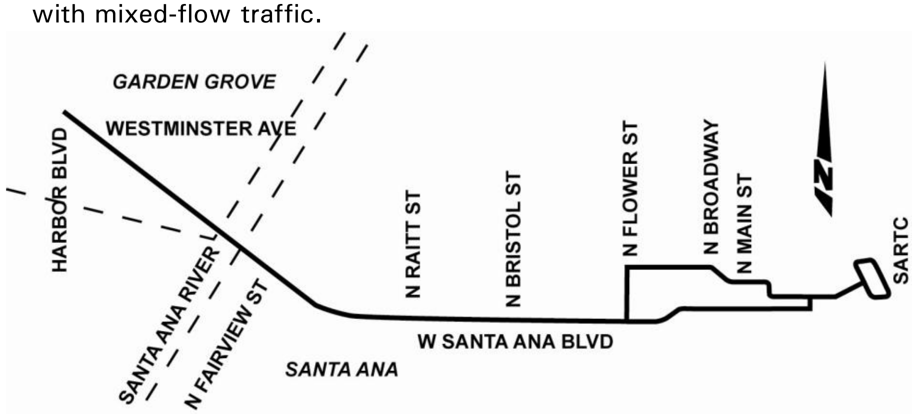
PE ROW, from Harbor Blvd. to Raitt St.: streetcars operate at-grade, bi-directionally, in exclusive ROW.

Santa Ana Blvd., from Raitt St. to Flower St.: streetcars operate in the street, at-grade, bi-directionally, along with mixed-flow traffic.

Santa Ana Blvd./5th St. and Civic Center Dr. Couplet, from Flower St. to Minter St.: streetcars operate in the street, at-grade, one-way, along with mixed-flow traffic.

6th St./Brown St., from Minter St. to Poinsettia St.: streetcars operate in the street, at grade,
bi-directionally, along with mixed-flow traffic.

Poinsettia St./Santa Ana Blvd. /Santiago St./6th St. (SARTC Loop): streetcars operate in a one-way loop, in the street, at-grade, along with mixed-flow traffic.

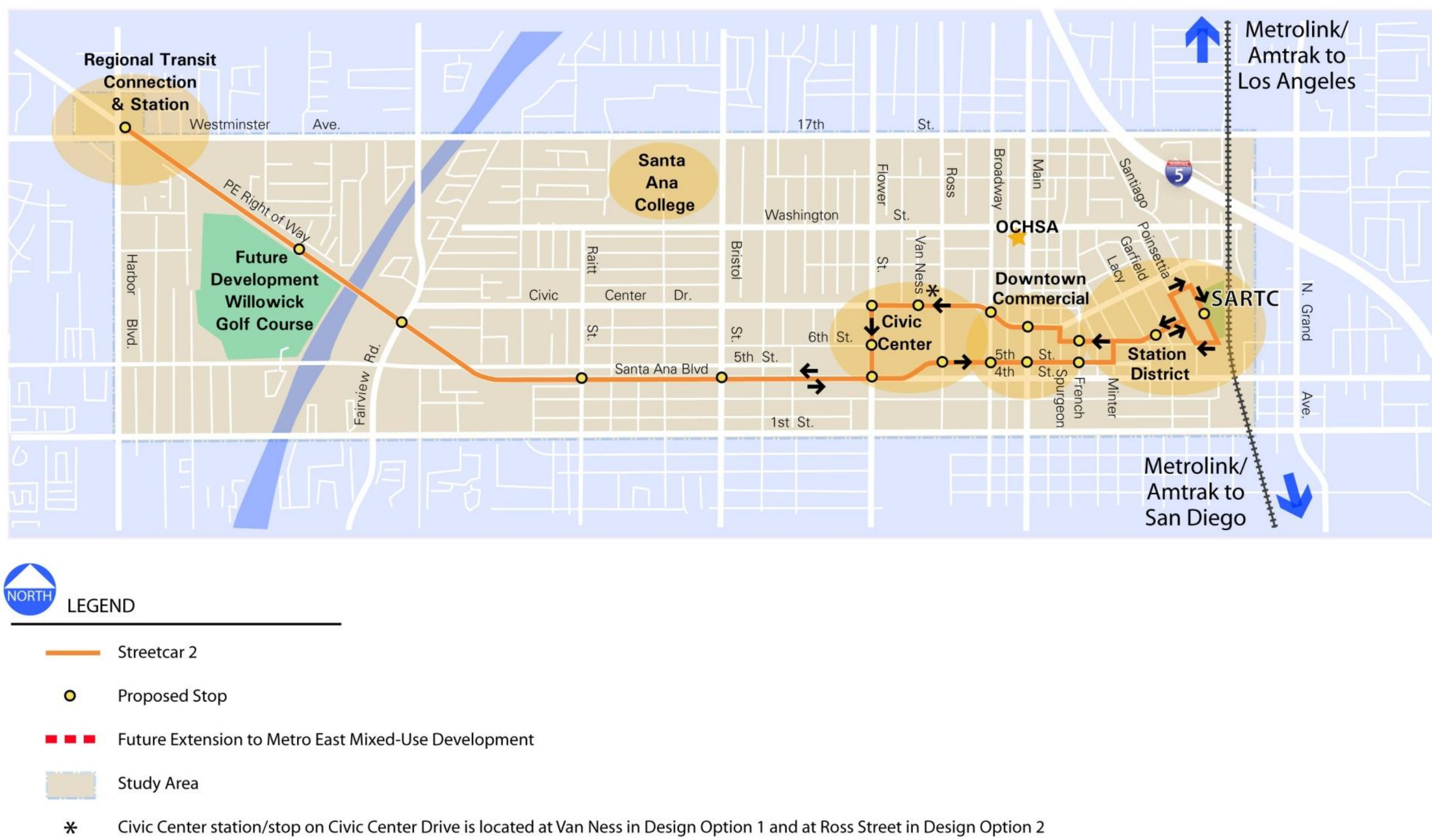


</td></tr>
<tr><td>Length of Alignment</td><td>4.5 miles (Harbor Blvd. to SARTC)</td></tr>
<tr><td>Stations
(13 Stations)</td><td>1. Harbor Blvd. and Westminster Ave.
2. Willowick
3. Fairview St. and PE ROW
4. Raitt St. and Santa Ana Blvd.
5. Bristol St. and Santa Ana Blvd.</td></tr>
</table>

KEY ATTRIBUTES	DESCRIPTIONS	
	Couplet Section (Eastbound) 6. Flower St. and Santa Ana Blvd. 7. ---------- 8. Ross St. and Santa Ana Blvd. 9. Broadway and 5th St. 10. Main St. and 5th St. 11. French St. and 5th St.	*Couplet Section (Westbound)* 6. Flower St. and 6th St. 7. Flower St. and Civic Center Dr. 8. Van Ness Ave. and Civic Center Dr. 9. Broadway and Civic Center Dr. 10. Main St. and Civic Center Dr. 11. French St. and Santa Ana Blvd.
	12. Brown Street and Porter Street 13. SARTC	
Alignment Design Options	Western Terminus (Harbor Blvd. and Westminster Ave.) • At-Grade Option • Elevated Option • Truncated At-Grade Option	
	Santa Ana River Crossing: • Bridge Replacement Option • Bridge Avoidance Option A • Bridge Relocation Option • Bridge Avoidance Option B	
	Civic Center Drive • Option 2A (Parking Removal and Additional Right-of-Way) • Option 2B (Reduce Number of Westbound of Travelled Lanes)	
Headways	Peak: 10 minutes (6:00 a.m. to 6:00 p.m.) Off-Peak: 15 minutes (after 6:00 p.m.)	
Hours of Operation (in revenue service)	Monday – Thursday: 6:00 a.m. to 11:00 p.m. (17 hours) Friday and Saturday: 6:00 a.m. to 1:00 a.m. (19 hours) Sunday: 7:00 a.m. to 10:00 p.m. (15 hours)	
Transit Vehicle	Streetcar – Vehicle type selection has yet to be determined. The two classifications under consideration include: • Classic Modern Streetcar (e.g., United Streetcar Portland vehicle) • CPUC Compliant Streetcar (e.g., Siemens S70)	
Power Source	Electric, Overhead Contact System, Traction Power Substations	
Operations and Maintenance Facility Sites	Two Candidate Sites: • **Site A:** South of SARTC, bordered by 4th St., 6th St., Poinsettia St., and the Metrolink tracks. • **Site B:** West of Raitt St., between the PE ROW and 5th St.	
Major Bicycle and Pedestrian Features	• Sidewalk and pedestrian improvements in the vicinity of proposed station platforms. • Civic Center Drive: Provide sufficient street width on Civic Center Drive between Flower Street and Spurgeon Street to support the City's planned development of a striped bike lane on each side of the street.	

Source: Cordoba Corporation, Conceptual Design Plan Set, October 2012

Figure 6-2: Streetcar Alternative 2 Alignment



6.1.3 Streetcar Alternatives Initial Operable Segments (IOSs)

In response to funding and phasing issues raised by fiscal constraints identified during OCTA's long range transportation planning process, the City of Santa Ana developed Initial Operable Segments (IOSs) for the Santa Ana-Garden Grove Fixed Guideway Project that are shorter segments of Streetcar Alternative 1 and Streetcar Alternative 2 that could be constructed and operated.

IOS-1 and IOS-2 include the same project features and design options as their respective full alignment Build Alternatives between Raitt Street and SARTC.

Both IOS-1 and IOS-2 would terminate at Raitt station (Raitt Street and Santa Ana Boulevard) in lieu of Harbor station (Harbor Boulevard and Westminster Avenue). Tail tracks for both IOS-1 and IOS-2 are located west of Raitt station within the PE ROW on ballasted track. These tracks would extend another hundred feet west within the PE ROW to reach the Operations and Maintenance Facility at Site B should this site ultimately be selected for either IOS-1 or IOS-2.

The configuration of Raitt as an interim terminus station is the same for IOS-1 and IOS-2. Just over 50 spaces would be provided for station parking at Raitt within the PE ROW on an interim basis to be replaced by parking at Harbor station upon completion of the full Project. Vehicular access to Raitt station parking would be via Daisy Avenue.

IOS-1 (Santa Ana Boulevard and Fourth Street Couplet) - IOS-1 follows the same alignment as Streetcar Alternative 1, but terminates at Raitt station rather than extending to Harbor station. See Figure 6-3 and Figure 6-4. The IOS-1 streetcar alignment is about 2.2 miles in length. IOS-1 includes the same project features, design options, and parking scenarios as Streetcar Alternative 1 between Raitt Street and SARTC (see Table 6-3).

IOS-2 (Santa Ana Boulevard/Fifth Street and Civic Center Drive Couplet) - IOS-2 follows the same alignment as Streetcar Alternative 2, but terminates at Raitt station rather than extending to Harbor station. See Figure 6-3 and Figure 6-5. The IOS-2 streetcar alignment is about 2.6 miles in length. IOS-2 includes the same project features and design options as Streetcar Alternative 2 between Raitt Street and SARTC (see Table 6-3).

Figure 6-3: Streetcar IOS-1 and IOS-2 Alignments

Figure 6-4: Streetcar IOS Raitt Street Terminus Configuration with Maintenance Facility Site A

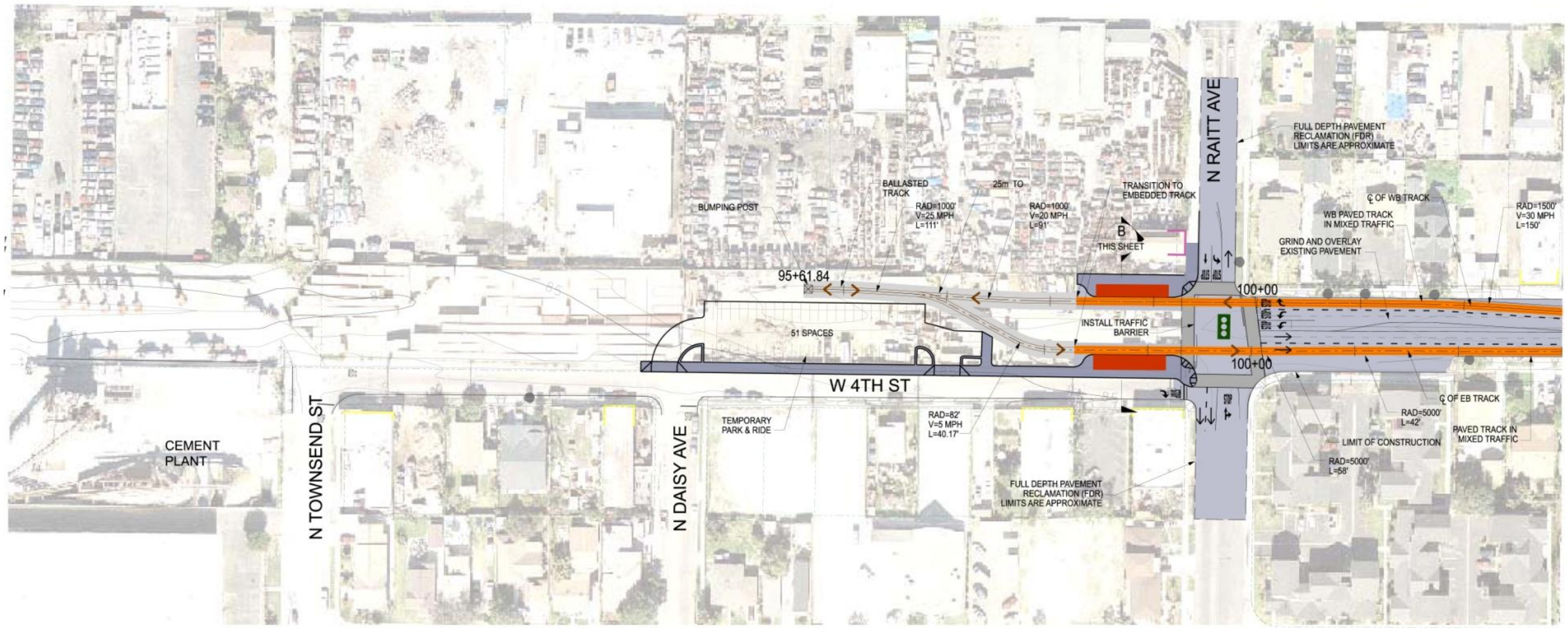


Figure 6-5: Streetcar IOS Raitt Street Terminus Configuration with Maintenance Facility Site B

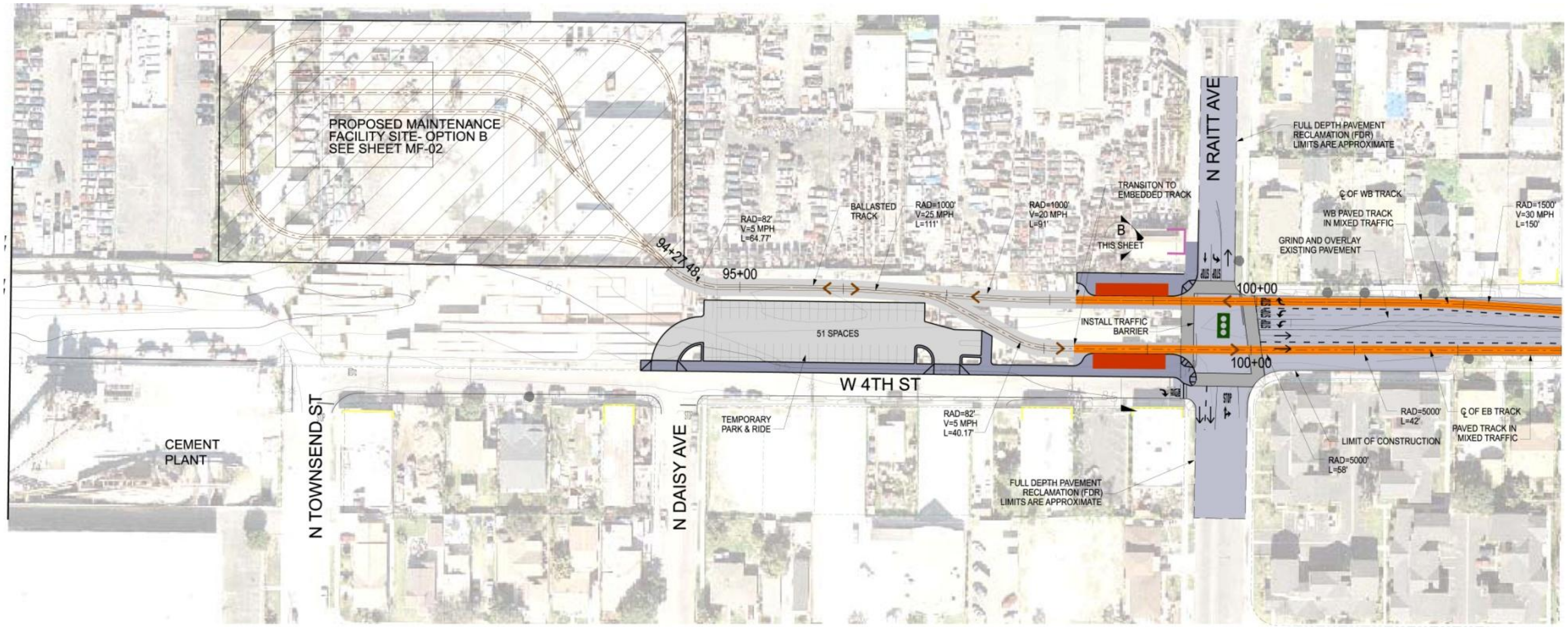


Table 6-3: Key Physical and Operational Attributes of Streetcar IOS-1 and IOS-2

<table>
<tr><th rowspan="2">KEY ATTRIBUTES</th><th colspan="4">DESCRIPTIONS</th></tr>
<tr><th colspan="2">IOS-1</th><th colspan="2">IOS-2</th></tr>
<tr><td>Termini</td><td colspan="4">Western Terminus: Raitt St.
Eastern Terminus: SARTC</td></tr>
<tr><td>Alignment Description</td><td colspan="2"><u>Routing by Segment:</u>
Santa Ana Blvd., from Raitt St. to Ross St.: streetcars operate in the street, at-grade, bi-directionally, along with mixed-flow traffic.
Fourth St./Santa Ana Blvd. Couplet, from Ross St. to Mortimer St.: streetcars operate in the street, at-grade, one-way, along with mixed-flow traffic.
Santa Ana Blvd. from Mortimer St. to SARTC: streetcars operate in the street, at-grade, bi-directionally, along with mixed-flow traffic.
.</td><td colspan="2"><u>Routing by Segment:</u>
Santa Ana Blvd., from Raitt St. to Flower St.: streetcars operate in the street, at-grade, bi-directionally, along with mixed-flow traffic.
Santa Ana Blvd./Fifth St. and Civic Center Dr. Couplet, from Flower St. to Minter St.: streetcars operate in the street, at-grade, one-way, along with mixed-flow traffic.
Sixth St./Brown St., from Minter St. to Poinsettia St.: streetcars operate in the street, at-grade, bi-directionally, along with mixed-flow traffic.
Poinsettia St./Santa Ana Blvd. /Santiago St./ Sixth St. (SARTC Loop): streetcars operate in a one-way loop, in the street, at-grade, along with mixed-flow traffic.</td></tr>
<tr><td>Length of Alignment</td><td colspan="2">2.2 miles (Raitt St. to SARTC)</td><td colspan="2">2.6 miles (Raitt St. to SARTC</td></tr>
<tr><td rowspan="2">Stations</td><td colspan="2"><u>Station Locations:</u>
• Raitt St. and Santa Ana Blvd.
• Bristol St. and Santa Ana Blvd.
• Flower St. and Santa Ana Blvd.</td><td colspan="2"><u>Station Locations:</u>
• Raitt St. and Santa Ana Blvd.
• Bristol St. and Santa Ana Blvd.</td></tr>
<tr><td>Couplet Section (Eastbound)
• Sasscer Park
• Broadway and 4th St.
• Main St. and 4th St.
• French St. and 4th St.</td><td>Couplet Section (Westbound)
• Ross St. and Santa Ana Blvd.
• Broadway and Santa Ana Blvd.
• Main St. and Santa Ana Blvd.
• French St. and Santa Ana Blvd.</td><td>Couplet Section (Eastbound)
• Flower St. and Santa Ana Blvd.
• Ross St. and Santa Ana Blvd.
• Broadway and 5th St.
• Main St. and 5th St.
• French St. and 5th St.</td><td>Couplet Section (Westbound)
• Flower St. and 6th St.
• Flower St. and Civic Center Dr.
• Van Ness Ave.* and Civic Center Dr.
• Broadway and Civic Center Dr.</td></tr>
</table>

KEY ATTRIBUTES	DESCRIPTIONS		
	• Lacy St. and Santa Ana Blvd. • SARTC	• Brown St. and Porter St. • SARTC	• Main St. and Civic Center Dr. • French St. and Santa Ana Blvd.
Headways	Peak: 10 minutes (6:00 a.m. to 6:00 p.m.) Off-Peak: 15 minutes (after 6:00 p.m.)		
Hours of Operation (in revenue service)	Monday – Thursday: 6:00 a.m. to 11:00 p.m. (17 hours) Friday and Saturday: 6:00 a.m. to 1:00 a.m. (19 hours) Sunday: 7:00 a.m. to 10:00 p.m. (16 hours)		
Power Source	Electric, Overhead Contact System, Traction Power Substations		
Operations and Maintenance Facility Sites	Two Candidate Sites: Site A: South of SARTC, bordered by Fourth St., Sixth St., Poinsettia St., and the Metrolink tracks. Site B: West of Raitt St., between the PE ROW and Fifth St.		

6.2 Design Options

During detailed evaluation, design options were developed to avoid identified constraints or to take advantage of specific opportunities presented along the alignments. In most cases the design options are the same for Streetcar Alternative 1 and Streetcar Alternative 2. However, where the design option is unique to a specific alternative, it is identified in the discussion.

6.2.1 Western Terminus Design Options

Three design options were defined for the western terminus of the Santa Ana-Garden Grove Fixed Guideway Project at the northeast corner of Harbor Boulevard and Westminster Avenue: Option A: At-grade, Option B: Elevated, and Option C: Truncated At-grade. Figure 6-6, Figure 6-7 and Figure 6-8 show the western terminus design options.

Option A: At-Grade assumes that the streetcar will cross Westminster Avenue at-grade, at a newly-created signalized intersection aligned with Nautilus Drive. Once north of Westminster Avenue, the streetcar would turn westerly through an existing light industrial/business park to a station platform within the PE ROW. The option would require acquisition of additional right-of-way as well as buildings that are within the proposed route.

Option B: Elevated assumes that the streetcar would cross Westminster Avenue on an elevated structure within the PE ROW, with the station platform at-grade within the PE ROW near Harbor Boulevard.

Option C: Truncated At-Grade would cross Westminster Avenue at-grade, at a newly-created signalized intersection aligned with Nautilus Drive, and stop along Nautilus Drive immediately north of Westminster Avenue. The option does not require acquisition of as much additional right-of-way as the At-Grade option (a small sliver along the south side of Westminster Avenue in order to align the streetcar perpendicularly to Westminster Avenue at Nautilus Drive) and would not impact existing buildings.

Figure 6-6: Western Terminus Design Option A: At-Grade

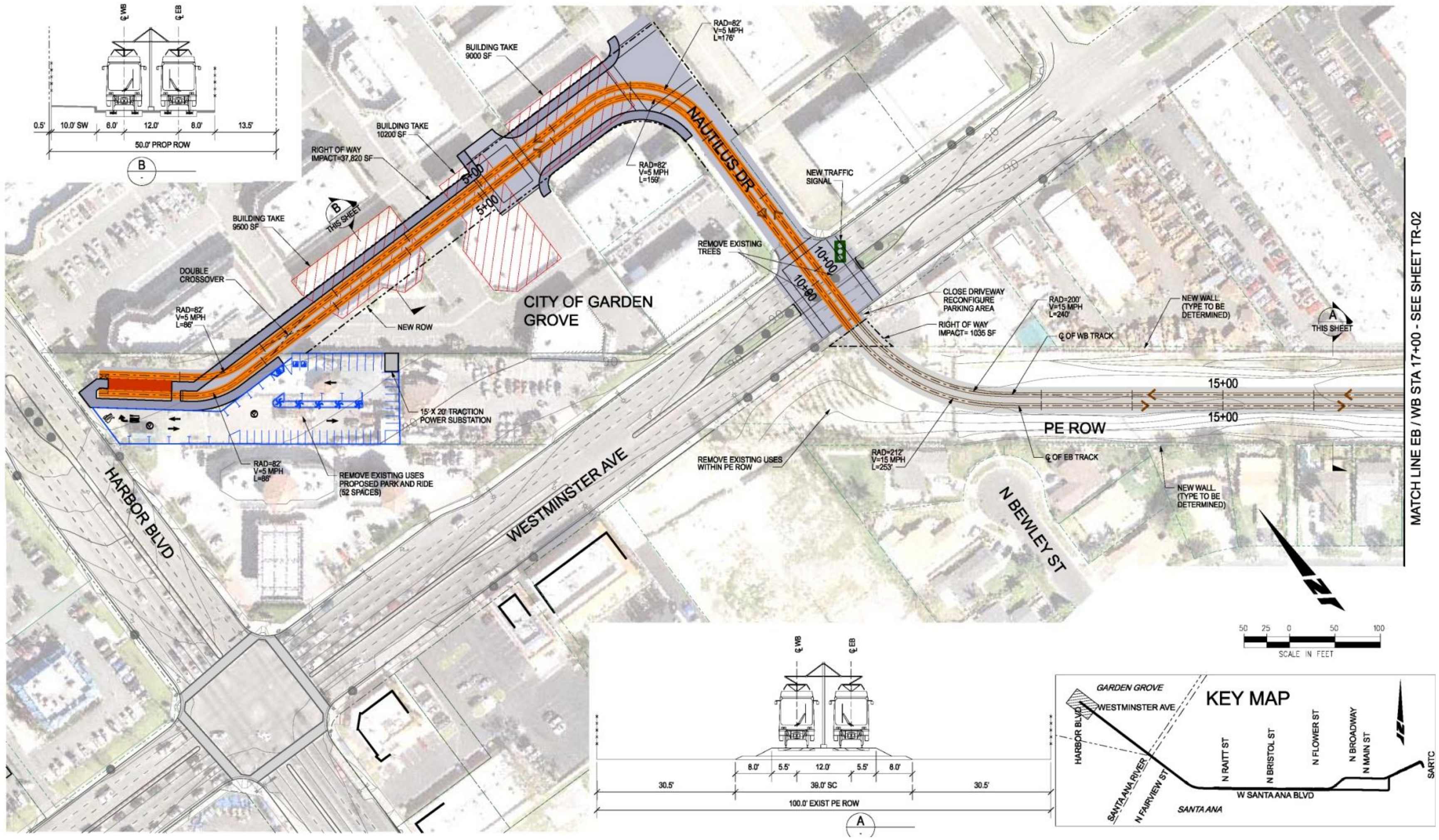


Figure 6-7: Western Terminus Design Option B: Elevated

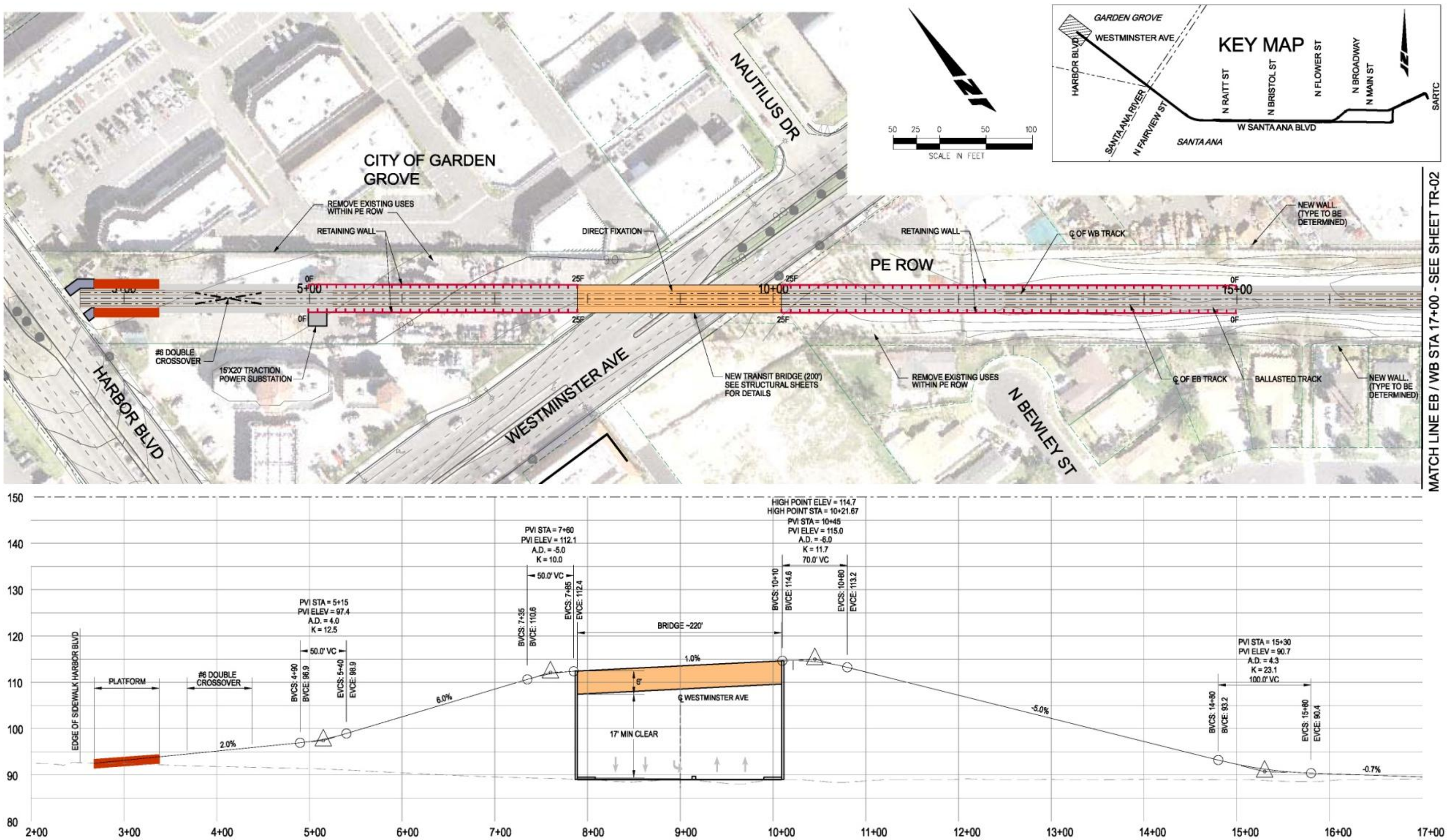
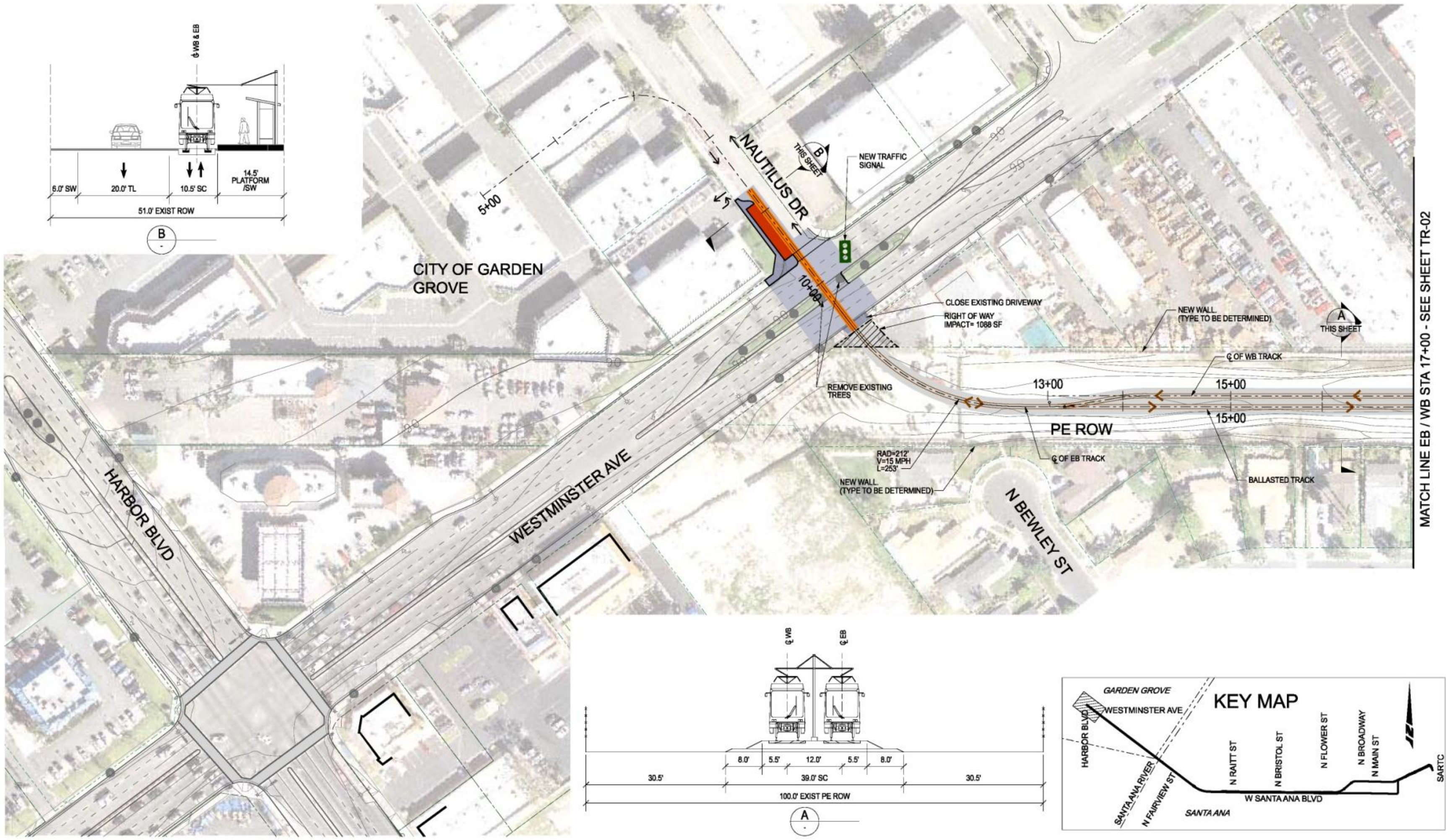


Figure 6-8: Western Terminus Design Option C: Truncated At-Grade



6.2.2 Santa Ana River Crossing Design Options

Both streetcar alternatives would utilize the PE ROW and cross over the Santa Ana River. This alignment was once used for the Pacific Electric Railway red car system and the old Pacific Electric Santa Ana River Bridge still remains. However, it has long been closed for use by vehicles or pedestrians. Based on a preliminary examination, it was determined that the existing bridge structure would not meet current capacity and load standards for transit use. However, previous studies, including the State Route 22/West Orange County Connection Final Environmental Impact Statement/Environmental Impact Report (March 2003), found the Old Santa Ana River Bridge eligible for inclusion in the National Register of Historic Places (NRHP). Therefore, four design options were developed for Streetcar Alternatives 1 and 2 at the Santa Ana River Crossing to address the needs of the streetcar system while at the same time minimizing the potential impact to an historic resource:

- Option 1: Bridge Replacement (Figure 6-9)
- Option 2: Bridge Avoidance – A (Figure 6-10)
- Option 3: Bridge Relocation (Figure 6-11)
- Option 4: Bridge Avoidance – B (Figure 6-12).

In Option 1: Bridge Replacement, the old bridge would be replaced with a new double-track bridge, designed to be similar in appearance to the old bridge. In Design Option 2: Bridge Avoidance A, two new single-direction bridges would be constructed on each side of the old existing bridge. In Option 3: Bridge Relocation, the existing old bridge will be relocated approximately 650 feet south of its existing location and reset on new foundations for future use as a pedestrian/bicycle bridge; a new double-track bridge will be constructed across the Santa Ana River within the PE ROW. Option 4: Bridge Avoidance B will provide a new single-track bridge, with bi-directional operations to be located adjacent to and south of the existing bridge.

Figure6-9: Santa Ana River Crossing Option 1: Bridge Replacement

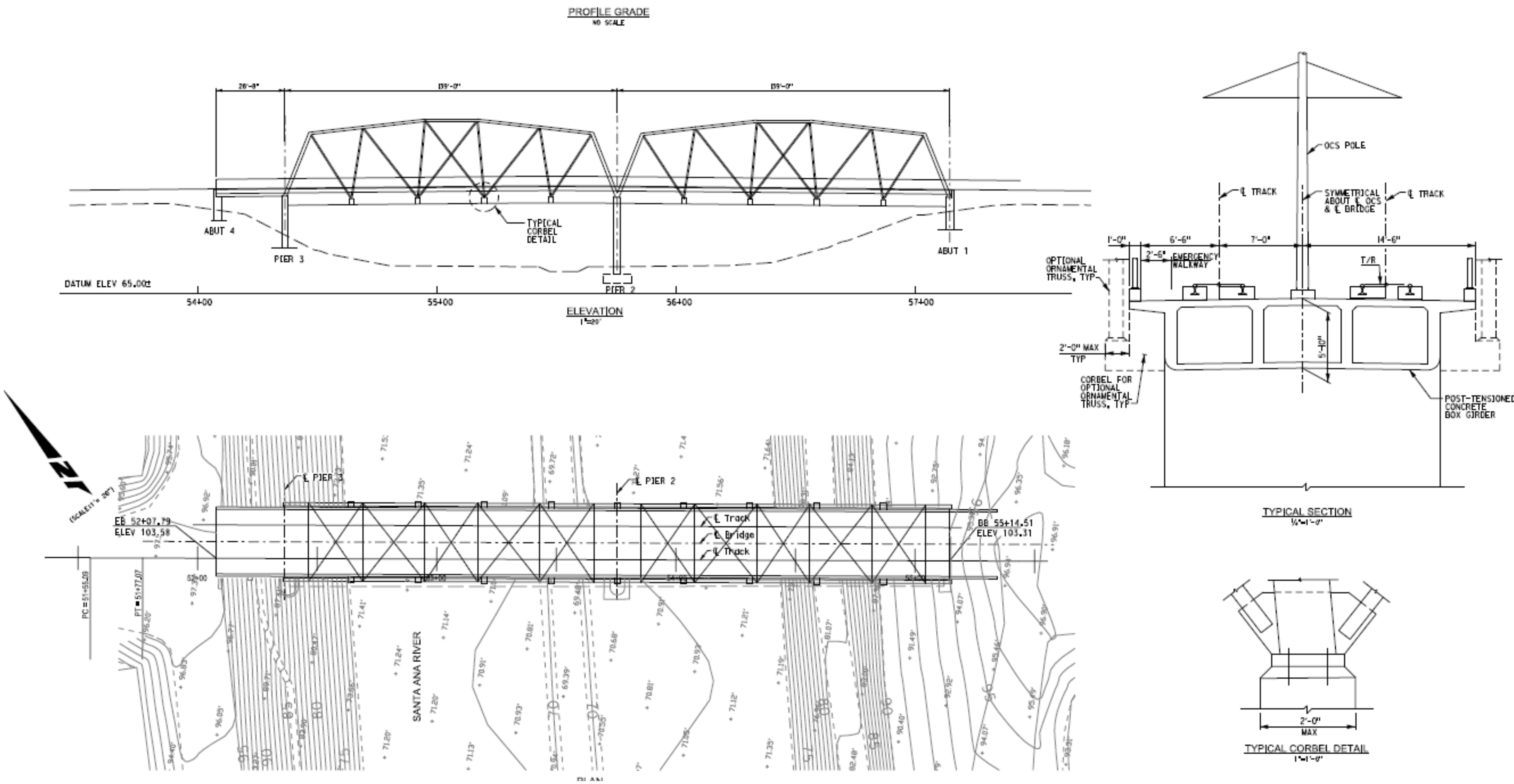


Figure 6-10: Santa Ana River Crossing Option 2: Bridge Avoidance - A

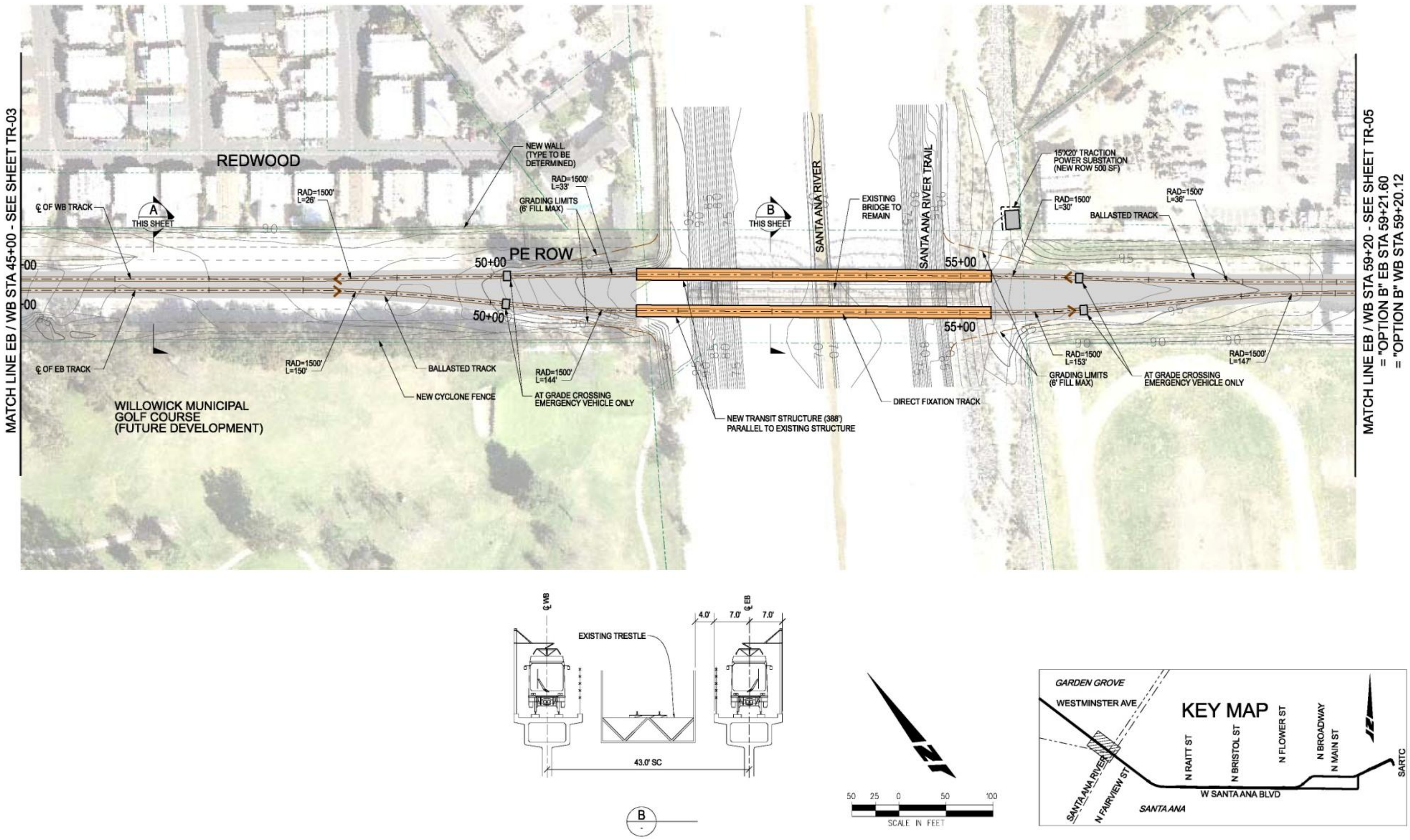
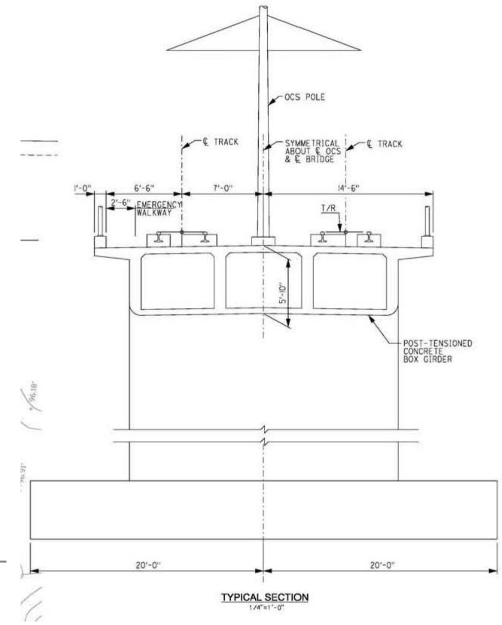
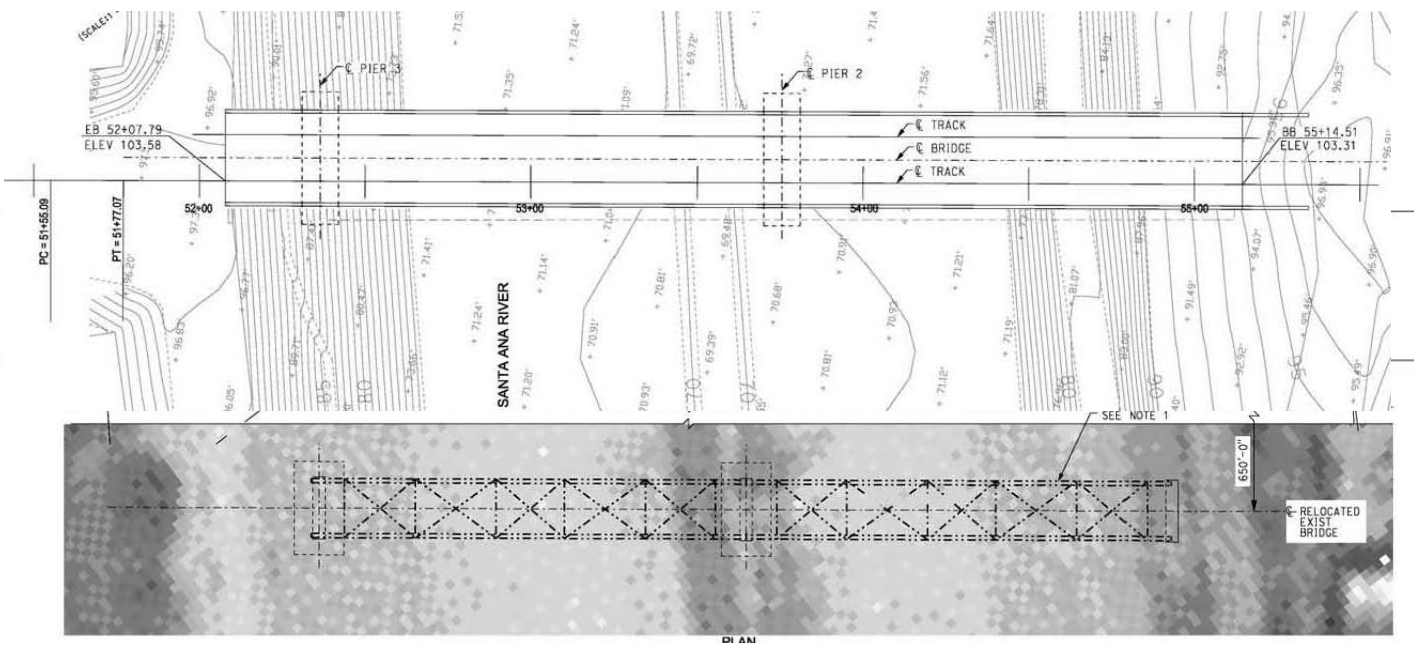


Figure 6-11: Santa Ana River Crossing Option 3: Bridge Relocation

New Double-Track Bridge





Existing Bridge

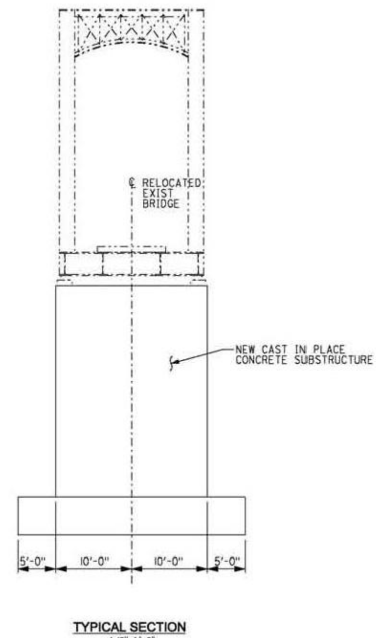
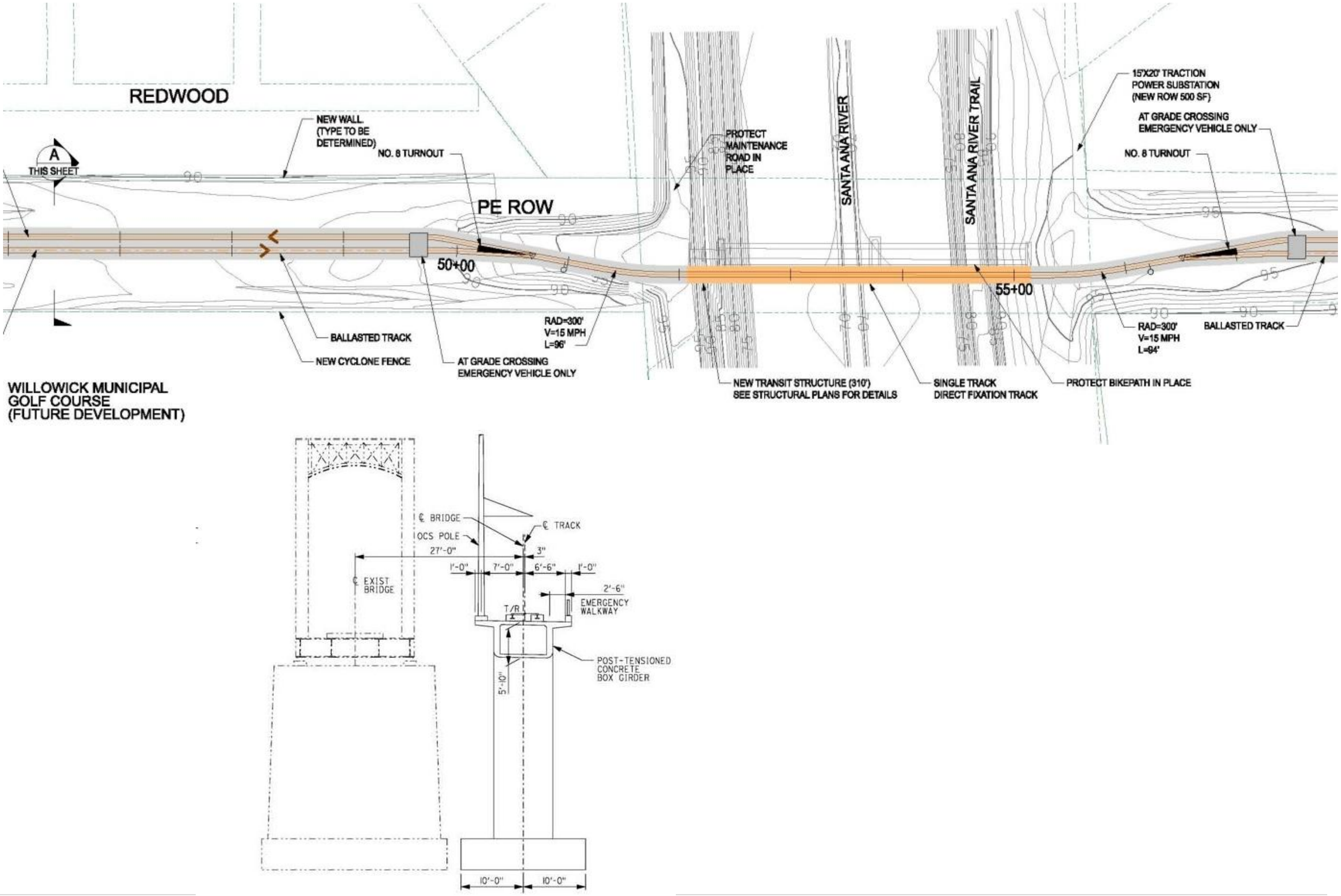


Figure 6-12: Santa Ana River Crossing Option 4: Bridge Avoidance - B



6.2.3 Operations and Maintenance Facility Site Options

Both Streetcar Alternatives 1 and 2 would require the construction of a streetcar maintenance and operations facility. An operations and maintenance facility is a stand-alone building which would meet the maintenance, repair, operational and storage needs of the proposed streetcar system. The facility accommodates daily and routine vehicle inspections, interior/exterior cleaning of the streetcars, preventative (scheduled) maintenance, unscheduled maintenance, and component change-outs. The proposed facility would also provide a venue for rebuilding components, and for long-term component repair for the streetcars.

The site for the maintenance and operations facility would need to accommodate a building that houses both maintenance and administrative functions; provide for off-street employee parking; and provide for various functions such as outside storage of system components, vehicle washing, and local requirements for landscaping and screening. For a more detailed discussion of these facilities and their functions refer to the *Draft Conceptual Design Technical Report*, January 2012.

Currently, two candidate maintenance and operations facility sites have been identified for either Streetcar Alternative 1 or Streetcar Alternative 2. See Figure 6-13 for the approximate locations of these sites.

Site A (near SARTC) - Site A is an irregularly shaped parcel slightly larger than 2.2 acres, and bordered by 6th Street to the north, 4th Street to the south, the Metrolink tracks to the east, and various industrial and commercial businesses to the west. Currently used as a waste transfer and recycling center, this site contains one primary structure with the remainder of the site used for receiving and sorting recycling materials, and parking. Figure 6-14 shows the proposed location of Site A and Figure 6-15 shows a conceptual layout of Site A. The site connects to either streetcar alternative via a nonrevenue extension of track on Santiago Street for the equivalent of approximately two city blocks.

Site B (near Raitt Street) – Site B is a rectangular site slightly larger than 2.4 acres. It is located west of Raitt Street and is bordered by 5th Street to the north and the PE ROW to the south. Located in an area zoned for industrial and commercial uses, this site is comprised of three parcels, two of which contain existing businesses and a combination of industrial buildings. The third parcel contains several residences. Figure 6-16 shows the proposed location of Site B and Figure 6-17 shows a conceptual layout of Site B. The site connects to the streetcar alignment for Streetcar Alternatives 1 or 2 from the PE ROW. Motor vehicle access to the site would be to and from 5th Street.

Figure 6-13: Candidate Locations for Operations & Maintenance Facilities

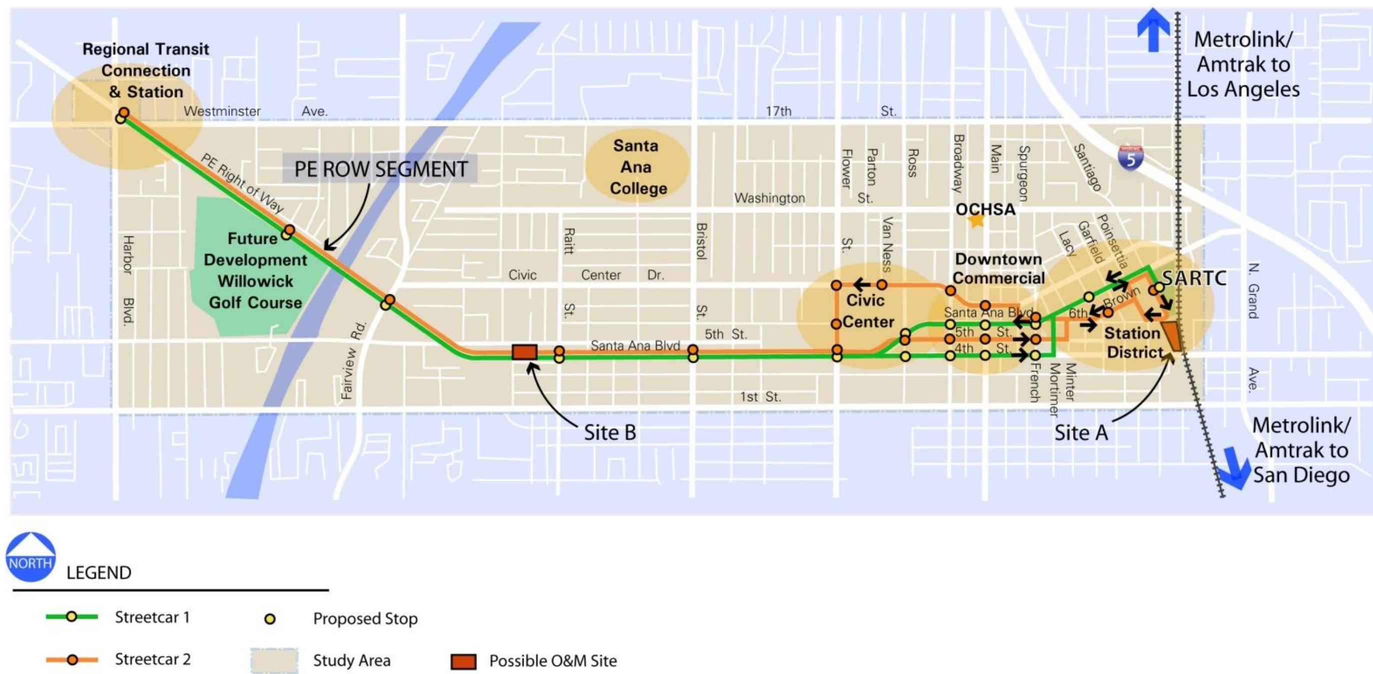


Figure 6-14: Operations and Maintenance Facility Site A - Location and Configuration

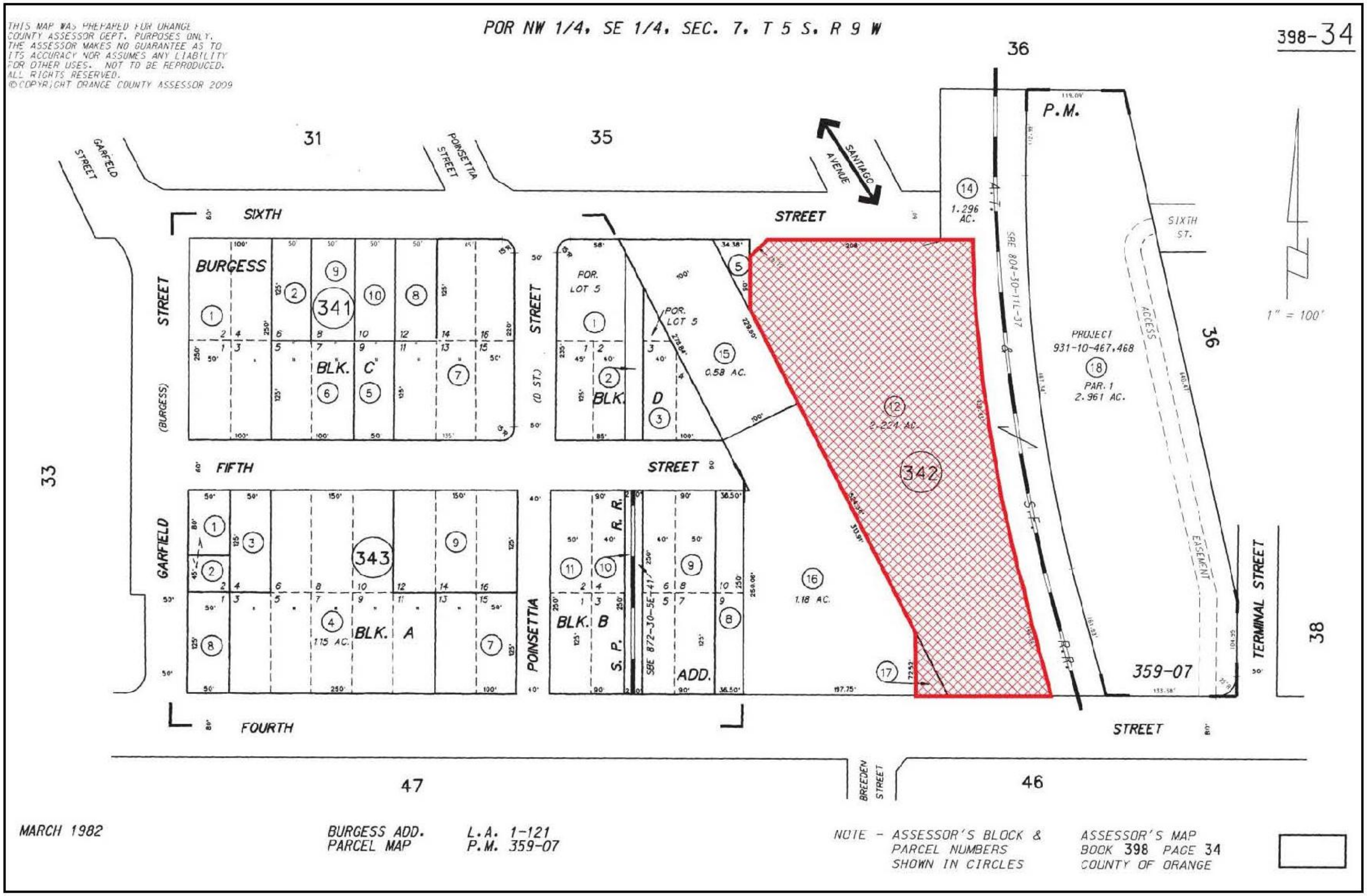


Figure 6-15: Operations and Maintenance Facility Site A - Conceptual Layout

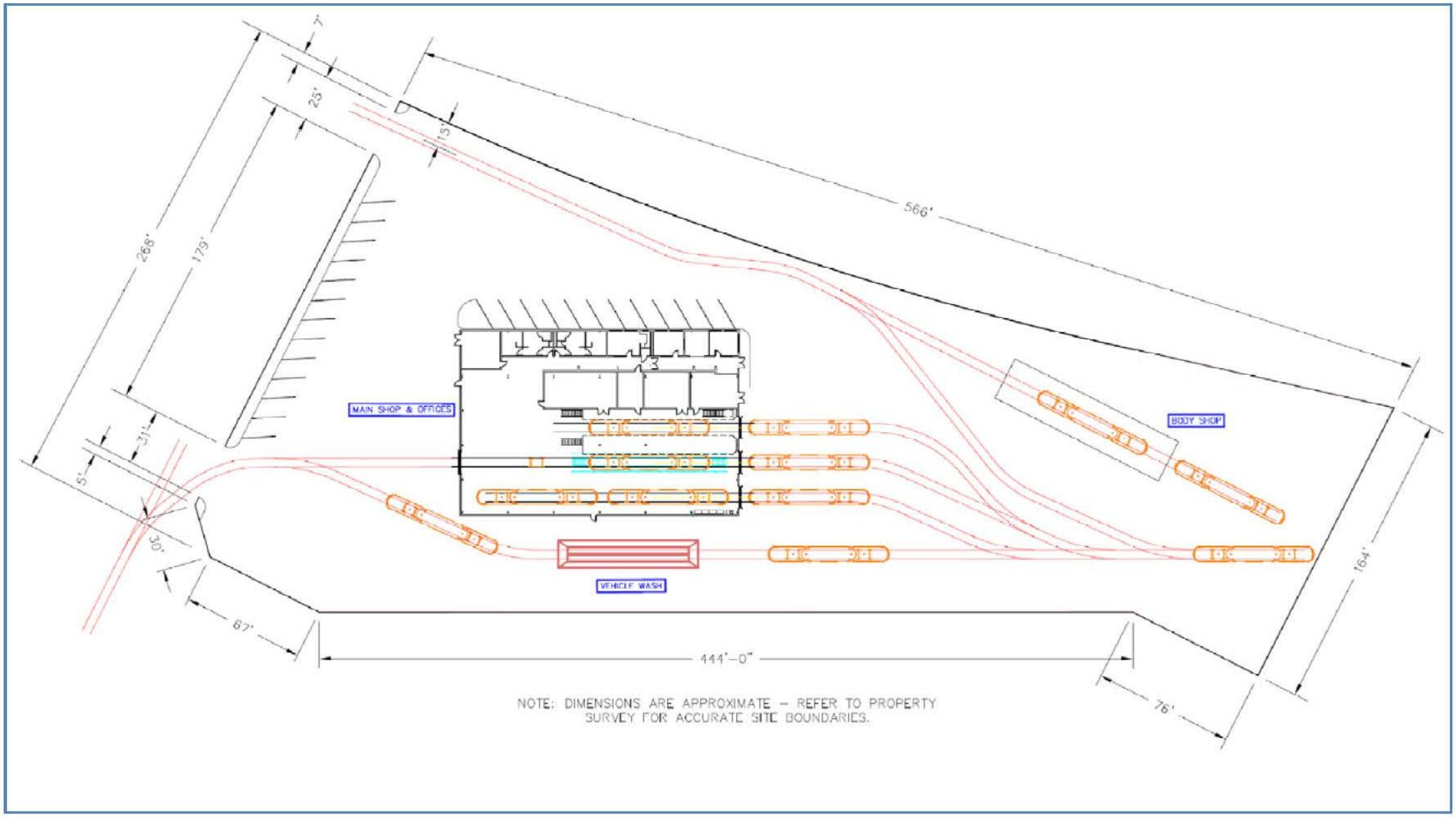


Figure 6-16: Operations and Maintenance Facility Site B - Location and Configuration

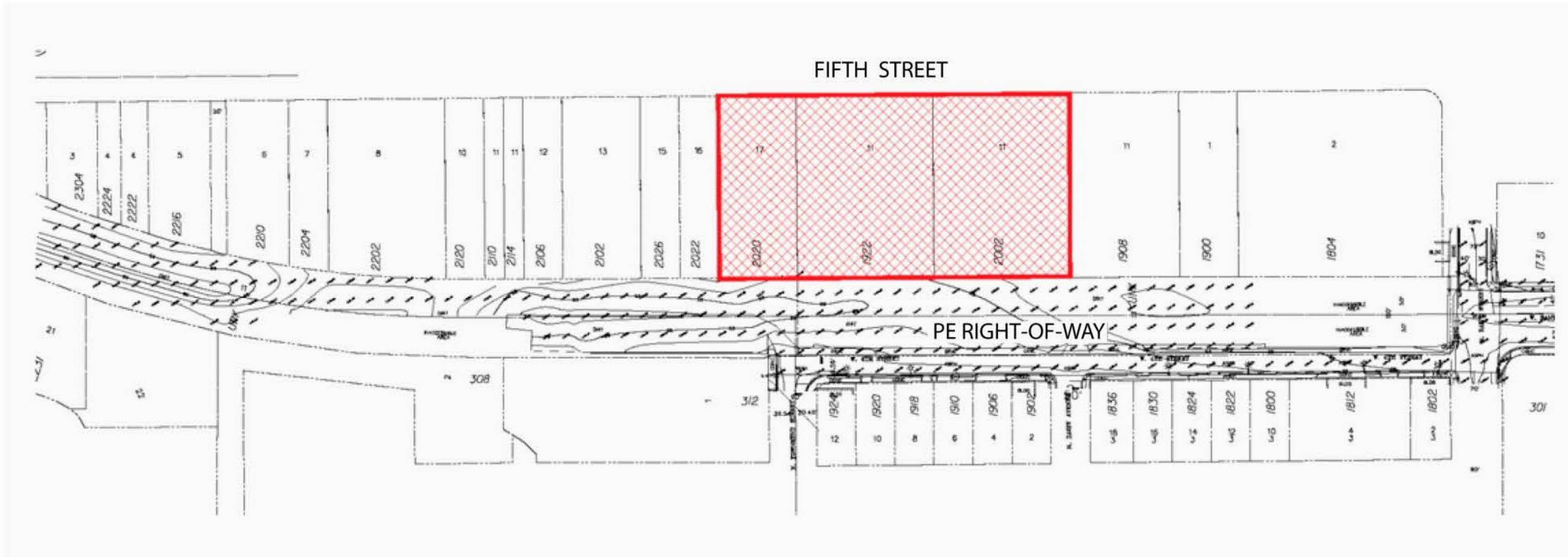
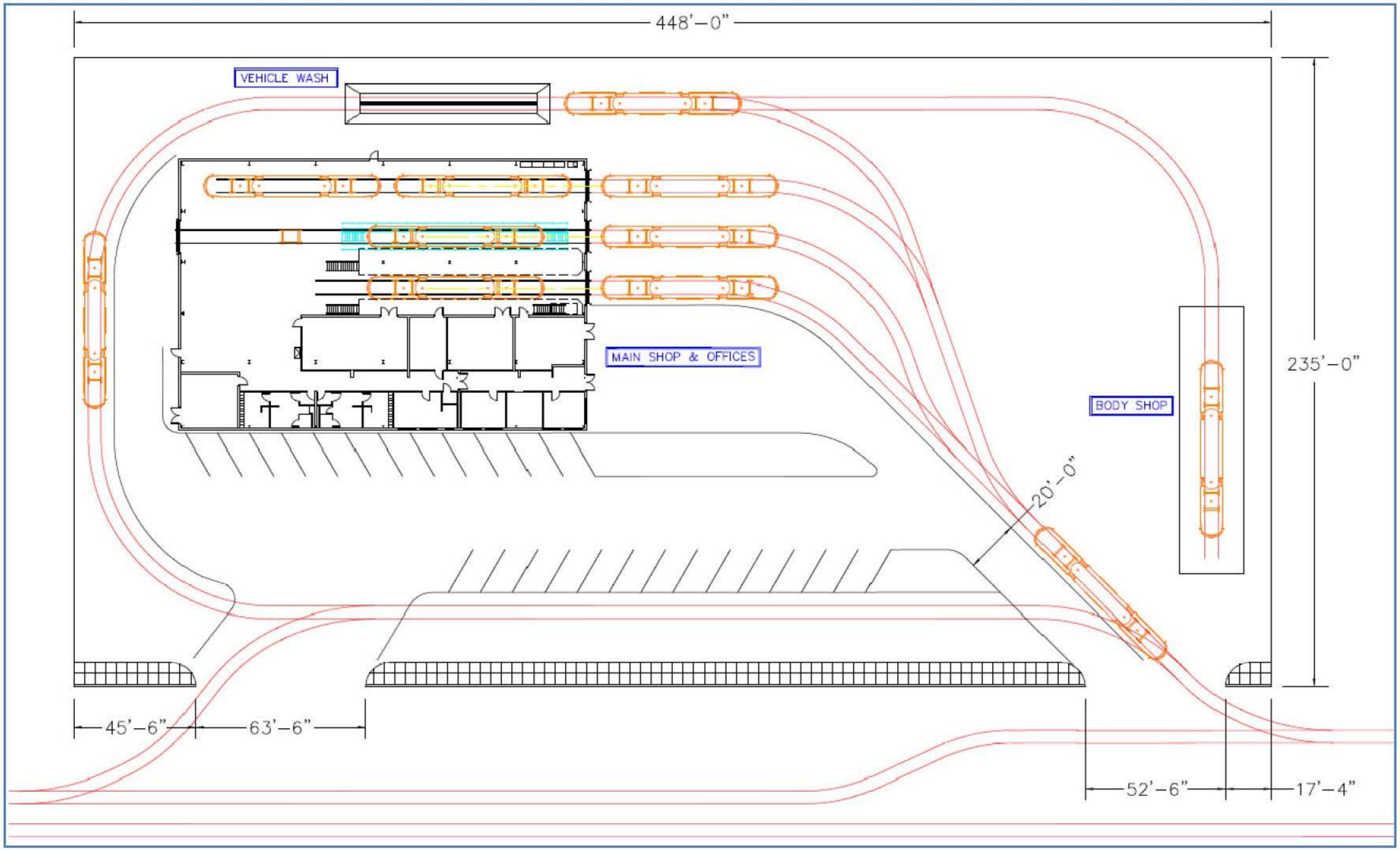


Figure 6-17: Operations and Maintenance Facility Site B - Conceptual Layout



6.2.4 Sasscer Park Design Options

For Streetcar Alternative 1, the Downtown segment features couplet operations with the westbound streetcar alignment on Santa Ana Boulevard, and the eastbound streetcar alignment on 4th Street. Two options have been identified for the eastbound transition from Santa Ana Boulevard to 4th Street: A) direct route from Santa Ana Boulevard along a public easement on the southern edge of Sasscer Park to 4th Street; or B) curved route around the park via Santa Ana Boulevard to Ross Street to 4th Street (see Figure 6-18).

6.2.5 4th Street Parking Scenarios

The Streetcar Alternative 1 alignment would utilize 4th Street between Ross Street and Mortimer Street in the westbound direction. From east of Ross Street to French Street, 4th Street has one travel lane in each direction with head-in diagonal parking along each side of the roadway. The diagonal parking, with vehicles exiting parking spaces by backing into the travel lane, is incompatible with reliable streetcar operations. Three design options were identified to address the diagonal parking on 4th Street as described below and shown on Figure 6-19Figure 6-19.

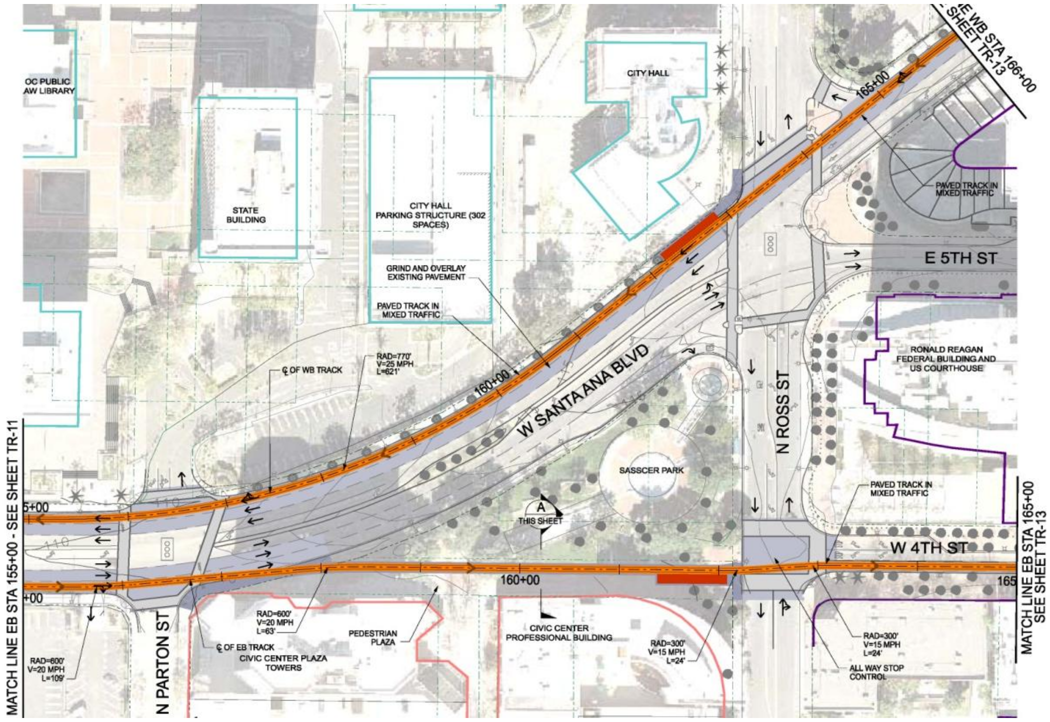
- Scenario A: Convert the diagonal parking along the south side of 4th Street to parallel parking; widen the sidewalk along the south side from 12 feet to 20 feet.
- Scenario B: Remove the diagonal parking along the south side of 4th Street and widen the sidewalk along the south side from 12 feet to 28 feet.
- Scenario C: Remove the diagonal parking along both sides of 4th Street and widen the sidewalks along both sides from 12 feet to 28 feet. In this option, only the parking removal and sidewalk widening along the south side would be included in the cost of the project. The City of Santa Ana would pursue alternative funding to construct the improvements to the north side.

6.2.6 Civic Center Bike Lane Design Options

The Streetcar Alternative 2 alignment travels westbound through the Civic Center along Civic Center Drive between Spurgeon and Flower Streets. As part of the City of Santa Ana's *Complete Streets Program* bicycle lanes are proposed for Civic Center Drive. Two options have been developed for Streetcar Alternative 2 on Civic Center Drive between Flower Street and Surgeon Street that would accommodate the planned bicycle lane along with streetcar and mixed-flow traffic operations: 1) Option 2A: Acquire Additional Right-of-Way (see Figure 6-20); or 2) Option 2B: Reduce Number of Westbound Travel Lanes (see Figure 6-21). In the first option, additional right-of-way would be required in the vicinity of the station platforms in order to accommodate the bike lane behind the station platform. In the second option, one westbound through traffic lane would be removed and the roadway reconfigured to allow for the bike lanes behind the platforms in the station areas.

Figure 6-18: Sasscer Park Design Options

Option 1A: Direct Route



Option 1B: Curved Route

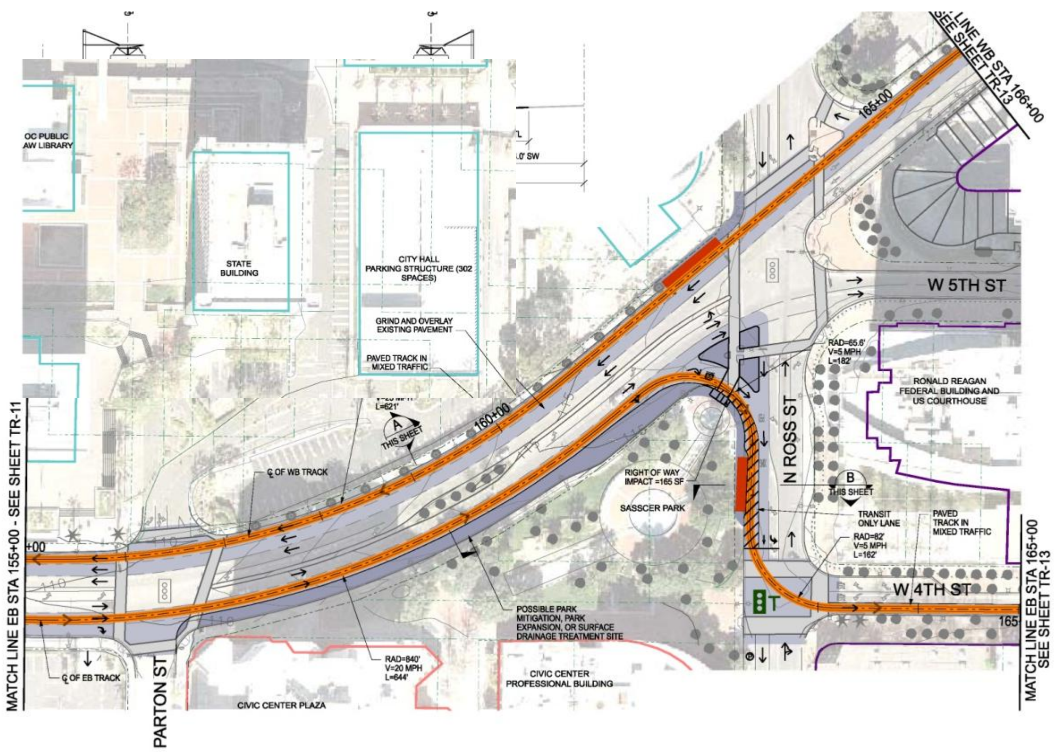
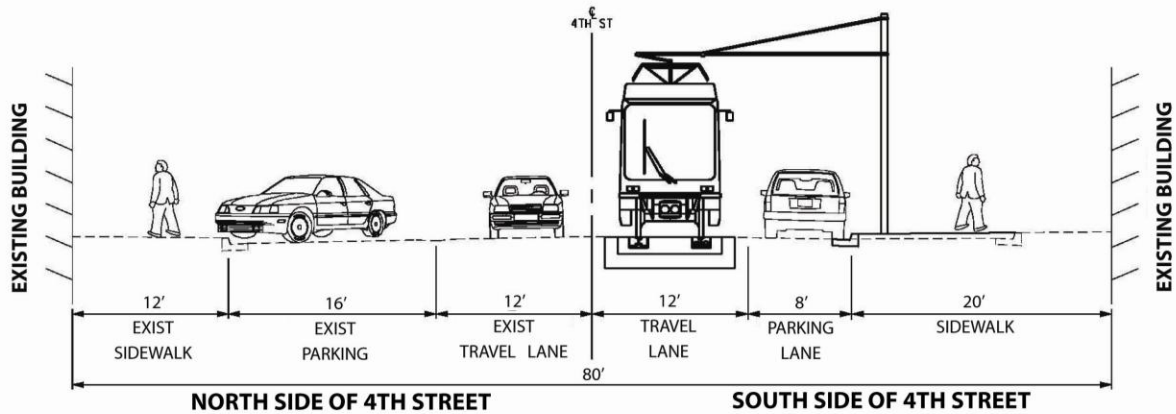
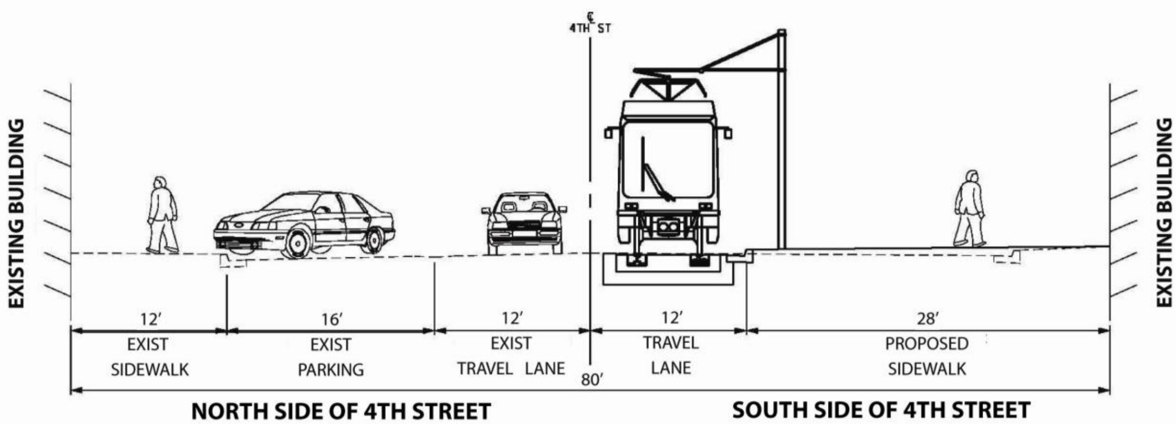


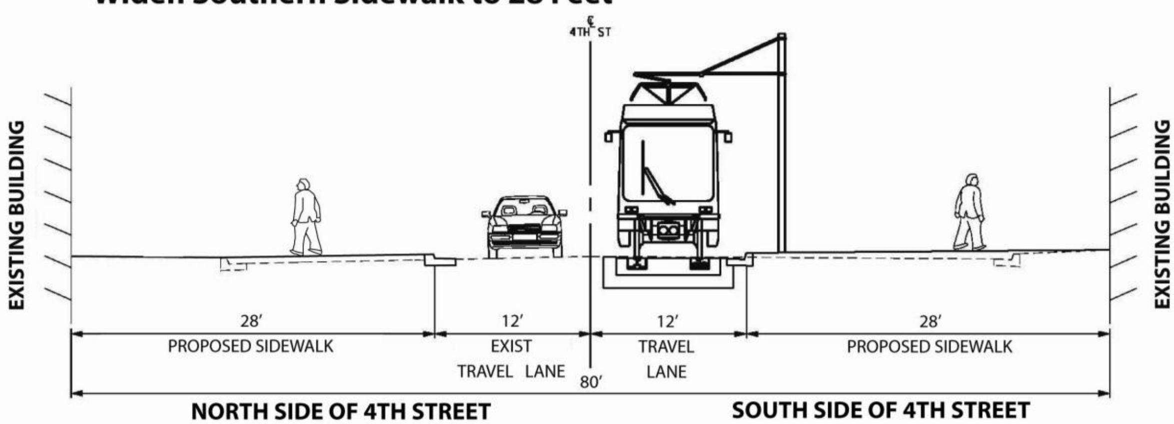
Figure 6-19: 4th Street Parking Scenarios



4th Street Parking Scenario A: Convert Parking along South Side to Parallel and Widen Southern Sidewalk to 20 Feet



4th Street Parking Scenario B: Remove Parking along South Side and Widen Southern Sidewalk to 28 Feet

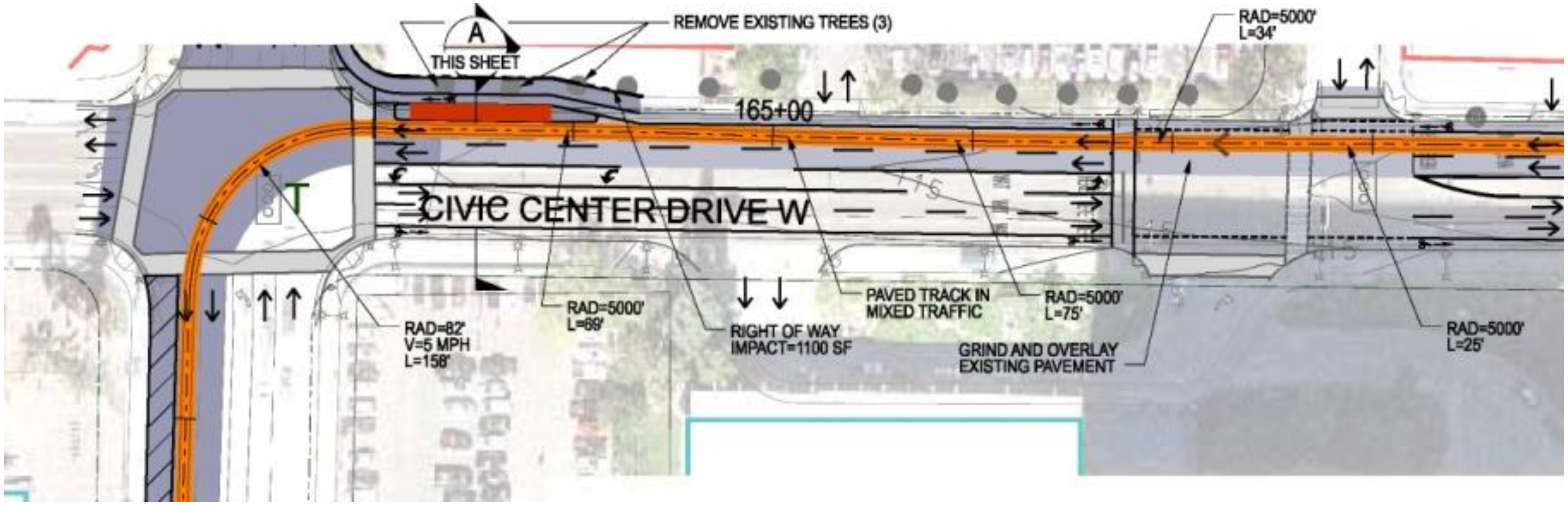


4th Street Parking Scenario C: Remove Parking along South Side and North Side and Widen Sidewalks to 28 Feet

6.2.7 Civic Center Bike Lane Design Options

The Streetcar Alternative 2 alignment travels westbound through the Civic Center along Civic Center Drive between Spurgeon and Flower Streets. As part of the City of Santa Ana's *Complete Streets Program* bicycle lanes are proposed for Civic Center Drive. Two options have been developed for Streetcar Alternative 2 on Civic Center Drive between Flower Street and Surgeon Street that would accommodate the planned bicycle lane along with streetcar and mixed-flow traffic operations: 1) Option 2A: Acquire Additional Right-of-Way (see Figure 6-20); or 2) Option 2B: Reduce Number of Westbound Travel Lanes (see Figure 6-21). In the first option, additional right-of-way would be required in the vicinity of the station platforms in order to accommodate the bike lane behind the station platform. In the second option, one westbound through traffic lane would be removed and the roadway reconfigured to allow for the bike lanes behind the platforms in the station areas.

Figure 6-20: Civic Center Drive Bike Lane Option A: Acquire Additional Right-of-Way



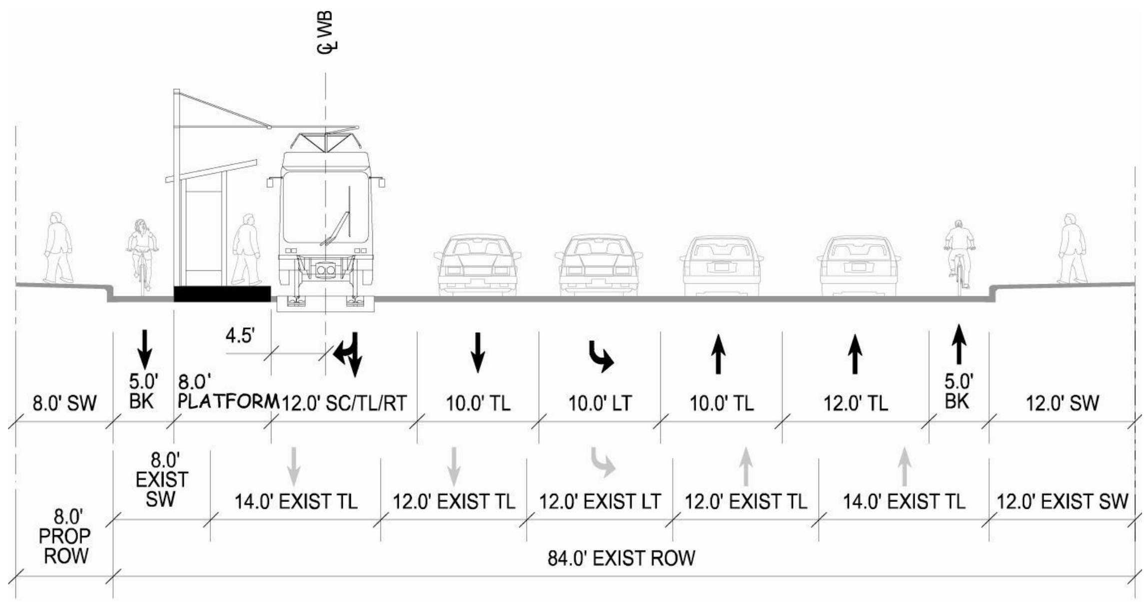
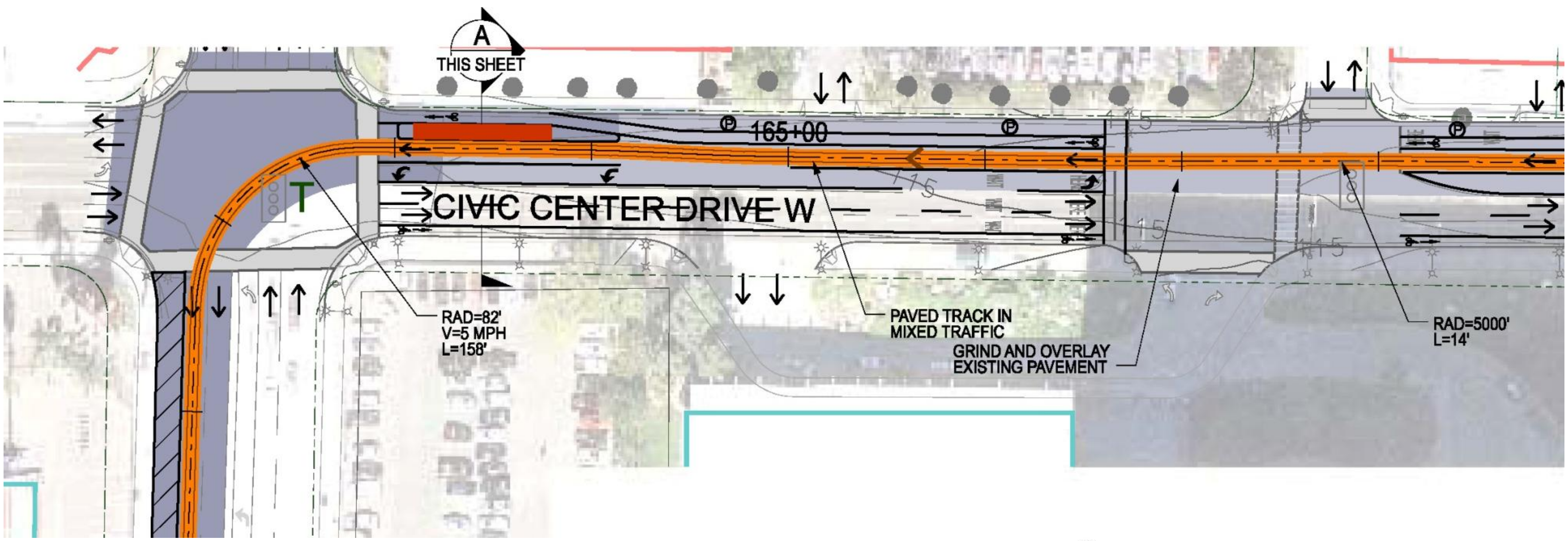
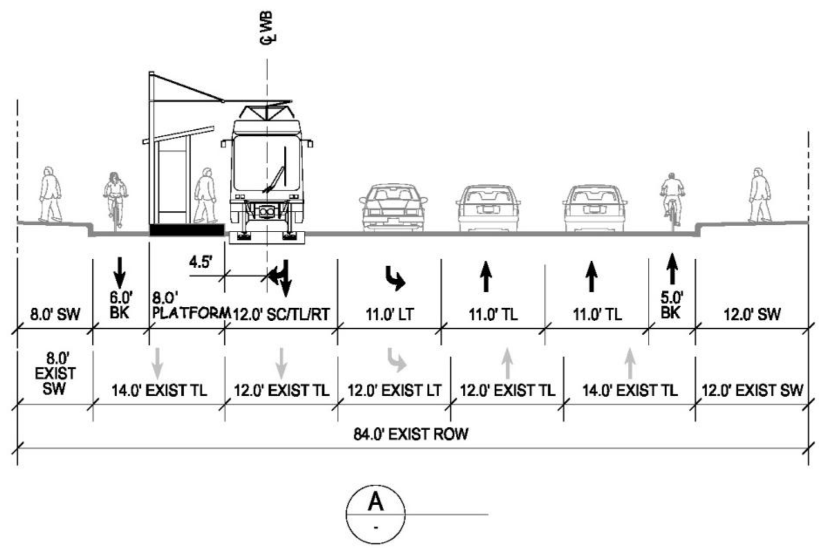


Figure 6-21: Civic Center Drive Bike Lane Option B: Reduced Travel Lanes





6.3 Initial Screening of the Design Options

This section presents the analysis of design options developed for elements of the Streetcar Alternatives and recommends those options to be carried forward. The recommendations of preferred options for two of the elements include factors beyond technical analysis and cost considerations, and also require taking into account community comment which will occur as part of the environmental review process. For that reason, no recommendation is offered for the Operations and Maintenance Facility Site Options or for the 4th Street Parking Scenarios. All options will be evaluated through the environmental review process and presented to the public for comment.

The design options for all other elements were evaluated by applying the measures of effectiveness (MOEs), which were based upon the Purpose and Need and project goals and objectives and used to evaluate the full alternatives during the stage 1 initial screening process. However, for each design option only a limited number of MOEs that most effectively illustrated the potential advantages and disadvantages of each of the design options were used. The full results of the analysis of the design options are provided in the *Detailed Evaluation of Alternatives Technical Report,* March 2012 (see Appendix A).

6.3.1 Western Terminus Analysis Results

The western terminus design options were evaluated based on four of the evaluation measures: Community Support, Right-of-Way Required, Environmental Tradeoffs, and, Capital Cost.

Option A: At-grade is the most expensive of the three options for the western terminus. Compared to the No Build conditions, it results in worsened traffic conditions at the intersection of Harbor Boulevard and Westminster Avenue, requiring additional right-of-way to accommodate intersection improvements to mitigate. The right-of-way to accommodate the alignment as well as to mitigate traffic impacts would require acquisition of three buildings, and displacement and relocation of businesses located in the buildings.

Although Option C: Truncated At-grade minimizes the need for right-of-way acquisition and costs less than the other options, it also results in worsened traffic conditions at the Harbor Boulevard/Westminster Avenue intersection, requiring mitigation.

Option B: Elevated has no right-of-way impacts, and traffic impacts related to construction of the bridge over Westminster Avenue will be short-term and temporary. The bridge structure over Westminster Avenue will alter the visual character of the area compared to No Build Conditions. However, in this densely developed, aesthetically diverse commercial corridor, the change in character as a result of the new bridge is not expected to be negative. Option B costs more than Option C but less than Option A. Option B is recommended to be carried forward.

6.3.2 Santa Ana River Crossing Analysis Results

The Santa Ana River Crossing options were evaluated based on three of the evaluation measures: Community Support, Environmental Tradeoffs and Capital Cost. Based on the evaluation of the design options, one option is recommended to be carried forward for further study in the environmental review:

- Option 4: Bridge Avoidance B - Existing bridge remains; construct new single-track bridge south of existing bridge.

Option 1: Bridge Replacement will be eliminated from further consideration because, based on the requirements of NEPA and Section 4(f), the impacts to the old bridge represent a "fatal flaw" when there is an available option that does not significantly impact the bridge as an historic resource.

Option 2: Bridge Avoidance A will be eliminated from further consideration. It failed to perform well in terms of Impact to Historic Resource because the construction of two new bridges immediately adjacent and on each side of the old bridge would obstruct the view of the old bridge and alter the visual setting. Option 2 was also incompatible with future plans and improvements within the PE ROW, and would necessitate acquisition of considerable additional right-of-way with potential community impacts if future improvements were to be accommodated.

Option 3: Bridge Relocation will be eliminated for the same reason as Option 1. The impacts of relocating and repurposing the bridge would create a potentially significant impact to an historic resource under Section 4(f).

6.3.3 Sasscer Park Analysis Results

The Sasscer Park design options were evaluated based on six of the evaluation measures: Community Support, Transit Benefit to Existing Land Use, Right-of-Way required, Environmental Tradeoffs, Travel Time and Capital Cost.

Option A: Direct Route is the shorter route, thereby providing a 1:38 minute travel time advantage compared to Option B: Curved Route. Option A provides greater potential benefit of accessibility and visibility to existing adjacent commercial land uses than Option B and is estimated to cost approximately $2.3 million less than Option B. It is therefore recommended to be carried forward.

6.3.4 Civic Center Bike Lane Analysis Results

The Civic Center Bike Lane design options were evaluated based on three of the evaluation measures: Community Support, Environmental Tradeoffs and Capital Cost.

By removing one westbound travel lane, Option B significantly impacts traffic conditions along Civic Center Drive resulting in the level of service at the intersection of Civic Center

Drive at Flower Street deteriorating for LOS E to F. These impacts cannot be fully mitigated because of constraints posed by commercial and institutional development immediately behind the public rights-of-way on all four corners. Option A is more expensive than Option B (approximately $3.3 million more) in part due to the need to acquire right-of-way, including an existing business at Civic Center Drive and Main Street which will require relocation. However, Option A does not result in any adverse impacts that cannot be mitigated. Option A is recommended to be carried forward. Further detail on the evaluation of these options can be found in Section 6.7.2 of the *Detailed Evaluation of Alternatives Report.*

6.3.5 Findings and Recommendations

The Streetcar Alternative Design Options that are recommended to be included in the Streetcar Alternatives are summarized in Table 6-4.

Table 6-4: Design Options Analysis Recommendations

DESIGN OPTION	RECOMMENDED OPTION?
Western Terminus Design Options	
Option A: At-grade	No
Option B: Elevated	**Yes**
Option C: Truncated At-grade	No
Santa Ana River Crossing	
Option 1: Bridge Replacement	No
Option 2: Bridge Avoidance A	No
Option 3: Bridge Relocation	No
Option 4: Bridge Avoidance B	**Yes**
Sasscer Park Design Options	
Option 1A: Direct Route	**Yes**
Option 1B: Curved Route	No
Civic Center Bike Lane Design options	
Option 2A: Parking Removal and Additional Right-of-way to Accommodate Bike Lane and Streetcar Platforms	**Yes**
Option 2B: Reduce Number of Westbound Travel Lanes to Accommodate Bike Lane and Streetcar Platforms	No

7.0 COMPARATIVE EVALUATION OF ALTERNATIVES

The alternatives and design options evaluated in Section 7 also undergo a full environmental benefits and impacts analysis in the complementary Draft EIR/EA. See that document for further details on the alternatives/options environmental benefits and impacts.

7.1 Detailed Evaluation of Design Options

The previous section described the Design Options identified to address several elements of the Streetcar Alternatives. An initial screening identified clear advantages or disadvantages for some of the options under consideration, resulting in a recommendation of the options to be carried forward for further study. Two of the elements for which design options have been identified are sufficiently complex that, while the technical analysis and evaluation of these options provided useful information in considering the advantages and disadvantages of each, the analysis conducted as part of the environmental review process and the accompanying public comment is needed support the selection of the preferred option. The two elements requiring additional analysis of their design options are the Operations and Maintenance Facility Site options and the 4th Street Parking scenarios.

7.1.1 Operations and Maintenance Facility Site Options

Two sites have been proposed as possible candidate locations for the streetcar operations and maintenance facility. Site A is located south of SARTC at the corner of Santiago Street and 6th Street (see Figures 6-13 through 6-15 presented previously). The 2.2 acre site is currently being used as a material recovery/disposal transfer station. Site B is located between 5th Street and the PE ROW, west of Raitt Street (see Figures 6-13, 6-16 and 6-17 presented previously). This 2.4-acre rectangular site is comprised of three parcels. A materials reclamation/recycling facility is on the two eastern parcels. The western-most parcel has several residences. All three parcels are zoned "Industrial".

Site A: Near SARTC

Community Support – Evaluated on a scale of 0 to 3 with 0 indicating no community support and 3 indicating strong community support, Site A received a 3. The residents to the north and west of Site A expressed strong support for the proposed acquisition of Site A, which currently houses the Santa Ana Materials Recovery Facility (a waste disposal transfer station) and redevelopment of the site as a streetcar maintenance facility. The odors associated with the current activities on the site and, to a lesser degree, the noise generated by traffic and daily site operations have made the transfer facility an unpopular neighbor. The City of Santa Ana also supports location of the maintenance facility at Site A as consistent with their Rail Station District Plan and Transit Zoning Code for the area.

Right-of-Way Required – Site A would require acquisition of the property at 1035 E. 4th Street in Santa Ana (approximately 95,832 square feet). The existing recycling center/waste transfer facility would be relocated.

Environmental Tradeoffs – In evaluating the environmental tradeoffs for the candidate maintenance facility sites, two environmental issues areas were considered: 1) Acquisition, Displacement and Relocation; and 2) Noise and Vibration.

Acquisition, Displacement and Relocation: Compared to the No Build condition, Site A is worse in terms of acquisition, displacement and relocation. It would require acquisition of the waste transfer facility, resulting in displacement of this business and the need to relocate.

Noise/Vibration: Site A would not result in changes in noise levels compared to the No Build condition. The existing transfer facility accommodates a high volume of truck traffic and heavy equipment operations as part of its daily business activities. The streetcar maintenance facility would not result in increased noise levels compared to the existing facility, and may have reduced noise levels. In addition there are no sensitive receptors located near this site.

Ease of Transit Operations – Site A is smaller and more irregularly shaped than Site B. As a result, the layout of the proposed operations and maintenance facility is more constrained and provides for slightly less ease of transit operations compared to Site B.

Capital Cost – Acquisition of Site A and construction of the operations and maintenance facility at that location is estimated to cost approximately $38.4 million or approximately $12.0 million more than Site B.

Site B: Near Raitt Street

Community Support – Evaluated on a scale of 0 to 3 with 0 indicating no community support and 3 indicating strong community support, Option B received a 0. While there has been no expression of opposition to locating the operations and maintenance facility at Site B, there has been no expression of support either. The City of Santa Ana is less interested in Site B than Site A as the potential location of the facility.

Right-of-Way Required – Site B would require acquisition of three privately-owned parcels totaling approximately 104,544 square feet. Site B is approximately 8,712 square feet larger than site A.

Environmental Tradeoffs – Acquisition, Displacement and Relocation: Compared to the No Build condition, the Site A is notably worse in terms of acquisitions, displacements and relocation. Of the three parcels that would be acquired to accommodate the operations and maintenance facility at Site B, two currently house a materials reclamation/recycling facility. The third parcel has multi-family residential development (several small residential structures on the single parcel. The business and the residents would be displaced and require relocation as part of the acquisition of Site B.

Noise/Vibration: Noise and vibration is estimated to be somewhat worse with the operations and maintenance facility at Site B compared to the No Build condition, although design features would reduce noise to a level that is less than significant for sensitive receptors (residential properties) located north of 5th Street.

Ease of Transit Operations – Site B provides superior transit operations compared to Site A. The larger size and rectangular shape of the site provide for an optimal access, circulation and layout of facilities.

Capital Cost – Acquisition of Site B and construction of the operations and maintenance facility at that location is estimated to cost approximately $26.4 million, or approximately $12.0 million less than Site A.

Conclusions and Recommendations
Site A is slightly smaller than Site B and irregularly shaped, making the ease of operations somewhat less than with Site B. Site A is also more expensive than Site B. However it offers advantages in terms of environmental tradeoffs. It would not result in the displacement of any residents. It also would not create additional noise compared to existing conditions and may in fact reduce noise somewhat. Site A is consistent with adopted land use plans and policies of the City of Santa Ana. The environmental review process and accompanying public comment will further discern the relative advantages and disadvantages of each of these options and support the selection of the preferred option.

7.1.2 4th Street Parking Scenarios

The Streetcar 1 alignment would utilize 4th Street between Ross Street and Mortimer Street in the westbound direction. From east of Ross Street to French Street, 4th Street has one travel lane in each direction with head-in diagonal parking along each side of the roadway. The diagonal parking, with vehicles exiting parking spaces by backing into the travel lane, is incompatible with reliable streetcar operations. Three design options were identified to address the diagonal parking on 4th Street, shown previously on Figure 6-19 and described below:

- Scenario A: Convert the diagonal parking along the south side of 4th Street to parallel parking and widen the sidewalk along the south side from 12 feet to 20 feet.
- Scenario B: Remove the diagonal parking along the south side of 4th Street and widen the sidewalk along the south side from 12 feet to 28 feet.
- Scenario C: Remove the diagonal parking along both sides of 4th Street and widen the sidewalks along both sides from 12 feet to 28 feet. In this option, only the

parking removal and sidewalk widening along the south side would be included in the cost of the project since the streetcar will only operate on the south side (eastbound direction) of the street. The City of Santa Ana would pursue alternative funding to construct the improvements to the north side.

Scenario A: South Side Parallel Parking

Community Support – There has been little community comment to provide a basis to evaluate community support for this scenario, however, concern has been expressed by some members of the Downtown business community regarding the removal of existing on-street parking. This alternative would retain all of the on-street parking along the north side of 4th Street and convert the diagonal parking along the south side of 4th Street to a limited number of parallel parking spaces. Therefore, this scenario may better address those concerned with the loss of on-street parking.

Environmental Tradeoffs - In evaluating the environmental tradeoffs for the 4th Street parking design scenarios, four environmental issues areas were considered: 1) Traffic and Circulation, 2) Parking, 3) Bicycle and Pedestrian Facilities; and 4) Construction Impacts (Temporary).

Traffic/Circulation: Conversion of diagonal parking to parallel parking on the south side of 4th Street creates additional opportunities for conflicts/traffic delay for eastbound traffic on 4th Street as compared to the No Build condition

Parking: Between Ross Street and French Street, parking on the south side of 4th Street would be reconfigured, resulting in a loss of about 26 spaces.

Bicycle and Pedestrian Facilities: Sidewalks would be widened on the south side of 4th Street from 12 feet to about 20 feet, enhancing the pedestrian environment compared to the No Build.

Construction Impacts (Temporary): Construction work associated with sidewalk widening and reconfiguration of parking would result in minor disruption to business access as well as annoyance/inconvenience to patrons along the south side of 4th Street.

Ease of Transit Operations – The parallel parking along the south side of 4th Street would be an improvement compared to the existing diagonal parking since automobiles will not need to back into the travel lane to exit the parking space. However, the continued presence of on-street parking means that drivers will stop in the travel lane to wait for a driver that is exiting a space, and then need to maneuver into the parallel parking space. This activity will disrupt traffic flow along 4th Street and creating traffic delay and potential delay for the streetcar as well.

Capital Cost – Scenario A would cost approximately $1.3 million.

Scenario B: South Side Parking Removal

Community Support – As described in Scenario A, there has been little community comment on the 4th Street parking scenarios. Concern has been expressed by some members of the Downtown business community regarding the removal of existing on-street parking, and this scenario would remove all on-street parking along the south side of 4th Street. There has also been support expressed for the opportunity to widen the sidewalks along 4th Street and Scenario B would provide for the widening of sidewalks along the south side of 4th Street by 8 feet resulting in 20 feet wide sidewalks.

Environmental Tradeoffs – Traffic/Circulation: Removal of parking on the south side of 4th Street reduces opportunities for conflicts/traffic delay for eastbound traffic on 4th Street as compared to the No Build condition.

Parking: Between Ross Street and French Street, parking on the south side of 4th Street would be removed, resulting in a loss of about 77 spaces.

Bicycle and Pedestrian Facilities: Sidewalks would be widened on the south side of 4th Street from 12 feet to about 28 feet, enhancing the pedestrian environment.

Construction Impacts (Temporary): Construction work associated with sidewalk widening and removal of parking would result in minor disruption to business access as well as annoyance/inconvenience to patrons along the south side of 4th Street.

Ease of Transit Operations – The elimination of on-street parking along the south side of 4th Street would remove a potential source of conflict between automobiles and the streetcars, as well as eliminating a major source of traffic disruption and delay along eastbound 4th Street as drivers wait for and maneuver into and out of parking spaces.

Capital Cost – Scenario B would cost $1.5 million.

Scenario C: South Side and North Side Parking Removal

Community Support – As described in Scenarios A and B, there has been little community comment on the 4th Street parking scenarios. Concern has been expressed by some members of the Downtown business community regarding the removal of existing on-street parking, and this scenario would remove all on-street parking along 4th Street. There has also been support expressed for the opportunity to widen the sidewalks along 4th Street and this scenario would provide for the widening of sidewalks along both sides of 4th Street by 16 feet resulting in 28 feet wide sidewalks.

Environmental Tradeoffs – Traffic/Circulation: Removal of parking on both the north side and south side of 4th Street reduces opportunities for conflicts/traffic delay for traffic on 4th Street as compared to the No Build condition.

Parking: Between Ross Street and French Street, parking on the south side and the north side of 4th Street would be removed, resulting in a loss of about 132 spaces.

Bicycle and Pedestrian Facilities: Sidewalks would be widened on the south side of 4th Street from 12 feet to about 28 feet.

Construction Impacts (Temporary): Construction work associated with sidewalk widening and removal of parking would result in minor disruption to business access as well as annoyance/inconvenience to patrons along both sides of 4th Street.

Ease of Transit Operations – The removal of all on-street parking along 4th Street between Ross and French Streets would improve traffic flow along this roadway and reduce potential sources of traffic-related delay impacting streetcar operations.

Capital Cost – Scenario C would cost $3.1 million. But because the streetcar project would only operate in the eastbound direction along 4th Street, removal of the diagonal parking is only required along the south side of 4th Street. Therefore, only $1.5 million of the estimated cost of Scenario C would be included as a project cost. The City of Santa Ana would obtain alternate funding to complete the parking removal and improvements along the north side of 4th Street.

Conclusions and Recommendations

Overall, the benefits of removing all of the on-street parking and widening the sidewalks (Scenario C) are greater than under the two scenarios that only reduce or remove some of the parking. Scenario C would enhance the pedestrian character of 4th Street to the benefit of restaurants, cafes, shops and other adjacent businesses. Traffic flow along 4th Street would be improved, allowing for more reliable streetcar operations and reduced potential for conflicts between automobiles and streetcars. Although approximately 132 on-street parking spaces would be eliminated under Scenario C, there is adequate parking available in nearby parking structures located just off and accessible from 4th Street. However, the environmental review process and accompanying public comment will further discern the relative advantages and disadvantages of each of these options and support the selection of the preferred option.

7.2 Detailed Evaluation of Alternatives' Screening Criteria

The five screening criteria used to evaluate the Project Alternatives relate directly to the Purpose and Need and the goals and objectives for the Project, and they are similar with those used in the first stage of the initial screening. The measures of effectiveness identified for each criterion to be applied in the detailed evaluation were refined for the Detailed Evaluation to better highlight the distinguishing characteristics of each of the Project Alternatives as presented in Table 7-1.

Table 7-1: Detailed Evaluation Criteria and Measures of Effectiveness

SCREENING CRITERIA	MEASURES OF EFFECTIVENESS
Accessibility/Livability	Number of transit-dependent households within ¼ mile of the alignment
	Ridership
Economic Development, Transit Supportive Land Use and Community Goals	Assessment of the transit supportiveness of land uses served by the project
	Assessment of economic development opportunities of parcels served by the project
	Community Support
Environmental Responsibility and Sustainability	Amount of right-of-way required
	Environmental tradeoffs
Travel Benefits, Choice and Reliability	Customer service (route travel times between O-D pairs)
Cost and Financial Feasibility	Capital cost estimate
	Capital cost per route mile
	Estimated annualized operating cost
	Estimated operating cost per hour

7.3 Detailed Evaluation Results for the Alternatives

The following sections describe the results of applying the criteria and measures of effectiveness to the reduced set of alternatives for the Santa Ana-Garden Grove Fixed Guideway Corridor. A more detailed description of the detailed evaluation in provided in the *Detailed Evaluation of Alternatives Technical Report,* March 2012 (see Appendix A).

7.3.1 Accessibility and Livability

Number and Percent of Transit Dependent Households within 1/4 Mile of Alignment - Transit-dependent households were defined as households without an automobile, based on the Orange County Projections 2006 (OCP2006) data used by OCTA in their Orange County Transportation Analysis Model (OCTAM) travel forecasting tool. Households with

6 or more people in the household and only one automobile have also been considered in this analysis. Table 7-2 summarizes the number of 0-auto and 1-auto per 6+person households within 1/4 mile of the proposed alignments in 2008 and 2035.

Table 7-2: Summary of 0-Auto and 1-Auto/6+ Person Households within 1/4 Mile of Alignment

	TSM		STREETCAR ALTERNATIVE 1		STREETCAR ALTERNATIVE 2	
	0 AUTOS	1-AUTO, 6+PERSONS	0 AUTOS	1-AUTO, 6 +PERSONS	0 AUTOS	1-AUTO, 6+PERSONS
2008	1,059	746	1,302	881	1,200	825
2035	2,300	829	2,813	963	2,598	901

Source: Orange County Projections 2006.

In 2008, approximately 28 percent of households, or 2,183 households within 1/4 mile of the Streetcar Alternative 1 alignment were transit dependent (approximately 1,302 0-auto households and 881 1-auto with 6+ people households). The Streetcar Alternative 1 alignment would serve approximately 378 more currently transit dependent households than the TSM alternative and approximately 158 more households than Streetcar Alternative 2. By 2035, the Streetcar Alternative 1 alignment is estimated to serve approximately 3,776 transit dependent households located within 1/4 mile of the alignment. This is approximately 647 more households than served by the TSM alignment, and 277 more households than served by Streetcar Alternative 2.

Ridership - Travel demand forecasts were developed using the Orange County Transportation Analysis Model (OCTAM) 3.3. OCTAM is a conventional four-step regional model that has been developed and applied to support transportation infrastructure planning and design in Orange County. OCTAM shares the same model components as the Southern California Association of Governments (SCAG) Regional Model but has more detailed networks and zone structure within Orange County. A more detailed discussion of the methodology applied in developing the travel demand and ridership forecasts is provided in the *Santa Ana-Garden Grove Fixed Guideway Corridor Travel Demand Model Methodology Report*, April 2012 (see Appendix B).

Given the uncertainty inherent with any twenty year forecast and the characteristics of the streetcar mode, a risk analysis approach was applied in developing the forecasts. Ridership estimates were developed for low end and high end scenarios. For the low end forecasts, the streetcar was modeled as a local bus (mode 15) in OCTAM. However, instead of using OCTAM's standard local bus-speed to auto speed relationships, station-to-station travel times used rail run time simulations created for the each streetcar alternative.

To produce the upper end of the range of ridership forecasts for the streetcar, the urban rail mode (mode 18) was used to represent the streetcar in OCTAM. The streetcar possesses some of the qualities of urban rail. Streetcars look like light rail transit (LRT) vehicles with low floors and electrical power being delivered via overhead catenary wires. Acceleration and deceleration characteristics are also similar to LRT, providing improved ride quality compared to bus. There are other intangible characteristics that may contribute to rider preference for rail over bus. Since OCTAM's mode choice model does not currently have a streetcar mode, urban rail was used as a proxy for streetcar. Table 7-3 shows the resulting average weekday ridership forecast for the alternatives.

Table 7-3: 2035 Ridership Forecasts

ALTERNATIVE	BOARDINGS ON PROJECT ROUTE	
	LOW FORECAST	HIGH FORECAST
No Build	N/A	N/A
TSM*	3,085	N/A
Streetcar Alternative 1	3,770	8,410
Streetcar Alternative 2	3,020	6,425
Streetcar IOS 1	2,012	4,490
Streetcar IOS 2	1,540	3,280

Source: OCTAM 3.3 modified for the Santa Ana-Garden Grove Fixed Guideway Corridor.
*Boardings for TSM Alternative route between SARTC and Harbor Boulevard.

Streetcar Alternative 1 is estimated to have the highest daily ridership of the Build Alternatives, attracting between 3,770 and 8,400 riders. At the low end, this represents approximately 22 percent more riders than the TSM Alternative route between SARTC and Harbor Boulevard; at the high end, it represents approximately 172 percent more riders than with the TSM alternative. Streetcar 1 IOS is estimated to have approximately 2,012 to 4,490 daily boardings, or approximately 47 percent fewer riders than the full alignment.

At the low end, Streetcar Alternative 2 ridership would be equivalent to the TSM Alternative. At the high end, it would have approximately 108% more riders than the TSM Alternative route between SARTC and Harbor Boulevard. The Streetcar 2 IOS is estimated to have approximately 1,540 to 3,280 daily boardings, or approximately 47 percent fewer than the full alignment.

7.3.2 Economic Development, Transit Supportive Land Uses and Community Goals

Assessment of the Transit Supportiveness of Land Uses Served by the Alignment - The qualitative assessment of the transit supportiveness of land uses served by the project focuses on the land uses that front along the proposed alignments. In this way this measure assesses not only the degree to which an alignment serves adjacent land uses, but also the degree to which the land uses adjacent to the corridor contribute to a transit supportive environment.

The block faces within the corridor for each alignment were measured. The existing land uses along both sides of the alignment were inventoried by block. Each block was then rated based on the transit supportiveness of the land uses along each side of the block: "More Favorable" (1), "Neutral" (0), or "Less Favorable" (-1). Table 7-4 provides examples of study area land uses that would be considered More Favorable, Neutral and Less Favorable.

Table 7-4: Transit Supportiveness of Land Uses

MORE FAVORABLE	NEUTRAL	LESS FAVORABLE
High Density Residential	Medium Density Residential	Single Family Residential
Mixed Use Development	Transitional Commercial	Industrial
Business Frontage	Open Space/ Parks	Non-Public Serving Government Offices
High Rise Office	Low Rise Office - 2-3 Sty	
Public-serving Government Offices	Churches/schools	

The rating for each side of each block was multiplied by the length of the block. The results were summed for each alternative. The result was a transit supportiveness index that reflects not just the linear feet of transit supportive land uses along an alignment, but also the amount of land use that is not particularly favorable to transit. Table 7-5 summarizes the results of the analysis and ranks the alternatives in terms of the transit supportiveness of adjacent land uses.

Streetcar Alternative 1 has the best favorability value of the three alternatives and ranked the highest among the alternatives in terms of the transit supportiveness of the existing land uses that fronted along the alignment. This is because the alignment of Streetcar Alternative 1, from SARTC to Bristol Street has land use densities and development patterns which are highly conducive to a successful transit system. This alignment benefits from the transit-oriented, higher-density residential development in the vicinity of SARTC and along Santa Ana Boulevard between Santiago and Spurgeon Street. Also, the segment of Streetcar Alternative 1 along 4th Street, lined with ground floor commercial in historic multi-story office buildings, and multiple-family residential development represents a highly favorable environment for a transit system. The size, scale and mix of uses along 4th Street and the adjacent parallel streets that comprise the Downtown, make this area a very walkable residential and commercial district with the streetcar providing much needed areawide access.

Table 7-5: Transit Favorability Index

ALTERNATIVE	RANKING	TRANSIT SUPPORTIVENESS OF EXISTING LAND USES FRONTAGE (linear feet)		
		MORE FAVORABLE	NEUTRAL	LESS FAVORABLE
TSM	2	18,245	10,065	21,060
		37.0%	20.4%	42.7%
Streetcar Alternative 1 (Santa Ana Blvd./4th St.)	1	21,110	4,980	23,320
		42.7%	10.1%	47.2%
Streetcar Alternative 2 (Santa Ana Blvd./Civic Center Dr./5th St.)	3	17,288	5,905	25,397
		35.6%	12.2%	52.3%

The Streetcar Alternative 2 alignment does not provide the densities or types of land uses that are as transit-favorable as those along the Streetcar Alternative 1 alignment. As a result, the transit favorability rating is considerably lower than the other two alternatives.

Assessment of the Economic Development Opportunities of Parcels Served by the Alignment - The assessment of economic development opportunities along the Build Alternatives' alignments considered the General Plan land use designations and the zoning of parcels along each alignment. It also considered whether location along a high capacity transit route would be favorable to the type of development permitted under existing adopted plans thereby encouraging development/redevelopment opportunities ahead of parcels located elsewhere. Compared to the previous measure which evaluated existing land uses, this measure considers the potential future land use patterns along the alignments.

The land use designations of parcels fronting along the alignments of each of the alternatives were determined from adopted plans. The land use designations which would benefit from location along a high capacity transit corridor were determined using Table 7-4, presented previously. For example, parcels designated as high-density residential, High rise office, or mixed-used development were considered to be "more favorable";medium-density residential and low-rise office were considered "neutral"; and, land uses such as industrial and single-family residential were considered to be "less favorable". Parcels were identified as "very favorable" if they had a "favorable" land use designation, and they were located within the City of Santa Ana's Transit Zoning Code area. Policies within the Transit Zoning Code are intended to foster transit supportive and transit oriented development and redevelopment within the eastern portion of the study area.

Applying the same methodology used to determine the transit supportiveness of existing land uses along the alignments, the economic development favorability index for each alternative was calculated. The alternatives were ranked in terms of their overall economic development favorability. Table 7-6 summarizes the results of the analysis.

Table 7-6: Economic Development Favorability of Parcels along the Alignment

ALTERNATIVE	RANKING	ECONOMIC DEVELOPMENT OPPORTUNITY OF FRONTING PARCELS (linear feet)			
		VERY FAVORABLE	MORE FAVORABLE	NEUTRAL	LESS FAVORABLE
TSM	3	5,080	11,580	7,180	28,070
		9.8%	22.3%	13.8%	54.1%
Streetcar Alternative 1 (Santa Ana Blvd./4th St.)	1	12,295	11,495	2,730	22,890
		24.9%	23.3%	5.5%	46.3%
Streetcar Alternative 2 (Santa Ana Blvd./Civic Center Dr./5th St.)	2	10,480	13,846	2,730	24,824
		20.2%	26.7%	5.3%	47.8%

The TSM Alternative which ranked second in terms of its existing land uses, ranked lowest of the three alternatives in terms of economic development opportunity. Development/redevelopment opportunities are more limited along the TSM alignment which is substantially fronted by Institutional, Low-Density Residential, Medium Density Residential, General Commercial and Industrial land use designated area. It is unlikely that adopted plans and policies coupled with the improved bus service provided by the TSM alternative would be sufficient to stimulate significant levels of economic development along this alignment.

Streetcar Alternative 1 is ranked first among the alternatives in terms of the economic development potential of fronting land use parcels. The eastern portion of the alignment (east of Flower Street) is within the City of Santa Ana's Transit Zoning Code area. The types and densities of land use permitted under the Transit Zoning Code create significant development opportunity along the Streetcar Alternative 1 alignment that would benefit from location along a high-capacity transit route. This is particularly true through the Downtown area where the Transit Zoning Code would allow renovation of existing historic buildings for high density residential and mixed use development. Both cities are open to considering the redevelopment of Willowick Golf Course at the western end of the alignment. A high capacity transit corridor could provide considerable inducement to redevelopment of Willowick.

Streetcar Alternative 2 ranked second on economic development opportunity among the alternatives. Compared to Streetcar Alternative 1, Streetcar Alternative 2 includes the Civic Center Drive loop, where, as described previously, redevelopment opportunities are more limited due to the existing institutional uses on the south side of Civic Center Drive. Streetcar Alternative 2 also includes 5th Street. 5th Street through the Downtown is unlikely to redevelop in the near- to mid-term even though it is within the Transit Zoning Code area. A high capacity transit corridor offers little benefit to land uses such as the

Ronald Reagan Federal Building and Courthouse parking garage, the AT&T District Office and the parking garage for the East End Promenade (formerly the Fiesta Marketplace).

7.3.3 Environmental Responsibility and Sustainability

Amount of Additional Right-of-Way Required - The Santa Ana-Garden Grove Fixed Guideway is proposed to operate substantially within public right-of-way, in mixed flow traffic along city streets, or within an exclusive guideway in the PE ROW. While some “slivers” of right-of-way are required to accommodate platform areas or transitions from one roadway to another, the only element of the proposed system which requires significant amounts of additional right-of-way is the maintenance facility. The maintenance facility site, located near SARTC south of Santiago and 6th Streets, is a single parcel of approximately 95,832 square feet.

In Streetcar Alternative 1, approximately 9,110 square feet of additional right-of-way is required from the surface parking area at SARTC in order to accommodate two fixed guideway tracks and a center platform at the Eastern Terminus at SARTC.

Small amounts of additional right-of-way are required in Streetcar Alternative 2 in the vicinity of the station/stops in order to accommodate the bike lanes along Civic Center Drive. Table 7-7 shows the additional right-of-way required by each of the alternatives.

Table 7-7: Right-of-Way Required (Square Feet)

ALTERNATIVE	RIGHT-OF-WAY REQUIRED* (square feet)
TSM	0
Streetcar Alternative 1 - Assuming: • Western Terminus Option B: Elevated • Santa Ana River Crossing Option A: Bridge Avoidance B • Sasscer Park Option A: Direct Route	98,570 - 107,281
Streetcar Alternative 2 - Assuming: • Western Terminus Option B: Elevated • Santa Ana River Crossing Option A: Bridge Avoidance B • Civic Center Bike Lane Option A: ROW Acquisition and Parking Removal	121,259 - 129,970

*Right-of-way square footage range is based on whether Site A or Site B is selected for the maintenance facility.

Environmental Tradeoffs - This analysis is intended to convey “big picture,” comparative information for the alternatives as a whole. While the summary description of these environmental trade-offs is drawn from the technical environmental studies that were prepared for the project, its use and purpose is different from the detailed information that is presented in the draft (CEQA/NEPA) environmental documents. Among other things, the purpose of the draft environmental documents is to help determine if the proposed project is expected to result in an adverse effect or a significant adverse impact, and to identify project features/measures needed to avoid, minimize, or mitigate potential environmental impacts. The summary of key environmental trade-offs presented in Table 7-8 is intended to point out any major differences among the alternatives that do not necessarily rise to the level of a significant adverse or beneficial impact. Table 7-8 summarizes and highlights some of the key environmental distinguishers among the Build Alternatives under future conditions (Year 2035). The Build Alternatives were comparatively rated against the No Build Alternative in the following environmental issue areas:

- Visual/Aesthetics
- Air Quality
- Cultural resources
- Noise and Vibration
- Traffic and Circulation
- Parking
- Bicycle and Pedestrian Circulation
- Land Use
- Acquisitions, Displacement and Relocations
- Parkland and Recreation Areas
- Environmental Justice

The information presented in Table 7-8 presumes that the project features and measures that have been identified through the environmental analyses in order to avoid, minimize or mitigate potential environmental impacts are included as part of the proposed alternatives (TSM Alternative, Streetcar Alternative 1, and Streetcar Alternative 2). Unless otherwise noted, the potential environmental tradeoffs (both positive and adverse) of the TSM Alternative and the two Streetcar Alternatives reflect how they compare to the No Build Alternative.

The TSM Alternative would generally result in no change compared to the No Build alternative, except in four issue areas where the TSM Alternative is estimated to result in somewhat better conditions. The areas anticipated to be somewhat better include Air Quality, Bicycle and Pedestrian Circulation, Land Use and Environmental Justice. This is to be expected since the TSM Alternative does not include any significant infrastructure improvements or construction, only bus transit service enhancements.

Table 7-8: Summary of Environmental Trade-Offs

Rating System: Notably Worse (red) | Worse (orange) | Somewhat Worse (yellow) | Same/No Change (white) | Somewhat Better (light green) | Better (green)

ENVIRONMENTAL ISSUE AREA	NO BUILD ALTERNATIVE	TSM ALTERNATIVE	STREETCAR ALTERNATIVE 1	STREETCAR ALTERNATIVE 2
Visual/Aesthetics	Same/No Change	Same/No Change	Somewhat Worse	Somewhat Worse
Air Quality	Somewhat Better	Somewhat Better	Somewhat Better	Somewhat Better
Cultural Resources	Same/No Change	Same/No Change	Somewhat Worse	Somewhat Worse
Noise and Vibration	Same/No Change	Same/No Change	Somewhat Worse	Somewhat Worse
Traffic and Circulation	Somewhat Worse	Same/No Change	Same/No Change	Same/No Change
Parking	Same/No Change	Same/No Change	Worse	Somewhat Worse
Bicycle and Pedestrian Circulation	Somewhat Better	Somewhat Better	Better	Better
Land Use	Same/No Change	Somewhat Better	Better	Better
Acquisitions, Displacement and Relocations	Same/No Change	Same/No Change	Somewhat Worse	Somewhat Worse
Parkland and Recreation Areas	Same/No Change	Same/No Change	Same/No Change	Same/No Change
Environmental Justice	Same/No Change	Somewhat Better	Better	Better

Source: URS Corporation, January 2011

The two Streetcar Alternatives are similar in comparison to the No Build. Conditions related to Bicycle and Pedestrian Circulation, Land Use and Environmental Justice are estimated to benefit from the Streetcar Alternatives or be better compared to the No Build. Air Quality is estimated to be somewhat better compared to the No Build. Visual/ Aesthetics, Noise and Vibration, and Acquisitions, Displacement and Relocations are expected to be somewhat changed for the worse compared to the No Build Alternative. Cultural Resources will be somewhat changed for the worse, primarily due to the new single-track bridge somewhat obstructing the view of the old Pacific Electric Santa Ana

River Bridge from the south. Under Streetcar Alternative 1, parking conditions will be worse compared to the No Build Alternative due to the proposed removal of parking along limited areas of Santa Ana Boulevard, and on 4th Street. Under Streetcar Alternative 2, this change is estimated to be only somewhat worse because parking removal is limited to Santa Ana Boulevard.

7.3.4 Travel Benefits, Choice and Reliability

Customer Service as Measured by Route Travel Times between Key Origin-Destination Pairs - A key aspect of Customer Service is the effectiveness of an alternative in moving passengers to their destinations, as measured by travel times between key origin-destination pairs.

The following key origin-destination (O-D) pairs were identified:

- Santa Ana Regional Transportation Center (SARTC) to Harbor Boulevard/Westminster Avenue;
- SARTC to Orange County Superior Court;
- SARTC to Reagan Federal Building and Courthouse;
- Lacy Neighborhood to Santa Ana College; and
- Spurgeon Park to East End Promenade.

For the TSM alternative, in-vehicle travel times were obtained from OCTAM. For Streetcar Alternative 1 and Streetcar Alternative 2, in-vehicle travel times were obtained from the operations simulations prepared for the streetcar alternatives during Conceptual Engineering. Out-of-vehicle times were calculate for each O-D pair and added to the in-vehicle times to estimate total travel time.

Table 7-9 compares the travel times between key O-D pairs for the TSM Alternative, Streetcar Alternative 1 and Streetcar Alternative 2. The TSM alternative provides the shortest travel time from SARTC to the Orange County Superior Court, and from SARTC to Santa Ana College. The former is attributable to the TSM route's bi-directional alignment along Civic Center Drive, where the Orange County Superior Court is also located. The TSM travel time advantage between SARTC to Santa Ana College is because the TSM alternative provides direct service between SARTC and Santa Ana College, traveling on Civic Center Drive, Bristol Street and Westminster Avenue/17th Street.

Streetcar Alternative 1 provides travel time advantage compared to TSM and Streetcar Alternative 2 between SARTC and Harbor Boulevard/Westminster Avenue, between SARTC and the Reagan Federal Building and Courthouse, and between Spurgeon Park and East End Promenade. The Streetcar Alternative 1 alignment has the shortest distance between SARTC and Harbor Boulevard, and it is more centrally located to destinations in the downtown such as the Reagan Federal Building and Courthouse and East End

Promenade. It generally provides better service and connectivity to key destinations within the primary corridor area.

While Streetcar Alternative 2 offers travel time advantage compared to TSM for some O-D pairs, and compared to Streetcar Alternative 1 for other pairs, it does not provide the shortest travel time for any of the O-D pairs. This is primarily due to the length of the Streetcar Alternative 2 alignment, with its "directional loop" approach to SARTC and its Civic Center Drive couplet alignment

Table 7-9: Travel Time Comparison between Key Origin-Destination Pairs

DESCRIPTION	STATION ASSUMPTION		TOTAL TRAVEL TIME[1]					
			TSM		STREETCAR ALTERNATIVE 1		STREETCAR ALTERNATIVE 2	
	FROM	TO	EB	WB	EB	WB	EB	WB
Harbor Blvd. to SARTC	Harbor	SARTC	21.9	21.9	20.4	21.3	22.2	27.7
SARTC to Santa Ana Courthouse	SARTC	Flower	5.6	5.6	8.6	8.6	8.6	5.6
SARTC to Federal Building	SARTC	Ross	13.1	13.1	9.4	10.8	11.5	15.8
Lacy Neighborhood to Santa Ana College	Lacy	Bristol	13.7	12.6	19.7	20.9	20.7	25.4
Spurgeon Park to East End Promenade	Fairview	French/ Spurgeon	31.8[2]	33.1[2]	17.2	21.0	18.4	24.2

Source: OCTAM 3.3, and *Santa Ana Operations Simulation*, February 21, 2011.

Notes:

[1] Assumes walk from station to final destination

[2] Assumes OCTA fixed route bus connection

7.3.5 Cost and Financial Feasibility

Ease of Constructability - The TSM alternative does not include construction of any significant infrastructure improvements and, therefore, is the most easily constructed. Of the two streetcar alternatives, a number of elements were evaluated in considering their constructability and ease of construction including the linear footage of utilities located under the proposed alignment, as well as the linear footage of pressurized utilities (gas and water), disruption to adjacent land uses, and arterial crossings resulting in traffic disruption. Table 7-10 summarizes the results of the Constructability/Ease of Construction analyses.

Streetcar Alternative 1 presents some slight advantage in terms of ease of constructability compared to Streetcar Alternative 2. The two most significant challenges to the construction of Streetcar Alternative 2 are both along 5th Street: the underground AT&T vaults along 5th Street between Bush and Spurgeon Streets, which house the transmission hubs for city-wide telephone service, and the secured entrance to the Ronald Reagan

Federal Building and Courthouse parking garage. While these two challenges do not necessarily represent fatal flaws for the Streetcar Alternative 2 alignment, they add considerable complexity to construction planning and management that would not occur with Streetcar Alternative 1.

Table 7-10: Constructability/Ease of Construction

CONSTRUCTABILITY/EASE OF CONSTRUCTION	STREETCAR ALTERNATIVE 1	STREETCAR ALTERNATIVE 2
Utility Conflicts:		
All Utilities	Moderate	Moderate
Pressurized Utilities	Moderate	Moderate
Other	Minor	**Major**
Adjacent Uses:		
Federal Detention Center salliport operations & security	Minor	Minor
4th Street parking removal/ sidewalk reconstruction	Moderate	N/A
Reagan Federal Building and Courthouse parking structure access and security	N/A	**Major**
Arterial Street Crossings:		
Intersections	7	8
Arterial Crossings	8	9

Capital Cost - Capital cost estimates have been prepared based on the conceptual engineering completed for the project (see *Conceptual Design Plan Set*, October 2012 and *Conceptual Design Technical Report*, January 2012). A full description of the methodology used to estimate capital cost and the associated worksheets are contained in the *Capital Cost Methodology Technical Report*, August 1, 2012 (see Appendix C).

There are no costs associated with the No Build alternative. The cost to implement the TSM alternative is approximately $14.5 million (in 2011 dollars). The major element of the TSM alternative is the implementation of a bus rapid transit (BRT) route between SARTC and the vicinity of Harbor Boulevard and Westminster Avenue. The costs associated with the TSM alternative assume acquisition of 8 BRT vehicles, station area improvements comparable to those assumed for the Streetcar Alternatives, (i.e. shelters that incorporate Advance Traveler Information System technology), traffic signal system improvements/enhancements to optimize travel times along the route.

The estimated cost to construct Streetcar Alternative 1 with the recommended design options is $209.7 million in 2011 dollars. The estimated cost to construct Streetcar Alternative 2 with the recommended design option is $228.1 million in 2011 dollars. Table 7-11 shows the estimated capital costs for the Build alternatives.

Table 7-11 also shows the estimated capital cost of the IOS for each Streetcar Alternative. In both alternatives, the IOS cost is approximately 76-77 percent of the total project cost even though it is approximately half of the Full Build alignment length. This is because the IOS includes the eastern half of the alignment through the densely developed urban core of the corridor, resulting in substantial drainage and utility costs. Also, the IOS includes the maintenance facility and most of the vehicle and systems costs. The western half of the alignment is within the PE ROW, a substantially undeveloped right-of-way with no utility and minimal drainage issues. The two most significant cost components of the western half of the project are the two bridge structures, over the Santa Ana River and over Westminster Avenue.

Table 7-11: Estimated Capital Cost
(2011 $s in millions)

ALTERNATIVE	ESTIMATED CAPITAL COST[a] (2011 $s in millions)
TSM	$14.50
Streetcar Alternative 1 - Assuming: Western Terminus Option B: Elevated Santa Ana River Crossing Option 4: Bridge Avoidance B Sasscer Park Option A: Direct Route	$197.4 - $209.7
Streetcar Alternative 2 - Assuming: Western Terminus Option B: Elevated Santa Ana River Crossing Option 4: Bridge Avoidance B Civic Center Bike Lane Option A: ROW Acquisition and Parking Removal	$217.0 - $228.1
Streetcar Alternative 1 Initial Operable Segment	$146.5 - $158.8
Streetcar Alternative 2 Initial Operable Segment	$166.2 - $177.2

[a] Range for Streetcar 1 due to 4th Street Parking and Maintenance Facility Options. Range for Streetcar 2 due to Maintenance Facility Options

Capital Cost per Route Mile - Table 7-12 shows the capital cost per route mile for the Build Alternatives. The cost per mile for the TSM alternative is approximately $1.27 million in 2011 dollars. For Streetcar Alternative 1 the "per mile" or per track mile cost ranges between approximately $24.1 million and $25.6 million. For Streetcar Alternative 2, the cost is between approximately $25.5 million and $26.8 million per track mile.

Table 7-12: Estimated Capital Cost per Route/Track Mile (2011 $s in millions)

ALTERNATIVE	ESTIMATED CAPITAL COST[a] (2011 $s in millions)
TSM	$1.27
Streetcar Alternative 1 - Assuming:	$24.1 - $25.6
Western Terminus Option B: Elevated	
Santa Ana River Crossing Option 4: Bridge Avoidance B	
Sasscer Park Option A: Direct Route	
Streetcar Alternative 2 - Assuming:	$25.5 - $26.8
Western Terminus Option B: Elevated	
Santa Ana River Crossing Option 4: Bridge Avoidance B	
Civic Center Bike Lane Option A: ROW Acquisition and Parking Removal	
Streetcar Alternative 1 Initial Operable Segment	$33.30 - $36.1
Streetcar Alternative 2 Initial Operable Segment	$32.00 - $34.1

[a] Range for Streetcar 1 due to 4th Street Parking and Maintenance Facility Options. Range for Streetcar 2 due to Maintenance Facility Options

Operations and Maintenance Cost - The operations and maintenance cost methodology applied to the Build Alternatives to develop an estimate of annual operations and maintenance costs was described in *Santa Ana and Garden Grove Fixed Guideway Operations and Maintenance Cost Estimates and Methodology*, March 15, 2012 (see Appendix D). Based on current (Fiscal Year 2010-2011) OCTA bus operating and maintenance cost data, a cost per revenue hour of $119.95 was applied to the Route 64 overlay along 1st Street and the proposed new route between SARTC and Harbor Boulevard in the TSM Alternative. A cost per revenue hour of $149.49 was applied to the proposed expanded StationLink Route 462 service, which is currently a contract service to OCTA.

The cost per revenue hour for the Streetcar Alternatives was developed based on the ratio of bus cost to streetcar cost experienced in Portland (Tri-Met and Portland Streetcar Inc.)

and Seattle (King County Metro). The estimated annual vehicle revenue hours and revenue miles were based on the proposed alignments and operating plans for the Streetcar Alternatives. A cost per revenue hour of $187.12 was applied to the Streetcar Alternatives. Table 7-13 summarizes the estimated O&M costs for the TSM and each of the Build Alternatives. The TSM Alternative includes enhanced service levels on existing bus routes (Route 64 and Route 462) and the proposed BRT route between SARTC and Harbor Boulevard. As a result, the TSM Alternative produces significantly more annual revenue miles and hours of service and is estimated to have considerably high O&M costs than the Streetcar Alternatives. For comparison purposes with the Streetcar Alternatives, the O&M cost for only the BRT route between SARTC and Harbor Boulevard is also shown.

Table 7-13: Estimated Operations and Maintenance Costs (2011 $)

	TSM	TSM - SARTC TO HARBOR ROUTE ONLY	STREETCAR ALTERNATIVE 1	STREETCAR ALTERNATIVE 2	STREETCAR ALTERNATIVE 1 IOS	STREETCAR ALTERNATIVE 2 IOS
Annual Revenue Miles	1,061,590	419,120	332,015	363,459	213,127	209,976
Annual Revenue Hours	105,664	35,152	26,364	32,656	21,372	23,868
Peak Vehicles	22	8	6	7	4	5
O&M Costs	**$13.3M**	**$5.1M**	**$4.9M**	**$6.1M**	**$4.0M**	**$4.5M**
Cost per Rev. Mile	$12.51	$12.07	$14.86	$16.81	$18.76	$21.27
Cost per Rev. Hour	$125.70	$143.94	$187.12	$187.12	$187.12	$187.12

The complete TSM Alternative is estimated to have the highest O&M cost, however, it is estimated to have the lowest cost per revenue mile and per revenue hour of service. This is because, as described previously, the TSM Alternative produces considerably more annual revenue miles and revenue hours of service than the Streetcar Alternatives. When only the BRT element of the TSM Alternative (the route between SARTC and Harbor Boulevard) is considered, the O&M costs for the TSM Alternative are estimated to be slightly higher than for Streetcar 1, but approximately 28 to 30 percent lower than for Streetcar 2. The estimated O&M costs for Streetcar Alternative 1 are approximately 24 percent less than those for Streetcar Alternative 2. This is due to the increased length of the Streetcar Alternative 2 alignment and the slightly lower average travel speeds resulting in increased annual revenue hours of service.

7.4 Summary of Findings

The Build Alternatives were evaluated against technical criteria and measures of effectiveness (MOEs) that closely relate to the Purpose and Need for the Project. Based on the results of this analysis, the alternatives were ranked by MOE and overall. Table 7-14 summarizes the results of the comparison and ranking.

Table 7-14: Ranking of Alternatives Based on Analysis Results

	CRITERIA / MEASURE OF EFFECTIVENESS	TSM	STREETCAR ALTERNATIVE 1	STREETCAR ALTERNATIVE 2
1.	**ACCESSIBILITY AND LIVABILITY**			
1A	No. of transit-dependent households within 1/4 mile walking distance of proposed alignment	3	1	2
1B	No. of daily riders (average weekday boardings)	2	1	3
2.	**ECONOMIC DEVELOPMENT, TRANSIT SUPPORTIVE LAND USE AND COMMUNITY GOALS**			
2A	Assessment of the transit supportiveness of land uses served by the proposed alignment	2	1	3
2B	Assessment of the economic development potential of land uses served by the proposed alignment	3	1	2
2C	Community support	TBD		
3.	**ENVIRONMENTAL RESPONSIBILITY**			
3A	Amount of additional right-of-way required	1	2	3
3B	Environmental Tradeoffs	1	2	3
4.	**TRAVEL BENEFITS, CHOICE AND RELIABILITY**			
4A	Customer service (travel times between O-D pairs)	2	1	3
4B	Number of daily riders (average weekday boardings)	2	1	3
5.	**COST EFFECTIVENESS AND FINANCIAL FEASIBILITY**			
5A	Constructability/ease of construction	1	2	3
5B	Capital cost	1	2	3
5C	Capital cost per route mile	1	2	3
5D	Annualized operating cost*	1	2	3
5E	Operating cost per hour	1	2	2
	OVERALL RANKING	**2**	**1**	**3**

*For purposes of comparison to the Streetcar Alternatives, the Annualized Operating Cost for TSM includes only the SARTC-to-Harbor route.

7.5 Conclusions and Tradeoffs among Alternatives

Streetcar Alternative 1 was ranked first in all MOEs included in Accessibility and Livability because it served the greatest number of transit dependent households and was estimated to have the highest daily ridership of the three alternatives. It ranked the highest among the alternatives on Economic Development, Transit Supportive Land Use and Community Goals. The existing land uses along the eastern portion of the Streetcar Alternative 1 alignment provide the densities and development patterns to support a high capacity transit system. Adopted land use plans that cover the Streetcar Alternative 1 alignment support and encourage the types of development/redevelopment likely to occur in conjunction with high capacity and transit, and existing development patterns provide opportunity for such development/redevelopment to occur. Streetcar Alternative 1 effectively serves key destinations within the corridor area, ranking it first in Travel Benefit, Choice and Reliability.

The TSM alternative ranked first among the alternatives in Environmental Responsibility. Because it does not include substantial new construction, it does not require acquisition of right-of-way, nor does it adversely affect any conditions in the environment compared to the No Build Alternative.

In terms of Cost Effectiveness and Financial Feasibility, the TSM Alternative ranked first for constructability/ease of construction because of the very limited amount of construction likely to occur under this alternative. It has the lowest capital cost of the alternatives, and therefore the lowest cost per route mile.

Streetcar Alternative 1 ranked second in terms of constructability/ease of construction, and capital cost. It was estimated to be less expensive than Streetcar Alternative 2 primarily because of its shorter route length. Streetcar Alternative 1 ranked first in terms of annual operating cost and second on operating costs per hour. The TSM Alternative includes considerably greater number of revenue hours than Streetcar Alternative 1 or 2, although the cost per revenue hour for the TSM Alternative was less than for the Streetcar Alternatives.

Overall, Streetcar Alternative 1 ranked first among the alternatives based on this technical evaluation.

8.0 PUBLIC AND AGENCY INVOLVEMENT AND COORDINATION

8.1 Study Background

Meaningful public engagement was an important component of the Santa Ana-Garden Grove Fixed Guideway Project from the start. Well before any key decisions were made, the cities initiated a public scoping process to help define the appropriate range of issues to be addressed in the Alternatives Analysis (AA), Draft Environment Impact Report (DEIR) and Environmental Assessment (EA). This chapter documents the cities' compliance with the scoping requirements of the California Environmental Quality Act (CEQA) (PRC 21000 et seq.)

The first stage of public involvement was pre-scoping, which occurred from August 25, 2009 to May 23, 2010 in support of the Alternatives Analysis. The formal public scoping period for the DEIR began on May 24, 2010 and concluded on June 21, 2010. Although not required by state or federal regulations, the cities continued to share information with and seek input from the community, elected officials, and key stakeholders throughout the study process through meetings, dissemination of informational materials, a project website, and a project information line in support of the following public outreach goals:

- Use an inclusive outreach strategy that maximizes input from a broad range of project stakeholders;
- Provide forums for meaningful participation; and
- Create multiple opportunities for generation of ideas and comments.

8.2 Project Participants

In addition to the cities of Santa Ana and Garden Grove, the FTA and OCTA have participated in the Project. Cordoba Corporation has served as the Prime Consultant and has been supported by several sub-consultants.

8.2.1 Stakeholders Working Group

As part of the public outreach strategy, a Stakeholders Working Group (SWG) was created to provide an opportunity for dialogue between the project team and individual stakeholders that represent key constituencies and/or organizations throughout the Study Area, including: local, County, State, and federal elected and appointed officials; public agencies/officials; neighborhood councils, homeowners associations, and community councils; business and labor associations and groups; representatives of retail and employment centers; representatives of educational, cultural, religious, and health care institutions; transit advocacy and environmental groups; and individuals who live, work, and travel in the Study Area. Potential SWG members were identified through the City of Santa Ana's Com-Link database, which pinpoints community leaders, and by executive management in the City of Garden Grove. As the study progressed, additional members of the community asked to be included in the SWG. No one was turned away.

SWG members were charged with taking information back to their organizations, collecting feedback, and working with other members of the SWG in the spirit of cooperation to build consensus. As a sign of their strong interest in the Project, SWG members agreed to remain involved for the duration of the environmental phase of the Project.

SWG members include:

- Adams Iron
- Alfredo Amezcua & Associates
- Artesia Pilar Neighborhood Association
- Artists Village Restaurant Association
- C & C Development
- Com-Link
- Corinthian College
- County of Orange
- Cal State Fullerton Grand Central Arts
- California Department of General Services
- Downtown Inc.
- Downtown Business Association
- Downtown Lofts Homeowners Association
- Downtown Neighborhood Association
- East Garden Grove Neighborhood Association
- Ebell Club
- Episcopal Church of the Messiah
- Everest College
- First American Title Company
- First Presbyterian Church
- French Park Neighborhood Association
- Garden Grove Chamber of Commerce
- Garden Grove Planning Commission
- Garden Grove Traffic Commission
- Greater Santa Ana Business Association
- Kennedy Commission
- La Luz del Mundo
- Lacy Neighborhood Association
- Latino Health Access
- Logan Neighborhood Association
- Main Street Community Liaison

- Mercy House
- Orange County Superior Court
- Orange County Transportation Authority
- Orange County AFL-CIO
- Rancho Santiago Community College District Board of Trustees
- Regency Centers
- Riverview West Neighborhood Association
- Santa Ana Collaborative for Responsible Development
- Santa Ana College
- Santa Ana Merchants Association
- Santa Ana Restaurant Association
- Santa Ana Senior Center
- Santa Ana Unified School District
- Santiago Lofts Homeowners Association
- St. Joseph Church
- State of California Appellate Court
- Tardiff Sheet Metal
- Templo Calvario
- Tobin Steel
- Tom's Truck Center
- United States General Service Administration
- Washington Square Neighborhood Association
- Waterline Technologies
- Westend Neighborhood Association

8.3 Pre-Scoping Activities for the Alternatives Analysis

Between August 2009 and June 2010, the cities of Santa Ana and Garden Grove, in cooperation with OCTA, a cooperating and funding agency, conducted five pre-scoping meetings for the Santa Ana-Garden Grove Fixed Guideway Project in support of the Alternatives Analysis and in preparation for the public scoping process. The public meetings included a City Council Workshop, a Stakeholders Working Group meeting, and two Community Listening Sessions. The meeting locations were selected based on geographic location and recommendations from the Stakeholders Working Group. To facilitate community participation, meetings were scheduled at different times throughout the day.

8.3.1 City Council Workshop

The City of Santa Ana City Council held a Work Study Session on Tuesday, August 25, 2009 at Santa Ana City Hall, 20 Civic Center Plaza, Santa Ana, California, to discuss the

Santa Ana/Garden Grove Transit Vision and Go Local Project Concept. It was an open public meeting. Attendees were briefed on the four components of the Go Local Project:

- Santa Ana-Garden Grove Fixed Guideway
- Santa Ana Regional Transportation Center (SARTC) Expansion
- Santa Ana Boulevard Grade Separation
- Multi-Modal Use of the Pacific Electric Right-of-Way

The Santa Ana-Garden Grove Fixed Guideway team provided an overview of the proposed Project and reviewed key project milestones. Council requested that the Environment and Transportation Advisory Committee (ETAC) review the project and report progress to the City Council on a regular basis.

8.3.2 Stakeholders Working Group #1

The initial meeting of the SWG took place on January 26, 2010 at the Santa Ana Police Department Community Room, 60 Civic Center Plaza, Santa Ana, California. Members were provided an introduction to the project and the environmental process. In addition, the proposed format and content for the Community Listening Sessions were discussed. Members were asked to help publicize the Community Listening Sessions and to encourage attendance at them.

8.3.3 Community Listening Sessions

Two Community Listening Sessions were conducted several months in advance of formal public scoping to gain community input on the project purpose and need, alternatives, and evaluation criteria, to introduce the environmental review process, and to identify special environmental/community concerns that may need to be addressed as part of the alternative analysis process. The first Community Listening Session was conducted on February 2, 2010 at SARTC, 1100 W Santa Ana Boulevard, Santa Ana, California, from 5 - 7 p.m. The second was held on February 3, 2010 at the Santa Ana Police Department Community Room, 60 Civic Center Plaza, Santa Ana, California, from 8 - 10 a.m. Both sessions were advertised via a bilingual (English/Spanish) mailer that was sent to property owners and key stakeholders within the Study Area. Meeting notices were also made available at the information counters of civic buildings, including Santa Ana City Hall, Garden Grove City Hall, and the public libraries in the Study Area.

The Community Listening Sessions were conducted utilizing an open house format that allowed participants to drop by at their convenience. Project team members were on hand to walk attendees through a series of information boards, answer questions, and receive feedback. Comment sheets were also available for attendees to complete or mail back.

8.3.4 Summary of Pre-Scoping Comments

The following provides a brief summary of the comments received during the community listening sessions:

General Comments

- Excitement towards a new transit system being developed
- Concern related to neighborhood impacts in residential areas and near schools
- Support for an environmentally friendly and safe system

Comments Regarding Technology Options

- Lack of interest in traditional bus or trolleybus service
- One comment in support of Bus Rapid Transit
- One comment in support of Personal Rapid Transit (PRT)
- Strong support for a streetcar or light rail system
- No support for monorail, low speed mag-lev, commuter rail or subway

Comments Regarding Alignment Options

- No comments received

Along with Purpose and Need, the public comments received during the Pre-Scoping period helped to guide the preliminary definition of alternatives and preliminary screening process.

8.4 Public Scoping Period Activities

The Public Scoping Period for the Santa Ana-Garden Grove Fixed Guideway Project began on May 24, 2010 with publication of the Notice of Preparation by the State Clearinghouse, as noted below, and concluded on June 21, 2010.

8.4.1 Stakeholders Working Group #2

On June 3, 2010, the Stakeholders Working Group reconvened at the Santa Ana Police Department Community Room for its second meeting (see Section 8.3.2 for the discussion of the first meeting). The project team previewed and accepted comments on the information that had been prepared for the public scoping meetings, announced the public scoping meeting dates, times and locations, and encouraged member assistance in sharing scoping meeting information with community members.

8.4.2 Public Scoping Meeting Notification

Several methods were used to notify the public about the scoping meetings. The scoping meetings were publicized via publication of the NOP by the State Clearinghouse, mailings, door-to-door business walks, meeting notices posted and handed out at SARTC, electronic notices to the SWG and Com-Link, project factsheets, a press release, the project website, and display advertisements in local English and Spanish language newspapers.

Notification Database

A database of approximately 4,500 resident and business addresses near the proposed Project corridor was assembled by the cities of Santa Ana and Garden Grove; it encompassed all properties within a 300-foot radius of the proposed corridor.

Noticing

The NOP for the Santa Ana-Garden Grove Fixed Guideway Project was published by the State Clearinghouse on May 24, 2010 (SCH # 2010051060). In addition, copies of the meeting notice were posted at the Santa Ana and Garden Grove City Hall information desks and Public Works Department information counters. Copies of the Notice of Preparation (NOP) were also made available at public libraries in both cities.

Mailings

To notify the public that four Public Scoping Meetings had been scheduled, notices were mailed to every address in the notification database.

Door-to-Door Business Walks

During the Public Scoping Period, two door-to-door business walks were conducted targeting downtown area tenants and business owners to inform them of the scoping meeting being held on June 9, 2010 in Downtown Santa Ana.

Meeting Notices Distributed at SARTC

On June 8 and June 9, 2010 City of Santa Ana interns distributed meeting notices onsite to Santa Ana Metrolink commuters at SARTC informing them of the June 10, 2010 meeting.

Electronic Notices

Electronic notices were sent to all members of the Stakeholders Working Group as well as the City of Santa Ana's Com-Link database, which includes more than 60 Santa Ana neighborhood associations.

Project Factsheets

Factsheets which provided information about the proposed Project's purpose and need, location, technical and environmental review processes, and technology and alignment alternatives were distributed at the June 3, 2010 SWG meeting, the door-to-door business walks, SARTC and both City Halls. The factsheets included details regarding public scoping meeting dates, times and locations. They also listed the project call-in number, website, and electronic mail address.

Press Release

A bilingual press release for the public scoping meetings was distributed to Orange County Register's reporter, Doug Irving, and Excelsior's (Spanish language weekly of the Orange

County Register) reporters Celestino Orozco and Patricia Puentes. The press release was also distributed to Dolores Velazquez of Miniondas.

Project Website

A project website, www.santa-ana.org/transitvision, was established for the proposed Project. In addition, the City of Santa Ana, the City of Garden Grove, and OCTA posted information about the proposed Project and the public scoping meetings on their websites.

Newspaper Legal Notices

Legal notices were published in The Orange County Register and Miniondas (a local weekly Spanish language publication) on Thursday, June 3, 2010. In addition, an article promoting the meetings was published in the Downtown Inc. monthly newsletter on June 1, 2010. Meeting notices were also placed in both City Halls, on the cities' websites, www.santa-ana.org and www.ci.garden-grove.ca.us, and in all of the public libraries in the Study Area at least two weeks before the first meeting date.

8.5 Public Scoping Meetings

Between June 8 and June 14, 2010, the cities of Santa Ana and Garden Grove, in coordination with OCTA, conducted four Public Scoping Meetings for the Santa Ana-Garden Grove Fixed Guideway Project in accordance with the requirements of CEQA. Per CEQA guidelines, public notice was provided to the community 11 business days prior to the first public scoping meeting via issuance of a Notice of Preparation (NOP).

The Public Scoping Meetings were conducted at different times of the day to accommodate the busy schedules of the area residents and to provide different times and opportunities for them to attend (including a weekend meeting). The dates and locations of the meetings are listed below:

- Tuesday, June 8, 2010, 6:30 – 8:30 p.m. – Spurgeon Intermediate School, 2701 W 5th Street, Santa Ana, California
- Wednesday, June 9, 2010, 7:30 – 9:30 a.m. – Downtown Santa Ana, Grand Central Art Center, 125 N Broadway, Santa Ana, California,
- Thursday, June 10, 2010, 4:30 – 7 p.m. – Santa Ana Regional Transportation Center (SARTC), 1100 W Santa Ana Boulevard, Santa Ana, California
- Saturday, June 12, 2010, 2 – 4 p.m. – Santa Ana Public Library, 26 Civic Center Plaza, Santa Ana, California

The Public Scoping Meetings enabled stakeholders and the general public to officially comment on the scope of the environmental documents, potential environmental impacts and issues that should be evaluated in the Draft Environmental Impact Report (EIR), and to provide feedback on the technology and alignment alternatives being proposed for the Fixed Guideway Project.

8.5.1 Scoping Meeting Format

The Public Scoping Meetings provided members of the community forums through which they had the opportunity to ask questions, learn about the proposed Project, and provide feedback on issues pertaining to the proposed Project – especially potential issues of environmental concern. The Public Scoping Meetings were conducted utilizing an open house format that allowed participants to drop by at their convenience. Project team members were on hand to walk attendees through a series of information boards, answer questions, and receive feedback. In addition, comment sheets were also available for attendees to complete or mail back.

Display Boards

A total of 17 display boards were used to provide information to the public. Boards illustrating the various alternatives being considered were placed around the room providing comprehensive project information. They were divided among five information stations:

- Project Introduction
- Project Purpose and Need
- Transportation Alternatives
- Environmental Issues and Evaluation Criteria
- Comments and Suggestions

The display boards were printed in English and Spanish and native speakers of both languages were on hand to answer questions and provide additional information.

Comment Cards

Comment cards were available at each scoping meeting for attendees who wished to provide written comments.

Meeting Transcripts

Bilingual (English/Spanish) transcriptionists were available at each scoping meeting for attendees who preferred to provide oral comments.

8.6 Interagency Scoping Meeting

In addition to the public scoping meetings, an interagency scoping meeting was held on June 9, 2010 with representatives from participating agencies, coordinating agencies, and interested agencies at the Santa Ana City Hall, 20 Civic Center Plaza, Santa Ana, California.

8.6.1 Interagency Scoping Meeting Notification

In addition to the Notice of Preparation published by the State Clearinghouse, a copy of the six-page notice, an agenda, and informational materials were sent to known contacts of agencies with a potential interest in the project or with resources in the project Study Area, inviting them to attend an interagency scoping meeting.

The following agencies were contacted directly via e-mail:

- U.S. Fish and Wildlife Service, Carlsbad Office
- U.S. Army Corps of Engineers, Los Angeles District
- U.S. Environmental Protection Agency, Southern California Field Office, Region IX
- Caltrans, District 12
- California Department of Fish and Game, Region 5
- California Regional Water Quality Control Board, Region 8
- California Public Utilities Commission, Los Angeles Office
- Southern California Regional Rail Authority
- Southern California Association of Governments
- South Coast Air Quality Management District
- Office of Historic Preservation/California Department of Parks, Sacramento
- Orange County Transportation Authority
- County of Orange
- City of Santa Ana
- City of Garden Grove
- City of Costa Mesa
- City of Fountain Valley
- City of Orange
- City of Irvine
- City of Tustin
- City of Westminster
- Amtrak, Oakland Office
- Pacific Bell
- Southern California Edison, Santa Ana Office
- Southern California Gas Company, Orange County Division

8.7 Summary of Scoping Comments

The cities of Santa Ana and Garden Grove accepted written and oral comments throughout the scoping period, from May 24, 2010 until June 21, 2010. All comments were recorded and kept on file at the City of Santa Ana Public Works Department as well as at the public outreach consultant's office and are included in the *Santa Ana and Garden Grove Fixed Guideway Draft Environmental Impact Report.*

8.7.1 Summary of Public Comments

Community participation in the Public Scoping Meetings was fairly low; however, the comments received generally indicated support for the proposed Project. Residents who participated had questions about how the proposed Project would impact their immediate neighborhoods. Likewise, business owners along the proposed alignments expressed concern about how their businesses would be impacted, especially during the construction phase.

Following is a summary of comments provided by stakeholders at each of the Public Scoping Meetings:

<u>Public Scoping Meeting at Spurgeon Intermediate School</u>
One individual who attended the meeting said she lives a few blocks from the proposed alignment and was concerned about potential noise and safety impacts.

<u>Public Scoping Meeting in Downtown Santa Ana</u>
Feedback received at the Downtown Santa Ana meeting primarily focused on the proposed alignments in the downtown area. Generally, the comments provided were favorable towards the proposed Project and stakeholders expressed a strong desire to connect the core of Downtown Santa Ana with other important destinations in the Study Area. Stakeholders also stated that 4th Street should be the main route for the system.

<u>Public Scoping Meeting at SARTC</u>
Attendees at the SARTC meeting mostly asked questions about the type of technology that would be utilized for the proposed Project and indicated a strong preference for some sort of rail system as opposed to bus transit. Stakeholders also expressed their desire to have the system connect to other areas of the City, such as Santa Ana College.

<u>Public Scoping Meeting at Santa Ana Public Library</u>
Attendees of the meeting at the Santa Ana Public Library were mostly concerned with the type of technology that would be utilized for the proposed Project. One individual said he would prefer a rail system because he believes buses carry a socio-economic stigma that would not allow the project to be successful.

8.7.2 Summary of Agency Comments

In addition to the Notice of Preparation published be the State Clearinghouse, a copy of the six-page notice, an agenda, and informational materials were sent to known contacts of agencies with a potential interest in the project or resources in the project Study Area, inviting them to attend an Interagency Scoping meeting that was held on June 9, 2010 at the City of Santa Ana. In all, 26 Federal, State, regional and local agencies were contacted. Seven agencies attended the Interagency Scoping Meeting on June 9, 2010. The comments received that day were:

- Consider using First Street for the east-west transit alignment in lieu of 4th Street
- Address bicycle and pedestrian issues in the vicinity of the Pacific Electric Santa Ana River Bridge
- Follow the guidelines that need to be considered when siting new transportation infrastructure in close proximity to major federal buildings located within the Civic Center complex

Six agencies submitted comment letters during the public scoping period. A brief summary of each is provided below:

<u>County of Orange Public Works</u>

- Provided descriptions of new requirements associated with updates to the Countywide Drainage Area Management Plan and Santa Ana Regional Water Quality Control Board Orange County Municipal NPDES Stormwater Permit.
- Coordinate with the County of Orange and U.S. Army Corps of Engineers regarding replacement or rehabilitation of the old Pacific Electric bridge.
- Address potential impacts to the existing Class I Santa Ana River Bikeway and the Santa Ana River Regional Riding/Hiking Trail.
- Consider adding First Street as a new east-west transit alignment.
- Coordinate with federal agencies and the County on any potential impacts (including access) associated with their facilities/properties located within the project area.

<u>County of Orange, Sheriff-Coroner</u>

Related concerns associated with potential conflicts between the proposed Project and vehicular traffic into and out of their facilities as well as potential utility disruptions during project construction.

<u>Caltrans, District 12</u>

Caltrans requested that the cities coordinate with Caltrans regarding any potential proposed Project impacts that affect travel demand or traffic circulation on State transportation facilities.

<u>Department of Toxic Substances Control</u>

The Department's letter listed the database that should be consulted as well as requirements that should be followed during project assessment, development, construction, and operation.

California Energy Commission

The Commission provided a list of potential energy impacts and a list potential conservation measures to be considered during the development of the Draft EIR for the project.

California Public Utilities Commission (CPUC)

Described the informal consultation activities that have taken place amongst CPUC staff and the project team to date; cited rules and requirements for rail fixed guideway projects over existing streets, design of at-grade crossings, warning devices for at-grade crossings, and safety rules and regulations for light-rail transit; and encouraged continued CPUC informal consultation and involvement during development of the Draft EIR and early design phases of the project.

8.8 Incorporation of Scoping Comments in Draft EIR

The purpose of scoping is to provide agencies and the public an opportunity to comment on a proposed project's purpose and need and range of alternatives proposed for analysis as well as to help identify issues that should be evaluated in the Draft EIR. All comments that fall within the scope of the CEQA process are addressed in the Draft EIR. In addition, the cities have continued to work closely with agencies and stakeholder groups to address issues identified through the scoping process.

9.0 PRELIMINARY COST ESTIMATES

9.1 Preliminary Capital Cost Estimates

The capital cost estimates presented in Table 9-1 are based on the *Santa Ana and Garden Grove Fixed Guideway Corridor Conceptual Engineering Plan Set* dated December 20, 2011. The plans were developed to approximately 5 to 10 percent level of design. The capital costs are, therefore, preliminary and will be refined during subsequent phases. At this early stage of the planning process, healthy contingencies are applied to the cost estimates. It is anticipated that the contingencies will be reduced substantially as the project progresses. More detailed information is provided in the *Capital Cost Methodology Technical Report* dated August 1, 2012. A low and high cost estimate for each of the Streetcar Alternatives is presented based on which options are assumed for the 4th Street parking scenario and the maintenance facility site.

Table 9-1: Preliminary Capital Cost Estimates (in 2011 $s)

ALTERNATIVE	LOW	HIGH
TSM Alternative	$14.5	
Streetcar Alternative 1	$197.4	$209.7
Streetcar Alternative 2	$217.0	$228.1
Streetcar IOS-1	$146.5	$158.8
Streetcar IOS-2	$166.2	$177.2

9.2 Factors that Contribute to the Range of Capital Cost Estimates

9.1.1 Western Terminus Design Options (Streetcar Alternatives 1 and 2)

There are three design options for the streetcar alternatives as they approach the Western Terminus at Harbor Boulevard and Westminster Avenue.

Option A: At-Grade assumes that the streetcar will cross Westminster Avenue at-grade, at a newly-created signalized intersection aligned with Nautilus Drive. Once north of Westminster Avenue, the streetcar would turn westerly through an existing light industrial/business park to a station platform within the PE ROW. The option would require acquisition of additional right-of-way as well as buildings that are within the proposed route.

Option B: Elevated assumes that the streetcar would cross Westminster Avenue on an elevated structure within the PE ROW, with the station platform at-grade within the PE ROW near Harbor Boulevard.

Option C: Truncated At-Grade would cross Westminster Avenue at-grade, at a newly-created signalized intersection aligned with Nautilus Drive, and stop along Nautilus Drive immediately north of Westminster Avenue. The option does not require acquisition of as much additional right-of-way as the At-Grade option (a small sliver along the south side of Westminster Avenue in order to align the streetcar perpendicularly to Westminster Avenue at Nautilus Drive) and would not impact existing buildings.

Table 9-2 shows the costs associated with each of the Western Terminus design options. The At-Grade option has the highest cost because it requires acquisition of building structures and right-of-way. The Elevated option is the second most expensive because it requires construction of a bridge over Westminster Avenue to carry the streetcar.

Table 9-2: Western Terminus Design Options

DESIGN OPTION	CAPITAL COST
Option A: At-grade	$12,181,596
Option B: Elevated	$12,109,159
Option C: Truncated At-Grade	$2,424,981

9.1.2 Santa Ana River Crossing Options (Streetcar Alternatives 1 and 2)

Both streetcar alternatives include alignments within the PE ROW that cross the Santa Ana River. The old Pacific Electric Santa Ana River Bridge has been abandoned since 1961 and even if it were not well beyond its functional life expectancy and in disrepair, it would be inadequate to accommodate the proposed streetcar systems. There are four options to address the crossing of the Santa Ana River. In Option 1: Bridge Replacement, the old bridge would be replaced with a new bridge, designed to be similar in appearance to the old bridge. In Design Option 2: Bridge Avoidance A, two new single-direction bridges would be constructed on each side of the old existing bridge. In Option 3: Bridge Relocation, the old bridge would be relocated approximately 650 feet south of its current location and a new double-track bridge would be constructed for the streetcar within the PE ROW. In Option 4: Bridge Avoidance B, a new single-track bridge would be constructed adjacent to and south of the old bridge; two-way operations would be provided along the single-track bridge through the use of interlock and signals. Table 9-3 shows the estimated cost for each of the Santa Ana River Crossing options.

Table 9-3: Santa Ana River Crossing Options Capital Costs

DESIGN OPTION	CAPITAL COST
Option 1: Bridge Replacement	$4,603,500
Option 2: Bridge Avoidance A	$3,564,000
Option 3: Bridge Relocation	$5,791,500
Option 4: Bridge Avoidance B	$2,079,000

9.1.3 Maintenance Facility Site Options (Streetcar Alternatives 1 and 2)

Both alternatives also include the same two design options for the maintenance facility: a facility located south of Santiago and 6th Streets (Site A in the Conceptual Design Report) in the vicinity of SARTC, or a facility located west of Raitt Street (in the vicinity of Townshend Street) between 5th Street and the PE ROW (Site B in the Conceptual Design Report). The facilities proposed to be constructed on each of these sites are identical. The cost difference between the options is approximately $11 million, and is related to the estimated cost to acquire the right-of-way. Table 9-4 shows the costs associated with the two maintenance facility options.

Table 9-4: Maintenance Facility Site Options Capital Costs

DESIGN OPTION	CAPITAL COST
Site A: Near SARTC	$38,451,843
Site B: Near Raitt Street	$27,429,460

9.1.4 Sasscer Park Design Options (Streetcar Alternative 1 Only)

Through downtown Santa Ana, the streetcar will operate in a couplet configuration, traveling westbound on Santa Ana Boulevard, and returning eastbound on 4th Street. There are two design options for the eastbound transition from Santa Ana Boulevard to 4th Street. In the first option, the streetcar transitions from Santa Ana Boulevard immediately east of the Parton Street intersection, and enters a City of Santa Ana maintenance easement between existing buildings and Sasscer Park that aligns with 4th Street east of Ross Street. In the second option, the streetcar would continue east on Santa Ana Boulevard to Ross Street; it would turn right on Ross Street and left onto 4th Street. The second option is estimated to cost approximately $2.27 million more than the option that utilizes the maintenance easement. This is because the route is somewhat longer and would require significant reconstruction of the southeast quadrant of the Santa Ana Boulevard/Ross Street intersection as well as the abutting portion of Sasscer Park.

9.1.5 4th Street Parking Scenarios (Streetcar Alternative 1 Only)

Through the Downtown, head-in, diagonal parking is currently provided on-street along 4th Street between Ross and French Streets. The parking along the south side of 4th Street would interfere with the streetcar operating in the eastbound lane. Three parking scenarios have been identified to address this condition: Scenario A: convert the diagonal parking to parallel along the south side and widen the sidewalk by 8 feet, resulting in a 20-foot wide sidewalk; Scenario B: remove the parking along the south side and widen the sidewalk by 16 feet, resulting in a 28-foot wide sidewalk; and, Scenario C: remove the parking along both sides of 4th Street and widen the sidewalks by 16 feet. With design option 3, only the south side sidewalk widening would be included as part of the project; while removing parking along the north side will further improve traffic flow and therefore streetcar operations along 4th Street, it is not actually a necessary part of the project. If this option is selected as part of the Locally Preferred Alternative, the City will pursue alternative funding for the north side sidewalk widening.

9.1.6 Civic Center Bike Lane Design Options (Streetcar Alternative 2 Only)

The City of Santa Ana plans to construct a bike lane along Civic Center Drive. For the portion of Civic Center Drive where the streetcar will operate adjacent to the bike lane, the bike lane will be routed behind the station platforms in the station/stop areas (Flower, Van Ness/Ross, Broadway, Main). There is insufficient right-of-way to accommodate the existing travel lanes, the planned bike lane and the station platforms. In Design Option 2A, additional right-of-way would be required in the vicinity of the station platforms in order to accommodate the bike lane behind the station platform. The cost to acquire the additional right-of-way is approximately $3.9 million. An alternative design option (Design Option 1) is to remove one westbound through traffic lane and reconfigure the roadway to allow for the bike lanes behind the platforms in the station areas. While this alternative does not incur the cost associated with additional right-of-way acquisition, there are some additional costs associated with the reconfiguration of the roadway. However, Design Option 1 is estimated to cost approximately $3.3 million less than the Streetcar Alternative 2 base alternative.

9.3 Preliminary O&M Cost Estimates

The projection of O&M costs is an important part of project planning. O&M cost projections are important for two reasons:

- Cost Effectiveness Measures. The projection of design-year O&M costs is a critical input to the determination of the New Starts measures of cost effectiveness.

- Financial Planning. The projections of annual O&M costs are vital to the development of financial plans that cover multiple years of construction and operations of the project.

The Santa Ana-Garden Grove Fixed Guideway TSM Alternative is comprised of modifications to existing bus service and the addition of a new bus route. The TSM bus costs were estimated based on current transit cost information provided by OCTA. The O&M cost projections for the streetcar alternatives were prepared using the same Excel spreadsheet model that was used for the TSM Alternative. Operating Cost per Revenue Hour (OM$/Rev Hr) was derived from historical Portland and Seattle bus-to-streetcar O&M cost per revenue vehicle hour ratios. These ratios were averaged and applied to the OCTA bus cost per revenue vehicle hour. More detailed information is provided in the *Santa Ana and Garden Grove Fixed Guideway Operations and Maintenance Cost Estimates and Methodology*, March 15, 2012 (see Appendix D). The estimated O&M cost for each Build Alternative is summarized in Table 9-5.

Table 9-5: O&M Cost Model Results

	TSM	TSM - SARTC TO HARBOR ROUTE ONLY	STREETCAR ALTERNATIVE 1	STREETCAR ALTERNATIVE 2
Annual Revenue Miles	1,061,590	419,120	332,015	363,459
Annual Revenue Hours	105,664	35,152	26,364	32,656
Peak Vehicles	22	8	6	7
O&M Costs	$13,282,258	$5,059,779	$4,933,284	$6,110,656
Cost per Rev. Mile	$12.51	$12.07	$14.86	$16.81
Cost per Rev. Hour	$125.70	$143.94	$187.12	$187.12

The TSM Alternative includes enhanced service levels on existing bus routes (Route 64 and Route 462) and the proposed BRT route between SARTC and Harbor Boulevard. As a result, the TSM Alternative produces significantly more annual revenue miles and hours of service and is estimated to have considerably high O&M costs than the Streetcar Alternatives. When only the BRT element of the TSM Alternative (the route between SARTC and Harbor Boulevard) is considered, the O&M costs for the TSM Alternative are estimated to be slightly higher than for Streetcar 1, but approximately 28 to 30 percent lower than for Streetcar 2.

10.0 NEXT STEPS

10.1 Public Review of Draft Environmental Impact Report/Environmental Assessment

Concurrent with this Alternatives Analysis, the Draft Environmental Impact Report (DEIR) and the Environmental Assessment (EA) are being prepared. It is scheduled for public release in Spring 2014. Upon completion of the Draft EIR and the EA, they will be released for public review. During the 45-day public review period, public workshops will be conducted in the Study Area to provide the community surrounding the Santa Ana-Fixed Guideway Corridor the opportunity to ask questions and offer comments on the proposed project.

10.2 Selection and Refinement of the Locally Preferred Alternative

Following the close of the public review period for the DEIR and the EA, and receipt of public comments, and based on the information provided in the AA, the DEIR and the EA, a Locally Preferred Alternative (LPA) for the Santa Ana-Garden Grove Fixed Guideway will be recommended. The LPA may be one of the alternatives or may be a variation or hybrid of the alternatives. Additional engineering will be performed to refine the alternative recommended to the Santa Ana and Garden Grove City Councils for adoption. If necessary to address comments received during the environmental public review, or if the recommended LPA is a variation or hybrid of the Build Alternatives analyzed in the DEIR and the EA, additional engineering may be performed to refine the conceptual design of the LPA prior to presentation to the City Councils. In addition, if the selected alternative is a hybrid and results in changes outside the envelope of the environmental analysis and associated impacts, then an environmental re-evaluation may be needed.

Once the LPA has been adopted by the cities of Santa Ana and Garden Grove, it will be presented to the OCTA Board of Directors for approval. Upon receipt of OCTA approval, the LPA may be submitted to the FTA for funding consideration under the section 5309 Capital Investment Program, and if so, for permission to enter into Project Development.

10.3 Final Environmental Impact Report and Notice of Determination

Following the close of the public review period the Environmental Impact Report will be finalized. Responses to the comments received during the public review period will be prepared. A mitigation monitoring reporting program will be defined and the findings for the Project will be prepared. The Final Environmental Impact Report will be certified by Santa Ana City Council (the City of Santa Ana is the lead agency under CEQA) and a Notice of Determination will be issued.

10.4 Finding of No Significant Impact

Because the proposed project would not result in any adverse environmental impacts under NEPA, it is anticipated that FTA will prepare and issue a Finding of No Significant Impact.

10.5 Project Development

With the Project environmentally cleared, it is anticipated that preliminary engineering on the Santa Ana-Garden Grove Fixed Guideway would begin in early 2015. Final design would begin in mid-2016, with construction beginning in 2017. Operations would begin in 2018.

APPENDIX A: Excerpted Chapters 5 through 8 of the Detailed Evaluation of Alternatives Report, April 2012, Updated November 2012

5. EVALUATION CRITERIA

The detailed evaluation of alternatives is intended to allow the public and decision makers to compare the performance of the Build Alternatives to each other and to the No Build and TSM Alternatives. Combined with the information provided in the Draft Environmental Impact Report/Environmental Assessment and public feedback received through the environmental review process, decision makers will have the information they require to select a Locally Preferred Alternative.

5.1 Evaluation Criteria and Measures of Effectiveness

Five screening criteria were identified that relate directly to the Purpose and Need and the study goals and objectives:

1. Accessibility and livability
2. Economic development, transit supportive land uses and community goals
3. Environmental responsibility and sustainability
4. Travel benefits, choice and reliability
5. Cost effectiveness and financial feasibility.

Performance measures were developed for each of the criteria (see Table 5-1) to differentiate among alternatives, and to measure and compare their performance.

Table 5-1: Evaluation Criteria and Measures of Effectiveness

SCREENING CRITERIA	MEASURES OF EFFECTIVENESS
1. Accessibility/Livability	Number of transit-dependent households within 1/4 mile of the alignment
	Ridership
2. Economic Development, Transit Supportive Land Use and Community Goals	Assessment of the transit supportiveness of land uses served by the project
	Assessment of economic development opportunities of parcels served by the project
	Community Support
3. Environmental Responsibility and Sustainability	Amount of right-of-way required
	Environmental tradeoffs
4. Travel Benefits, Choice and Reliability	Customer service (route travel times between O-D pairs)

SCREENING CRITERIA	MEASURES OF EFFECTIVENESS
5. Cost Effectiveness and Financial Feasibility	Ease of Constructability
	Capital cost estimate
	Capital cost per route mile
	Estimated annualized operating cost
	Estimated operating cost per hour

The goals and objectives for the project provide the framework for the detailed evaluation criteria and performance measures. The performance measures reflect the more detailed understanding of the physical and operating characteristics of each alternative and address to a greater degree and detail than the initial alternatives screening the ability of each alternative to satisfy the goals and objectives for the project. Many of the measures are quantitative. However, some qualitative measures are also included to better characterize the relative advantages and disadvantages among the alternatives. As in screening, depending upon the characteristics of the alternatives, some of the measures may more effectively assess relative strengths and weaknesses, and differentiate between alternatives.

5.1.1 Accessibility and Livability

Performance measures for detailed evaluation include:

- Number of transit dependent households within 1/4 mile of alignment
- Ridership.

With a high degree of transit dependency within the study area, improving accessibility for this segment of the population enhances the livability, walkability and overall attractiveness of the communities, and quality of life for residents along an alignment.

Forecast ridership provides an indication of each alternative’s effectiveness in enhancing accessibility for residents, workers visitors and students within the corridor area.

5.1.2 Economic Development, Transit Supportive Land Use and Community Goals

Performance measures for detailed evaluation include:

- Qualitative assessment of the transit supportiveness of land uses served by the project
- Qualitative assessment of the economic development opportunities of parcels served by the project
- Community support.

The first measure considers the degree to which existing land use and development patterns along each alignment create a transit supportive environment capable of sustaining a high capacity transit system. While each of the Build Alternatives includes alignments that generally serve areas of high activity and development density, the specific land uses and their transit supportive potential vary from street to street and on different blocks within the same street. This block-by-block assessment provides a detailed comparison of the advantages and disadvantages of each Build Alternative alignment in terms of existing land uses.

The second measure is similar to the first in that it focuses on a block-by-block analysis of the Build Alternatives' alignments. However, rather than evaluating existing land use and development patterns, this measure considers the potential for economic development in the form of future development opportunities on vacant parcels or redevelopment of underutilized parcels. This measure takes into account the transit supportiveness of land use plans and policies adopted by the cities of Santa Ana and Garden Grove which could influence future development opportunities within the corridor.

The last measure provides a qualitative assessment of the community support for each alternative as determined through public comment received at the Community Listening Sessions, during scoping, at Stakeholder Meetings, through one-on-one interviews, or through surveys or other communications. Public input anticipated to be received through the environmental review pro. Therefore, while public comments received prior to the detailed evaluation of alternatives has been reflected in this analysis and discussion, and is included in the determination of the technical ranking of the alternatives (see Section 8), a Locally Preferred Alternative will not be recommended until after the close of the environmental public review period.

5.1.3 Environmental Responsibility and Sustainability

Performance measures for detailed evaluation include:

- Amount of right-of-way required;
- Environmental tradeoffs.

In a substantially built-out environment, environmental and community impacts are closely associated with the amount of right-of-way required for project implementation. The first measure will assess the amount of right-of-way required to accommodate each alternative, including alignment, station areas, power stations and maintenance facilities. A key requirement for the project that has been established by the cities of Santa Ana and Garden Grove is to minimize right-of-way impacts to the extent feasible. This measure is part of OCTA's Go Local criteria and provides assurance that, to the degree that an alternative requires right-of-way acquisition, there is reasonable expectation that the needed right-of-way can be obtained.

In evaluating the environmental tradeoffs associated with each of the Build Alternatives, this measure considers and compares how aspects of the environment will be changed with implementation of the TSM Alternative and each of the Build Alternatives compared to the No Build Alternative. This measure is not intended to identify specific environmental impacts or affects. A Draft Environmental Impact Report (in accordance with CEQA) and an Environmental Assessment (in accordance with NEPA) are being prepared for the project alternatives. The environmental documents and supporting technical studies provide the information needed to identify, and avoid or mitigate potential environmental impacts or affects associated with the TSM and Build Alternatives.

5.1.4 Travel Benefits, Choice and Reliability

Performance measures for detailed evaluation include:

- Customer service (route travel times between O-D pairs).

In this measure, the level of customer service provided by each alternative is measured by the travel time between specific origins and destinations within the corridor. The estimated travel times take into account both in-vehicle and out-of-vehicle travel time or the time required to complete the trip from door-to-door.

5.1.5 Cost Effectiveness and Financial Feasibility

Performance measures for detailed evaluation include:

- Capital cost estimate
- Capital cost per route mile
- Estimated annualized operating and maintenance (O & M) cost
- Estimated annualized operating cost per hour.

These performance measures focus on the cost of constructing, operating and maintaining each alternative, and provide a basis for comparing the relative cost-effectiveness of each alternative.

6. ANALYSIS OF DESIGN OPTIONS

6.1 Analysis of Design Options

This section presents the analysis of design options developed for elements of the Streetcar Alternatives and recommends the options to be carried forward for further study. The design options were developed either to avoid identified constraints or to take advantage of specific opportunities presented along the alignments. In most cases the design options are the same for Streetcar 1 and Streetcar 2. However, where the design option is unique to a specific alternative, it is identified in the discussion.

While preferred options are recommended for most of the elements, the recommendations for two of the elements include factors beyond technical analysis and cost considerations, and require taking into account community comment which will occur as part of the environmental review process. For that reason, no recommendation is offered for the Operations and Maintenance Facility Site Options or for the 4th Street Parking Scenarios. All options for these two elements will be evaluated through the environmental review process and presented to the public for comment.

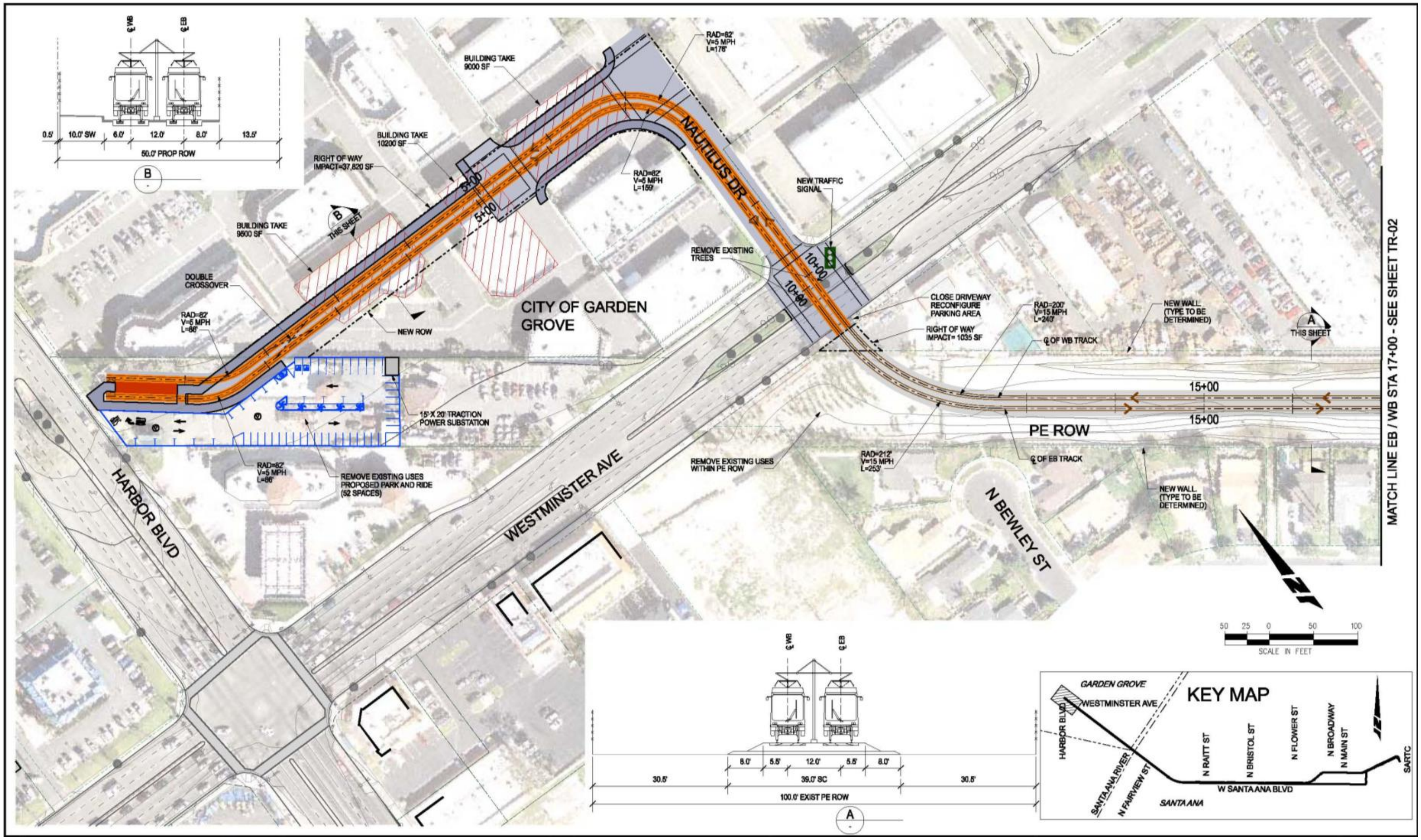
The design options for all other elements were evaluated by applying the measures of effectiveness (MOEs) which have been used to evaluate the full alternatives, however, for each design option only a limited number of MOEs that most effectively illustrated the potential advantages and disadvantages of each of the design options were used, as described below.

6.2 Western Terminus Design Options

Three design options have been defined for the Santa Ana and Garden Grove Fixed Guideway Project western terminus located east of Harbor Boulevard and north of Westminster Avenue:

- Option A: At-grade – the streetcar would transition out of the PE ROW to approach Westminster Avenue from the south aligned with Nautilus Drive on the north side. The streetcar would cross Westminster Avenue at a newly signalized intersection of Westminster Avenue and Nautilus Drive and continue north on Nautilus Drive for approximately 230 feet. It would then turn west through two existing industrial/ business park developments, returning to the PE ROW and the terminus station platforms approximately 90 feet east of Harbor Boulevard. Figure 6-1 shows Western Terminus Design Option A. Option A will require approximately 37,820 square feet of right-of-way acquisition and removal of three buildings (approximately 28,700 square feet).

Figure 6-1: Western Terminus Design Option A: At-Grade



- Option B: Elevated – in this option the streetcar would cross Westminster Avenue on an bridge structure within the PE ROW. Retaining walls and fill would support the track to/from the bridge structure. The retaining walls would extend for approximately 500 feet south of Westminster Avenue and 300 feet north of Westminster Avenue. The western terminus platforms would be at-grade approximately 55 feet east of Harbor Boulevard within the PE ROW. Figure 6-2 shows Western Terminus Design Option B. No right-of-way acquisition is required for this option and no structures are impacted.
- Option C: Truncated At-grade – as in Option A, the streetcar would transition out of the PE ROW to approach Westminster Avenue from the south aligned with Nautilus Drive on the north side. The streetcar would cross Westminster Avenue at a newly signalized intersection of Westminster Avenue and Nautilus Drive. The western terminus platform would be located along the west side of Nautilus Drive immediately north of Westminster Avenue. Figure 6-3 shows Western Terminus Design Option C. In this option, automobile traffic would be prohibited from accessing Westminster Avenue from southbound Nautilus Drive. Approximately 1,088 square feet of right-of-way is required in Option C in order to align the tracks to cross Westminster Avenue perpendicularly at Nautilus Drive.

The Western Terminus design options were evaluated based on four of the measures that have been used to evaluate the complete alternatives. These measures were selected because they most effectively illustrated the potential advantages and disadvantages of each of the design options for the Western Terminus:

- Community Support
- Right-of-Way Required
- Environmental Tradeoffs
- Capital Cost

The following describes the analysis and findings for each of the Western Terminus Station options.

6.2.1 Option A: At-grade

Community Support – Evaluated on a scale of 0 to 3 with 0 indicating no community support and 3 indicating strong community support, Option A received a 0. This is due primarily to the need to acquire right-of-way and impact buildings within two existing industrial/business parks located in the City of Garden Grove. Additionally, the new signalized intersection of Westminster Avenue at Nautilus Drive would be located approximately 695 feet east of the intersection of Westminster Avenue and Harbor Boulevard. Given the volume of traffic along Westminster Avenue, and the vehicle queuing

Figure 6-2: Western Terminus Design Option B: Elevated

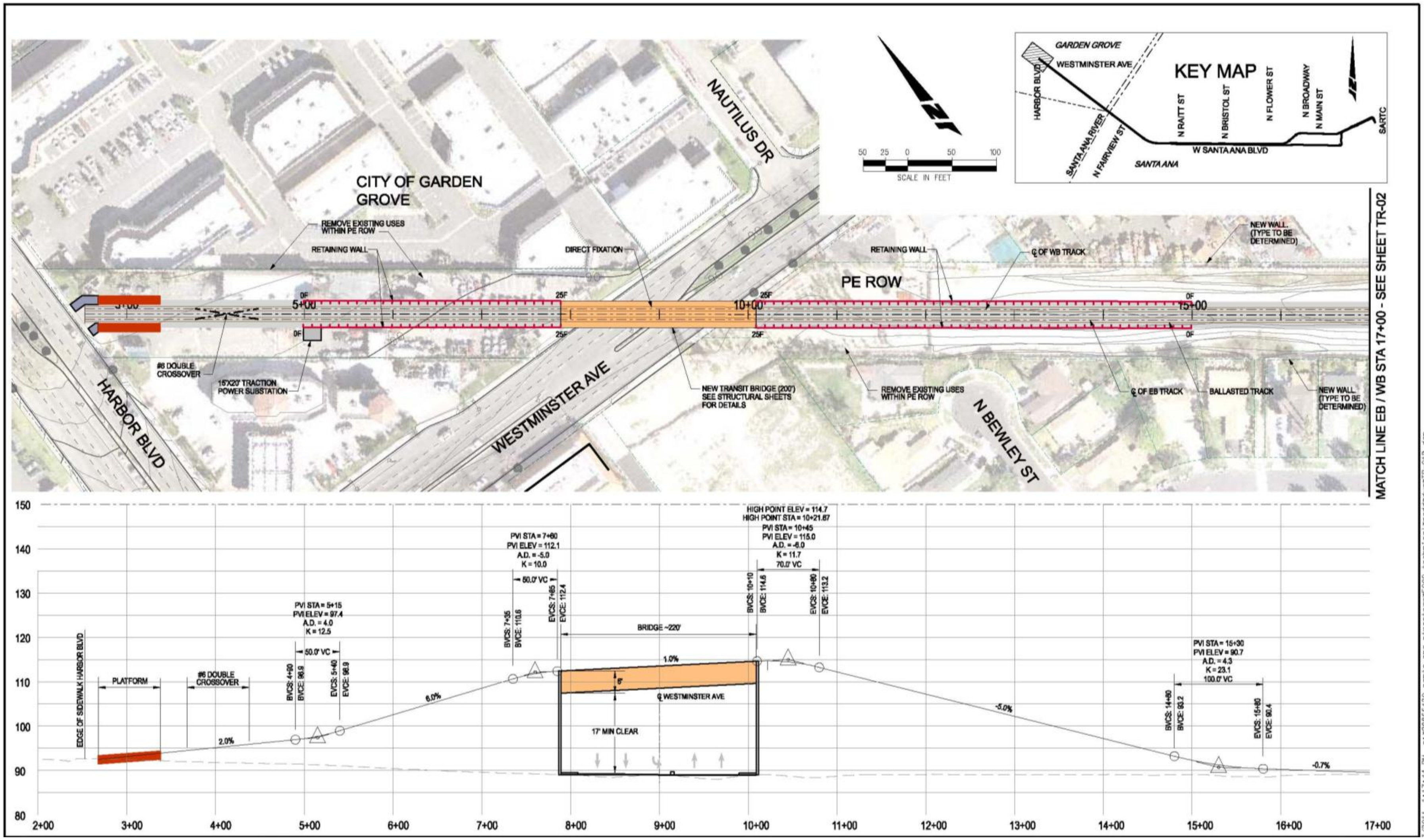
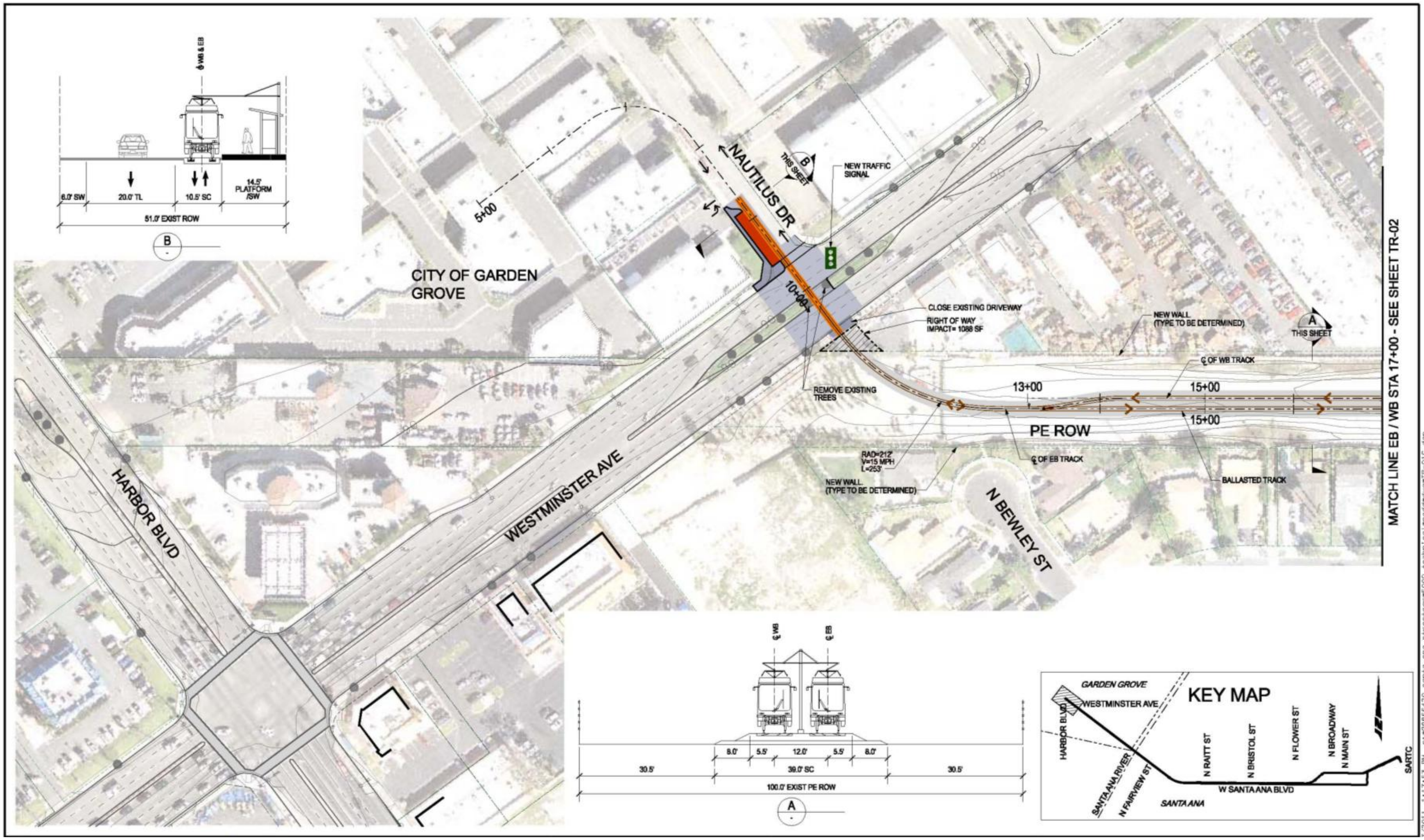


Figure 6-3: Western Terminus Design Option C: Truncated At-Grade



that occurs, particularly during peak traffic periods, at the intersection of Westminster Avenue and Harbor Boulevard, the new intersection is estimated to negatively impact traffic operations at this major intersection. For these reasons the City of Garden Grove did not support this option.

Right-of-Way Required - Option A will require approximately 50,136 square feet of right-of-way acquisition (37,820 square feet for the track alignment, 11,281 square feet for mitigation at the Harbor Boulevard/Westminster Avenue intersection, and 1,035 square feet to align the tracks to cross Westminster Avenue perpendicularly at Nautilus Drive) and removal of three buildings (approximately 28,700 square feet).

Environmental Tradeoffs – In evaluating the environmental tradeoffs between the Western Terminus Options, three environmental issue areas to considered: 1) Traffic and Circulation; 2) Visual/Aesthetics; and 3) Acquisitions, Displacement and Relocation.

Traffic/Circulation: Compared to the No Build condition, Option A will result in worse traffic conditions. This is due to impacts to traffic operations at the intersection of Harbor Boulevard and Westminster Avenue resulting from the new intersection at Westminster Avenue and Nautilus Drive. The distance between Harbor Boulevard and Nautilus Drive is insufficient to accommodate vehicle queuing between these two intersections, particularly during peak traffic hours, resulting in increased delay at the Harbor Boulevard, Westminster Avenue intersection. To mitigate these traffic impacts would require the addition of a second left turn lane at each of the approaches to the Harbor Boulevard/Westminster Avenue intersection. Additional right-of-way would need to be acquired to achieve the necessary roadway widths for this improvement.

Visual/Aesthetics: Option A is not estimated to change the visual/aesthetic character of the surrounding area compared to the No Build Alternative. The introduction of the streetcar crossing at a new signalized intersection along Westminster Avenue is not inconsistent with corridor viewscape which includes signalized intersections at ½ mile or less intervals, commercial and industrial buildings, billboards, streetlights and other overhead features fronting along the roadway.

Acquisitions, Displacement, and Relocation: Conditions are estimated to be notably worse with Option A compared to the No Build condition. This is because, as described previously, the At-grade Option will require removal of three existing buildings totaling approximately 28,700 square feet, and the acquisition of approximately 38,855 square feet of private property to accommodate the streetcar alignment.

Capital Cost – Option A is estimated to cost approximately $12.3 million, the highest of the three options. A major component of the cost (approximately 30 percent) is for right-of-way acquisition and the cost to relocate the displaced businesses. This estimate also includes the cost of mitigating the traffic impacts at the intersection of Harbor Boulevard and Westminster Avenue, which involves adding second left turn lanes to each of the four approaches of the intersection and requires additional right-of-way.

6.2.2 Option B: Elevated

Community Support – Evaluated on a scale of 0 to 3 with 0 indicating no community support and 3 indicating strong community support, Option B received a 3. The City of Garden Grove strongly supported Option B because it would not impact traffic flow and operations along Westminster Avenue or at the intersection of Westminster Avenue and Harbor Boulevard. Under Option B, the streetcar alignment is completely within the PE ROW and therefore would not require any additional right-of-way, or impact adjacent development in the City of Garden Grove as the Option A did.

Right-of-Way Required - Option B does not require right-of-way.

Environmental Tradeoffs – Traffic/Circulation: Compared to the No Build condition, the Option B will not alter traffic conditions in the surrounding area. Crossing Westminster Avenue on a bridge the streetcar will not interact with traffic along Westminster Avenue. The tied-arch bridge proposed for this crossing would span Westminster Avenue requiring no modification to the roadway below.

Visual Aesthetic: The Option B would alter the visual/aesthetic condition of the surrounding area compared to the No Build alternative. The elevated bridge structure will be visible along Westminster Avenue and may also be visible to nearby residents whose homes back up to the south side of the PE ROW, south of Westminster Avenue.

Acquisitions, Displacement, and Relocation: Conditions are unchanged compared to the No Build condition with Option B. Located entirely within the PE ROW, Option B does not result in displacement, relocation or the need for right-of-way acquisition.

Capital Cost – Option B is estimated to cost approximately $9.4 million.

6.2.3 Option C: Truncated At-grade

Community Support – Evaluated on a scale of 0 to 3 with 0 indicating no community support and 3 indicating strong community support, Option C received a 1. Both the City of Santa Ana and the City of Garden Grove expressed interest in this option because it offered cost savings compared to Option B, and did not have the right-of-way and displacement impacts of Option A. However, the City of Garden Grove expressed concern about the impacts to traffic that would occur with Option C, similar to Option A.

Right-of-Way Required - Option C will require acquisition of approximately 1,088 square feet of right-of-way along the southeast side of the PE ROW as it approaches Westminster Avenue. This right-of-way is required in order to align the streetcar tracks with Nautilus Drive to the north. An additional 11,281 square feet of right-of-way is required along Harbor Boulevard and along Westminster Avenue in proximity to the Harbor

Boulevard/Westminster Avenue intersection to mitigate traffic impacts of the at-grade streetcar crossing on that intersection.

Environmental Tradeoffs – Traffic/Circulation: Compared to the No Build condition, Option C will result in worse traffic conditions. As described in Option A, this is primarily due to impacts to the intersection of Harbor Boulevard and Westminster Avenue resulting from the new intersection at Westminster Avenue and Nautilus Drive. Additionally, under Option C, traffic would be prohibited from exiting Nautilus Drive onto Westminster Avenue; existing traffic would be rerouted to the intersection of Enterprise Drive at Westminster Avenue approximately 400 feet to the east of Nautilus Drive. This would mean that motorists who are currently exiting onto westbound Westminster Avenue via Nautilus Drive will have some out-of-direction travel as a result of Option C.

Visual/Aesthetic: Option C is not estimated to change the visual/aesthetic character of the surrounding area compared to the No Build Alternative. As described for Option A, the introduction of the streetcar crossing at a new signalized intersection along Westminster Avenue is not inconsistent with corridor viewscape which includes signalized intersections at ½ mile or less intervals, commercial and industrial buildings, billboards, streetlights and other overhead features fronting along the roadway.

Acquisitions, Displacement, and Relocation: In Option C, the streetcar terminus platform is located curbside along the west side of Nautilus Drive. No right-of-way would be required to accommodate the platform or the terminus station, however, approximately 1,088 square feet of right-of-way is required to align the streetcar tracks perpendicular to Westminster Avenue at Nautilus Drive. Parking for the terminus station would be provided within the PE ROW, approximately 300 feet from the platform.

Capital Cost – Option C is estimated to cost approximately $3.1 million. This includes approximately $1.8 million for the streetcar improvements, and approximately $1.3 million to mitigate the impacts of the at-grade crossing on the traffic operations at Harbor Boulevard and Westminster Avenue. With no elevated structure and a shorter track-length compared to the other Options, Option C is the least expensive of the three options.

6.2.4 Conclusions and Recommendations

Option A is the most expensive of the three options for the Western Terminus. Compared to the No Build conditions, it results in worsened traffic conditions, and right-of-way impacts that would require acquisition, displacement and relocation of businesses in three buildings. Option C eliminates the need to acquire buildings that occur with Option A. It also costs the least of the three options. However, it results in worsened traffic conditions. Option B has no right-of-way or traffic impacts. It will alter the visual character of the area compared to No Build Conditions. It costs more than Option C but less than Option A.

Option B is recommended for the Western Terminus because of its reduced impacts compared to the other two options, and the strong interest and support expressed for this option by the City of Garden Grove.

6.3 Santa Ana River Crossing

Streetcar Alternatives 1 and 2 both utilize the PE ROW which requires crossing over the Santa Ana River. This alignment was once used for the Pacific Electric Railway red car system and the old Pacific Electric Santa Ana River Bridge still remains. However, it has long been closed for use by vehicles or pedestrians. Based on a preliminary examination, it was determined that the existing bridge structure would not meet current capacity and load standards for transit use. However, previous studies, including the State Route 22/West Orange County Connection Final Environmental Impact Statement/Environmental Impact Report (March 2003), found the Old Santa Ana River Bridge eligible for inclusion in the National Register of Historic Places (NRHP). Therefore, four design options were developed for Streetcar Alternatives 1 and 2 at the Santa Ana River Crossing to address the needs of the streetcar system while at the same time minimizing the potential impact to an historic resource

- <u>Option 1: Bridge Replacement</u> – Under Option 1, the existing PE bridge structure would be removed and a new bridge structure to support two tracks of the proposed streetcar alignment would be built in its place (see Figure 6-4). The new bridge would match the span arrangement and pier placement of the existing bridge so as not to significantly alter the channel hydraulics of the Santa Ana River. In order to aesthetically replace the form of the existing bridge, a non- structural ornamental truss would be designed and attached to the new bridge structure. This ornamental steel provides a canopy for the new bridge that matches the form of the existing bridge steel truss.
- <u>Option 2: Bridge Avoidance A</u> – Under Option 2, the PE Santa Ana River Bridge would be left in place. Two new bridge structures would be built on each side of the existing bridge to support the proposed streetcar alignment – one track on each side (see Figure 6-5). This allows the proposed streetcar alignment for Streetcar Alternatives 1 and 2 to remain entirely within the PE ROW. The substructure of the two new bridges would align with the span arrangement and pier placement of the existing bridge so as to not significantly alter the channel hydraulics of the Santa Ana River.

- <u>Option 3: Bridge Relocation</u> - In Option 3, the old PE Santa Ana River Bridge would be detached from its existing foundation and moved approximately 650 feet south of its current location. It would be positioned on a new foundation and piers providing the potential for future repurposing of the bridge for bicyclists and pedestrians. A new double-track bridge would be constructed within the PE ROW to accommodate the fixed guideway. Figure 6-6 shows the Option 3 concept.

Figure 6-4: Santa Ana River Crossing Option 1: Bridge Replacement

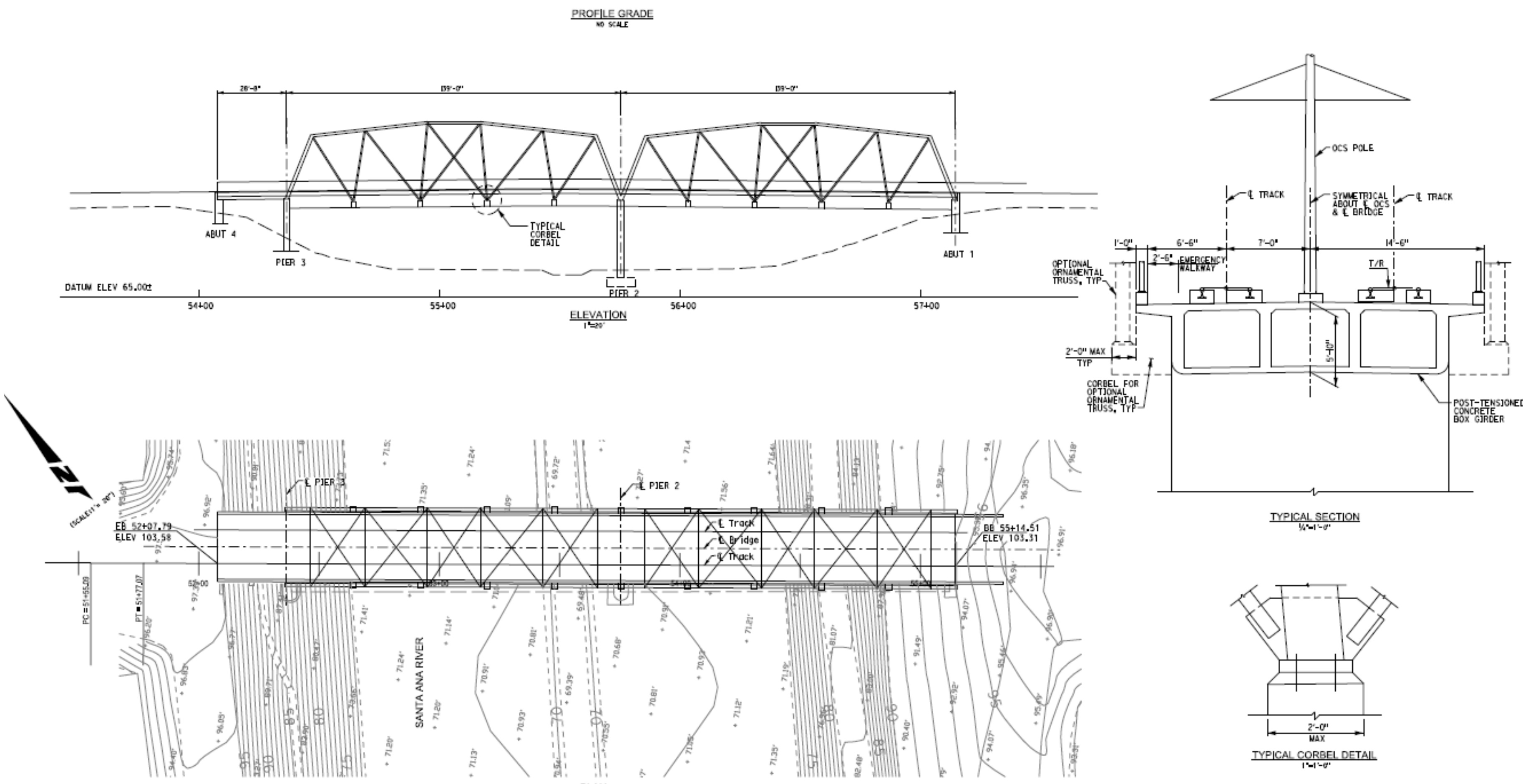


Figure 6-5: Santa Ana River Crossing Option 2: Bridge Avoidance A

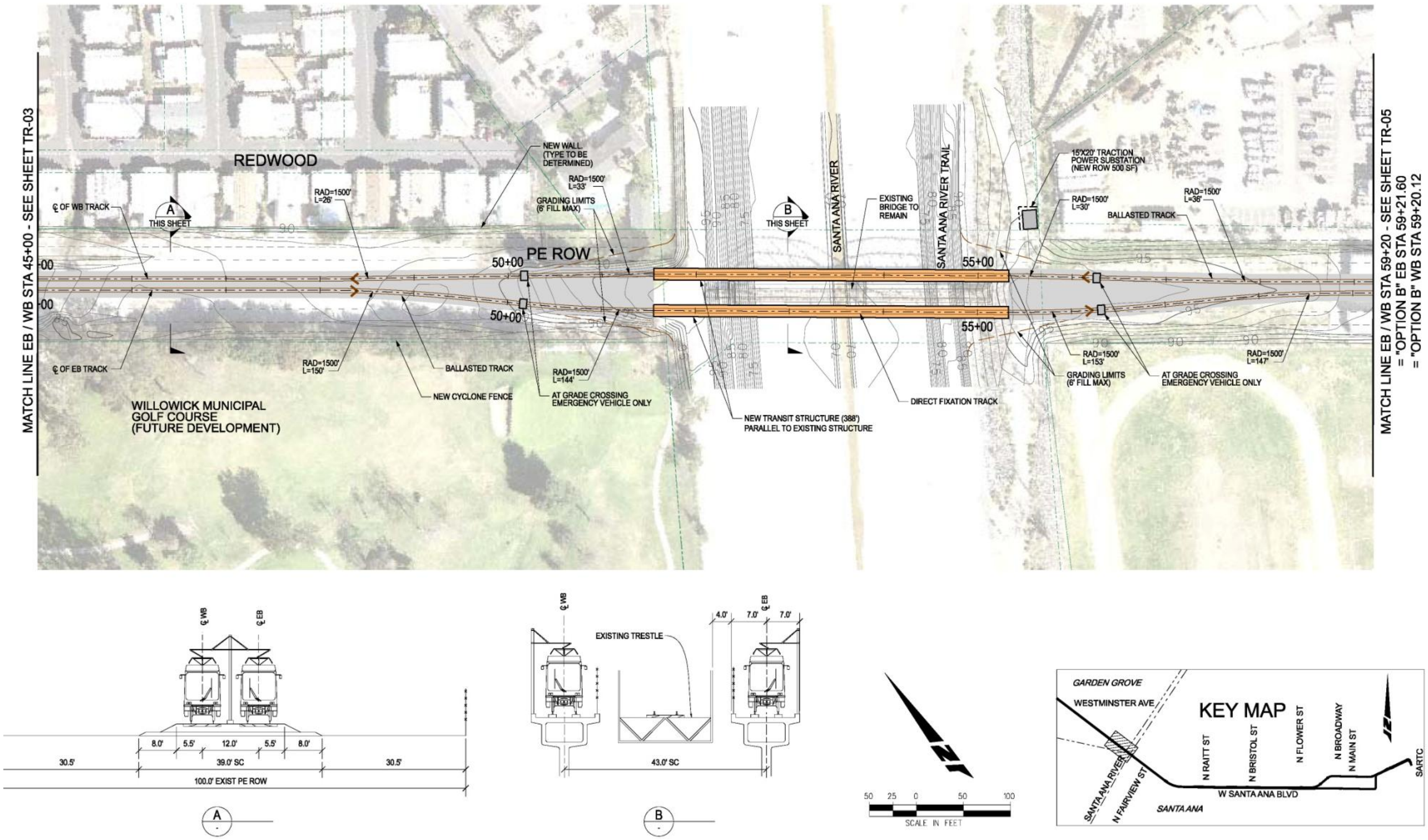
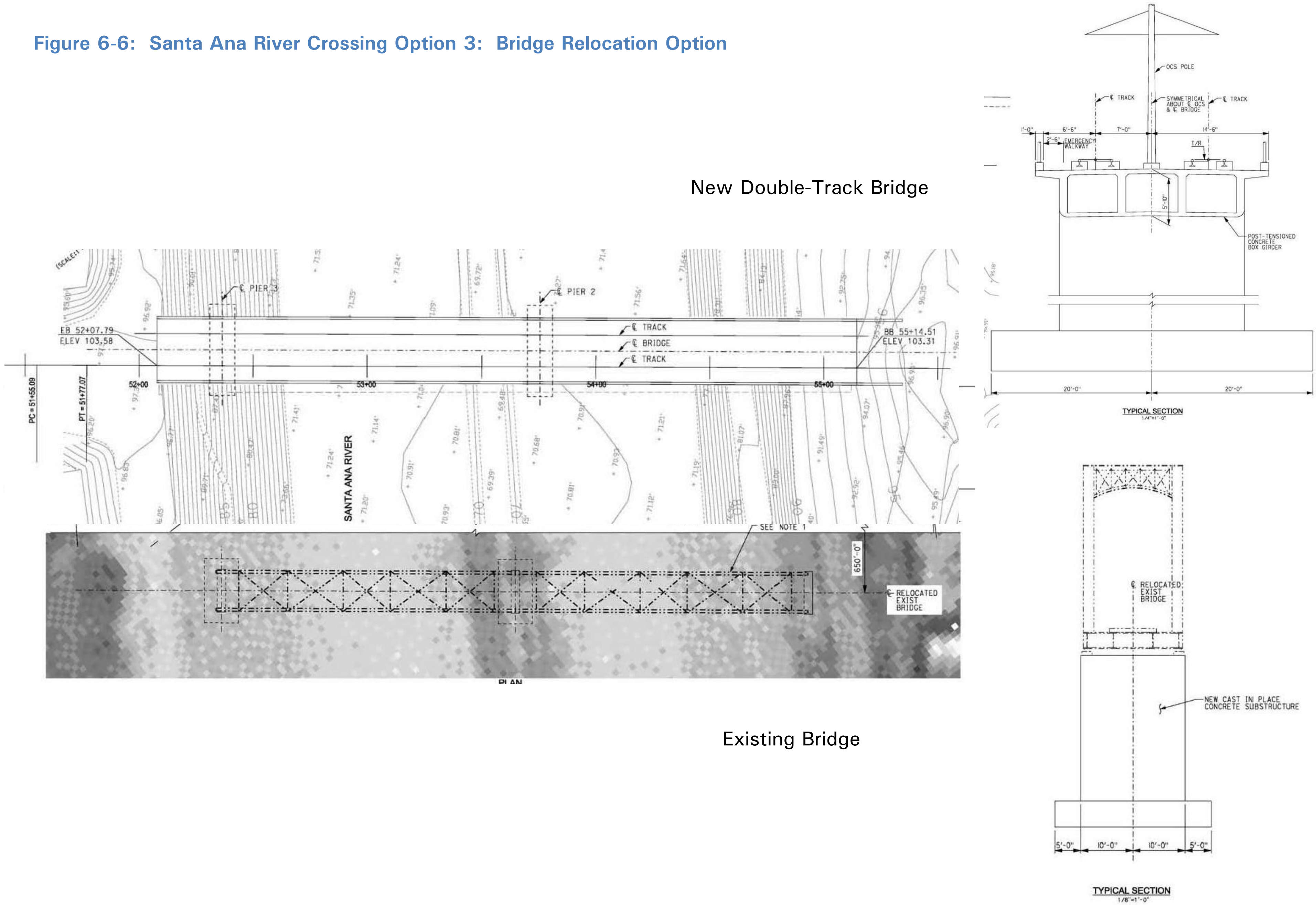


Figure 6-6: Santa Ana River Crossing Option 3: Bridge Relocation Option



Option 4: Bridge Avoidance B - In Option 4, the old PE Santa Ana River Bridge would remain in its current location and condition. A new single-track bridge would be constructed immediately south of the historic bridge to carry the fixed guideway. Through the use of gates and signaling, the single-track bridge would accommodate bi-directional fixed guideway operations. Although adequate for the proposed fixed guideway project, this will pose some capacity constraints for future expansion of fixed guideway operations. Although the, the view of the historic bridge would be somewhat obstructed by the new bridge when viewed from the south, the view from the north would remain unchanged. Figure 6-7 shows the Option 4 concept.

6.3.1 Option 1: Bridge Replacement

Community Support – During public outreach which was conducted throughout the development and evaluation of project alternatives, the Santa Ana Historical Preservation Society and some interested members of the community expressed concern about the proposed demolition of the old Pacific Electric Santa Ana River Bridge. They indicated their profound interest in consideration of alternatives that would preserve the old bridge as a community resource.

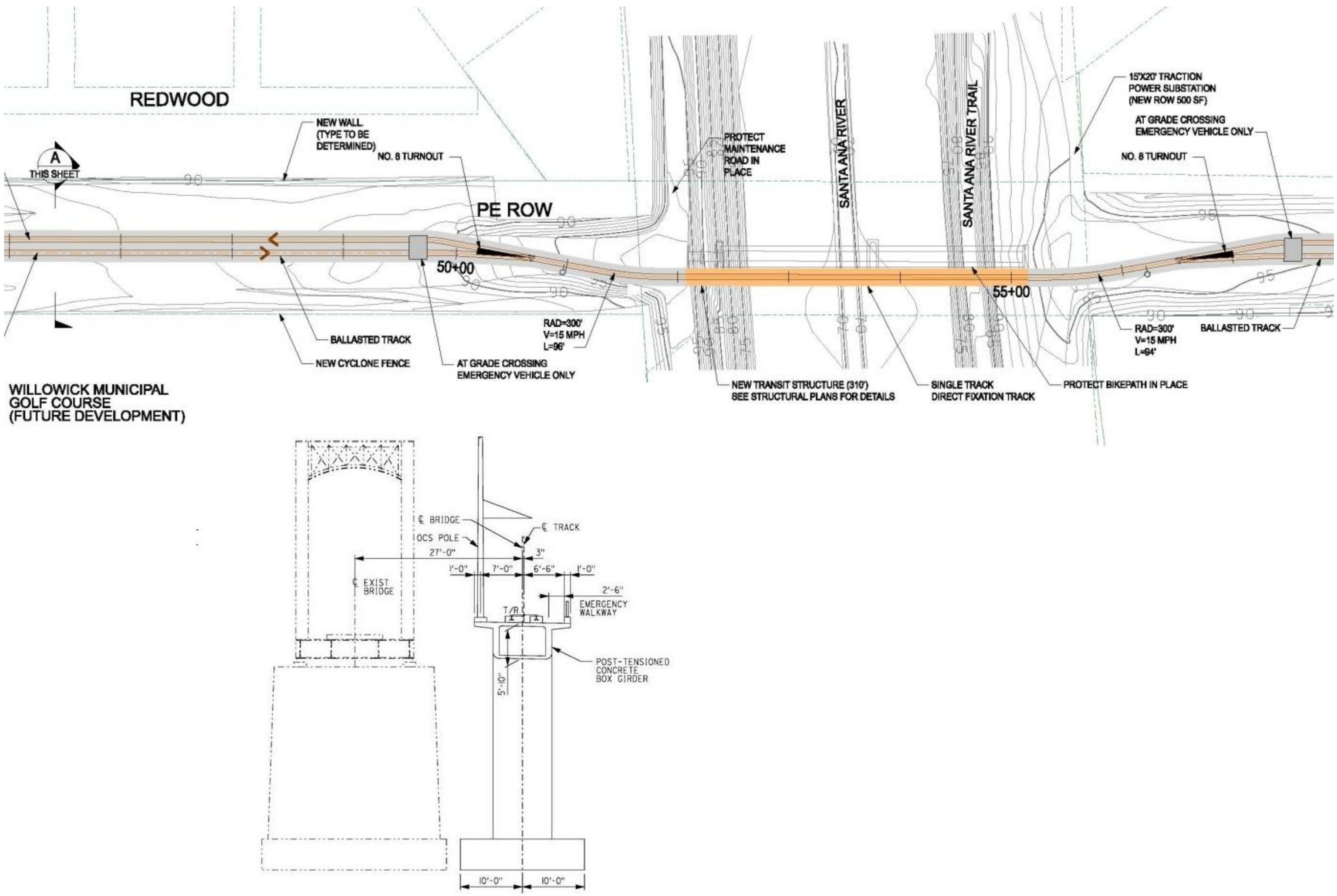
Environmental Tradeoffs – Cultural Resources: In this design option, the existing old Pacific Electric Santa Ana River Bridge would be adversely affected. Initial consultations with the California State Historic Preservation Office, suggested that the replacement of the old bridge with a new bridge designed to look like the old bridge and serving a similar function was an appropriate mitigation. However, based on subsequent research, it was determined that existing bridge was eligible for inclusion in the National Register of Historic Places (NRHP), and therefore subject to the requirements of U.S. Department of Transportation Act of 1966 Section 4(f). Based on the requirements set forth in Section 4(f), if an evaluation of alternatives identifies a feasible and prudent alternative that completely avoids Section 4(f) properties, it must be selected. If there is no feasible and prudent alternative that avoids all Section 4(f) properties, the alternative that causes the least overall harm must be selected. Option 1 does not avoid the bridge, nor is it the least harmful to the bridge of the alternatives which have been identified.

Visual/Aesthetics: Under Option 1, a new bridge would be constructed to include an ornamental truss similar in design and style as the original bridge. Given the condition of the existing bridge, the new bridge would represent an improvement in the aesthetic appearance and visual character compared to the existing bridge.

Traffic/Circulation: Replacement of the Pacific Electric Santa Ana River Bridge would not alter existing traffic nor would it conflict with planned arterial improvements within this area.

Capital Cost – Option 1 is estimated to cost $4.9 million.

Figure 6-7: Santa Ana River Crossing Option 4: Bridge Avoidance B



6.3.2 Option 2: Bridge Avoidance A

Community Support – Although community support, particularly as expressed by the Santa Ana Historical Preservation Society, was somewhat greater for Option 2 than Option 1, concerns were expressed regarding the impact to the view of the old bridge once new bridges were constructed immediately adjacent and on each side of the old bridge.

Environmental Tradeoffs – Cultural Resources: Under this design option, the existing bridge would remain in place and new single-track bridges would be constructed on each side of the existing bridge. Some modifications to the existing bridge would be necessary in order to accommodate the maintenance road and the multipurpose regional trail along the west bank of the Santa Ana River. So while this option has less impact to this cultural resource than Option 1, both the bridge and its setting would be affected to some degree.

Visual/Aesthetic: Construction of two new bridge structures parallel to the existing old bridge would alter the existing view shed somewhat compared to existing conditions. While this visual effect is less than significant, the new structures would partially obscure some views of the old bridge.

Traffic/Circulation: Construction of two new bridge structures parallel to the existing bridge would conflict with a four-lane arterial included on Orange County's Master Plan of Arterial Highways for this segment of the PE ROW between SR-22 and Raitt Street. While the placement of these bridges would not necessarily preclude the eventual construction of the future PE ROW arterial; additional right-of-way would be required in the vicinity of this bridge crossing for the PE ROW arterial bridge structure.

Capital Cost –Option 2 is estimated to cost approximately $4.6 million. Option 2 is estimated to cost slightly less than Option 1, even though two separate structures would be constructed. This is because, under Option 2, each structure would carry streetcar track for a single direction. Therefore the bridges would be approximately half as wide as the bi-directional bridge that would be constructed under the Option 1. Additionally, there would be no costs associated with demolishing the existing bridge since it would remain in place. Also, it is unlikely that the decorative truss proposed in Option 1 would be included in Option 2, since it would further obstruct the view of the existing bridge.

6.3.3 Option 3: Bridge Relocation

Community Support – The Santa Ana Historical Preservation Society expressed interest in the opportunity to relocate the old Pacific Electric Bridge approximately 650 feet to the south of its current and location and rehabilitate and repurpose the bridge for use by pedestrians and bicyclists. However, they were concerned about the viability of moving the old bridge and the possibility of damage to the structure during relocation. There was also some interest expressed by members of the community it the possibility of reusing the bridge to enhance bicycle/pedestrian trail connectivity.

Environmental Tradeoffs – Cultural Resources: Based on discussions with the State Historical Preservation Office (SHPO), the relocation of the old Pacific Electric Santa Ana River Bridge from the abandoned rail corridor would significantly impact the old bridge by altering its historic context. SHPO also expressed concerns regarding the potential for damaging the bridge during relocation.

Visual/Aesthetic: The view of the old bridge would be altered as a result of its relocation. The construction of the new bridge within the PE ROW would also slight obstruct the view of the old bridge from the north looking south.

Traffic/Circulation: Construction of the new bridge within the PE ROW would not conflict with the four-lane arterial included on Orange County's Master Plan of Arterial Highways along the PE ROW between SR-22 and Raitt Street. The relocation and repurposing of the old bridge would enhance trail connectivity across the Santa Ana River for pedestrians and bicyclists.

Capital Cost –Option 3 is estimated to cost approximately $5.8 million and is the most costly of the bridge options. The capital cost estimate includes the costs associated with dismantling and relocating the old bridge onto new foundations as well as the cost of constructing the new double-track bridge within the PE ROW.

6.3.4 Option 4: Bridge Avoidance B

Community Support – The Santa Ana Historical Preservation Society expressed preference for Option 4 because the existing bridge would remain undisturbed and the construction of the single-track bridge to the south would have only limited visual impact on the old bridge. Some concern was expressed, including from OCTA, regarding the capacity of the single-track bridge and its capability to safely accommodate anticipated streetcar traffic without impacting travel times.

Environmental Tradeoffs – Cultural Resources: Under this design option, the existing bridge would remain in place and a new single-track bridge would be constructed on the south side of the existing bridge. Some modifications to the existing bridge would be necessary in order to accommodate the maintenance road and the multipurpose regional trail along the west bank of the Santa Ana River. So while this option has less impact to this cultural resource than the other options, both the bridge and its setting would be affected to some degree.

Visual/Aesthetic: Construction of a new bridge structure parallel to the existing old bridge would alter the existing view shed somewhat compared to existing conditions. While this visual effect is less than significant, the new structures would partially obscure some views of the old bridge.

Traffic/Circulation: Construction of a new bridge structure parallel to the existing bridge would conflict with the four-lane arterial included on Orange County's Master Plan of

Arterial Highways for the PE ROW between SR-22 and Raitt Street. While the placement of the bridge would not necessarily preclude the eventual construction of the future PE arterial; additional right-of-way would be required in the vicinity of this bridge crossing for the PE ROW arterial bridge structure.

Capital Cost –Option 4 is estimated to cost approximately $2.1 million. Option 4 is the least costly of the options. This is because, under Option 4, one single-track bridge structure would be constructed. Two-way streetcar operations would be provided through the use of interlock and signals, which have been included in the cost estimate for Option 4. Additionally, there would be no costs associated with demolishing the existing bridge since it would remain in place.

6.3.5 Conclusions and Recommendations

Based on the evaluation and ranking of the design options, one option will be carried forward for further study in the environmental review:

- Option 4: Bridge Avoidance B - Existing bridge remains; construct new single-track bridge south of existing bridge.

Option 1 will be eliminated from further consideration because, based on the requirements of NEPA and Section 4(f), the impacts to the old bridge represent a "fatal flaw" when there is an available option that does not significantly impact the bridge as an historic resource.

Option 2 will be eliminated from further consideration. It failed to perform well in terms of Impact to Historic Resource because the construction of two new bridges immediately adjacent and on each side of the old bridge would obstruct the view of the old bridge and alter the visual setting. Option 2 was also incompatible with future plans and improvements within the PE ROW, and would necessitate acquisition of considerable additional right-of-way with potential community impacts if future improvements were to be accommodated.

Option 3 will be eliminated for the same reason as Option 1. The impacts of relocating and repurposing the bridge would create a potentially significant impact to an historic resource under Section 4(f).

6.4 Operations and Maintenance Facility Site Options

Two sites have been proposed as possible candidate locations for the streetcar operations and maintenance facility. Site A is located south of SARTC at the corner of Santiago Street and 6th Street (see Figures 4-4 through 4-6 presented previously). The 2.2 acre site is currently being used as a material recovery/disposal transfer station. Site B is located between 5th Street and the PE ROW, west of Raitt Street (see Figures 4-4 and 4-7 through 4-8 presented previously). This 2.4-acre rectangular site is comprised of three parcels. A materials reclamation/recycling facility is on the two eastern parcels. The western-most parcel has several residences. All three parcels are zoned "Industrial".

6.4.1 Site A: Near SARTC

Community Support – Evaluated on a scale of 0 to 3 with 0 indicating no community support and 3 indicating strong community support, Site A received a 3. The residents to the north and west of Site A expressed strong support for the proposed acquisition of Site A, which currently houses the Santa Ana Materials Recovery Facility (a waste disposal transfer station) and redevelopment of the site as a streetcar maintenance facility. The odors associated with the current activities on the site and, to a lesser degree, the noise generated by traffic and daily site operations have made the transfer facility an unpopular neighbor. The City of Santa Ana also supports location of the maintenance facility at Site A as consistent with their Rail Station District Plan and Transit Zoning Code for the area.

Right-of-Way Required – Site A would require acquisition of the property at 1035 E. 4th Street in Santa Ana (approximately 95,832 square feet). The existing recycling center/waste transfer facility would be relocated.

Environmental Tradeoffs – In evaluating the environmental tradeoffs for the candidate maintenance facility sites, two environmental issues areas were considered: 1) Acquisition, Displacement and Relocation; and 2) Noise and Vibration.

Acquisition, Displacement and Relocation: Compared to the No Build condition, Site A is worse in terms of acquisition, displacement and relocation. It would require acquisition of the waste transfer facility, resulting in displacement of this business and the need to relocate.

Noise/Vibration: Site A would not result in changes in noise levels compared to the No Build condition. The existing transfer facility accommodates a high volume of truck traffic and heavy equipment operations as part of its daily business activities. The streetcar maintenance facility would not result in increased noise levels compared to the existing facility, and may have reduced noise levels. In addition there are no sensitive receptors located near this site.

Ease of Transit Operations – Site A is smaller and more irregularly shaped than Site B. As a result, the layout of the proposed operations and maintenance facility is more constrained and provides for slightly less ease of transit operations compared to Site B.

Capital Cost – Acquisition of Site A and construction of the operations and maintenance facility at that location is estimated to cost approximately $38.4 million or approximately $12.0 million more than Site B.

6.4.2 Site B: Near Raitt Street

Community Support – Evaluated on a scale of 0 to 3 with 0 indicating no community support and 3 indicating strong community support, Option B received a 0. While there has been no expression of opposition to locating the operations and maintenance facility at Site B, there has been no expression of support either. The City of Santa Ana is less interested in Site B than Site A as the potential location of the facility.

Right-of-Way Required – Site B would require acquisition of three privately-owned parcels totaling approximately 104,544 square feet. Site B is approximately 8,712 square feet larger than site A.

Environmental Tradeoffs – Acquisition, Displacement and Relocation: Compared to the No Build condition, the Site A is notably worse in terms of acquisitions, displacements and relocation. Of the three parcels that would be acquired to accommodate the operations and maintenance facility at Site B, two currently house a materials reclamation/recycling facility. The third parcel has multi-family residential development (several small residential structures on the single parcel. The business and the residents would be displaced and require relocation as part of the acquisition of Site B.

Noise/Vibration: Noise and vibration is estimated to be somewhat worse with the operations and maintenance facility at Site B compared to the No Build condition, although design features would reduce noise to a level that is less than significant for sensitive receptors (residential properties) located north of 5th Street.

Ease of Transit Operations – Site B provides superior transit operations compared to Site A. The larger size and rectangular shape of the site provide for an optimal access, circulation and layout of facilities.

Capital Cost – Acquisition of Site B and construction of the operations and maintenance facility at that location is estimated to cost approximately $26.4 million, or approximately $12.0 million less than Site A.

6.4.3 Conclusions and Recommendations

Site A is slightly smaller than Site B and irregularly shaped, making the ease of operations somewhat less than with Site B. Site A is also more expensive than Site B. However it offers advantages in terms of environmental tradeoffs. It would not result in the displacement of any residents. It also would not create additional noise compared to existing conditions and may in fact reduce noise somewhat. Site A is consistent with adopted land use plans and policies of the City of Santa Ana. However, the analysis conducted as part of the environmental review process and accompanying public comment will further discern the relative advantages and disadvantages of each of these options and support the selection of the preferred option.

6.5 Sasscer Park Design Options

In Streetcar 1, the Downtown segment features couplet operations with the westbound streetcar alignment on Santa Ana Boulevard, and the eastbound streetcar alignment on 4th Street. Two options have been identified for the eastbound transition from Santa Ana Boulevard to 4th Street: 1) a direct route from Santa Ana Boulevard along a public easement on the southern edge of Sasscer Park to 4th Street; or 2) a curved route around the park via Santa Ana Boulevard to Ross Street to 4th Street (see Figure 6-8).

6.5.1 Option 1A: Direct Route

Community Support – There has been no community comment to provide a basis to evaluate community support for this option. The public will have additional opportunity to consider this option as part of the public review of the Draft Environmental Impact Report/Environmental Assessment for the Santa Ana and Garden Grove Fixed Guideway. Comments received during environmental public review process will be taken into consideration during the selection of the Locally Preferred Alternative.

Transit Benefit to Existing Land Use – Option 1A would benefit the commercial office buildings along the south side of the alignment adjacent to Sasscer Park by enhancing accessibility and visibility. It would likewise improve access to Sasscer Park itself and enhance visibility and awareness of the park.

Right-of-Way Required – No right-of-way is required for Option 1A.

Environmental Tradeoffs - In evaluating the environmental tradeoffs for the Sasscer Park alignment options, two environmental issues areas were considered: 1) Acquisition, Displacement and Relocation; and 2) Public Parkland, Recreational Areas.

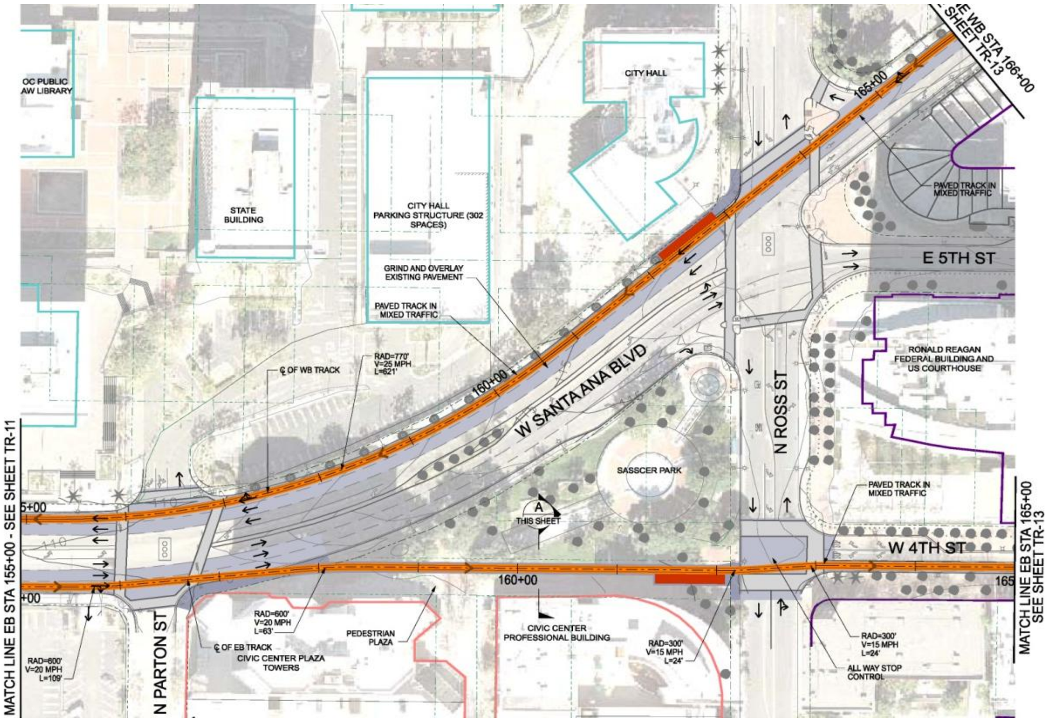
Acquisition, Displacement and Relocation: In terms of acquisition, displacement and relocation, there is no change with Option 1A compared to the No Build condition since no right-of-way is required.

Public Parkland, Recreational Areas: Option 1A would introduce a transportation facility along the southern edge of Sasscer Park. Compared to the No Build condition this would represent a somewhat worse condition for public parkland since the streetcar would be an "active" element introduced into an otherwise passive recreation area, resulting in some minimal noise and the need for pedestrian awareness.

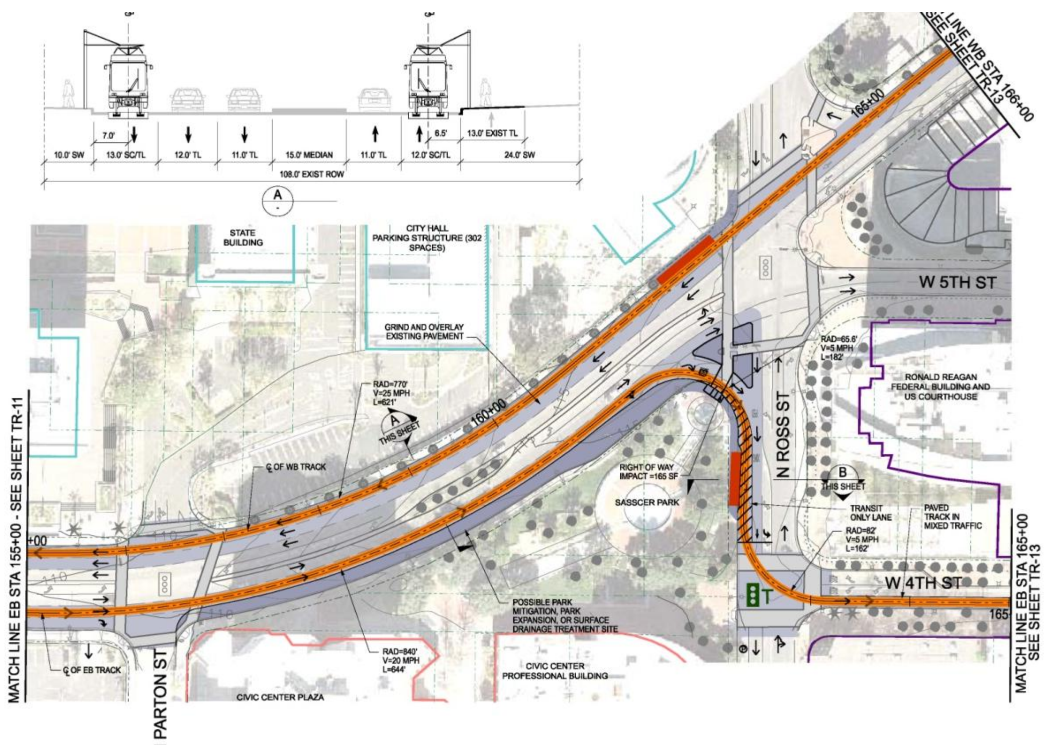
Travel Time – The Option 1A alignment is a shorter distance than Option 1B, resulting in 1:38-minute shorter travel time along the Downtown Segment compare to Option B.

Capital Cost – Option 1A would cost $2.3 million less than Option 1B.

Figure 6-8: Sasscer Park Design Options



Option 1A: Direct Route



Option 1B: Curved Route

6.5.2 Option 1B: Curved Route

Community Support – There has been no community comment to provide a basis to evaluate community support for this option. The public will have additional opportunity to consider this option as part of the public review of the Draft Environmental Impact Report/Environmental Assessment for the Santa Ana and Garden Grove Fixed Guideway. Comments received during environmental public review process will be taken into consideration during the selection of the Locally Preferred Alternative.

Transit Benefit to Existing Land Use – The Option 1B alignment remains within the curb lane on Santa Ana Boulevard and on Ross Street, passing the Federal Building, Santa Ana City Hall, the California State Appellate Court, the Ronald Reagan Federal Building and Courthouse and Sasscer Park. While the streetcar would enhance accessibility to these government facilities, there is little other benefit to existing land uses which are institutional and unlikely to change, improve or receive enhanced value with the introduction of the streetcar. Option1B is therefore considered to be less beneficial than Option 1A.

Right-of-Way Required – Approximately 165 square feet of right-of-way is required at the southwest corner of Santa Ana Boulevard and Ross Street, along the northeastern edge of Sasscer Park, in order to accommodate the turn radius of the streetcar.

Environmental Tradeoffs – Acquisition, Displacement and Relocation: Option 1B is somewhat worse compared to the No Build condition since 165 square feet of the northeastern edge of Sasscer Park is required.

Public Parkland and Recreation Area: There would also be a slight change with Option 1B compared to the No Build condition for Public Parkland and Recreation Area due to the need for the small amount of right-of-way from the northeastern edge of Sasscer Park.

Travel Time – The Option 1B alignment is longer than Option A and would result in 1:38 minutes more travel time along the Downtown Segment compare to Option A.

Capital Cost – Option 1B would cost $2.3 million more than Option A.

6.5.3 Conclusions and Recommendations

Option 1A provides the greatest potential to benefit existing land uses. No right-of-way is required for Option 1A, therefore in terms of acquisition, displacement and relocation environmental tradeoffs, there is no difference between Option1A and the No Build. Option 1A will introduce a transportation element along the southern edge of Sasscer Park, but it is a mode that is compatible with the pedestrian character of the park and the adjacent easement. Option 1A is a shorter route and therefore provides a reduced travel time compared to Option 1B. It is estimated to cost approximately $2.3 million less than

Option 1B. For all of these reasons, Option 1A is recommended for the Streetcar 1 alignment.

6.6 4th Street Parking Scenarios

The Streetcar 1 alignment would utilize 4th Street between Ross Street and Mortimer Street in the westbound direction. From east of Ross Street to French Street, 4th Street has one travel lane in each direction with head-in diagonal parking along each side of the roadway. The diagonal parking, with vehicles exiting parking spaces by backing into the travel lane, is incompatible with reliable streetcar operations. Three design options were identified to address the diagonal parking on 4th Street as described below and shown on Figure 6-9:

- Scenario A: Convert the diagonal parking along the south side of 4th Street to parallel parking and widen the sidewalk along the south side from 12 feet to 20 feet.
- Scenario B: Remove the diagonal parking along the south side of 4th Street and widen the sidewalk along the south side from 12 feet to 28 feet.
- Scenario C: Remove the diagonal parking along both sides of 4th Street and widen the sidewalks along both sides from 12 feet to 28 feet. In this option, only the parking removal and sidewalk widening along the south side would be included in the cost of the project since the streetcar will only operate on the south side (eastbound direction) of the street. The City of Santa Ana would pursue alternative funding to construct the improvements to the north side.

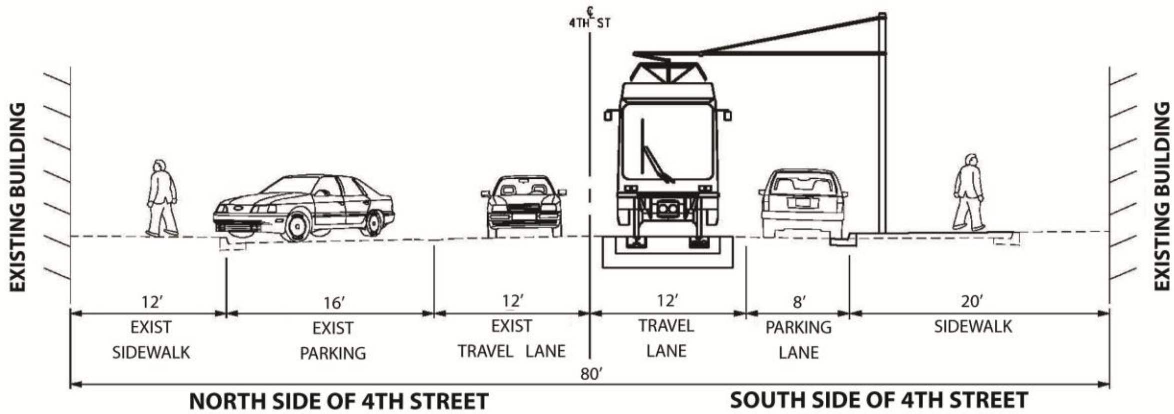
6.6.1 Scenario A: South Side Parallel Parking

Community Support – There has been little community comment to provide a basis to evaluate community support for this scenario, however, concern has been expressed by some members of the Downtown business community regarding the removal of existing on-street parking. This alternative would retain all of the on-street parking along the north side of 4th Street and convert the diagonal parking along the south side of 4th Street to a limited number of parallel parking spaces. Therefore, this scenario may better address those concerned with the loss of on-street parking.

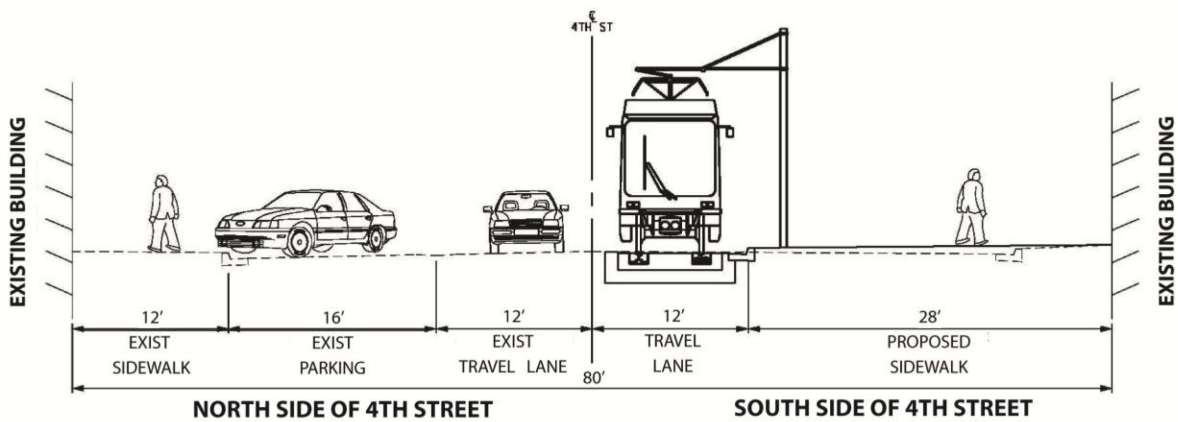
Environmental Tradeoffs - In evaluating the environmental tradeoffs for the 4th Street parking design scenarios, four environmental issues areas were considered: 1) Traffic and Circulation, 2) Parking, 3) Bicycle and Pedestrian Facilities; and 4) Construction Impacts (Temporary).

Traffic/Circulation: Conversion of diagonal parking to parallel parking on the south side of 4th Street creates additional opportunities for conflicts/traffic delay for eastbound traffic on 4th Street as compared to the No Build condition

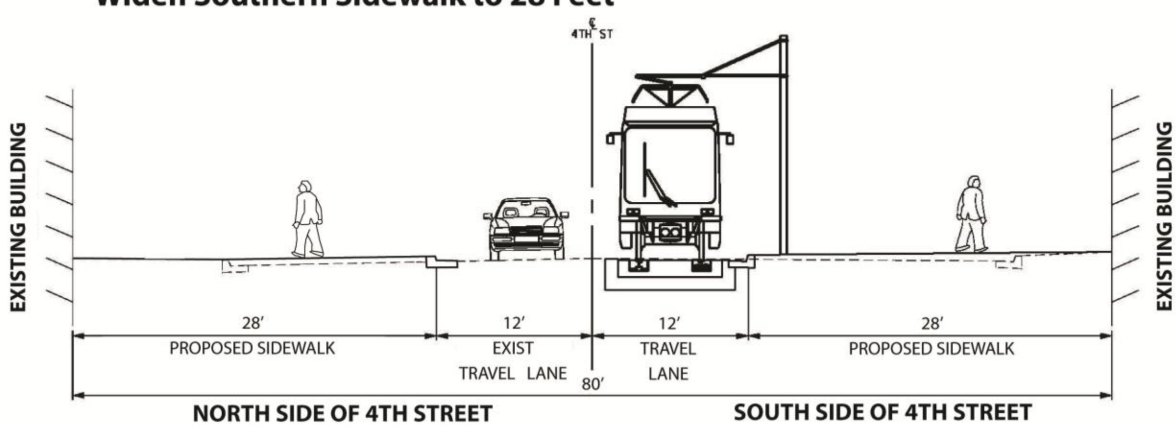
Figure 6-9: 4th Street Parking Scenarios



4th Street Parking Scenario A: Convert Parking along South Side to Parallel and Widen Southern Sidewalk to 20 Feet



4th Street Parking Scenario B: Remove Parking along South Side and Widen Southern Sidewalk to 28 Feet



4th Street Parking Scenario C: Remove Parking along South Side and North Side and Widen Sidewalks to 28 Feet

Parking: Between Ross Street and French Street, parking on the south side of 4th Street would be reconfigured, resulting in a loss of about 26 spaces.

Bicycle and Pedestrian Facilities: Sidewalks would be widened on the south side of 4th Street from 12 feet to about 20 feet, enhancing the pedestrian environment compared to the No Build.

Construction Impacts (Temporary): Construction work associated with sidewalk widening and reconfiguration of parking would result in minor disruption to business access as well as annoyance/inconvenience to patrons along the south side of 4th Street.

Ease of Transit Operations – The parallel parking along the south side of 4th Street would be an improvement compared to the existing diagonal parking since automobiles will not need to back into the travel lane to exit the parking space. However, the continued presence of on-street parking means that drivers will stop in the travel lane to wait for a driver that is exiting a space, and then need to maneuver into the parallel parking space. This activity will disrupt traffic flow along 4th Street and creating traffic delay and potential delay for the streetcar as well.

Capital Cost – Scenario A would cost approximately $1.3 million.

6.6.2 Scenario B: South Side Parking Removal

Community Support – As described in Scenario A, there has been little community comment on the 4th Street parking scenarios. Concern has been expressed by some members of the Downtown business community regarding the removal of existing on-street parking, and this scenario would remove all on-street parking along the south side of 4th Street. There has also been support expressed for the opportunity to widen the sidewalks along 4th Street and Scenario B would provide for the widening of sidewalks along the south side of 4th Street by 8 feet resulting in 20 feet wide sidewalks.

Environmental Tradeoffs – Traffic/Circulation: Removal of parking on the south side of 4th Street reduces opportunities for conflicts/traffic delay for eastbound traffic on 4th Street as compared to the No Build condition.

Parking: Between Ross Street and French Street, parking on the south side of 4th Street would be removed, resulting in a loss of about 77 spaces.

Bicycle and Pedestrian Facilities: Sidewalks would be widened on the south side of 4th Street from 12 feet to about 28 feet, enhancing the pedestrian environment.

Construction Impacts (Temporary): Construction work associated with sidewalk widening and removal of parking would result in minor disruption to business access as well as annoyance/inconvenience to patrons along the south side of 4th Street.

Ease of Transit Operations – The elimination of on-street parking along the south side of 4th Street would remove a potential source of conflict between automobiles and the streetcars, as well as eliminating a major source of traffic disruption and delay along eastbound 4th Street as drivers wait for and maneuver into and out of parking spaces.

Capital Cost – Scenario B would cost $1.5 million.

6.6.3 Scenario C: South Side and North Side Parking Removal

Community Support – As described in Scenarios A and B, there has been little community comment on the 4th Street parking scenarios. Concern has been expressed by some members of the Downtown business community regarding the removal of existing on-street parking, and this scenario would remove all on-street parking along 4th Street. There has also been support expressed for the opportunity to widen the sidewalks along 4th Street and this scenario would provide for the widening of sidewalks along both sides of 4th Street by 16 feet resulting in 28 feet wide sidewalks.

Environmental Tradeoffs – Traffic/Circulation: Removal of parking on both the north side and south side of 4th Street reduces opportunities for conflicts/traffic delay for traffic on 4th Street as compared to the No Build condition.

Parking: Between Ross Street and French Street, parking on the south side and the north side of 4th Street would be removed, resulting in a loss of about 132 spaces.

Bicycle and Pedestrian Facilities: Sidewalks would be widened on the south side of 4th Street from 12 feet to about 28 feet.

Construction Impacts (Temporary): Construction work associated with sidewalk widening and removal of parking would result in minor disruption to business access as well as annoyance/inconvenience to patrons along both sides of 4th Street.

Ease of Transit Operations – The removal of all on-street parking along 4th Street between Ross and French Streets would improve traffic flow along this roadway and reduce potential sources of traffic-related delay impacting streetcar operations.

Capital Cost – Scenario C would cost $3.1 million. But because the streetcar project would only operate in the eastbound direction along 4th Street, removal of the diagonal parking is only required along the south side of 4th Street. Therefore, only $1.5 million of the estimated cost of Scenario C would be included as a project cost. The City of Santa Ana would obtain alternate funding to complete the parking removal and improvements along the north side of 4th Street.

6.6.4 Conclusions and Recommendations

Overall, the benefits of removing all of the on-street parking and widening the sidewalks (Scenario C) are greater than under the two scenarios that only reduce or remove some of the parking. Scenario C would enhance the pedestrian character of 4th Street to the benefit of restaurants, cafes, shops and other adjacent businesses. Traffic flow along 4th Street would be improved, allowing for more reliable streetcar operations and reduced potential for conflicts between automobiles and streetcars. Although approximately 132 on-street parking spaces would be eliminated under Scenario C, there is adequate parking available in nearby parking structures located just off and accessible from 4th Street. However, the analysis conducted as part of the environmental review process and accompanying public comment will further discern the relative advantages and disadvantages of each of these options and support the selection of the preferred option.

6.7 Civic Center Bike Lane Design Options

The Streetcar 2 alignment travels westbound through the Civic Center along Civic Center Drive between Spurgeon and Flower Streets. As part of the City of Santa Ana's *Complete Streets Program* bicycle lanes are proposed for Civic Center Drive. Two options have been developed for Streetcar Alternative 2 on Civic Center Drive between Flower Street and Surgeon Street that would accommodate the planned bicycle lane along with streetcar and mixed-flow traffic operations:

- Option 2A – Under Option 2A room for a planned five-foot wide striped bicycle lane is provided along Civic Center Drive in each direction, and the four existing through lanes (two in each direction) are maintained (see Figure 6-10). In the westbound direction, streetcars would share the outside through lane with mixed-flow traffic. However, existing parking along the north side of Civic Center Drive would be removed in order to accommodate all four travel lanes and the bike lanes. Additional right-of-way (1000 square feet or less) would be need to be acquired at each of the four station locations on Civic Center Drive to provide sufficient space for both the bicycle lane and the streetcar station platforms.
- Option 2B – Similar to Option 2A, Option 2B makes room for planned, five-foot-wide bicycle lanes on Civic Center Drive in each direction (see Figure 6-11). To eliminate the need for additional right-of-way, Option 2B reduces the number of westbound through lanes from two travel lanes to only one travel lane, which is shared with streetcar operation. Under Option 2B, the streetcar station platforms and the planned bicycle lanes are fully contained within the existing street right-of-way on Civic Center Drive.

6.7.1 Option 2A: Acquire Additional Right-of-Way to Accommodate Bicycle Lane and Streetcar Platforms

<u>Community Support</u> - There has been no community comment to provide a basis to evaluate community support for this option. The public will have additional opportunity to consider this option as part of the public review of the Draft Environmental Impact Report/Environmental Assessment for the Santa Ana and Garden Grove Fixed Guideway.

Figure 6-10: Civic Center Drive Bike Lane Option A: Acquire Additional Right-of-Way

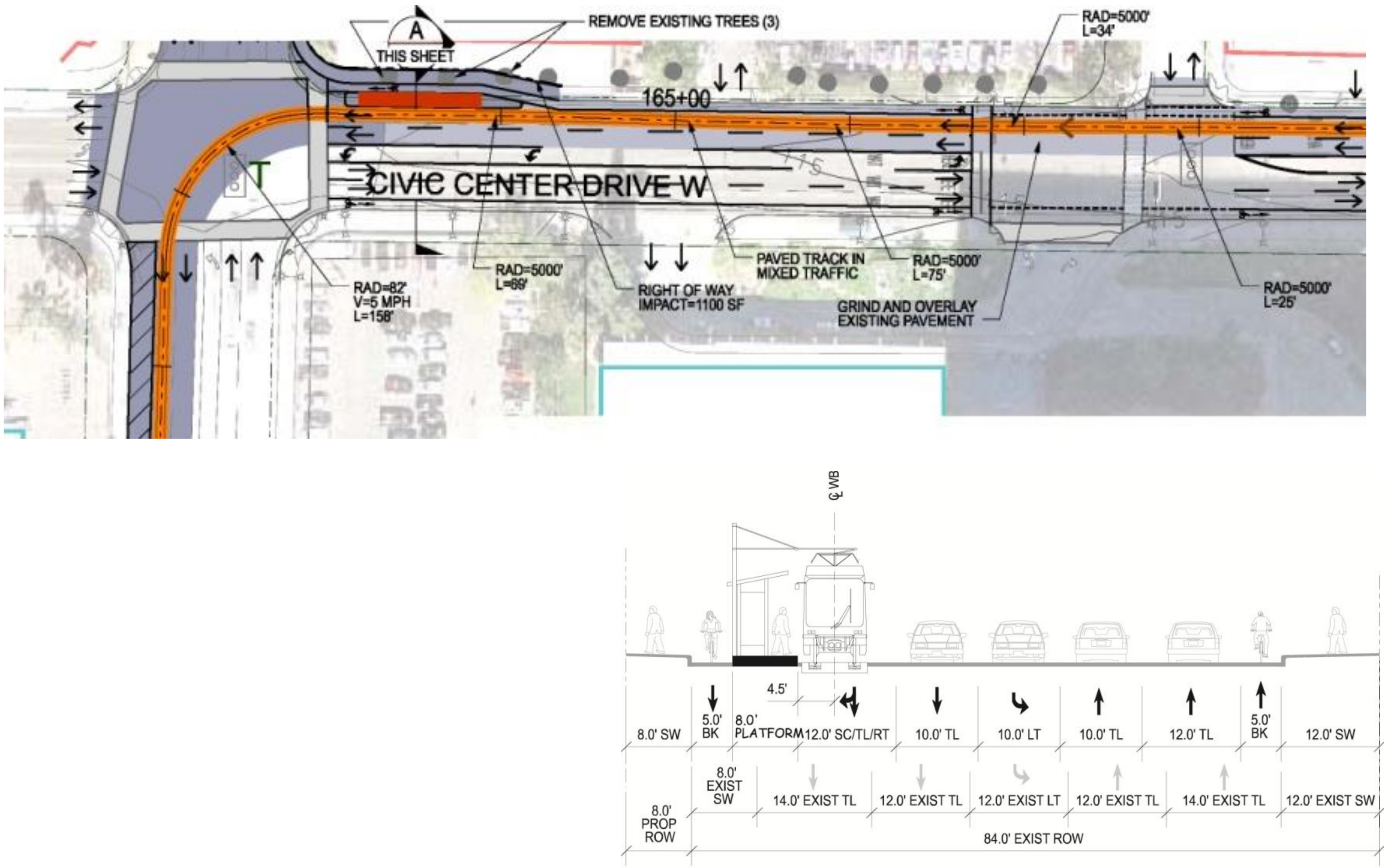
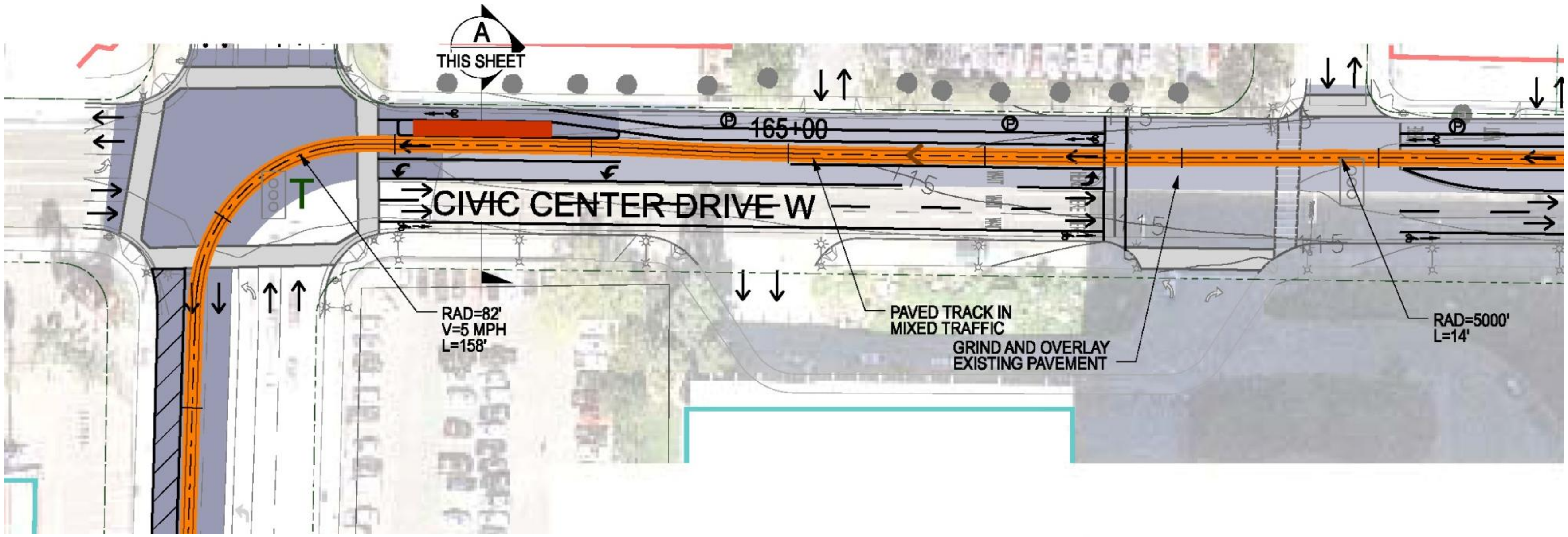
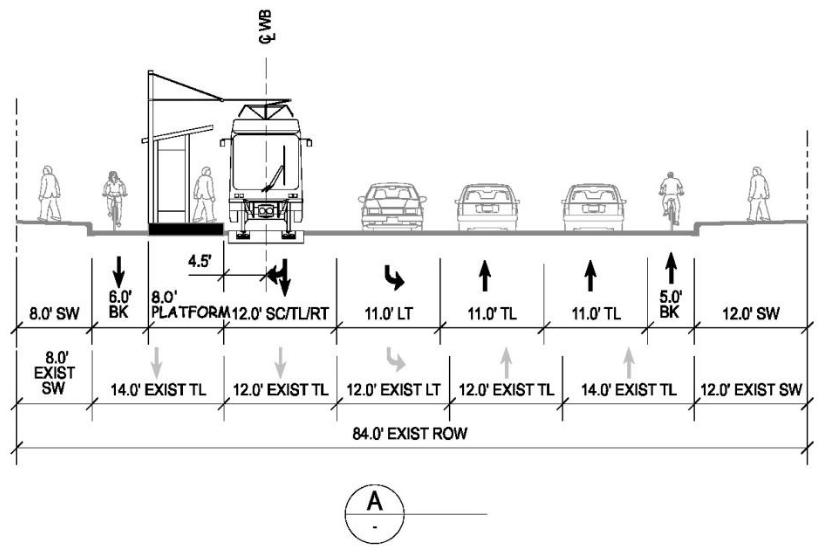


Figure 6-11: Civic Center Drive Bike Lane Option B: Reduce Travel Lanes





Comments received during environmental public review process will be taken into consideration during the selection of the Locally Preferred Alternative.

Right-of-Way Required – Option 2A would require acquisition of approximately 3,305 square feet of right-of-way.

Environmental Tradeoffs – In evaluating the environmental tradeoffs for the Civic Center Bike Lane design options, four environmental issues areas were considered: 1) Traffic and Circulation, 2) Parking, 3) Bicycle and Pedestrian Facilities; and 4) Acquisitions, Displacements, and Relocation.

Traffic/Circulation: Streetcars would operate along with mixed flow traffic in the westbound direction of Civic Center Drive. Additional traffic controls proposed along with streetcar operation is not predicted to adversely impact traffic circulation as compared to the No Build condition.

Parking: A small amount of on-street parking would be removed from the south side of Civic Center Drive – generally between Sycamore Street and Spurgeon Street – in order to accommodate the proposed bike lane.

Bicycle and Pedestrian Facilities: Civic Center Drive would be widened to provide the additional width needed to support the City's planned development of a Class II bike along Civic Center Drive between Flower Street and Spurgeon Street.

Acquisition, Displacement and Relocation: Three parcels would be partially impacted and one parcel would be fully impacted at the station stop locations along the north side of Civic Center Drive to make room for streetcar platforms.

Capital Cost – Option A would cost approximately $3.3 million more than Option B.

6.7.2 Option 2B: Reduce Number of Westbound Travel Lanes to Accommodate Bike Lane and Streetcar Platforms

Community Support – There has been no community comment to provide a basis to evaluate community support for this option. The public will have additional opportunity to consider this option as part of the public review of the Draft Environmental Impact Report/Environmental Assessment for the Santa Ana and Garden Grove Fixed Guideway. Comments received during environmental public review process will be taken into consideration during the selection of the Locally Preferred Alternative.

Environmental Tradeoffs – Traffic/Circulation: Under this design option, the number of westbound travel lanes would be reduced from two through lanes to one through lane. As a consequence, three intersections along Civic Center Drive would drop below acceptable thresholds (LOS E or worse) as compared to the No Build condition. Adverse impacts to one of these intersections (Civic Center Drive and Flower Street) cannot be resolved without triggering additional physical and ROW impacts.

Parking: About 80 parking spaces would be created on the north side of Civic Center Drive between Flower Street and Spurgeon Street.

Bicycle and Pedestrian Facilities: Civic Center Drive would be widened to provide the additional width needed to support the City's planned development of a Class II bike along Civic Center Drive between Flower Street and Spurgeon Street.

Acquisition, Displacement and Relocation: No parcels along Civic Center Drive would be impacted as a result of this design option.

Capital Cost – Option 2B would cost approximately $3.3 million less than Option 2A.

6.7.3 Conclusions and Recommendations

By removing one travel lane, Option 2B significantly impacts traffic conditions along Civic Center Drive. These impacts cannot be fully mitigated because of constraints posed by existing development. Option 2A is more expensive than Option 2B, in part due to the need to acquire right-of-way and relocate an existing business. However, Option 2A does not result in any adverse impacts that cannot be mitigated. Option 2A is the preferred Civic Center Drive Bike Lane Design Option to be included in Streetcar 2.

6.8 Summary of Design Options Analysis Results

The Streetcar Alternative Design Options that are recommended to be included in the Streetcar Alternatives are summarized in Table 6-1.

Of the Western Terminus Design Options, Option B: Elevated is recommended to be included in both Streetcar 1 and Streetcar 2. Although it costs somewhat more than Option C: Truncated At-grade, it does not require right-of-way and therefore has far less community impact than Options A and C. It also does not impact traffic flow along Westminster Avenue or operations at the Harbor Boulevard/Westminster Avenue intersection as Options A and C do.

For the Santa Ana River Crossing, Option 4: Bridge Avoidance B is recommended. Option 4 is the only option which would not have significant adverse effects on the old Pacific Electric Santa Ana River Bridge, thereby complying with the requirements of the U.S. Department of Transportation Act of 1966, Section 4(f). Option 1 would require the demolition of the existing Santa Ana River Bridge. Option 2, while preserving the original bridge, would obstruct the view of the original bridge. It would also impact the planned arterial within the PE ROW, requiring acquisition of ROW in the vicinity of the bridge crossing to accommodate the arterial bridge structure(s). In Option 3, the proposed relocation of the existing bridge creates the risk of damage to the historic structure; the relocation also alters historic setting and context, as well as the view of the old bridge.

Table 6-1: Design Options Analysis Recommendations

DESIGN OPTION	RECOMMENDED OPTION?
Western Terminus Design Options	
Option A: At-grade	No
Option B: Elevated	**Yes**
Option C: Truncated At-grade	No
Santa Ana River Crossing	
Option 1: Bridge Replacement	TBD*
Option 2: Bridge Avoidance A	
Option 3: Bridge Relocation	
Option 4: Bridge Avoidance B	
Operations and Maintenance Facility Site Options	
Site A: Near SARTC	**Yes**
Site B: Near Raitt Street	No
Sasscer Park Design Options	
Option 1A: Direct Route	**Yes**
Option 1B: Curved Route	No
4th Street Parking Scenarios	
Scenario A: South Side Parallel Parking	TBD*
Scenario B: South Side Parking Removal	
Scenario C: South Side and North Side Parking Removal	
Civic Center Bike Lane Design options	
Option 2A: Parking Removal and Additional Right-of-way to Accommodate Bike Lane and Streetcar Platforms	**Yes**
Option 2B: Reduce Number of Westbound Travel Lanes to Accommodate Bike Lane and Streetcar Platforms	No

* TBD (To Be Determined): Selection of a preferred option will incorporate analyses conducted as part of the environmental review as well as public comment.

A preferred option for the site of the operations and maintenance facility has not yet been identified. Site A is also more expensive than Site B. However it offers advantages in terms of environmental tradeoffs. It would not result in the displacement of any residents. It also would not create additional noise compared to existing conditions and may in fact reduce noise somewhat. Site A is consistent with the City of Santa Ana's adopted land use plans and policies. Selection of a preferred site will incorporate analyses conducted as in preparing the DEIR/EA for the project as well as public comment received on the DEIR/EA.

Option 1A: Direct Route of the Sasscer Park Design Options is recommended. It provides the greatest benefit to existing land use and requires no right-of-way. While it introduces a transportation mode along the southern edge of Sasscer Park, it is a mode that is compatible with the pedestrian character of the park. It is a shorter route, resulting in reduced travel time for the alignment, and is estimated to cost approximately $2.3 million less than Option 1B.

As is the case with the Operations and Maintenance Facility, the selection of a preferred 4th Street Parking Scenario will incorporate the analyses performed in preparing the DEIR/EA for the project. It will also consider public comment received during the environmental document review period. Based on this technical evaluation of design options, Scenario C would enhance the pedestrian character of 4th Street to the benefit of restaurants, cafes, shops and other adjacent businesses. Traffic flow along 4th Street would be improved, allowing for more reliable streetcar operations and reduced potential for conflicts between automobiles and streetcars. Although approximately 132 on-street parking spaces would be eliminated under Scenario C, there is adequate parking available in nearby parking structures located just off and accessible from 4th Street.

Option 2A of the Civic Center Bike Lane Design Options is recommended. Option 2A would require acquisition of right-of-way and relocation of an existing business, however it does not create the significant unmitigable traffic impacts that would result with the removal of a travel lane proposed in Option 2B. Option 2A does not result in any adverse impacts that cannot be mitigated.

7. DETAILED EVALUATION OF ALTERNATIVES

7.1 Analysis of Build Alternatives

The detailed evaluation of alternatives is intended to allow the public and decision makers to compare the performance of the Build Alternatives. Combined with the information provided in the Draft Environmental Impact Report/Environmental Assessment and public feedback received through the environmental review process, decision makers will have the information they require to select a Locally Preferred Alternative.

The following section presents the analysis of the TSM and Build Alternatives against evaluation criteria and measures of effectiveness designed to reflect the Purpose and Need and goals and objectives for the project (see Section 5).

7.2 Accessibility and Livability

7.2.1 Number and Percent of Transit Dependent Households within 1/4 Mile of Alignment

Transit-dependent households were defined as households without an automobile, based on the Orange County Projections 2006 (OCP2006) data used by OCTA in their Orange County Transportation Analysis Model (OCTAM) travel forecasting tool. The number of households with 6 or more people in the household and only one automobile has also been considered in this analysis. Table 7-1 summarizes the number of 0-auto and 1-auto per 6+persons households within 1/4 mile of the proposed alignments in 2008 and 2035.

In 2008, approximately 1,059 households (or 15 percent of total households) within 1/4 mile of the TSM alternative alignment were 0-car households. Another 746 households (11 percent) had one car and 6 or more people. By 2035, this number is estimated to increase to 2,300 0-car households within 1/4 mile of the TSM alignment and 829 1-car per 6+ person households. In 2035 approximately 3,120 households or 24 percent of households within1/4 mile of the TSM alignment are transit dependent for mobility.

Table 7-1: Summary of 0-Auto and 1-Auto/6+ Person Households within 1/4 Mile of Alignment

	TSM		STREETCAR 1		STREETCAR 2	
	0 AUTOS	1-AUTO, 6+PERSONS	0 AUTOS	1-AUTO, 6 +PERSONS	0 AUTOS	1-AUTO, 6+PERSONS
2008	1,059	746	1,302	881	1,200	825
2035	2,300	829	2,813	963	2,598	901

Source: Orange County Projections, 2006.

In 2008, approximately 28 percent of households within 1/4 mile of the Streetcar 1 alignment were transit dependent (approximately 1,302 0-auto households and 881 1-auto with 6+ people households). When considering the IOS for Streetcar 1, this percentage does not change (28 percent), although there are slightly fewer households because the alignment is shorter. Under IOS 1 there are estimated to be approximately 1,256 0-auto households and 817 households with 1-auto and 6+ people within 1/4 mile of the Streetcar 1 alignment.

By 2035, there are estimated to be 3,776 transit dependent households (or 25 percent of total households) within 1/4 mile of the Streetcar 1 alignment. Approximately 3,607 of these households are within 1/4 mile of the Streetcar 1 IOS. The Streetcar 1 alignment potentially serves the greatest number of transit-dependent households of the three alternatives.

In 2008, there are approximately 2,025 transit-dependent household within 1/4 mile of the Streetcar 2 alignment, or approximately 27 percent of total households. In 2035, the Streetcar 2alignment is estimated to potentially serve 3,499 transit dependent households, or 25 percent of households within 1/4 mile of the alignment. Approximately 3,330 of these households are within 1/4 mile of the Streetcar 2 IOS.

7.2.2 Ridership

Travel demand forecasts were developed using the Orange County Transportation Analysis Model (OCTAM) 3.3. OCTAM is a conventional four-step regional model that has been developed and applied to support transportation infrastructure planning and design in Orange County. OCTAM shares the same model components as the Southern California Association of Governments (SCAG) Regional Model but has more detailed networks and zone structure within Orange County. A more detailed discussion of the methodology applied in developing the travel demand and ridership forecasts is provided in the *Santa Ana-Garden Grove Fixed Guideway Corridor Travel Demand Model Methodology Report*, April 2012.

Given the uncertainty inherent with any twenty year forecast and the characteristics of the streetcar mode, a risk analysis approach was applied in developing the forecasts. Ridership estimates were developed for low end and high end scenarios. For the low end forecasts, the streetcar was modeled as a local bus (mode 15) in OCTAM. However, instead of using OCTAM's standard local bus-speed to auto speed relationships, station-to-station travel times used rail run time simulations created for the each streetcar alternative.

To produce the upper end of the range of ridership forecasts for the streetcar, the urban rail mode (mode 18) was used to represent the streetcar in OCTAM. The streetcar possesses some of the qualities of urban rail. Streetcars look like light rail transit (LRT) vehicles with low floors and electrical power being delivered via overhead catenary wires. Acceleration and deceleration characteristics are also similar to LRT, providing improved ride quality compared to bus. There are other intangible characteristics that may contribute to rider preference for rail over bus. Since OCTAM's mode choice model does not currently have a streetcar mode, urban rail was used as a proxy for streetcar. Table 7-2 shows the resulting average weekday ridership forecast for the alternatives.

Table 7-2: 2035 Average Weekday Boardings

ALTERNATIVE	BOARDINGS ON PROJECT ROUTE	
	LOW FORECAST	HIGH FORECAST
No Build	N/A	N/A
TSM*	2,684	N/A
Streetcar Alternative 1	3,770	8,410
Streetcar Alternative 2	3,020	6,425
Streetcar IOS 1	2,012	4,490
Streetcar IOS 2	1,540	3,280

Source: OCTAM 3.3 modified for the Santa Ana-Garden Grove Fixed Guideway
*Boardings for TSM Alternative route between SARTC and Harbor Boulevard only.

Streetcar Alternative 1 is estimated to have the highest daily ridership of the Build Alternatives, attracting between 3,770 and 8,400 riders. At the low end, this represents approximately 22 percent more riders than the TSM alternatives; at the high end, it represents approximately 172 percent more riders than with the TSM alternative. Streetcar 1 IOS is estimated to have approximately 2,012 to 4,490 daily boardings, or approximately 47 percent fewer riders than the full alignment.

At the low end, Streetcar Alternative 2 ridership would be equivalent to the TSM Alternative. At the high end, it would have approximately 108% more riders than the TSM Alternative route between SARTC and Harbor Boulevard. The Streetcar 2 IOS is estimated to have approximately 1,540 to 3,280 daily boardings, or approximately 47 percent fewer than the full alignment.

7.3 Economic Development, Transit Supportive Land Uses and Community Goals

7.3.1 Assessment of the Transit Supportiveness of Land Uses Served by the Alignment

The qualitative assessment of the transit supportiveness of land uses served by the project focuses on the land uses that fronted along the proposed alignments. In this way this measure assesses not only the degree to which an alignment serves adjacent land uses, but also the degree to which the land uses adjacent to the corridor contribute to a transit supportive environment.

The block faces within the corridor for each alignment were measured. In order to ensure consistency in measurement of block face segments common to more than one alternative, and the overall lengths of the alternatives, the measurement was taken from the centerline to centerline of the adjacent intersections. The existing land uses along both sides of the alignment were inventoried by block. Each block was then rated based on the transit supportiveness of the land uses along each side of the block: "More Favorable" (1), "Neutral" (0), or "Less Favorable" (-1). Table 7-3 provides examples of study area land uses that would be considered More, Favorable, Neutral and Less Favorable.

Table 7-3: Transit Supportiveness of Land Uses

MORE FAVORABLE	NEUTRAL	LESS FAVORABLE
High Density Residential	Medium Density Residential	Single Family Residential
Mixed Use Development	Transitional Commercial	Industrial
Business Frontage	Open Space/ Parks	Non-Public Serving Government Offices
High Rise Office	Low Rise Office - 2-3 Sty	
Public-serving Government Offices	Churches/schools	

The rating for each side of each block was multiplied by the length of the block. The results were summed for each alternative. The result was a transit supportiveness index that reflects not just the linear feet of transit supportive land uses along an alignment, but also the amount of land use that is not particularly favorable to transit. In addition to the existing land use on a parcel, consideration was also given to the adopted zoning for the parcel. Therefore, while many of the buildings in Downtown are currently underutilized, recent changes in zoning as a result of the adoption of the Transit Zoning Code provides for future use and reuse of these buildings in ways that would be favorable to transit. By contrast, buildings like the AT&T facility (Santa Ana Boulevard and 5th Street, Bush Street and Spurgeon Street) and many of the City's parking structures are unlikely to be redeveloped in the near future even though zoning would permit. Table 7-4 summarizes the results of the analysis.

Table 7-4: Transit Favorability Index

ALTERNATIVE	RANKING	FAVORABILITY INDEX	TRANSIT SUPPORTIVENESS OF EXISTING LAND USES FRONTAGE (linear feet)		
			MORE FAVORABLE	NEUTRAL	LESS FAVORABLE
TSM	2	-2,815	18,245	10,065	21,060
			37.0%	20.4%	42.7%
Streetcar 1 (Santa Ana Blvd./4th St.)	1	-2,210	21,110	4,980	23,320
			42.7%	10.1%	47.2%

ALTERNATIVE	RANKING	FAVORABILITY INDEX	TRANSIT SUPPORTIVENESS OF EXISTING LAND USES FRONTAGE (linear feet)		
			MORE FAVORABLE	NEUTRAL	LESS FAVORABLE
Streetcar 2 (Brown St./6th St./Santa Ana Blvd./5th St.)	3	-8,109	17,288	5,905	25,397
			35.6%	12.2%	52.3%
Streetcar 1 IOS (Santa Ana Blvd./4th St.)	NA	13,695	20,110	3,705	6,415
			66.5%	12.3%	21.2%
Streetcar 2 IOS (Brown St./6th St./Santa Ana Blvd./5th St.)	NA	7,796	16,288	4,630	8,492
			55.4%	15.7%	28.9%

The TSM and full build alternatives (Streetcar 1 and Streetcar 2) all have negative transit favorability index values. This is due to the character of existing land uses and land use patterns west of Flower Street. The area east of Flower Street includes neighborhoods with transit oriented development, and medium to high density residential, the historic downtown with commercial and multi-story office buildings, and the Civic Center. The portion of the study area east of Flower Street would be well served by high-capacity transit and provides the densities and development patterns to support a transit system.

West of Flower Street, the TSM Alternative runs along Civic Center Drive to Bristol Street, fronted substantially by stable single family residential neighborhoods. At Bristol Street, the alignment turns north along Bristol Street to Westminster Avenue/17th Street. Bristol Street is currently being improved to a six-lane divided arterial. Land uses fronting Bristol Street between Civic Center Drive and south of Westminster Avenue/17th Street include single family residential and strip commercial development. At the corner of Bristol Street at 17th Street, Santa Ana College, high-rise office and a community commercial center provide the mix of land uses that can be well-served by transit. Turning west onto 17th Street and continuing to the intersection with Harbor Boulevard, fronting land uses include strip commercial, medium density residential and industrial development. These land uses and development patterns are also less favorable to transit. It is unlikely that the improved bus service provided by the TSM alternative would be sufficient to stimulate the level of economic development that would result in significant alteration or intensification of land uses along this corridor.

Although a negative number, Streetcar 1 has the best favorability value of the three alternatives. This is because the alignment of Streetcar 1, from SARTC to Bristol Street has land use densities and development patterns which are highly conducive to a successful transit system. This alignment benefits from the transit-oriented, higher-density residential development in the vicinity of SARTC and along Santa Ana Boulevard between Santiago and Spurgeon Street. West of Spurgeon Street, medical offices/clinics and high-rise offices front along much of Santa Ana Boulevard. The two exceptions are: 1) the block between Spurgeon and Bush Streets where the AT&T facility occupies the south side of the street, and the U.S. Post Office distribution annex along the north side of the street, neither of which generate travel demand that would support transit; 2) the block between Main Street and Broadway, where the historic Courthouse and the First Presbyterian Church front along the north side of the street would not be expected to contribute significantly to average weekday transit ridership. West of Flower Street, the Orange County Sheriff's facility and jail, and the transitional uses along the north side of Santa Ana Boulevard are not considered to be favorable to a transit system. However, the segment along 4th Street, lined with ground floor commercial in historic multi-story office buildings, and multiple-family residential development represents a highly favorable environment for a transit system. The size, scale and mix of uses along 4th Street and the adjacent parallel streets that comprise the Downtown, make this area a very walkable residential and commercial district with the streetcar providing much needed areawide access.

West of Bristol Street, the Streetcar 1 alignment enters the PE ROW, where adjacent land uses include industrial, single family residential, transitional uses and a golf course. While the existing land uses along this segment may be even less compatible with a successful transit system than those along Bristol Street and 17th Street/Westminster Avenue in the TSM alternative, the segment is considerably shorter in length. However, a more important consideration is that the adjacent land uses along this segment are more transitional and far more likely to redevelop than those along the TSM alignment. The cities of Santa Ana and Garden Grove have both been involved in discussions with potential developers regarding the future of the Willowick Golf Course. The potential for transportation to serve as a catalyst to economic develop and redevelopment is greater along the streetcar alignment than the TSM alignment through this segment because the development patterns are more conducive to development/redevelopment.

As would be expected, the Streetcar 1 IOS has the overall highest transit favorability value. By excluding the PE ROW from the calculations, the area served by the Streetcar 1 IOS includes those areas and land uses within the study area which can best be served by and support a high capacity transit system.

By contrast, Streetcar 2 has the poorest transit favorability index value. Streetcar 2 has the same issues as Streetcar 1 west of Bristol Street. However, east of Bristol Street, Streetcar 2's alignment which includes 6th Street, Brown Street, Santa Ana Boulevard, Civic Center Drive and 5th Street, does not provide the densities or types of land uses that are as transit-favorable as those along the Streetcar 1 alignment. As a result, the transit favorability rating for the full alignment is a negative number and considerably lower than the other two alternatives, and the rating for the Streetcar 2 IOS was a little over half that of Streetcar 1.

7.3.2 Assessment of the Economic Development Opportunities of Parcels Served by the Alignment

The assessment of economic development opportunities of parcels served by the project considered the General Plan land use designations and the zoning of parcels along each alignment. It also considered whether location along a high capacity transit route would be favorable to the type of development permitted under existing adopted plans thereby encouraging development/redevelopment opportunities ahead of parcels located elsewhere.

The land use designations of parcels fronting along the alignments of each of the alternatives were determined from adopted plans. The land use designations which would benefit from location along a high capacity transit corridor were determined using Table 7-3, presented previously. Parcels were identified as "very favorable" if they had a "favorable" land use designation, and they were located within the City of Santa Ana's Transit Zoning Code area. Policies within the Transit Zoning Code are intended to foster transit supportive and transit oriented development and redevelopment within the eastern portion of the study area.

Applying the same methodology used to determine the transit supportiveness of existing land uses along the alignments, the economic development favorability index for each alternative was calculated. On a block-by-block basis, the favorability of land use designations for the block (-1 for less favorable; 0 for neutral; 1 for favorable; and 2 for very favorable) were multiplied by the block length. The results were summed for each alignment to yield and overall economic development favorability index for each alternative, and then the alternatives were ranked. Table 7-5 summarizes the results of the analysis.

The TSM Alternative ranks lowest of the three alternatives in terms of economic development opportunity for many of the same reasons that it does not perform well in terms of transit supportiveness of existing land uses. Only land uses along the south side of Civic Center Drive are within the Transit Zoning Code area and many are institutional uses not likely to redevelop. The north side of Civic Center Drive through the Civic Center provides somewhat greater opportunity with Professional and Administrative Office (PAO) designations and existing low density office buildings and surface parking lots. West of Flower Street, Civic Center Drive is fronted substantially by stable single family residential neighborhoods. There are few transit-supportive development opportunities along Bristol Street between Civic Center Drive and south of Westminster Avenue/17th Street with most parcels designated for General Commercial or Open Space. Likewise, parcels along the 17th Street/Westminster Avenue corridor offer few opportunities for transit supporting development, with most of the length between Bristol Street and Harbor Boulevard designated for single-family and multi-family residential, general commercial and industrial

Table 7-5: Economic Development Favorability of Parcels along the Alignment

ALTERNATIVE	RANKING	ECONOMIC DEVELOPMENT FAVORABILITY INDEX	ECONOMIC DEVELOPMENT OPPORTUNITY OF FRONTING PARCELS (linear feet)			
			VERY FAVORABLE	MORE FAVORABLE	NEUTRAL	LESS FAVORABLE
TSM	3	-6,330	5,080	11,580	7,180	28,070
			9.8%	22.3%	13.8%	54.1%
Streetcar 1 (Santa Ana Blvd./4th St.)	1	13,195	12,295	11,495	2,730	22,890
			24.9%	23.3%	5.5%	46.3%
Streetcar 2 (Brown St./6th St./ Santa Ana Blvd./ 5th St.)	2	9,982	10,480	13,846	2,730	24,824
			20.2%	26.7%	5.3%	47.8%
Streetcar 1 IOS (Santa Ana Blvd./4th St.)	NA	21,760	9,515	10,995	1,455	8,265
			31.5%	36.4%	4.8%	27.3%
Streetcar 2 IOS (Brown St./6th St./Santa Ana Blvd./ 5th St.)	NA	18,647	7,345	13,701	1,910	9,744
			22.5%	41.9%	5.8%	29.8%

uses. It is unlikely that adopted plans and policies coupled with the improved bus service provided by the TSM alternative would be sufficient to stimulate significant levels of economic development along this alignment.

Streetcar 1 is ranked first among the alternatives in terms of the economic development potential of fronting land use parcels. The eastern portion of the alignment (east of Flower Street) is within the City of Santa Ana's Transit Zoning Code area. The types and densities of land use permitted under the Transit Zoning Code create significant development opportunity along the Streetcar 1 alignment that would benefit from location along a high-capacity transit route. This is particularly true through the Downtown area where the Transit Zoning Code would allow renovation of existing historic buildings for high density residential and mixed use development. Both cities are open to considering the redevelopment of Willowick Golf Course at the western end of the alignment. A high capacity transit corridor could provide considerable inducement to redevelopment of Willowick.

Streetcar 2 ranked second on economic development opportunity among the alternatives. Compared to Streetcar 1, Streetcar 2 includes the Civic Center Drive loop, where, as described previously, redevelopment opportunities are more limited due to the existing institutional uses on the south side of Civic Center Drive. Streetcar 2 also includes 5th

Street. Development along 5th Street through the Downtown is unlikely to redevelop in the near- to mid-term even though it is within the Transit Zoning Code area. A high capacity transit corridor offers little benefit to land uses such as the Ronald Reagan Federal Building and Courthouse parking garage, the AT&T District Office and the parking garage for the East End Promenade (formerly the Fiesta Marketplace).

7.3.3 Community Support

Community Listening Sessions, Stakeholder Working Group Meetings, Public Scoping Meetings and meetings with residents, business owners, interested and affected agencies and community groups all helped to validate the Purpose and Need for the project, and define and shape the alternatives to address the Purpose and Need. The result was a TSM Alternative and two Streetcar Alternatives whose alignments fell within a narrow and well-defined corridor which fully responded to the interests, issues and concerns raised by the public through the outreach program.

To date, public comment has been substantially limited to general expressions of excitement towards the possibility of a new transit system, strong expressions of enthusiasm for a streetcar or light rail system, a lack of interest in more traditional bus service, and a general concern about and interest in understanding the potential impacts in residential areas and near schools.

It is the intent of the decision makers in the Cities of Santa Ana and Garden Grove that the public continue to be involved as a Locally Preferred Alternatives for the Santa Ana and Garden Grove Fixed Guideway is selected. Towards that end, the Alternatives Analysis will provide the public and participating agencies with the results of the detailed technical evaluation of the alternatives, while Draft EIR/EA will provide them information about the potential impacts and effects of the proposed alternatives on the environment. The public and participating agencies will be able to submit comments, questions, concerns, and expressions of preferences for the alternatives during the public review period for the Draft EIR/EA and at the public workshops to be held during that period.

The information received through the environmental public review period will be incorporated into the evaluation process and the recommendation of the Locally Preferred Alternatives for consideration and adoption by the city councils of Santa Ana and Garden Grove.

7.4 Environmental Responsibility and Sustainability

7.4.1 Amount of Additional Right-of-Way Required

The Santa Ana and Garden Grove Fixed Guideway is proposed to operate substantially within public right-of-way, in mixed flow traffic along city streets, or within an exclusive guideway in the PE ROW. While some “slivers” of right-of-way are required to accommodate platform areas or transitions from one roadway to another, only two elements of the proposed system require significant amounts of additional right-of-way: the Western Terminus at-grade option and the maintenance facility.

In the Build alternatives there are three design options for the Western Terminus: Elevated, At-Grade and At-Grade Truncated. The Elevated option is entirely within the PE ROW and requires no additional right-of-way. The At-Grade option includes a minor transition of the alignment south of Westminster Avenue in order for the guideway to intersect Westminster Avenue perpendicularly and aligned with Nautilus Drive on the north side of Westminster Avenue. This adjustment requires approximately 1,035 square feet of additional right-of-way immediately south of Westminster Avenue. In this option, the fixed guideway crosses Westminster Avenue at Nautilus Drive, and the turns west through existing industrial/business parks and returns to the PE ROW and the terminus station. Approximately 37,820 square feet of additional right-of-way are required to accommodate this transition. In addition, acquisition of the needed right-of-way will impact three business park/light industrial buildings located north of Westminster Avenue and west of Nautilus Drive, in the city of Garden Grove and totaling approximately 28,700 square feet.

The At-Grade Truncated option requires approximately 1,088 square feet of additional right-of-way to adjust the alignment to intersect with Nautilus Drive at Westminster Avenue. Unlike the At-Grade option, no additional right-of-way is required north of Westminster Avenue. The station/stop is accommodated along Nautilus Drive within the public right-of-way.

Two options have been identified for the maintenance facility for the streetcar: a site located near SARTC, south of Santiago and 6th Streets; or a site west of Raitt Street, between 5th Street and the PE ROW in the vicinity of Townshend Street. The first site is a single parcel of approximately 95,832 square feet. The second site includes multiple parcels totaling approximately 104,544 square feet.

In Streetcar 1, approximately 9,110 square feet of additional right-of-way is required from the surface parking area at SARTC in order to accommodate two fixed guideway tracks and a center platform at the Eastern Terminus at SARTC.

Small amounts of additional right-of-way are required in Streetcar 2 in the vicinity of the station/stops in order to accommodate the bike lanes along Civic Center Drive. Table 7-6 shows the additional right-of-way required by each of the alternatives.

The Initial Operable Segment (IOS) for each of the alternatives avoids the right-of-way acquisition requirements associated with crossing Westminster Avenue. While the elevated crossing of Westminster Avenue is not estimated to require acquisition of additional right-of-way, the at-grade crossing requires approximately 38,855 square feet of additional right-of-way and impacts three buildings (totaling 28,700 square feet); the truncated crossing requires a partial right-of-way take of approximately 1,088 square feet as the PE ROW approaches the south side of Westminster Avenue.

Table 7-6: Right-of-Way Required (Square Feet)

ALTERNATIVE	RIGHT-OF-WAY REQUIRED (square feet)
TSM	0
Streetcar 1 - Assuming: Western Terminus Option B: Elevated Santa Ana River Crossing Option 4: Bridge Avoidance B Sasscer Park Option A: Direct Route	98,570 – 107,281
Streetcar 2 - Assuming: Western Terminus Option B: Elevated Santa Ana River Crossing Option 4: Bridge Avoidance B Civic Center Bike Lane Option A: ROW Acquisition and Parking Removal	121,259 – 129,970
Streetcar 1 Initial Operable Segment	96,432 – 105,143
Streetcar 2 Initial Operable Segment	119,121 – 127,832

The IOSs also do not include the approximately 500 square feet of right-of-way on the west side of Susan Street adjacent to the PE ROW for a traction power substation. The IOSs require approximately 2,139 square feet less right of way than the full build alternatives.

7.4.2 Environmental Tradeoffs

Table 7-7 summarizes and highlights some of the key environmental distinguishers among the four alternatives under future year travel conditions (Year 2035). It is intended to convey "big picture," comparative information for the alternatives as a whole. While the summary description of these environmental trade-offs is drawn from the technical environmental studies that were prepared for the project, its use and purpose is different from the detailed information that is presented in the draft (CEQA/NEPA) environmental document. Among other things, the purpose of the draft environmental document is to help determine if the proposed project is expected to result in a significant adverse impact and to identify project features / measures needed to avoid, minimize, or mitigate potential environmental impacts. On the other hand, the summary of key environmental trade-offs presented in Table 7-7 is intended to point out any major differences among the alternatives that do not necessarily rise to the level of a significant adverse or beneficial impact.

Unless otherwise noted, the potential environmental impacts (both positive and adverse) of the TSM Alternative and the two Build Alternatives (Streetcar Alternative 1 and Streetcar Alternative 2) are described in terms of how they compare to the No Build Alternative. In contrast, the No Build Alternative is described in terms of how the future condition (Year 2035) would result in a notable change as compared to existing conditions in the project study area. For most environmental issue areas, the No Build Alternative is generally the same as existing conditions. However, where there are exceptions (e.g., traffic), this descriptive text is provided under the No Build Alternative in the table below.

The information presented in Table 7-7 presumes that the project features and measures that have been identified through the environmental analyses in order to avoid, minimize or mitigate potential environmental impacts are included as part of the proposed project for the proposed alternatives (TSM Alternative, Streetcar Alternative 1, and Streetcar Alternative 2).

Table 7-7: Summary of Environmental Trade-Offs

Rating System:

Notably Worse	Worse	Somewhat Worse	Same/No Change	Somewhat Better	Better

NO BUILD ALTERNATIVE	TSM ALTERNATIVE	STREETCAR ALTERNATIVE 1	STREETCAR ALTERNATIVE 2
Visual/Aesthetics			
Same/No Change • No visual changes beyond those future, approved projects that have already been previously assessed.	Same/No Change • Proposed TSM improvements (expanded bus service) would not affect visual resources and community character within the project area.	Somewhat Worse • Within PE ROW and industrial areas, proposed streetcar system with its urban design and landscaping components, would be more aesthetically appealing compared to current conditions. • The streetcar system would introduce some new components to the built environment within downtown and residential streets, including poles, catenary, traction power substations, station platforms and shelters, and potentially two new bridges (Santa Ana River, Westminster Avenue), but these changes are minor and project design features would be consistent with the visual character within these areas. • For purposes of pedestrian safety, additional lighting would be required in station areas and for mid-block crossing areas. This lighting will be shielded and directed downward and away from adjacent properties.	Somewhat Worse • Within PE ROW and industrial areas, proposed streetcar system with its urban design and landscaping components, would be more aesthetically appealing compared to current conditions. • The streetcar system would introduce some new components to the built environment within downtown and residential streets, including poles, catenary, traction power substations, station platforms and shelters, and potentially two new bridges (Santa Ana River, Westminster Avenue), but these changes are minor and project design features would be consistent with the visual character within these areas • For purposes of pedestrian safety, additional lighting would be required in station areas and for mid-block crossing areas. This lighting will be shielded and directed downward and away from adjacent properties.

NO BUILD ALTERNATIVE	TSM ALTERNATIVE	STREETCAR ALTERNATIVE 1	STREETCAR ALTERNATIVE 2
Air Quality			
• Despite future increases in vehicle miles traveled (VMT) forecast for study area roadways due to regional growth, technological improvements associated with public and privately owned vehicles, use of cleaner burning fuels, and more stringent vehicle emissions standards are predicted to result in modest decreases in mobile source pollutants for the region by the Year 2035.	• Proposed TSM improvements (expanded bus service) utilizing clean fueled buses would be consistent with the moderate beneficial impact predicted for the No Build Alternative.	• Proposed streetcars would be powered by electricity and would not contribute to emissions within the study area. • A screening-level hot spot analysis that was performed for this alternative showed that minor shifts of traffic that are predicted to occur as a result of streetcar operation, would not result in a local air quality impact. • The development of transit infrastructure is considered to be a transportation control measure (TCM) under SCAQMD's Air Quality Management Plan, which satisfies an important regional goal related to reducing vehicle trips and congestion.	• Proposed streetcars would be powered by electricity and would not contribute to emissions within the study area. • A screening-level hot spot analysis that was performed for this alternative showed that minor shifts of traffic that are predicted to occur as a result of streetcar operation, would not result in a local air quality impact. • The development of transit infrastructure is considered to be a transportation control measure (TCM) under SCAQMD's Air Quality Management Plan, which satisfies an important regional goal related to reducing vehicle trips and congestion.
Cultural Resources			
• Under the No Build Alternative, no impacts to cultural resources are anticipated.	• Proposed TSM improvements (expanded bus service) would not impact cultural resources.	• While there are several significant historic properties located within the general vicinity of the proposed streetcar alignment, with the exception of the Pacific Electric Santa Ana River Bridge, Streetcar Alternative 1 would not impact these properties. • The streetcars and trackwork would	• While there are several significant historic properties located within the general vicinity of the proposed streetcar alignment, with the exception of the Pacific Electric Santa Ana River Bridge, Streetcar Alternative 2 would not impact significant historic properties. • The streetcars and trackwork would

		be located within developed areas that also feature numerous non-historic period elements. The operation of the streetcars would not cause a change in the historic properties' use or distinctive physical features, and would be considered in-scale and appropriate with the built environment. • The old Pacific Electric Santa Ana River Bridge would be directly impacted by modifications to its western abutments to accommodate the maintenance road/multi-purpose trail, and the new bridge adjacent would somewhat obstruct the view of the old bridge from the south. • Research and field survey analysis identified no significant archaeological or paleontological resources within the area of potential effect.	be located within developed areas that also feature numerous non-historic period elements. The operation of the streetcars would not cause a change in the historic properties' use or distinctive physical features, and would be considered in-scale and appropriate with the built environment. • The old Pacific Electric Santa Ana River Bridge would be directly impacted by modifications to its western abutments to accommodate the maintenance road/multi-purpose trail, and the new bridge adjacent would somewhat obstruct the view of the old bridge from the south. • Research and field survey analysis identified no significant archaeological or paleontological resources within the area of potential effect.
Noise and Vibration			
• Modest, future increases in roadway traffic attributable to regional population and employment growth is not predicted to measurably affect noise levels for sensitive receivers within the study area.	• Proposed TSM improvements (expanded bus service) would not result in a change in noise and vibration levels within the study area.	• Noise levels associated with the operation of streetcar vehicles on either ballasted track or on trackage embedded within pavement are not predicted to result in an adverse noise impact. • The potential for wheel squeal in areas of tight turns is low for streetcars as opposed to other forms of rail transit due to factors such as lighter vehicle weight, slower vehicle	• Noise levels associated with the operation of streetcar vehicles on either ballasted track or on trackage embedded within pavement are not predicted to result in an adverse noise impact. • The potential for wheel squeal in areas of tight turns is low for streetcars as opposed to other forms of rail transit due to factors such as lighter vehicle weight,

		speeds, shorter truck wheel base to the point of articulation of the body, and the absence of a center truck. • Increased noise levels due to audible warning devices (crossing gates, streetcar warning horns) would be mitigated to a level that is less than significant by establishing quiet zones at these few, mid-block crossing locations along the alignment. In most areas of the alignment no audible warning devices are required since the streetcars would operate in street and would be controlled by conventional traffic signals along other mixed flow traffic. • Vibration analysis shows no adverse impacts to adjacent land uses associated with operation of the streetcar system.	slower vehicle speeds, shorter truck wheel base to the point of articulation of the body, and the absence of a center truck. • Increased noise levels due to audible warning devices (crossing gates, streetcar warning horns) would be mitigated to a level that is less than significant by establishing quiet zones at these few, mid-block crossing locations along the alignment. In most areas of the alignment no audible warning devices are required as the streetcars would operate in street and would be controlled by conventional traffic signals along other mixed flow traffic. • Vibration analysis shows no adverse impacts to adjacent land uses associated with operation of the streetcar system.
Traffic and Circulation			
● • Future increases in roadway traffic attributable to regional population and employment growth would slightly exacerbate congested roadways and intersections within the study area (LOS E or worse). Two additional intersections in the study area are predicted to	○ • Implementation of the TSM Alternative improvements (expanded bus service) is not predicted to measurably alter overall congestion levels within the study area as compared to the No Build Alternative.	○ • Overall, traffic levels within the study area remain essentially the same under Streetcar Alternative 1 (less than one percent change in vehicle miles traveled compared to the No Build Alternative). • Streetcar operation would entail adjustments to selected traffic signals to account for additional transit phasing and the provision of additional traffic controls at selected	○ • Overall, traffic levels within the study area remain essentially the same under Streetcar Alternative 2 (less than one percent change in vehicle miles traveled compared to the No Build Alternative). • Streetcar operation would entail adjustments to selected traffic signals to account for additional transit phasing and the provision of additional traffic controls at selected

operate at LOS E or worse) compared to existing conditions for a total of five intersections. • Traffic congestion on Bristol Street is improved as additional capacity is planned for this roadway by 2035.		unsignalized intersections. Affected traffic signals would be optimized. • With traffic signal and operational improvements, implementation of Streetcar Alternative 1 would reduce the number of deficient intersections (those that operate at LOS E or worse) from five to three. While two of these intersections were shown to exceed thresholds that would result in a potential traffic impact, intersection improvements are proposed as additional project features, which would bring these intersections back to acceptable levels of service.	unsignalized intersections. Affected traffic signals would be optimized. • Implementation of Streetcar Alternative 2 would reduce the number of deficient intersections (those that operate at LOS E or worse) from five to three. Two of these three intersections represent a potential adverse traffic impact without mitigation. Intersection improvements proposed as mitigation for Streetcar Alternative 2, bring these intersections back to acceptable levels of service.
Parking			
○ • There are no anticipated on-street or off-street parking impacts under the No Build Alternative.	○ • There are no anticipated on-street or off-street parking impacts that would occur as a result of the TSM Alternative.	● • Implementation of Streetcar Alternative 1 would result in the loss of 50% of available on street parking on Santa Ana Boulevard, between Raitt and Flower Street. • Along 4th Street, between Ross Street and Mortimer Street, Streetcar 1 would result in the loss of as much as 97% of available on-street parking, • In the remaining portions of the alignment, implementation of Streetcar Alternative 1 would affect 23% of available parking along Santa Ana Blvd east of Bush Street and along Mortimer Street between 4th Street and 6th Street. • While there is ample off-street	● • Implementation of Streetcar Alternative 2 would result in the loss of 50% of available on street parking on Santa Ana Boulevard, between Raitt and Flower Street. • Along the remaining portion of the alignment, between Flower Street and Santiago Street, implementation of Streetcar 2 would result in a loss of about 16% of available parking on affected city streets. • While there is ample off-street parking within downtown Santa Ana and parking availability along side streets; these on-street parking losses would likely be perceived as an annoyance to Santa Ana residents.

		parking within downtown Santa Ana and parking availability along side streets; these on-street parking losses would likely be perceived as an annoyance to Santa Ana residents and customers.	
Bicycle and Pedestrian Circulation			
• Through implementation of the transit zoning code and other planned improvements included in the No Build Alternative, a limited number of additional bicycle lanes and enhanced pedestrian facilities will be provided within the study area, which will have a beneficial effect on bicycle and pedestrian circulation.	• Enhancements are proposed as part of the TSM Alternative include transit operational improvements, transit amenities, and bicycle/pedestrian improvements that reinforce bicycle and pedestrian circulation within the study area.	• In addition to the bicycle and pedestrian enhancements included in the No Build and the TSM Alternatives, Streetcar Alternative 1 would provide additional sidewalk and pedestrian walkway improvements in the vicinity of the proposed streetcar stations, such as: connecting sidewalks; signing, striping, and traffic controls; and lighting/landscaping. • Streetcar Alternative 1 also includes the widening of sidewalks along 4th Street between Ross and French Streets.	• In addition to the bicycle and pedestrian enhancements included in the No Build and TSM Alternatives, Streetcar Alternative 2 would provide additional sidewalk and pedestrian walkway improvements in the vicinity of the proposed streetcar stations, such as: connecting sidewalks; signing, striping, and traffic controls; and lighting/landscaping. • Streetcar Alternative 2 provides the additional width needed to support the City's planned development of a Class II bike lane along Civic Center Drive between Flower Street and Spurgeon Street.
Land Use			
• Under the No Build Alternative, no impacts to land uses and zoning are anticipated beyond those	• Improvements proposed under the TSM Alternative are consistent with the land use plans,	• The route of the streetcar system was designed to provide efficient modes of transit an urbanized area of central Orange County while not	• The route of the streetcar system was designed to provide efficient modes of transit in an urbanized area of central Orange County while

that have been previously analyzed and approved by the Cities of Santa Ana and Garden Grove.	policies, and regulations of the cities of Santa Ana and Garden Grove. • Provision of enhanced bus transit services would increase access to transit and connectivity to neighborhoods which are currently underserved by transit.	considerably aggravating existing land use conditions. Stations are strategically situated within each of the neighborhoods along the alignment within the PE ROW and along city streets away from sensitive receptors. In addition, many of the stations have been proposed near public use areas and activity centers such as parks and civic/retail areas. • A total of twelve stations are currently proposed under Streetcar Alternative 1. This alternative would promote mixed use development around the stations or nodes, would support planned residential development in the vicinity of the stations, and would facilitate access to downtown and other high-intensity areas of employment, commercial development, and recreational activities. • Streetcar transit operations would be consistent with land use goals established for the cities of Santa Ana and Garden Grove. • Streetcar Alternative 1 would represent a clear investment in transit infrastructure, which serves as an inducement to expand development activity; maximize use of existing buildings; support increased variety and affordability of housing, promote walkability, and minimize need for an automobile.	not considerably aggravating existing land use conditions. Stations are strategically situated within each of the neighborhoods along the alignment within the PE ROW and along city streets away from sensitive receptors. In addition, many of the stations have been proposed near public use areas and activity centers such as parks and civic/retail areas. • A total of thirteen stations are currently proposed under Streetcar Alternative 2. This alternative would promote mixed use development around the stations or nodes, would support planned residential development in the vicinity of the stations, and would facilitate access to downtown and other high-intensity areas of employment, commercial development, and recreational activities. • Streetcar transit operations would be consistent with land use goals established for the cities of Santa Ana and Garden Grove. • Streetcar Alternative 2 would represent a clear investment in transit infrastructure, which serves as an inducement to expand development activity; maximize use of existing buildings; support increased variety and affordability of housing, promote walkability, and minimize need for an automobile.

Acquisitions, Displacement and Relocations			
○	○	●	●
• The No Build Alternative would involve no property acquisitions and would therefore result in no displacements.	• Under the TSM Alternative, only operational and minor physical changes (e.g., bus shelters) would occur within the study area. The TSM Alternative would not result in any property acquisitions, displacement, or relocation.	• Under Streetcar Alternative 1, 7 parcels have the potential to be impacted, depending upon the design options selected. These are substantially partial or sliver takes, and consist of commercial / industrial properties, parking lots, and vacant land. • A potential full acquisition is related to the central maintenance facility site location (Site A). • Since the total amount of privately owned parcels identified as full or partial acquisitions is relatively small in light of the property inventory in the study area, the resulting loss of property tax revenues would be considered negligible and short term.	• Under Streetcar Alternative 2, 11 parcels have the potential to be impacted, depending upon the design options selected. These are substantially partial or sliver takes, and consist of commercial / industrial properties, parking lots, and vacant land. • The potential full acquisitions are generally related to the central maintenance facility site location (Sites A); and the Civic Center Drive bike lane for Streetcar Alternative 2. • Since the total amount of privately owned parcels identified as full or partial acquisitions is relatively small in light of the property inventory in the study area, the resulting loss of property tax revenues would be considered negligible and short term.
Parkland and Recreation Areas			
○	○	○	○
• The No Build Alternative is not expected to result in direct impacts to any parkland or recreational resources beyond those future, approved projects that have already been	• The transit improvements and enhancements associated with the TSM Alternative would have no adverse impacts to any existing or planned parks or recreational	• The Santa Ana River Trail crosses under the proposed project alignment for Streetcar 1. As part of the construction for Streetcar Alternative 1, a new bridge is proposed for the streetcar alignment over the Santa Ana River Channel. While	• The Santa Ana River Trail crosses under the proposed project alignment for Streetcar 2. As part of the proposed construction for Streetcar Alternative 2, a new bridge is proposed for the streetcar alignment over the Santa Ana River

previously assessed.	resources within the study area.	construction may have a temporary effect on the Santa Ana River Trail, no permanent change to this resource is proposed and the nature of the project meets the criteria for avoidance of a temporary use of a Section 4(f) resource. • Under Streetcar Alternative 1, the alignment would exit the Santa Ana Boulevard street right-of-way, just east of Parton Street, and head due east on new location skirting the southern boundary of Sasscer Park within a former emergency access corridor. Although the parcel for the former emergency access corridor is publically owned, the parcel has not been associated with the park. Rather the parcel is abandoned 4th Street right-of-way that previously functioned as an emergency access lane for the City Fire Department. Alternatively, while Sasscer Park Implementation of Streetcar Alternative 1 would not result in a direct, temporary, or constructive use of Sasscer Park. • Streetcar Alternative 1 would improve transit access to recreational facilities within the project area. Several recreational facilities are located within walking distance of proposed streetcar platform stops in this alternative. However, the increased use of recreational facilities is not expected to be significant enough to adversely affect these facilities.	Channel. While construction may have a temporary effect on the Santa Ana River Trail, no permanent change to this resource is proposed and the nature of the project meets the criteria for avoidance of a temporary use of a Section 4(f) resource. • Streetcar Alternative 2 would improve transit access to recreational facilities within the project area. Several recreational facilities are located within walking distance of proposed streetcar platform stops in this alternative. However, the increased use of recreational facilities is not expected to be significant enough to adversely affect these facilities.

Environmental Justice			
• The No Build Alternative does not propose any action that would physically divide an established community.	• The TSM Alternative does not propose any actions that would adversely impact community character and cohesion. • The TSM Alternative includes transit improvements and enhancements that would provide additional transit service and amenities to residents within the community.	• Streetcar Alternative 1 provides additional transit service and connectivity between residential neighborhoods and public use areas, civic buildings, and activity centers within the community. • The location of the Santa Ana River within the study area currently acts as a natural divider between Garden Grove/Western Santa Ana and the central portion of Santa Ana. The streetcar alignment includes a new bridge over the Santa Ana River Channel, which would provide an additional transit connection linking the two sides of the river. • While the proposed streetcar would add urban elements such as streetcar tracks, an electric overhead contact system, bridges, and station platforms, the proposed alignment would not result in any permanent physical barriers that can be deemed to divide a community. The project would not result in full acquisitions of any residential properties or result in the relocation of residences.	• Streetcar Alternative 2 provides additional transit service and connectivity between residential neighborhoods and public use areas, civic buildings, and activity centers within the community. • The location of the Santa Ana River within the study area currently acts as a natural divider between Garden Grove/Western Santa Ana and the central portion of Santa Ana. The streetcar alignment includes a new bridge over the Santa Ana River Channel, which would provide an additional transit connection linking the two sides of the river. • While the proposed streetcar would add urban elements such as streetcar tracks, an electric overhead contact system, bridges, and station platforms, the proposed alignment would not result in any permanent physical barriers that can be deemed to divide a community. The project would not result in full acquisitions of any residential properties or result in the relocation of residences.

7.5 Travel Benefits, Choice and Reliability

7.5.1 Customer Service as Measured by Route Travel Times between Key Origin-Destination Pairs

For this detailed evaluation of alternatives, one measure of effectiveness for Travel Benefit, Choice and Reliability is Customer Service. A key aspect of Customer Service is the effectiveness of an alternative in moving passengers to their destinations, as measured by travel times between key origin-destination pairs.

The following key origin-destination (O-D) pairs were identified:

- Santa Ana Regional Transportation Center (SARTC) to Harbor Boulevard/Westminster Avenue;
- SARTC to Orange County Superior Court;
- SARTC to Reagan Federal Building and Courthouse;
- Lacy Neighborhood to Santa Ana College; and
- Spurgeon Park to Fiesta Marketplace.

For the TSM alternative, in-vehicle travel times were obtained from OCTAM. For Streetcar 1 and Streetcar 2, in-vehicle travel times were obtained from the operations simulations prepared for the streetcar alternatives during Conceptual Engineering. Out-of-vehicle times were calculated for each O-D pair and added to the in-vehicle times to estimate total travel time. In two cases, it was assumed that OCTA fixed route service would provide the connection from the station closed to the destination, when the distance to the destination was considered too far to walk. The two situations included:

- TSM Alternative: Spurgeon Park to Fiesta Marketplace - In the vicinity of Spurgeon Park (Fairview Street) the TSM route runs along Westminster Avenue/17th Street. It was assumed that a person would walk from Spurgeon Park to the Route 47 stop at Civic Center Drive; take Route 47 to Westminster Avenue to connect with the TSM route.
- Streetcar 1 and Streetcar 2: SARTC to Santa Ana College – It was assumed that a person would take the streetcar from SARTC to Bristol Street, connect with Route 57 at Bristol Street to travel to Santa Ana College at Bristol Street/17th Street.

Table 7-8 compares the travel times between key O-D pairs for the TSM, Streetcar 1 and Streetcar 2. Review of Table 7-8 shows that the TSM alternative provides that shortest travel time from SARTC to the Orange County Superior Court, and from SARTC to Santa Ana College. The former is attributable to the TSM route's bi-directional alignment along Civic Center Drive, where the Orange County Superior Court is also located. Streetcar 2 also travels along Civic Center Drive past the court in the westbound direction, but travels on Santa Ana Boulevard in the eastbound direction. In Streetcar 2, riders would return to

SARTC from the courthouse by walking to the streetcar station at Flower Street and Santa Ana Boulevard. The Streetcar 1 alignment runs along Santa Ana Boulevard in the vicinity of the courthouse; riders would exit the streetcar at the Flower Street station (Flower Street and Santa Ana Boulevard) and walk to the courthouse, and walk back to the Flower Street Station to return to SARTC.

The TSM travel time advantage between SARTC to Santa Ana College is because the TSM alternative provides direct service between SARTC and Santa Ana College, traveling on Civic Center Drive, Bristol Street and Westminster Avenue/17th Street. Traveling between SARTC and Santa Ana College via the streetcar (Streetcar 1 or Streetcar 2) requires transferring to OCTA Route 57 at Bristol Street to complete the trip.

Streetcar 1 provides travel time advantage compared to TSM and Streetcar 2 between SARTC and Harbor Boulevard/Westminster Avenue, between SARTC and the Reagan Federal Building and Courthouse, and between Spurgeon Park and Fiesta Marketplace. The Streetcar 1 alignment has the shortest distance between SARTC and Harbor Boulevard, and it is more centrally located to destinations in the downtown such as the Reagan Federal Building and Courthouse and Fiesta Marketplace.

While Streetcar 2 offers travel time advantage compared to TSM from some O-D pairs, and compared to Streetcar 1 for other pairs, it does not provide the shortest travel time for any of the O-D pairs. This is primarily due to the length of the Streetcar 2 alignment, with its "direction loop" approach to SARTC and its Civic Center Drive couplet alignment.

Table 7-8: Travel Time Comparison between Key Origin-Destination Pairs

DESCRIPTION	STATION ASSUMPTION		TOTAL TRAVEL TIME[1] (in minutes)					
			TSM		STREETCAR 1		STREETCAR 2	
	FROM	TO	EASTBOUND	WESTBOUND	EASTBOUND	WESTBOUND	EASTBOUND	WESTBOUND
Harbor Blvd. to SARTC	Harbor	SARTC	21.9	21.9	20.4	21.3	22.2	27.7
SARTC to Santa Ana Courthouse	SARTC	Flower	5.6	5.6	8.6	8.6	8.6	5.6
SARTC to Federal Building	SARTC	Ross	13.1	13.1	9.4	10.8	11.5	15.8
Lacy Neighborhood to Santa Ana College	Lacy	Bristol	13.7	12.6	19.7	20.9	20.7	25.4
Spurgeon Park to Fiesta Marketplace	Fairview	French/ Spurgeon	31.8[2]	33.1[2]	17.2	21.0	18.4	24.2

Source: OCTAM 3.3, and *Santa Ana Operations Simulation*, February 21, 2011.

Notes:

[1] Assumes walk from station to final destination

[2] Assumes OCTA fixed route bus connection

7.6 Cost and Financial Feasibility

7.6.1 Ease of Constructability

The TSM alternative does not include construction of any significant infrastructure improvements and, therefore, is the most easily constructed. Of the two streetcar alternatives, a number of elements were evaluated in considering their constructability and ease of construction including the linear footage of utilities located under the proposed alignment, as well as the linear footage of pressurized utilities (gas and water), disruption to adjacent land uses, and arterial crossings resulting in traffic disruption.

Utility Conflicts

With respect to utilities, both alternatives share the same track alignment from the western terminus at Harbor Boulevard and Westminster Avenue to Flower Street (the PE ROW Segment and the Raitt to Flower Segment). It is estimated that approximately 2,535 feet of the track alignment in these two segments, common to both alternatives, lie on top of or less than 3 feet from underground utility lines including gas, water, sewer, electricity, CATV, etc. Within the Downtown Segment (from Flower Street to SARTC), Streetcar 1 is estimated to have approximately 9,575 feet of track which lie on top of or less than 3 feet from underground utility lines. Of the 9,575 feet, approximately 5,945 feet are on top or within 3 feet of pressurized utilities that will need to be relocated outside the track envelope. The implications for constructability and the ease of construction of Streetcar 1 have been reflected in the estimated capital cost to implement Streetcar 1. For purposes of this analysis, the effects of these potential utility conflicts on constructability/ease of construction are estimated to be moderate.

Within the Downtown Segment of Streetcar 2, approximately 8,585 feet of the track alignment lie on top or within less than 3 feet of underground utilities. This is approximately 12 percent less than in Streetcar 1. Approximately 5,155 linear feet of track (or 15 percent fewer than in Streetcar 1) lie on top or within less than 3 feet of pressurized utilities requiring relocation. As in Streetcar 2, the effects of these potential utility conflicts on constructability /ease of construction are estimated to be moderate.

While Streetcar 2 has fewer linear feet of track alignment that potentially conflict with underground utilities or utility access, there is one potentially significant utility resource within the track alignment of Streetcar 2. The district office for AT&T occupies the block bounded by 5th Street on the south, Santa Ana Boulevard on the north, Bush Street on the west and Spurgeon Street on the east. Based on communications with AT&T engineers, the telephone transmission lines for the entire City of Santa Ana initiate from this location and are housed in a series of underground vaults under 5th Street between Bush Street and Spurgeon Street. Further research is required to fully understand the implications of the locations of the vaults for streetcar construction and operations, but in initial communications with AT&T it has been suggested that relocation of the vault would not be viable due to the cost and complexity of the undertaking, and the lack of available space within the immediate area to accommodate a new vault. This potential utility conflict is considered to be major.

Disruption to Adjacent Land Uses

Construction of the streetcar is anticipated to result in some short term disruption and access limitations for land uses adjacent to the alignments. Within the Downtown Segment, the Streetcar 1 alignment along Santa Ana Boulevard west of Parton Street passes in front of the Federal Building. At the west end of the Federal Building is a salliport entrance to a detention area. Access to this secured entrance must be maintained during hours of operations, even during construction of the streetcar. During construction, steel plates could be used to cover the track trench and allow vehicles to access the salliport. This provision would be included as a condition within the construction contract. This potential disruption is therefore considered to be minor.

With the Streetcar 1 alignment, project construction will include removal of existing diagonal on-street parking along 4th Street between Ross and French Streets, and widening of the existing sidewalk(s). Depending upon the design option, this could involve widening of the sidewalks only on the south side of 4th Street or on both sides of 4th Street. Track installation and accompanying parking removal and sidewalk widening is expected to disrupt the flow of vehicles, and to a lesser degree, pedestrians during the construction period. However, construction will be staged to minimize disruption to 4th Street. The tight grid network of downtown streets and the relatively short blocks (approximately 300 feet) will facilitate traffic management and maintenance of access for adjacent land uses during construction. The disruption to adjacent land uses of Streetcar 1 Downtown Segment Construction is estimated to be moderate.

With the Streetcar 2 alignment, the eastbound tracks pass behind the Ronald Reagan Federal Building and Courthouse and past the only entrance/exit to the secured parking garage that serves the building. During peak entrance periods (during the AM peak hour and following midday court recesses) vehicles entering the parking garage queue along the south side of 5th Street for security inspection and clearance prior to being allowed entrance to the parking garage. Construction activities would need to be conducted in such a manner that would ensure access to the parking garage through the construction period, as well as allowing adequate space along 5th Street to conduct necessary security activities. Maintaining secured access to the Ronald Reagan Federal Building and Courthouse throughout construction has potentially major implications for ease of construction of Streetcar 2.

Arterial Street Crossings

Managing arterial traffic during construction of a streetcar arterial crossing affects the ease of construction of the system. The Streetcar 1 alignment results in 8 arterial crossings at 7 locations. The Streetcar 1 alignment results in crossings of both Santa Ana Boulevard and Santiago Street in the vicinity of their intersection as the streetcar travels into and out of its eastern terminus station at SARTC. While these have been identified as separate arterial crossings, they would likely be constructed together with vehicular traffic managed to minimize activity at that intersection during the period of construction.

The Streetcar 2 alignment results in 9 arterial crossings at 8 locations. As with Streetcar 1, the Streetcar 2 alignment crosses two arterials at a single intersection as the streetcar transitions from Civic Center Drive to Flower Street. While each arterial crossing (Civic Center Drive, Flower Street) has been identified, the crossings would likely be constructed together through the intersection of Civic Center Drive at Flower Street. Streetcar 2 therefore has one additional crossing compared to Streetcar 1.

Table 7-9 summarizes the results of the Constructability/Ease of Construction analyses.

In summary, Streetcar 1 presents some slight advantage in terms of ease of constructability compared to Streetcar 2. The two most significant challenges to the construction of Streetcar 2 are both along 5th Street: the underground ATT&T vaults along 5th Street between Bush and Spurgeon Streets, and the secured entrance to the Ronald Reagan Federal Building and Courthouse parking garage. While these two challenges do not necessarily represent fatal flaws for the Streetcar 2 alignment, they add considerable complexity to construction planning and management that would not occur with Streetcar 1.

Table 7-9: Constructability/Ease of Construction

CONSTRUCTABILITY/EASE OF CONSTRUCTION	STREETCAR 1	STREETCAR 2
Utility Conflicts:		
All Utilities	Moderate	Moderate
Pressurized Utilities	Moderate	Moderate
Other	Minor	**Major**
Adjacent Uses:		
Federal Detention Center salliport operations & security	Minor	Minor

CONSTRUCTABILITY/EASE OF CONSTRUCTION	STREETCAR 1	STREETCAR 2
4th Street parking removal/ sidewalk reconstruction	Moderate	N/A
Reagan Federal Building and Courthouse parking structure access and security	N/A	**Major**
Arterial Street Crossings:		
Intersections	7	8
Arterial crossings	8	9

7.6.2 Capital Cost

Capital cost estimates have been prepared based on the conceptual engineering completed for the project (See *Conceptual Design Plan Set*, August 19, 2011 and *Conceptual Design Technical Report*, October 14, 2011). The capital cost methodology and assumptions are described in Section 7. A full description and the associated worksheets are contained in the *Capital Cost Methodology Technical Report*, September 7, 2011.

There are no costs associated with the No Build alternative. The cost to implement the TSM alternative is approximately $14.5 million (in 2011 dollars). The major element of the TSM alternative is the implementation of a bus rapid transit (BRT) route between SARTC and the vicinity of Harbor Boulevard and Westminster Avenue. The costs associated with the TSM alternative assume acquisition of 8 BRT vehicles, station area improvements comparable to those assumed for the Build alternatives, (i.e. shelters that incorporate Advance Traveler Information System technology), traffic signal system improvements/enhancements to optimize travel times along the route, and a maintenance facility.

The estimated cost to construct Streetcar 1 with the recommended design options is $209.7 million in 2011 dollars. The estimated cost to construct Streetcar 2 with the recommended design options is $228.1 million in 2011 dollars. Table 7-10 shows the estimated capital costs for the Build alternatives.

Table 7-10 also shows the estimated capital cost of the IOS for each Streetcar Alternative. In both alternatives, the IOS cost is approximately 78 percent of the total project cost even though it is approximately half of the Full Build alignment length. This is because the IOS includes the eastern half of the alignment through the densely developed urban core of the corridor, resulting in substantial drainage and utility costs. Also, the IOS includes the maintenance facility and most of the vehicle and systems costs. The western half of the alignment is within the PE ROW, a substantially undeveloped right-of-way with no utility and minimal drainage issues. The two most significant cost components of the western half of the project are the two bridge structures, over the Santa Ana River and over Westminster Avenue. The detailed cost estimates by Standard Cost Category are included in Appendix A.

Table 7-10: Estimated Capital Cost
(2011 $s in millions)

ALTERNATIVE	ESTIMATED CAPITAL COST (2011 $s in millions)
TSM	$14.50
Streetcar 1 - Assuming: Western Terminus Option B: Elevated Santa Ana River Crossing Option 4: Bridge Avoidance B Sasscer Park Option A: Direct Route 4th Street Parking Scenario C: South Side and North Side Parking Removal Maintenance Facility Site A: SARTC	$209.7
Streetcar 2 - Assuming: Western Terminus Option B: Elevated Santa Ana River Crossing Option 4: Bridge Avoidance B Civic Center Bike Lane Option A: ROW Acquisition and Parking Removal Maintenance Facility Site A: SARTC	$228.1
Streetcar 1 Initial Operable Segment	$158.8
Streetcar 2 Initial Operable Segment	$177.2

7.6.3 Capital Cost per Route Mile

Table 7-11 shows the capital cost per route mile for the Build Alternatives. The cost per mile for the TSM alternative is approximately $1.27 million in 2011 dollars. For Streetcar 1 the "per mile" cost is approximately $50.5 million. For Streetcar 2, the cost is approximately $54.3 million per mile.

Table 7-11: Estimated Capital Cost per Route Mile (2011 $s in millions)

ALTERNATIVE	ESTIMATED CAPITAL COST (2011 $s in millions)
TSM	$1.27
Streetcar 1 - Assuming:	$50.5
Western Terminus Option B: Elevated	
Santa Ana River Crossing Option 4: Bridge Avoidance B	
Sasscer Park Option A: Direct Route	
4th Street Parking Scenario C: South Side and North Side Parking Removal	
Maintenance Facility Site A: SARTC	
Streetcar 2 - Assuming:	$54.3
Western Terminus Option B: Elevated	
Santa Ana River Crossing Option 4: Bridge Avoidance B	
Civic Center Bike Lane Option A: ROW Acquisition and Parking Removal	
Maintenance Facility Site A: SARTC	
Streetcar 1 Initial Operable Segment	$72.2
Streetcar 2 Initial Operable Segment	$68.2

7.7 Operations and Maintenance Cost

The operating and maintenance cost methodology applied to the Build Alternatives to develop an estimate of annual operations and maintenance costs was described in the *Santa Ana Operations and Maintenance Cost Estimates Including O&M Cost Methodologies and Assumptions,* March 15, 2011. The O&M cost estimating methodology is based on current fiscal year bus operating cost information provided by OCTA, and on recent bus and streetcar information from Portland (Tri-Met and Portland Streetcar, Inc.) and Seattle (King County Metro).

To estimate the O&M costs associated with the TSM Alternative, current (Fiscal Year 2010-2011) OCTA bus operating and maintenance cost data was used. Based on that information, a cost per revenue vehicle hour of service of $119.95 was applied to the Route 64 overlay along 1st Street. The proposed new route between SARTC and Harbor Boulevard will have attributes of BRT service such as increased amenities at station/stops. The cost per revenue vehicle hour of service was increased by 20 percent compared to standard fixed route bus service, resulting in a rate of $143.94. A cost per revenue vehicle hour of service of $82.22 was applied to the proposed expanded StationLink Route 462 service, which is currently a contract service to OCTA.

The cost per revenue vehicle hour of service for the Streetcar Alternatives was developed based on the ratio of bus cost to streetcar cost experienced in Portland (Tri-Met and Portland Streetcar Inc.) and Seattle (King County Metro). The average of the ratio streetcar cost to bus cost between Portland and Seattle was then applied to current OCTA bus costs. The result was a cost per revenue vehicle hour of service of $187.12. This rate was used to estimate the O&M costs the Streetcar Alternatives. The results are presented in Table 7-12. The calculation worksheets are included in Appendix B.

Table 7-12: Estimated Operations and Maintenance Costs (2011 $)

	TSM	TSM - SARTC TO HARBOR ROUTE ONLY	STREETCAR 1	STREETCAR 2	STREETCAR 1 IOS	STREETCAR 2 IOS
Annual Revenue Miles	1,061,590	419,120	332,015	363,459	213,127	209,976
Annual Revenue Hours	105,664	35,152	26,364	32,656	21,372	23,868
Peak Vehicles	22	8	6	7	4	5
O&M Costs	**$13.2M**	**$5.1M**	**$4.9M**	**$6.1M**	**$4.0M**	**$4.5M**
Cost per Rev. Mile	$12.51	$12.07	$14.86	$16.81	$18.76	$21.27
Cost per Rev. Hour	$127.50	$143.94	$187.12	$187.12	$187.12	$187.12

The O&M costs for the TSM Alternative are estimated to be approximately $13.32 million per year. This includes the cost for all services enhancements proposed as part of the TSM Alternative. The O&M cost for the proposed new bus route between SARTC and Harbor Boulevard is estimated to be $5.1 million per year.

The TSM Alternative includes enhanced service levels on existing bus routes (Route 64 and Route 462) and the proposed BRT route between SARTC and Harbor Boulevard. As a result, the TSM Alternative produces significantly more annual revenue miles and hours of service and is estimated to have considerably high O&M costs than the Streetcar Alternatives. For comparison purposes with the Streetcar Alternatives, the O&M cost for only the BRT route between SARTC and Harbor Boulevard is also shown.

The complete TSM Alternative is estimated to have the highest O&M cost, however, it is estimated to have the lowest cost per revenue mile and per revenue hour of service. This is because, as described previously, the TSM Alternative produces considerably more annual revenue miles and revenue hours of service than the Streetcar Alternatives. When only the BRT element of the TSM Alternative (the route between SARTC and Harbor Boulevard) is considered, the O&M costs for the TSM Alternative are estimated to be slightly higher than for Streetcar 1, but approximately 28 to 30 percent lower than for Streetcar 2. The estimated O&M costs for Streetcar Alternative 1 are approximately 24 percent less than those for Streetcar Alternative 2. This is due to the increased length of the Streetcar Alternative 2 alignment and the slightly lower average travel speeds resulting in increased annual revenue hours of service.

8. COMPARATIVE EVALUATION OF ALTERNATIVES

8.1 Summary of Findings

The TSM and Build Alternatives have been evaluated against technical criteria and measures of effectiveness (MOEs) that closely relate to the Purpose and Need for the Project. Based on the results of this analysis, the alternatives were ranked by MOE and overall. Table 8-1 summarizes the results of the comparison and ranking.

Table 8-1: Ranking of Alternatives Based on Analysis Results

	CRITERIA / MEASURE OF EFFECTIVENESS	TSM	STREETCAR 1	STREETCAR 2
1.	**ACCESSIBILITY AND LIVABILITY**			
1A.	No. of transit-dependent households within 1/4 mile walking distance of proposed alignment	3	1	2
1B.	No. of daily riders (average weekday boardings)	2	1	3
2.	**ECONOMIC DEVELOPMENT, TRANSIT SUPPORTIVE LAND USE AND COMMUNITY GOALS**			
2A.	Assessment of the transit supportiveness of land uses served by the proposed alignment	2	1	3
2B.	Assessment of the economic development potential of land uses served by the proposed alignment	3	1	2
2C.	Community support		TBD	
3.	**ENVIRONMENTAL RESPONSIBILITY**			
3A.	Amount of additional right-of-way required	1	2	3
3B.	Environmental Tradeoffs	1	2	3
4.	**TRAVEL BENEFITS, CHOICE AND RELIABILITY**			
4A.	Customer service (travel times between O-D pairs)	2	1	3
4B.	Number of daily riders (average weekday boardings)	2	1	3
5.	**COST EFFECTIVENESS AND FINANCIAL FEASIBILITY**			
5A.	Constructability/ease of construction	1	2	3
5B.	Capital cost	1	2	3
5C.	Capital cost per route mile	1	2	3
5D.	Annualized operating cost*	1	2	3
5E.	Operating cost per hour	1	2	2
	OVERALL RANKING	**2**	**1**	**3**

*For purposes of comparison to the Streetcar Alternatives, the Annualized Operating Cost for TSM includes only the SARTC-to-Harbor route.

8.2 Conclusions and Tradeoffs among Alternatives

Streetcar 1 was ranked first in all MOEs included in Accessibility and Livability because it served the greatest number of transit dependent households and was estimated to have the highest daily ridership of the three alternatives. It ranked the highest among the alternatives on Economic Development, Transit Supportive Land Use and Community Goals. The existing land uses along the eastern portion of the Streetcar 1 alignment provide the densities and development patterns to support a high capacity transit system. Adopted land use plans that cover the Streetcar 1 alignment support and encourage the types of development/redevelopment likely to occur in conjunction with high capacity and transit, and existing development patterns provide opportunity for such development/redevelopment to occur. Streetcar 1 effectively serves key destinations within the corridor area, ranking it first in Travel Benefit, Choice and Reliability.

The TSM alternative ranked first among the alternatives in Environmental Responsibility. Because it does not include substantial new construction, it does not require acquisition of right-of-way, nor does it adversely affect any conditions in the environment compared to the No Build Alternatives.

In terms of Cost Effectiveness and Financial Feasibility, the TSM Alternative ranked first for constructability/ease of construction because of the very limited amount of construction likely to occur under this alternative. It has the lowest capital cost of the alternatives, and therefore the lowest cost per route mile.

Streetcar 1 ranked second in terms of constructability/east of construction, and capital cost. It was estimated to be less expensive than Streetcar 2 primarily because of its shorter route length. Streetcar 1 ranked first in terms of annual operating cost and second on operating costs per hour. The TSM Alternative includes considerably greater number of revenue hours than Streetcar 1 or 2, although the cost per revenue hour for the TSM Alternatives was less than for the Streetcar Alternatives.

Overall, Streetcar 1 ranked first among the alternatives based on this technical evaluation.

8.3 Recommendation Alternative

To be added upon completion of outreach efforts.

APPENDIX B: Travel Demand Model Methodology Report

DRAFT
Travel Demand Model Results

in support of the

SANTA ANA AND GARDEN GROVE
FIXED GUIDEWAY CORRIDOR PROJECT

Harbor Boulevard to Santa Ana Regional Transportation Center (SARTC)

Prepared for
City of Santa Ana
in cooperation with
City of Garden Grove
Orange County Transportation Authority

Prepared by
URS Corporation
111 SW Colombia, Suite 1500
Portland, Oregon 97201

April 27, 2012

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1.0 PROJECT BACKGROUND

The cities of Santa Ana and Garden Grove are committed to providing a range of transportation choices for those that live, work or visit the study area. Figure 1 shows the location of the Santa Ana-Garden Grove Fixed Guideway Corridor study area. Incorporating the core of the fourth most densely populated city in the U.S. (Santa Ana), and with the anticipation that growth will continue over the next 25 years, the cities of Santa Ana and Garden Grove understand that addressing its mobility needs is a key to its future success.

From a transit perspective, the study area is well-served from a regional basis by a combination of existing and planned services such as Metrolink and OCTA fixed route bus service. However, the cities are exploring methods of providing an efficient and effective means of distributing trips locally while reinforcing desired economic development goals. In partnership with the Orange County Transportation Authority (OCTA), the cities of Santa Ana and Garden Grove are exploring the potential of building a fixed guideway transit system to provide service between the Santa Ana Regional Transportation Center (SARTC) and a new transit center near the intersection of Harbor Boulevard and Westminster Avenue. The system would distribute trips from SARTC as well as function as an urban circulator throughout Santa Ana including the Downtown and the Civic Center areas and connect with Garden Grove on the west.

The reduced set of alternatives to be carried forward into conceptual design and environmental analysis (National Environmental Policy Act/California Environmental Quality Act) include a No Build Alternative, Transportation Systems Management Alternatives and two modern streetcar alignments. Figure 2 shows the bus elements of the TSM Alternative. Figures 3 and 4 show the two streetcar alignments. The streetcar alternatives have a common alignment west of Flower Street, using Santa Ana Boulevard and the abandoned Pacific Electric Right-of-Way (PE ROW) to the vicinity of Harbor Boulevard and Westminster Avenue. East of Flower Street, the two options use different combinations of 4th Street, 5th Street, Santa Ana Boulevard and Civic Center Drive to traverse the Civic Center and Downtown areas east to SARTC.

The purpose of this memorandum is to discuss the modeling process that was used in the development of the ridership forecasts in support of the Santa Ana and Garden Grove Fixed Guideway Study. Section 2 discusses the modeling methodology that was used. Section 3 provides a detailed description of the alternatives that were evaluated. Section 4 presents the ridership results for the alternatives.

Figure 1: Study Area Location Map

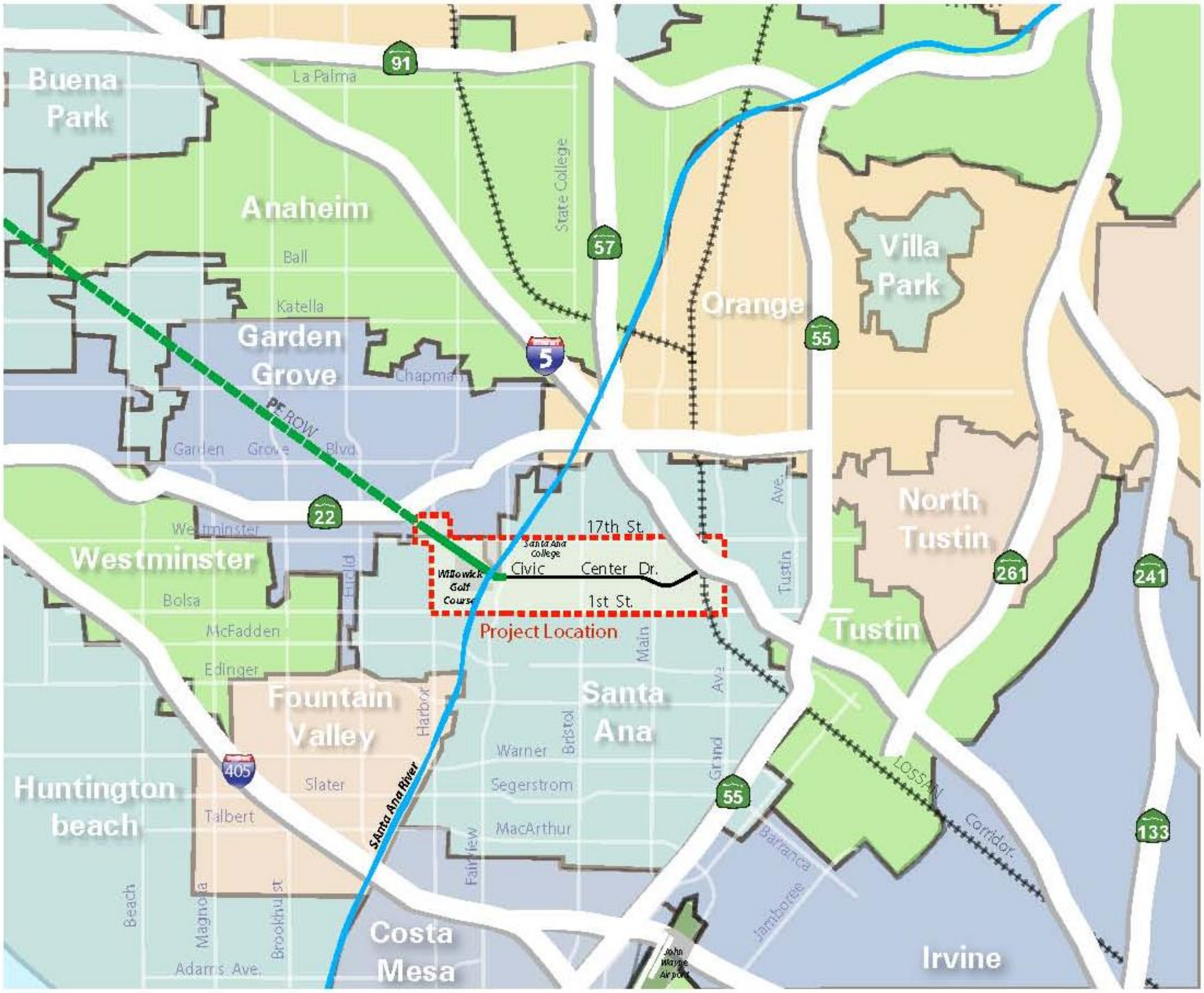
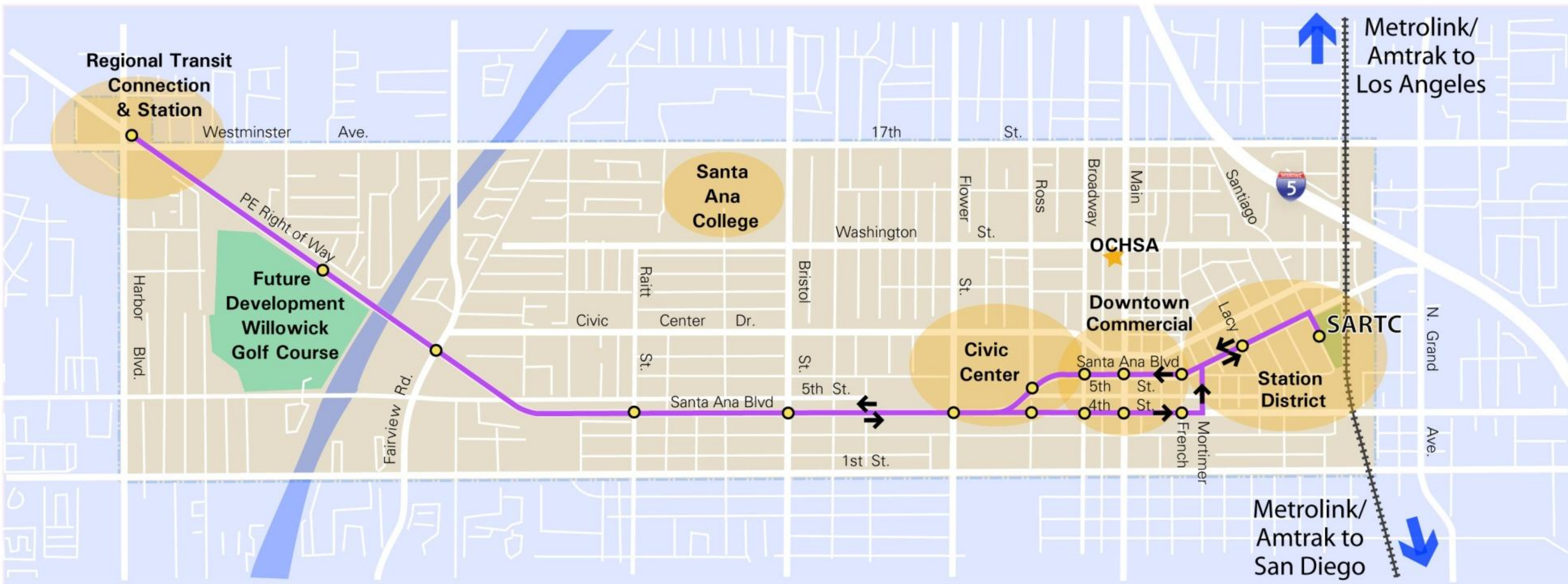


Figure 2: Transportation Systems Management (TSM) Alternative

Figure 3: Modern Streetcar Alternative 1 Alignment



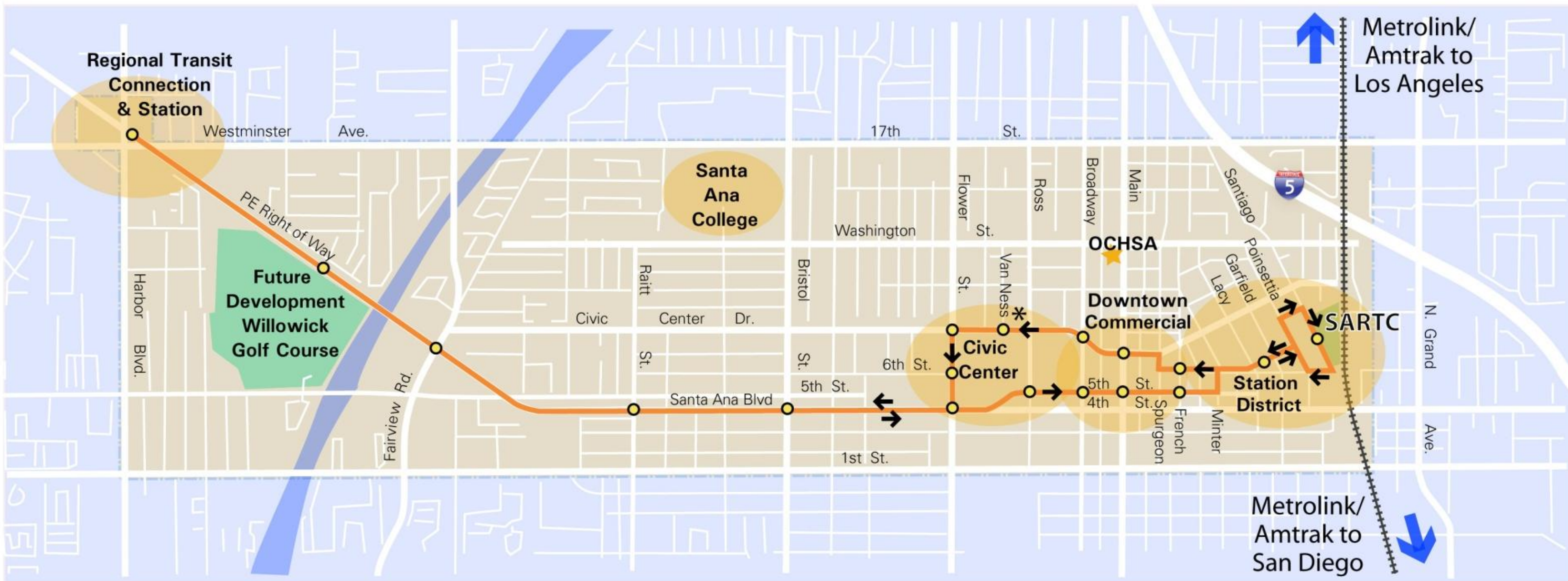
NORTH

LEGEND

- Streetcar 1
- Proposed Stop
- Future Extension to Metro East Mixed-Use Development
- Study Area

Alternative 1 Design Option 1
Sasscer Park mitigation

Figure 4: Modern Streetcar Alternative 2 Alignment



NORTH

LEGEND

- Streetcar 2
- Proposed Stop
- Future Extension to Metro East Mixed-Use Development
- Study Area
- * Civic Center station/stop on Civic Center Drive is located at Van Ness in Design Option 1 and at Ross Street in Design Option 2

2.0 MODEL PROCESS

This section documents the approach used to develop travel demand forecasts in support of the Santa Ana-Garden Grove Fixed Guideway Corridor Study.

2.1 Model Process

Travel demand forecasts for this project were developed using the Orange County Transportation Analysis Model (OCTAM) 3.3, the most current version of the OCTAM system available at the beginning of the study. Year 2035 forecasts were developed to support the environmental analysis and preparation of the Environmental Impact Report/Environmental Assessment. OCTAM is the tool used in developing long-range travel forecasts for Orange County.

OCTAM is a conventional four-step regional model that has been implemented with TRANPLAN software and customized FORTRAN programs. OCTAM shares the same model components as the Southern California Association of Governments (SCAG) Regional Model but has more detailed networks and zone structure within Orange County. Geographically, OCTAM includes the counties of Orange, Los Angeles, Ventura and portions of Riverside and San Bernardino.

2.1.1 Transit Skimming Validation

Although OCTAM 3.3 has been validated by OCTA, transit skims were reviewed to verify reasonableness for this specific application. Transit skims are a composite measure of transit service levels, travel times, and costs. The proper representation of transit skims is important because they are used as inputs for OCTAM's mode choice model and can affect how many trips are estimated to be made by each of the available travel modes.

To determine whether OCTAM was building reasonable transit skims, observed trip tables were created from 2010 transit on-board survey data. At the time the survey data were obtained in July 2010, OCTA had surveyed about 65 percent of their targeted routes systemwide. Eleven study area routes were included in the total. The surveyed routes included: Routes 43, 47, 53, 55, 56, 57, 59, 60, 62, 64, and 145.

Survey records were expanded to match year 2005 average weekday boardings by route for the peak and off-peak periods. The observed trip tables were assigned and modeled boardings on the routes were compared with the 2005 observed boardings. Overall, the modeled boardings were about 4 percent less than observed. At the route level, the larger differences for some of the routes could be attributable to having an incomplete on-board survey. In general, the results indicate that the model will be acceptable for use in developing the initial long range (2035) forecasts for the Santa Ana-Garden Grove Fixed Guideway Corridor. As project planning progresses, and opening year forecasts are required for FTA Small Starts, additional refinements will be made to the overall modeling methodology to enhance sensitivity and increase accuracy. Table 1 shows a summary of the results.

Table 1: Assigned Results of Observed Transit Trip Table

ROUTE	DESCRIPTION	OBSERVED 2005 BOARDINGS	MODELED 2005 BOARDINGS	ABSOLUTE DIFFERENCE	PERCENT DIFFERENCE
43	La Habra to Costa Mesa	18,489	19,252	(763)	4.1%
47	Brea to Newport Beach	10,831	9,786	1,045	-9.7%
53	Brea to Irvine	10,377	9,048	1,329	-12.8%
55	Santa Ana to Newport Beach	8,189	8,339	(150)	1.8%
57	Brea to Newport Beach via State College Blvd/Bristol St.	13,951	12,837	1,114	-7.9%
59	Brea to Irvine	3,954	4,125	171	4.3%
60	Long Beach to Tustin	14,471	9,899	4,582	-31.7%
62	Huntington Beach to Santa Ana	1,220	1,421	(201)	16.5%
64	Huntington Beach to Tustin	9,968	10,998	(1,030)	10.3%
145	Santa Ana to Costa Mesa	909	3,078	(2,169)	238.6%
	TOTAL	**92,359**	**88,773**	**3,586**	**-3.9%**

2.2 Development of Forecasts

One major goal in developing the travel forecasts for the Santa Ana-Garden Grove Fixed Guideway was to develop ridership forecasts that were reasonable using a transparent methodology. Ridership estimates were developed that represented a low-end estimate and a high-end estimate. This was done for two reasons. First, providing one forecast, especially one that is twenty years out, suggests a level of precision that is not possible given the number of assumptions that are incorporated into the travel forecasting process. Second, the modern streetcar possesses characteristics of several transit modes which make representation in most travel models such as OCTAM, that does not have an explicit streetcar mode, challenging.

In some respects, the streetcar operates like a local bus which provides frequent stops in an urban setting. Generally, the spacing between transit stops is a quarter mile or less. Like buses, streetcars typically operate in mixed flow traffic with autos. On the other hand, the streetcar possesses some of the qualities of urban rail. Streetcars, as envisioned for the Santa Ana-Garden Grove Fixed Guideway will look similar to light rail transit (LRT) vehicles with low floors and electrical power delivered via overhead catenary wires. Unlike buses, streetcar routing is more identifiable because of the tracks and catenary, and stops may have more amenities and appearance of permanence than signed bus stops. Acceleration and deceleration characteristics of the streetcar are also similar to LRT, providing a smoother, more comfortable ride than buses. These latter characteristics that differentiate modern streetcars from buses may explain some of the preference for streetcar over buses that have been expressed in areas that have replaced bus routes with modern streetcar systems, with significant increases in ridership.

The streetcar was initially modeled as a local bus (mode 15) in OCTAM. However, instead of using OCTAM's standard local bus-speed to auto speed relationships, station-to-station travel times were based on rail run time simulations developed for each of the streetcar alternatives. Overall, the average streetcar speed based on the simulations was about 9.5 -11.5 miles per hour as compared to average bus speeds of 15.3 miles per hour. In the western end of the corridor, the streetcar achieved an average speed of 31 miles per hour, but only when operating in an exclusive right-of-way where stations are 0.5 miles apart. In downtown Santa Ana, average speeds are typically 4 to 10 miles per hour. This represents a worst case scenario because the simulation assumed that the streetcar would approach each signalized intersection on a red phase and be required to stop.

To produce the upper end of the range of ridership forecasts for the streetcar, the urban rail mode (mode 18) was used to represent the streetcar in OCTAM. In mode choice models, constants are used to capture the unobserved attributes of a mode such as safety, ride quality, reliability, or other intangible characteristics. Typically, the value of constants for rail is higher than for more conventional modes such as buses. Since OCTAM's mode choice model does not currently have a streetcar mode, urban rail was used as a proxy for streetcar.

3.0 EVALUATION OF ALTERNATIVES

The alternatives that were modeled for the Santa Ana and Garden Grove Fixed Guideway Project include:

- No-Build
- Transportation Systems Management (TSM)
- Streetcar 1 Alternative (Santa Ana Boulevard & Fourth Street Couplet)
- Streetcar 2 Alternative (Santa Ana Boulevard & Civic Center Drive/5th Street Couplet)

3.1 No-build Alternative

The No-Build Alternative for Year 2035 assumed an existing plus committed (E+C) transit network. Transit service assumed in this alternative are essentially bus routes either operating today or those programmed for implementation in OCTA's short-range plan. Three bus rapid transit (BRT) routes have been identified by OCTA as "committed" projects that will be implemented in the near future. The routes are planned for operation in the following corridors: Westminster Avenue/17th Street, Harbor Boulevard, and State College Boulevard/Bristol Street. There are no bus routes in the No-build that follow the alignment of the TSM or streetcar routing.

3.2 Transportation Systems Management Alternative

The Transportation Systems Management (TSM) Alternative is a lower cost option to the Build scenarios. Conceptually, it is intended to satisfy the same mobility goals and objectives of the project but with a lower capital cost. The major changes made to the TSM network include an addition of a BRT route with similar geographic coverage and operating assumptions as the streetcar assumed in the Build Alternatives.

The TSM BRT route would start at the Santa Ana Regional Transportation Center (SARTC), travel west on Civic Center Drive, north on Bristol Street, west on Westminster Avenue to the terminus Westminster Avenue/Harbor Boulevard. It would operate at 10-minutes frequencies in the peak period and 15-minutes during the midday. Stops would be provided at the following locations:

1. SARTC
2. Civic Center Dr./ Lacy St.
3. Civic Center Dr./ French St.

4. Civic Center Dr./ Main St.
5. Civic Center Dr./ Broadway
6. Civic Center Dr./ Ross St.
7. Civic Center Dr./ Flower St.
8. Civic Center Dr./Bristol St.
9. Bristol St./Washington St.
10. Bristol St./17th St.
11. 17th St./College Ave.
12. 17th St./Westminster Ave./Fairview St.
13. Westminster Ave./Harbor Blvd

Other route changes from the No-Build include headway improvements on the Routes 55, 206, 462, 463, and 757.

3.3 Streetcar Alternative 1

Streetcar Alternative 1 assumes roughly the same background bus network and service levels as the TSM Alternative. One change includes the elimination of the Route 462 which would be replaced by the streetcar. The streetcar would begin at SARTC, travel east on Santa Ana Boulevard (and Fourth Street in the downtown area) and enter the PE ROW just west of Raitt Street, terminating at approximately Harbor Boulevard/Westminster Avenue. The streetcar was assumed to operate at 10-minutes peak and 15-minutes off-peak frequencies and would stop at the following stations:

1. Harbor Blvd. and Westminster Ave.
2. Willowick
3. Fairview St. and PE ROW
4. Raitt St. and Santa Ana Blvd.
5. Bristol St. and Santa Ana Blvd.
6. Flower St. and Santa Ana Blvd.

Couplet Section

7E. Sasscer Park	7W. Ross St. and Santa Ana Blvd.
8E. Broadway and 4th St.	8W. Broadway and Santa Ana Blvd.
9E. Main St. and 4th St.	9W. Main St. and Santa Ana Blvd.
10E. French St. and 4th St.	10W. French St. and Santa Ana Blvd.

11. Lacy St. and Santa Ana Blvd.
12. SARTC

3.4 Streetcar Alternative 2

Streetcar Alternative 2 assumes the same background bus network and service levels as Streetcar Alternative 1. The route, beginning at SARTC, would travel east on Brown Street/6th Street, north on Bush Street, west on Civic Center Drive, south on Flower Street, west on Santa Ana Boulevard, and enter the PE ROW west of Raitt Street and continue to Harbor Boulevard. In the eastbound direction, the alignment would follow the same alignment via PE ROW, Santa Ana Boulevard to 5th Street, north on Minter Street, then east on 6th Street/Brown Street to SARTC. The streetcar was assumed to operate at 10-minutes peak and 15-minutes off-peak and would stop at the following stations:

1. Harbor Blvd. and Westminster Ave.
2. Willowick
3. Fairview St. and PE ROW
4. Raitt St. and Santa Ana Blvd.
5. Bristol St. and Santa Ana Blvd.

Couplet Section

6E. Flower St. and Santa Ana Blvd.	6W. Flower St. and 6th St.
7E. -------------	7W. Flower St. and Civic Center Dr.
8E. Ross St. and Santa Ana Blvd.	8W. Van Ness Ave. and Civic Center Dr.
9E. Broadway and 5th St.	9W. Broadway and Civic Center Dr.
10E. Main St. and 5th St.	10W. Main St. and Civic Center Dr.
11E. French St. and 5th St.	11W. French St. and Santa Ana Blvd.

12. Brown St. and Lacy St.
13. SARTC

Table 3 shows the study area routes and their service frequencies assumed under each alternative.

Table 2: Service Assumptions for Background Transit Network

BUS ROUTE	DESCRIPTION	ROUTE TYPE	2035 NO-BUILD		TSM		STREETCAR 1		STREETCAR 2	
			AM	MD	AM	MD	AM	MD	AM	MD
43	Harbor Blvd	Local	20	20	20	20	20	20	20	20
43	Harbor Blvd short turn	Local	40	40	40	40	40	40	40	40
47	Fairview-Anaheim	Local	15	15	15	15	15	15	15	15
51	Flower	Local	30	45	30	45	30	45	30	45
53	Main short turn	Local	15	15	15	15	15	15	15	15
53	Main (CM-SA-ORG)	Local	30	36	30	36	30	36	30	36
55	Santa Ana Civic Center to Newport Beach	Local	20	30	15	20	15	20	15	20
56	Garden Grove - La Veta	Local	40	40	40	40	40	40	40	40
57	St. College - Bristol short turn	Local	60	60	60	60	60	60	60	60
57	St. College Bristol	Local	20	20	20	20	20	20	20	20
59	Grand-Glassell-Kraemer short turn	Local	15	45	15	45	15	45	15	45
59	Grand-Glassell-Kraemer	Local	--	60	--	60	--	60	--	60
60	Westminster/17th	Local	30	30	30	30	30	30	30	30
60	Westminster/17th short turn	Local	30	60	30	60	30	60	30	60
64	Bolsa-1st	Local	45	--	45	--	45	--	45	--
64	Bolsa-1st short turn	Local	20	17	20	17	20	17	20	17
145	Raitt Grenville	Community	45	45	45	45	45	45	45	45
205	LH-SA-DIS	Express	30	30	30	30	30	30	30	30
205	LH-SA-DIS ST short turn	Express	40	--	40	--	40	--	40	--
206	Santa Ana to Lake Forest Express	Express	60	--	30	--	30	--	30	--
462	The Depot At Santa Ana to Civic Center	StationLink	20	--	15	15	--	--	--	--
463	The Depot At Santa Ana to Hutton Centre	StationLink	25	--	20	--	20	--	20	--
464	The Depot At Santa Ana to Costa Mesa	StationLink	20	--	20	--	20	--	20	--

BUS ROUTE	DESCRIPTION	ROUTE TYPE	2035 NO-BUILD		TSM		STREETCAR 1		STREETCAR 2	
			AM	MD	AM	MD	AM	MD	AM	MD
757	Pomona to Santa Ana Express	Express	90	--	60	--	60	--	60	--
BRT 1	Harbor Blvd BRT	BRT	10	15	10	15	10	15	10	15
BRT 2	Westminster/17th St. BRT	BRT	10	15	10	15	10	15	10	15
BRT 2a	Westminster/17th BRT East short turn	BRT	20	30	20	30	20	30	20	30
BRT 3	St. College Bristol BRT	BRT	10	15	10	15	10	15	10	15
TSM	TSM BRT via Civic Center Dr.	BRT	-	-	10	15	--	--	--	--
BLD	Streetcar via Santa Ana	Streetcar	--	--	--	--	10	15	10	15

4.0 Ridership

Transit ridership on a new route is commonly measured by route boardings. This metric directly captures the total number of transit riders on the route. Boardings, however, provide no information on whether the transit users are existing transit users simply transferring to the new route or new transit riders. If an existing bus route has been replaced by rail service, many of the passengers on the new service will be existing riders as their original bus service will be terminated or reconfigured to serve the new rail line. Both existing and new transit riders are important since they are affected by changes in travel times and costs afforded by the new service.

Another metric to consider in measuring ridership is the linked transit trip. A linked transit trip is the complete journey made from one's origin to destination. Hence, a traveler may board one bus and a rail line to complete their trip from home to work. While this example involves two boardings, it represents one linked transit trip. Looking at the change in linked transit trips is the primary way to determine whether a transit investment has attracted new transit riders. Linked trips are important because they are used by the FTA in calculating the Cost-Effectiveness Index (CEI) for fixed-guideway projects submitted under Section 5309 – New Starts program.

4.1 No-Build Alternative

In the No-build Alternative, OCTAM forecasts 1,599,268 linked transit trips regionwide during an average weekday in 2035. It is important to note that the OCTAM modeling area is fairly expansive and includes Orange, Los Angeles, Riverside, San Bernardino, and Ventura Counties. Transit systems represented in OCTAM include OCTA, LA Metro, Metrolink, and local bus routes operating in San Bernardino, Ventura, and Riverside Counties.

4.2 TSM Alternative

For the TSM Alternative, year 2035 forecasted ridership for the BRT route along Civic Center Drive is 3,085 boardings during an average weekday. OCTAM suggests the stations with the highest passenger activity will be at SARTC and Bristol Street. Compared to the No-build, the TSM alternative adds 2,960 linked transit trips. The difference between the boardings on the TSM bus route and change in linked transit trips suggests that most of the riders on the route are new transit riders. The balance of the boardings, or 128, are existing transit riders who have switched from other transit routes.

Table 4 provides a summary of the station activity at the proposed stations. Station activity includes total boardings and alightings occurring at the stations. Ridership, on the other hand, accounts for only boardings on the route. One-half of the total station activity is equal to ridership.

Table 3: Total Station Activity for TSM Alternative

STATIONS	TOTAL STATION ACTIVITY
SARTC	1,893
Lacy / Civic Center Drive	826
French / Civic Center Drive	149
Main / Civic Center Drive	380
Broadway / Civic Center Drive	153
Ross / Civic Center Drive	79
Flower / Civic Center Drive	67
Bristol / Civic Center	1,156
Bristol / Washington	89
Bristol / 17th	866
17th / Westminster /Fairview	330
Westminster /Harbor	182
TOTAL	**6,170**

4.3 Streetcar Alternative 1

OCTAM forecasts 3,770 boardings for the streetcar during an average weekday. The stations forecasted to have the most passenger activity are SARTC, Bristol, and Harbor. Under this alternative, linked transit trips are expected to increase by 2,265 over the No-Build. When coded as urban rail, forecasted ridership on the streetcar is 8,410 boardings. Linked transit trips also increase by 5,730 over the No-Build. Table 5 provides a summary of total station activity for both the low and high forecasts.

Table 4: Total Station Activity for Streetcar 1

STATIONS	TOTAL STATION ACTIVITY - LOW	TOTAL STATION ACTIVITY - HIGH
SARTC	1,132	3,358
Lacy	573	499
French	244	235
Main	153	533
Broadway	141	1,164
Ross	234	1,320
Flower	812	368
Bristol	1,452	2,472
Raitt	570	1,734
Fairview	508	1,732
Willowick	824	929
Harbor	903	2,478
TOTAL	**7,546**	**16,822**

4.4 Streetcar Alternative 2

OCTAM forecasts roughly 3,020 boardings for the streetcar during an average weekday. The stations forecasted to have the most passenger activity are Harbor, SARTC, and Bristol. Linked transit trips are expected to increase by 2,125 over the No-Build alternative. As urban rail, 2035 ridership is forecasted to be 6,425 boardings with linked transit trips increasing by 4,160 over the No-Build condition. Table 6 provides a summary of total station activity for both the low and high forecasts.

Table 5: Total Station Activity for Streetcar 2

STATIONS	TOTAL STATION ACTIVITY - LOW	TOTAL STATION ACTIVITY - HIGH
SARTC	883	2,853
Lacy	438	429
French	185	72
Main / Civic Center Drive	126	379
Broadway / Civic Center Drive	101	731
Ross / Civic Center Drive	205	272
Flower / Civic Center Drive	335	162
Flower / 6th St	71	28
Bristol	741	1,655
Raitt	652	1,659
Fairview	496	1,650
Willowick	858	895
Harbor	947	2,335
TOTAL	**6,038**	**12,850**

4.5 Summary of Ridership Forecasts

Based on results from OCTAM, Streetcar Alternative 1 is forecasted to have the highest ridership among the alternatives. Compared to the second streetcar alternative, the alignment following Santa Ana Boulevard has a greater number of opportunities for bus transfers. Furthermore, the alignment for Streetcar Alternative 2 follows Civic Center Drive and back down to Santa Ana Boulevard via Flower Street, results in significantly slower travel times which affect the attractiveness of the route. For example, the estimated run time for this alternative is 6 minutes longer in the westbound direction and 1.5 minutes longer when traveling eastbound.

The range of forecasts demonstrated by using two different modes to represent the streetcar in OCTAM shows the impact of mode choice constants on streetcar ridership. In this case, the urban rail mode has a significant impact on travel demand. Since OCTAM

3.3 does not have a unique mode for streetcar, using the model's urban rail mode was expedient but also reasonable. This was originally done to address the unique characteristics of streetcars and to provide the ridership forecasts in a range.

For the streetcar alternatives, a park and ride was assumed at the western terminus at Harbor Boulevard/Westminster Avenue. This provides increased accessibility to not only streetcar users, but also to other routes along Westminster and Harbor that have transit stops at this location. Table 7 provides a comparison of boardings and linked transit trips between the four alternatives that were evaluated.

Table 6: Summary of Ridership Forecasts

	NO-BUILD	TSM	STREETCAR 1	STREETCAR 2
Low Forecast – Boardings on Project Route	NA	3,085	3,770	3,020
High Forecast - Boardings on Project Route	NA	NA	8,410	6,425
Regional Linked Transit Trips - Low	1,599,268	1,602,225	1,601,533	1,601,393
Difference from No-Build	-	2,957	2,265	2,125
Regional Linked Transit Trips – High	1,599,268	NA	1,604,998	1,603,426
Difference from No-Build	-	-	5,730	4,158

APPENDIX C: Capital Cost Methodology Technical Report

Santa Ana and Garden Grove Fixed Guideway Corridor

DRAFT CAPITAL COST METHODOLOGY TECHNICAL REPORT

AUGUST 1, 2012

CORDOBA CORPORATION

OCTA

SANTA ANA

GARDEN GROVE

DRAFT
Capital Cost Methodology Technical Report

in support of the

SANTA ANA AND GARDEN GROVE
FIXED GUIDEWAY CORRIDOR PROJECT

Harbor Boulevard to Santa Ana Regional Transportation Center (SARTC)

Prepared for
City of Santa Ana
in cooperation with
City of Garden Grove
Orange County Transportation Authority

Prepared by
Cordoba Corporation
1611 East 17th Street
Santa Ana, CA 92705

In association with
URS Corporation
LTK Engineering Services
HNTB Corporation
TAHA

August 1, 2012

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1.0 BACKGROUND AND PROJECT DESCRIPTION

1.1 Background

The cities of Santa Ana and Garden Grove, in cooperation with the Orange County Transportation Authority (OCTA), initiated the Alternatives Analysis and Draft Environmental Impact Report/Environmental Assessment for the Santa Ana and Garden Grove Fixed Guideway Corridor Study in October 2009. The purpose of the study was to evaluate a fixed guideway corridor that would provide high frequency transit service between the Santa Ana Regional Transportation Center (SARTC) and a new transportation hub to be located near the intersection of Harbor Boulevard and Westminster Avenue.

An Alternatives Analysis (AA) is a formal planning study that provides the analytical framework for making sound decisions about potential, major transit investments in metropolitan areas. This type of planning study, along with the accompanying environmental studies, is necessary for major projects seeking federal funding. While the AA is part of the federal planning process, decision-making takes place at the local and regional levels. For AA studies which may result in the local selection of a project eligible for Federal Transit Administration (FTA) New Starts or Small Starts funding, the AA further serves as the process for the development of technical information necessary to support a candidate project's entry into FTA's New Starts/Small Starts project development process.

Documentation that supports the AA includes environmental technical studies, conceptual engineering, and an "order of magnitude" cost associated with the various alternatives being considered. This technical memo addresses the methodology used to develop the order of magnitude capital cost estimate for the two build alternatives. This includes basis of estimate, estimate methodology, costs included in unit pricing, and order of magnitude cost summaries.

1.2 Purpose

The purpose of the estimate is to develop a basis for comparing the capital costs for the two streetcar build alternatives. The format for the capital cost estimate allows for conversion into FTA's Standard Cost Categories (SCC) for inclusion in the FTA Small Starts Report and Construction Grant Agreement.

2.0 CAPITAL COST

2.1 Basis of Estimate and Format

The Capital Cost Estimates are based on the Santa Ana and Garden Grove Fixed Guideway Corridor Conceptual Engineering Plan Set dated December 20, 2011. The plans were developed to approximately 5-10% level of design and the capital costs are therefore considered an "order of magnitude" estimate. Items developed in the plans were quantified and a unit cost applied to them. Unit costs were based upon recent streetcar-transit and in-street LRT design and construction projects including:

- Portland Streetcar Loop
- TriMet – South Corridor, Mall LRT Segment (completed 2009)
- City of Seattle – South Lake Union Streetcar (completed 2007)
- Portland Streetcar – Lowell Street Extension (completed 2007)

Unit costs were escalated to current year dollars (2011) and adjusted to Orange County construction costs where possible. Contingencies were allocated per line item according to FTA guidelines. The format of the estimate is based on FTA's Standard Cost Categories (SCC) for Capital Projects which includes:

10 Guideway and Track Elements
20 Stations, Stops, Terminals, Intermodal
30 Support Facilities: Yards, Shops, and Administration Buildings
40 Sitework and Special Conditions
50 Systems
60 Right of Way (ROW), Land, Existing Improvements
70 Vehicles
80 Professional Services
90 Unallocated Contingency

2.2 Segment Breakdown

For comparative purposes, the cost estimates have been broken down into fourteen independent segments as follows:

- **Downtown Segment *Alternative 1 - Option 1 – Scenario A:*** the portion of the alignment through the Santa Ana Civic Center, Downtown and easterly to SARTC; in Alternative 1 this segment generally involves Santa Ana Boulevard and 4th Street. The eastbound track in this alternative uses the maintenance easement between Sasscer Park and the adjacent building to the south to access 4th Street. This alternative also includes conversion of existing parking stalls along the south side of 4th Street from angled to parallel between Ross Street and French Street, allowing for an 8 foot sidewalk widening (sheets TR-11, TR-12A, TR-13A, TR-14A, TR-15A, TR-16, and TR-17).

- **Downtown Segment - Alternative *1 - Option 2 –Scenario A***: the alignment for this alternative and parking modifications are identical to Downtown Segment *Alternative 1 – Option 1 – Scenario A,* with the exception that the eastbound track continues on Santa Ana Boulevard, turns southbound on Ross Street, and continues eastbound on 4th Street, avoiding Sasscer Park (TR-11, TR-12B, TR-13A, TR-14A, TR-15A, TR-16, and TR-17).
- **Downtown Segment – *Alternative 1 - Option 1 – Scenario B:*** the alignment for this alternative is identical to Downtown *Segment Alternative 1 – Option 1 – Scenario A*, with the exception that it expands the width of the sidewalk on the south side of 4th Street by 16 feet, between Ross Street and French Street, by converting the head-in parking to usable sidewalk space and eliminating parking (sheets TR-11, TR-12A, TR-13B, TR-14B, TR-15B, TR-16, and TR-17).
- **Downtown Segment – *Alternative 1 - Option 1 – Scenario B:*** the alignment for this alternative is identical to Downtown Segment *Alternative 1 – Option 1 – Scenario A*, with the exception that it expands the width of the sidewalk on both the north side and south side of 4th Street by 16 feet, between Ross Street and French Street, by converting the head-in parking to usable sidewalk space and eliminating parking (sheets TR-11, TR-12A, TR-13C, TR-14C, TR-15C, TR-16, and TR-17).
- **Downtown Segment – *Alternative 2 – Option 1:*** the portion of the alignment through the Santa Ana Civic Center, Downtown and easterly to SARTC; in Alternative 2 this segment involves portions of Brown/6th Streets, Santa Ana Boulevard, Civic Center Drive, Spurgeon Street, Flower Street and 5th Street. This alternative includes acquiring private property along Civic Center Drive to provide the streetcar stations and a bike path between Flower Street and Spurgeon Street (sheets TR-18, TR-19, TR-20, TR-21, TR-22, TR-23, TR-24A, TR-25A, and TR-26A). The additional length of this alternative will require one additional streetcar vehicle (compared to Alternative 1).
- **Downtown Segment – *Alternative 2 - Option 2:*** the alignment for this alternative is identical to Downtown Segment Alternative 2, with the exception that it assumes eliminating one westbound lane on Civic Center Drive between Flower Street and Spurgeon Street, restriping the traffic lanes, and using the additional space to provide the proposed station platforms and bike path (sheets TR-18, TR-19, TR-20, TR-21, TR-22, TR-23, TR-24B, TR-25B, and TR-26B). The additional length of this alternative will require one additional streetcar vehicle (compared to Alternative 1).
- **Raitt Street to Flower Street Segment:** the portion of the alignment along Santa Ana Boulevard from Raitt Street to Flower Street (sheets TR-07 to TR-10).
- **PE ROW Segment:** the portion of the alignment generally within the Pacific Electric Right-of-Way (PE ROW) from south of Harbor Boulevard to just west of Raitt Street

(sheets TR-02 to TR-07). The estimate for this segment includes costs for a new transit bridge over the Santa Ana River (sheet S-01).

- **West Terminus at-Grade:** this western terminus option allows for an at-grade crossing of Westminster Avenue with connection to Nautilus Drive. This alternative will require additional right-of-way within the commercial property west of Nautilus Drive (sheet TR-01A) to accommodate the track and the terminal station.
- **West Terminus Elevated:** this western terminus option allows for an elevated crossing over Westminster Avenue (sheet TR-01B and S-02). The estimate for the elevated crossing includes the cost of one additional Traction Power Substation (TPS) station.
- **West Terminus At-Grade (truncated):** this western terminus option allows for an at-grade crossing of Westminster Avenue, with the terminal station located at the northwest corner of Nautilus Drive and Westminster Avenue (sheet TR-01C).
- **Maintenance Facility - Raitt Site:** development of the maintenance facility on the properties near the PE ROW and Raitt Street (sheet MF-02).
- **Maintenance Facility – SARTC Site:** development of the maintenance facility on the property south of SARTC (sheet MF-01).
- **Common Elements:** elements that are shared by each alternative. They include TPS and corrosion control.

2.2 Streetcar Alternatives Initial Operable Segments (IOSs)

In response to funding and phasing issues raised by fiscal constraints identified during OCTA's long range transportation planning process, the City of Santa Ana developed Initial Operable Segments (IOSs) for the Santa Ana-Garden Grove Fixed Guideway Project that are shorter segments of Streetcar Alternative 1 and Streetcar Alternative 2 that could be constructed and operated.

IOS-1 and IOS-2 include the same project features and design options as their respective full alignment Build Alternatives between Raitt Street and SARTC.

Both IOS-1 and IOS-2 would terminate at Raitt station (Raitt Street and Santa Ana Boulevard) in lieu of Harbor station (Harbor Boulevard and Westminster Avenue). Tail tracks for both IOS-1 and IOS-2 are located west of Raitt station within the PE ROW on ballasted track. These tracks would extend another hundred feet west within the PE ROW to reach the Operations and Maintenance Facility at Site B should this site ultimately be selected for either IOS-1 or IOS-2 (see sheet TR-07A-IOS and TR-07B-IOS).

The configuration of Raitt as an interim terminus station is the same for IOS-1 and IOS-2. Just over 50 spaces would be provided for station parking at Raitt within the PE ROW on an interim basis to be replaced by parking at Harbor station upon completion of the full Project. Vehicular access to Raitt station parking would be via Daisy Avenue.

IOS-1 (Santa Ana Boulevard and Fourth Street Couplet) - IOS-1 follows the same alignment as Streetcar Alternative 1, but terminates at Raitt station rather than extending to Harbor station The IOS-1 streetcar alignment is about 2.2 miles in length. IOS-1 includes the same project features, design options, and parking scenarios as Streetcar Alternative 1 between Raitt Street and SARTC.

IOS-2 (Santa Ana Boulevard/Fifth Street and Civic Center Drive Couplet) - IOS-2 follows the same alignment as Streetcar Alternative 2, but terminates at Raitt station rather than extending to Harbor station. The IOS-2 streetcar alignment is about 2.6 miles in length. IOS-2 includes the same project features and design options as Streetcar Alternative 2 between Raitt Street and SARTC.

For purposes of determining the "order of magnitude" costs for both build alternatives, we have included costs for both IOS-1 and IOS-2 with all design options and scenarios as described above (see Table 2-1).

2.3 Segment Permutations

The project has been defined as two Build Alternatives, however the various design options (i.e., 2 O&M sites, 3 alternatives for crossing Westminster Avenue, etc.) result in forty-eight potential combinations and cost estimates as follows:

Table 2-1: Design Option Combinations

Permutation #	West Terminus	PEROW Segment	Raitt to Flower Seg	Downtown Seg	Maint Facility	Common Elements
AG_Alt1_SARTC	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	SARTC	Common Elements
AG_Alt1_RAITT	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	Raitt	Common Elements
AG_Alt1-1_SARTC	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	SARTC	Common Elements
AG_Alt1-1_RAITT	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	Raitt	Common Elements
AG_Alt1-2_SARTC	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	SARTC	Common Elements
AG_Alt1-2_RAITT	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	Raitt	Common Elements
AG_Alt1-3_SARTC	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	SARTC	Common Elements
AG_Alt1-3_RAITT	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	Raitt	Common Elements
AG_Alt2_SARTC	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	SARTC	Common Elements
AG_Alt2_RAITT	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	Raitt	Common Elements
AG_Alt2-1_SARTC	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	SARTC	Common Elements
AG_Alt2-1_RAITT	At-grade	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	Raitt	Common Elements
AGT_Alt1_SARTC	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	SARTC	Common Elements
AGT_Alt1_RAITT	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	Raitt	Common Elements
AGT_Alt1-1_SARTC	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	SARTC	Common Elements
AGT_Alt1-1_RAITT	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	Raitt	Common Elements
AGT_Alt1-2_SARTC	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	SARTC	Common Elements
AGT_Alt1-2_RAITT	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	Raitt	Common Elements
AGT_Alt1-3_SARTC	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	SARTC	Common Elements
AGT_Alt1-3_RAITT	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	Raitt	Common Elements
AGT_Alt2_SARTC	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	SARTC	Common Elements
AGT_Alt2_RAITT	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	Raitt	Common Elements
AGT_Alt2-1_SARTC	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	SARTC	Common Elements
AGT_Alt2-1_RAITT	At-grade (truncated)	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	Raitt	Common Elements
EL_Alt1_SARTC	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	SARTC	Common Elements
EL_Alt1_RAITT	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	Raitt	Common Elements
EL_Alt1-1_SARTC	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	SARTC	Common Elements
EL_Alt1-1_RAITT	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	Raitt	Common Elements
EL_Alt1-2_SARTC	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	SARTC	Common Elements
EL_Alt1-2_RAITT	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	Raitt	Common Elements
EL_Alt1-3_SARTC	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	SARTC	Common Elements
EL_Alt1-3_RAITT	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	Raitt	Common Elements
EL_Alt2_SARTC	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	SARTC	Common Elements
EL_Alt2_RAITT	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	Raitt	Common Elements
EL_Alt2-1_SARTC	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	SARTC	Common Elements
EL_Alt2-1_RAITT	Elevated	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	Raitt	Common Elements
IOS_Alt1_SARTC	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	SARTC	Common Elements
IOS_Alt1_RAITT	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	Raitt	Common Elements
IOS_Alt 1-1_SARTC	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	SARTC	Common Elements
IOS_Alt 1-1_RAITT	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	Raitt	Common Elements
IOS_Alt 1-2_SARTC	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	SARTC	Common Elements
IOS_Alt 1-2_RAITT	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	Raitt	Common Elements
IOS_Alt 1-3_SARTC	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	SARTC	Common Elements
IOS_Alt 1-3_RAITT	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	Raitt	Common Elements
IOS_Alt 2_SARTC	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 2 - Opt 1	SARTC	Common Elements
IOS_Alt 2_RAITT	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 2 - Opt 1	Raitt	Common Elements
IOS_Alt 2-1_SARTC	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 2 - Opt 2	SARTC	Common Elements
IOS_Alt 2-1_RAITT	N/A	PE ROW - IOS	Raitt to Flower Seg	Alt 2 - Opt 2	Raitt	Common Elements

2.4 Estimating Methodology

The capital cost estimates were prepared in several steps:

- Quantities were developed for each individual segment and design option using the standard cost categories as a guide. The list of cost elements within each

SCC was itemized to give as much detail as possible given the level of mapping information available and design development to date (approximately 5-10%). See Appendix A.

- Elements were quantified on plan sheets and in electronic files, and unit costs were applied to the quantities to arrive at a base construction cost per segment. Unit costs were developed for each element based upon recent project experience (refer to Section 2.5 Unit Cost Assumptions for additional details on unit costs).
- A 33.5% allowance for Professional Services (SCC 90) for Engineering and Administration was then applied to the base construction costs. It is recommended that percentages used for professional services continue to be refined during preliminary engineering. Breakdown of the assumed allowance is as follows:

Table 2-2: Breakdown of Professional Services (E&A) Percentages

PERCENTAGE	ALLOWANCE
4%	Preliminary Engineering
6%	Final Design
5%	Project Management for Design and Construction
8%	Construction Administration and Management
2%	Insurance
3%	Legal, Permits, Review fees by other agencies, etc.
3%	Surveys, testing, investigation, inspection
1%	Start-up Costs and Agency Force Account Work
1.5%	Art Program
33.5%	**Total**

- Allocated contingencies were then applied to the sum of base construction cost and E&A. The percentage applied was determined based on the level of risk associated with the quantities, given the current design effort of 5-10%.

Table 2-3: Allocated Contingency Percentages

PERCENTAGE	DESCRIPTION
20%	Guideway Construction
25%	Civil Construction
20%	Traffic Signals, Signing, Striping & Lighting
30%	Utilities
30%	Structures
20%	Stations
30%	Operations Facility
25%	Traction Power System
25%	Communications and Central Control
20%	Fare Collection
5%	Vehicles
30%	Right of Way

- Unallocated Contingency (SCC 100) of 10% was applied to the sum of base construction cost, E&A, and allocated contingencies to offset anticipated, but undefined, project costs inherent to a conceptual level of project design definition. See Appendix B.
- The segments were then combined into the forty-eight permutations identified in Section 2.3 to arrive at forty-eight estimates grouped by western terminus design option. See Appendix C.
- The individual segments have also been broken down by SCC Categories 10-90 to aid with year of expenditure projections. See Appendix D.

2.5 Unit Costs Assumptions

The project design drawings were used to define the nature of the work and facilitate a "take-off" or measurement of the work to establish quantities. Most track, roadway, and utility quantities are based on track alignment lengths. More focused cost estimates have been developed for structures, drainage, O&M facilities, TPS, communications, and fare collection. These costs were prepared separately and included as lump sums in the final estimate. Where insufficient detail existed to estimate quantities with certainty (i.e. utilities), general assumptions on impacts were established and an "allowance" was assessed in the estimate.

Unit costs were calculated using comparable rates retrieved from various data bases from similar projects including recent projects by Portland Streetcar, Seattle Streetcar, Tri-Met's Mall LRT and Interstate Max. Other unique costs rates were calculated using standard estimating resources such as R.S. Means Construction Cost Data. All numbers have been adjusted to reflect 2011 dollars and Southern California construction costs where possible.

Unit prices established for estimating purposes include anticipated contractor margins such as mobilization, profit, insurance costs, and other ancillary activities such as clearing, grubbing, pavement removal and disposal, excavation, embankment hazardous material cleanup, erosion control, drainage, water treatment work and alternate parking.

The following assumptions have also been considered:

- No costs are included related to the ownership agreements of the PE ROW or the demolition and removal of existing interim uses within the right-of-way.
- No costs are included related to the remediation of existing contaminated soils within the PE ROW, the proposed maintenance facility sites, or the corridor.
- Costs include only minimal landscaping within the PE ROW.
- Screening walls and fencing were assumed within the PE ROW, intended to secure the right-of-way and comply with requirements of the California Public Utilities Commission.
- Vehicle costs assume on-board fare collection and exterior lighting. Cost for Ticket Vending Machines (TVM's) has been assumed only for the East and West terminal stations (SARTC and Westminster/Harbor Blvd) and the Downtown area.
- City of Santa Ana water and sewer facility impacts are based on memo provided by Taig Higgins from the City on March 1, 2011 with subject line "Light Rail/Street Car Alignment Conflicts." An additional utility relocation allowance has been itemized for private utility relocation pending clarification on agreements between the City and the utility companies.
- Vehicle cost is based on recent cost of the Siemens S70 vehicle.
- Right-of-way costs are based on general information provided by the City and will require verification by a right-of-way specialist during preliminary engineering.

3.0 Order of Magnitude Capital Cost Estimates - Summary

The Capital Cost estimates have been developed using 5-10% level engineering drawings and are therefore considered more of an order of magnitude cost and not a construction cost. As a result a healthy contingency has been applied to the estimates for items/issues that may emerge as the engineering design advances during preliminary engineering and final design. The applied contingencies should decrease substantially during the future phases of design.

Appendix A through Appendix D provide the details and backup for the cost associated with the 48 possible combinations of streetcar alignment options, terminus options, and maintenance site locations. Table 3-1 provides a short summary.

Table 3-1: Order of Magnitude Cost Summary Table

West Terminus	PEROW Segment	Raitt to Flower Segment	Downtown Segment	Maint Facility	Common Elements	TOTAL ORDER OF MAGNITUDE COST (in millions)
AG	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	SARTC	Common Elements	**$208.49**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	Raitt	Common Elements	**$197.47**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	SARTC	Common Elements	**$210.85**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	Raitt	Common Elements	**$199.83**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	SARTC	Common Elements	**$208.45**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	Raitt	Common Elements	**$197.43**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	SARTC	Common Elements	**$209.73**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	Raitt	Common Elements	**$198.71**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	SARTC	Common Elements	**$228.12**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	Raitt	Common Elements	**$217.09**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	SARTC	Common Elements	**$224.90**
AG	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	Raitt	Common Elements	**$213.88**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	SARTC	Common Elements	**$198.73**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	Raitt	Common Elements	**$187.71**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	SARTC	Common Elements	**$201.09**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	Raitt	Common Elements	**$190.07**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	SARTC	Common Elements	**$198.70**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	Raitt	Common Elements	**$187.67**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	SARTC	Common Elements	**$199.97**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	Raitt	Common Elements	**$188.95**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	SARTC	Common Elements	**$218.36**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	Raitt	Common Elements	**$207.34**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	SARTC	Common Elements	**$215.14**
AGT	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	Raitt	Common Elements	**$204.12**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	SARTC	Common Elements	**$208.42**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	Raitt	Common Elements	**$197.39**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	SARTC	Common Elements	**$210.78**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	Raitt	Common Elements	**$199.75**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	SARTC	Common Elements	**$208.38**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	Raitt	Common Elements	**$197.36**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	SARTC	Common Elements	**$209.66**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	Raitt	Common Elements	**$198.63**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	SARTC	Common Elements	**$228.04**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 1	Raitt	Common Elements	**$217.02**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	SARTC	Common Elements	**$224.83**
EL	PE ROW Seg	Raitt to Flower Seg	Alt 2 - Opt 2	Raitt	Common Elements	**$213.80**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	SARTC	Common Elements	**$157.59**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen A	Raitt	Common Elements	**$146.57**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	SARTC	Common Elements	**$159.95**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 1 - Opt 2, Scen A	Raitt	Common Elements	**$148.92**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	SARTC	Common Elements	**$157.55**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen B	Raitt	Common Elements	**$146.53**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	SARTC	Common Elements	**$158.83**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 1 - Opt 1, Scen C	Raitt	Common Elements	**$147.81**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 2 - Opt 1	SARTC	Common Elements	**$177.21**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 2 - Opt 1	Raitt	Common Elements	**$166.19**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 2 - Opt 2	SARTC	Common Elements	**$174.00**
N/A	PE ROW-IOS	Raitt to Flower Seg	Alt 2 - Opt 2	Raitt	Common Elements	**$162.97**

Santa Ana and Garden Grove Fixed Guideway Corridor

APPENDIX A
Summary of Quantities by Segment

CORDOBA CORPORATION

OCTA

SANTA ANA

GARDEN GROVE

DEIS Concept Plans
Order of Magnitude Cost Estimate
Quantities

			Santa Ana and Garden Grove Fixed Guideway Corridor Study																	
			Order of Magnitude Estimate																	
			QUANTITIES BY SEGMENT			A	A1	B	C	C-IOS	D	E	E1	E2	E3	F	F1	G	H	I
						Western Terminus at Grade	Western Terminus at Grade (Truncated)	Western Terminus Elevated	PE ROW Segment	PE ROW-IOS	Raitt to Flower Segment	Streetcar - Alt 1 - Opt 1 - Scen A	Streetcar - Alt 1 - Opt 2 - Scen A	Streetcar - Alt 1 - Opt 1 - Scen B	Streetcar - Alt 1 - Opt 1 - Scen C	Streetcar - Alt 2 - Opt 1	Streetcar - Alt 2 - Opt 2	Maintenance Facility - SARTC	Maintenance Facility - Raitt	Common Elements
Line NO.	Base	Code	Description	Unit	Unit Cost(1)	SHT TR-01A	SHT TR-01C	SHT TR-01B	SHTS TR-02 TO TR-07	SHT-TR7-IOS1 and SHT-TR7-IOS2	SHTS TR-08 TO TR-10	SHTS TR-11, TR-12A, TR-13A, TR-14A, TR-15A, TR-16, and TR-17	SHTS TR-11, TR-12B, TR-13A, TR-14A, TR-15A, TR-16, and TR-17	SHTS TR-11, TR-12A, TR-13B, TR-14B, TR-15B, TR-16, and TR-17	SHTS TR-11, TR-12A, TR-13C, TR-14C, TR-15C, TR-16, and TR-17	SHTS TR-18 TO TR-23, TR-24A, TR-25A, AND TR-26A	SHTS TR-18 TO TR-23, TR-24B, TR-25B, AND TR-26B	SHT MF-01	SHT MF-02	
10.0	**Guideway Construction**																			
10.1		10.09	Trackway - Double Track - Direct Fixation	TF	$425	0		220	350	0	0	0	0	0	0	0	0			
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	TF	$425	0		0	200	200	0	0	0	0	0	0	0			
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	TF	$425	0		0	7135	0	9560	13912	14150	13912	13912	16490	16490			
10.4		10.10	Trackway - Double Track - Paved	TF	$800	1,137		0	0	0	0	0	0	0	0	0	0			
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	TF	$275	0	430	0	0	325	0	0	0	0	0	0	0			
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	TF	$275	1,798	300	1227	1245	0	0	0	0	0	0	0	0			
10.7		10.11	Trackway - Double Track - Ballasted	TF	$500	0		0	525	0	0	0	0	0	0	0	0			
10.8		10.12	Trackway-Special-25M Turnout	EA	$175,000	0		0	0	1	0	1	1	1	1	4	4			
10.9		10.12	Turnout Ballasted	EA	$100,000	0		0	0	0	0	0	0	0	0	0	0			
11.0		10.12	#6 Double Crossover	EA	$500,000	1		1	1	0	0	0	0	0	0	0	0			
11.1		10.12	Trackway - Special Crossing	EA	$195,000	0	1	0	0	0	0	0	0	0	0	1	1			
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	TF	$1,000	511		0	0	0	158	618	962	618	618	1914	1914			
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	LS	$2,000,000	0		0	0	0	0	0	0	0	0	0	0			
11.4		40.05	Ballast Curb	LF	$60	0		0	0	0	0	0	0	0	0	0	0			
11.5		0.00																		
11.6		0.00																		
11.7		0.00																		
11.8		0.00																		
11.9		0.00																		
20.0	**Civil Construction**																			
20.1		40.01	Embankment (Compacted Fill)	CY	$18	0		0	0	0	0	0	0	0	0	0	0			
20.2		40.01	Clearing & Grubbing	AC	$30,000	0		0.3	4.57	0.5	0	0	0	0	0	0	0			
20.3		40.05	Chain Link Fence (H= 8')	LF	$20	0		0	2100	100	0	0	0	0	0	0	0			
20.4		40.05	Concrete Curb	LF	$40	425	50	0	670	500	0	1609	2794	1579	2651	0	0			
20.5		40.05	PE ROW Security Wall (H= 8')	LF	$200	0		0	14200	0	0	0	0	0	0	0	0			
20.6		40.06	Concrete Sidewalk	SF	$10	10,750	946	420	29885	5300	2371	35966	38504	44916	60087	31623	27581			
20.7		40.06	Landscape Allowance	LS	$500,000	0		0	1	0	0	1	1	1	2	0	0			
20.8		40.07	Roadway Reconstruction	SF	$15	0	3,000	0	27615	0	20724	0	0	0	0	0	0			
20.9		40.07	New Roadway Construction	SF	$18	12,600		0	0	0	0	0	0	0	0	0	0			
21.0		40.07	Reconstruct Existing Driveways and Parking	SF	$8	0		0	0	0	0	5500	5500	5500	5500	0	0			
21.1		40.07	Pavement Resurfacing	SF	$12	23,000		0	0	0	311650	392715	404458	383763	383763	571885	596781			
21.2		0.00																		
21.3		0.00																		
21.4		0.00																		
21.5		0.00																		
21.6		0.00																		
21.7		0.00																		
21.8		0.00																		
21.9		0.00																		
30.0	**Traffic Signals, Signing, Striping & Lighting**																			
30.1		40.06	Lighting Allowance	LF	$30	1,100	150	200	150	150	0	700	300	700	700	200	200			
30.2		50.01	Gated Crossing (Single)	EA	$200,000	0		0	4	0	0	0	0	0	0	0	0			
30.3		50.02	Traffic Signals - New (or full Replacement)	EA	$350,000	1	1	0	0	0	1	3	4	3	3	6	7			
30.4		50.02	Traffic Signals - Modified	EA	$150,000	0		0	0	0	0	0	0	0	0	0	0			
30.5		50.02	Traffic Signals - Add New Transit Phase	EA	$60,000	0		0	0	0	0	2	2	2	2	4	4			
30.6		50.02	Signing and Striping Allowance	LF	$15	610		0	150	0	3880	10714	11152	10714	10714	14569	14569			
30.7		50.02	Pedestrian Signal or Gate	EA	$80,000	0		0	0	0	0	0	0	0	0	0	0			
30.8		50.02	Temporary Traffic Control	LF	$60	450	450	450	450	0	5230	10714	11152	10714	10714	14569	14569			
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	EA	$100,000	0		0	0	0	6	15	15	15	15	17	17			
31.0		0.00																		
31.1		0.00																		
31.2		0.00																		
31.3		0.00																		
31.4		0.00																		
31.5		0.00																		
40.0	**Utilities**																			
40.1		40.02	Water Line Relocation Allowance	LF	$300						3075	3215	3415	3215	3215	2500	2500			
40.2		40.02	Water Line Sleeving Allowance	LF	$150				120		540	1200	1320	1200	1200	1060	1060			
40.3		40.02	Sanitary Sewer Relocation Allowance	LF	$300				280		360	5000	5460	5000	5000	4060	4060			
40.4		40.02	Drainage Improvements - PE ROW	LS	$495,000				1											
40.5		40.02	Drainage Improvements - Raitt St to Flower St	LS	$2,193,500						1									
40.6		40.02	Other Utilities (including private) Relocation Allowance	LF	$150	350	350	350	150		0	2350	2350	2350	2350	1800	1800			
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	LS	$3,277,750							1	1	1	1					
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	LS	$2,321,875											1	1			
40.9		0.00		0	$0															
50.0	**Structures**																			
50.1		40.01	Santa Ana River Bridge - Demoliton	LS	$165,000				1											
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	LS	$2,800,000			1												
50.3		40.05	Santa Ana River Bridge	LS	$2,056,000				1											
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	LS	$330,000				1											
50.5		40.05	Retaining Walls	SF	$100			19,000	1500											
50.6		0.00		0	$0															
50.7		0.00		0	$0															
50.8		0.00		0	$0															
50.9		0.00		0	$0															
51.0		0.00		0	$0															
51.1		0.00		0	$0															
51.2		0.00		0	$0															
51.3		0.00		0	$0															
51.4		0.00		0	$0															
51.5		0.00		0	$0															
51.6		0.00		0	$0															
51.7		0.00		0	$0															
51.8		0.00		0	$0															

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DEIS Concept Plans
Order of Magnitude Cost Estimate
Quantities

Santa Ana and Garden Grove Fixed Guideway Corridor Study

Order of Magnitude Estimate

QUANTITIES BY SEGMENT

Line NO.	Base	Code	Description	Unit	Unit Cost(1)	A	A1	B	C	C-IOS	D	E	E1	E2	E3	F	F1	G	H	I
						Western Terminus at Grade	Western Terminus at Grade (Truncated)	Western Terminus Elevated	PE ROW Segment	PE ROW-IOS	Raitt to Flower Segment	Streetcar - Alt 1 - Opt 1 - Scen A	Streetcar - Alt 1 - Opt 2 - Scen A	Streetcar - Alt 1 - Opt 1 - Scen B	Streetcar - Alt 1 - Opt 1 - Scen C	Streetcar - Alt 2 - Opt 1	Streetcar - Alt 2 - Opt 2	Maintenance Facility - SARTC	Maintenance Facility - Raitt	Common Elements
						SHT TR-01A	SHT TR-01C	SHT TR-01B	SHTS TR-02 TO TR-07	SHT-TR7-IOS1 and SHT-TR7-IOS2	SHTS TR-08 TO TR-10	SHTS TR-11, TR-12A, TR-13A, TR-14A, TR-15A, TR-16, and TR-17	SHTS TR-11, TR-12B, TR-13A, TR-14A, TR-15A, TR-16, and TR-17	SHTS TR-11, TR-12A, TR-13B, TR-14B, TR-15B, TR-16, and TR-17	SHTS TR-11, TR-12A, TR-13C, TR-14C, TR-15C, TR-16, and TR-17	SHTS TR-18 TO TR-23, TR-24A, TR-25A, AND TR-26A	SHTS TR-18 TO TR-23, TR-24B, TR-25B, AND TR-26B	SHT MF-01	SHT MF-02	
51.9		0.00		0	$0															
60.0	**Stations**																			
60.1		20.01	Street Car Stop - Side Platform	EA	$100,000	0		0	4	0	2	12	12	12	12	13	13			
60.2		20.01	Street Car Stop - Center Platform	EA	$150,000	0		0	1	0	0	0	0	0	0	0	0			
60.3		20.01	Enhanced Station Amenities Allowance	LS	$50,000	0		0	0	0	0	0	0	0	0	0	0			
60.4		20.01	Pedestrian Access Ramps	SF	$15	0		0	0	0	0	0	0	0	0	0	0			
60.5		20.01	Pedestrian Stairs	SF	$30	0		0	0	0	0	0	0	0	0	0	0			
60.6		20.01	Street Car Stop at Terminus - Side Platform	EA	$150,000	0		2	0	2	0	0	0	0	0	1	1			
60.7		20.01	Street Car Stop at Terminus - Center Platform	EA	$200,000	1	1	0	0	0	0	1	1	1	1	0	0			
60.8		40.07	Park & Ride Surface	Spc	$5,000	52		0	0	51	0	0	0	0	0	0	0			
60.9		0.00		0	$0															
61.0		0.00		0	$0															
61.1		0.00		0	$0															
61.2		0.00		0	$0															
61.3		0.00		0	$0															
61.4		0.00		0	$0															
61.5		0.00		0	$0															
70.0	**Operations Facility**																			
70.1		30.03	Maintenance Facility Allowance	LS	$7,065,000													1	1	
70.2		0.00		LS	$0															
70.3		0.00		LS	$0															
70.4		0.00		0	$0															
70.5		0.00		0	$0															
70.6		0.00		0	$0															
70.7		0.00		0	$0															
70.8		0.00		0	$0															
70.9		0.00		0	$0															
	Traction Power System																			
80.1		50.03	Traction Power Substation	EA	$1,040,000															5
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	EA	$676,500															
80.3		50.03	Corrossion Protection	LS	$65,500															1
80.4		50.04	Overhead Catenary System	TF	$225	2935	730	1427		525	9560	13912	14150	13912	13912	16490	16490			
80.5		50.04	Overhead Catenary System - Double Track	TF	$260				8730											
80.6		0.00		0	$0															
80.7		0.00		0	$0															
80.8		0.00		0	$0															
80.9		0.00		0	$0															
90.0	**Communications and Central Control**																			
90.1		50.05	Communications	TF	$0															
90.2		50.05	Radios	LS	$65,000													1	1	
90.3		50.05	Signal/Substation Buildings	EA	$200,000															
90.4		50.05	Interlocking Signal Controls	TF	$41	2935	730	1427	8730	525	9560	13912	14150	13912	13912	16490	16490			
90.5		50.05	Signal Allowance in Special	RF	$250															
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	EA	$1,833,182													1	1	
90.7		0.00		0	$0															
90.8		0.00		0	$0															
90.9		0.00		0	$0															
100.0	**Fare Collection**																			
100.1		50.06	Ticket Vending - Assume on the Vehicles	EA	$53,000				2			5	5	5	5	6	6			
100.2		50.06	Ticket Vending - At maintenance facility	LS	$575,000													1	1	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	EA	$50,000	1	1	1				2	2	2	2	2	2			
100.4		0.00		0	$0															
100.5		0.00		0	$0															
110.0	**Vehicles**																			
110.1		70.01	Vehicles	EA	$3,600,000				2			5	5	5	5	6	6			
110.2		70.07	Spare Parts (10%)	EA	$360,000				2			5	5	5	5	6	6			
110.3		0.00		0	$0															
110.4		0.00		0	$0															
110.5		0.00		0	$0															
120.0	**Right of Way**																			
120.1		60.01	ROW Encroachments and Partial Takes	SF	$35	2070	1088													
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	SF	$45	37820														
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	SF	$45														104544	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	SF	$45													95832		
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	LS	$3,013,125											1				
120.6		60.02	Western Terminus - Cost to Relocate Allowance	LS	$731,817	1														
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	LS	$1,900,000														1	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	LS	$10,000,000													1		
120.9		0.00		0	$0															
	TOTALS																			

(1) Unit costs are based on 2011 construction costs from projects of a similar nature

Draft UPDATED 06.27.2012

Santa Ana and Garden Grove Fixed Guideway Corridor

APPENDIX B
Detailed Order of Magnitude Cost by Segment

CORDOBA CORPORATION

OCTA

SANTA ANA

GARDEN GROVE

DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Western Terminus - At-grade

Length = 0.77 TK-mile
Cost/mile (millions)= $15.80

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$2,415,050		$809,042		$644,818		$3,868,910
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.4		10.10	Trackway - Double Track - Paved	1,137	TF	$800	$909,600	34%	$304,716	20%	$242,863	$1,457,179	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	1,798	TF	$275	$494,450	34%	$165,641	20%	$132,018	$792,109	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	0	EA	$175,000	$0	34%	$0	20%	$0	$0	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	1	EA	$500,000	$500,000	34%	$167,500	20%	$133,500	$801,000	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	511	TF	$1,000	$511,000	34%	$171,185	20%	$136,437	$818,622	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$638,100		$213,764		$212,966		$1,064,829
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$10,800	34%	$3,618	25%	$3,605	$18,023	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	425	LF	$40	$17,000	34%	$5,695	25%	$5,674	$28,369	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	10,750	SF	$10	$107,500	34%	$36,013	25%	$35,878	$179,391	
20.7		40.06	Landscape Allowance	0	LS	$500,000	$0	34%	$0	25%	$0	$0	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	12,600	SF	$18	$226,800	34%	$75,978	25%	$75,695	$378,473	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	23,000	SF	$12	$276,000	34%	$92,460	25%	$92,115	$460,575	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$419,150		$140,415		$111,913		$671,478
30.1		40.06	Lighting Allowance	1,100	LF	$30	$33,000	34%	$11,055	20%	$8,811	$52,866	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	1	EA	$350,000	$350,000	34%	$117,250	20%	$93,450	$560,700	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	0	EA	$60,000	$0	34%	$0	20%	$0	$0	
30.6		50.02	Signing and Striping Allowance	610	LF	$15	$9,150	34%	$3,065	20%	$2,443	$14,658	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	450	LF	$60	$27,000	34%	$9,045	20%	$7,209	$43,254	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
40.0	**Utilities**						$52,500		$17,588		$21,026		$91,114
40.1		40.02	Water Line Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.2		40.02	Water Line Sleeving Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	
40.3		40.02	Sanitary Sewer Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	350	LF	$150	$52,500	34%	$17,588	30%	$21,026	$91,114	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Western Terminus - At-grade

Length = **0.77 TK-mile**
Cost/mile (millions)= **$15.80**

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$460,000		$154,100		$122,820		$736,920
60.1		20.01	Street Car Stop - Side Platform	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	1	EA	$200,000	$200,000	34%	$67,000	20%	$53,400	$320,400	
60.8		40.07	Park & Ride Surface	52	Spc	$5,000	$260,000	34%	$87,100	20%	$69,420	$416,520	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$660,375		$221,226		$220,400		$1,102,001
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	2,935	TF	$225	$660,375	34%	$221,226	25%	$220,400	$1,102,001	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$120,335		$40,312		$40,162		$200,809
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	2,935	TF	$41	$120,335	34%	$40,312	25%	$40,162	$200,809	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$50,000		$16,750		$13,350		$80,100
100.1		50.06	Ticket Vending - Assume on the Vehicles	0	EA	$53,000	$0	34%	$0	20%	$0	$0	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	1	EA	$50,000	$50,000	34%	$16,750	20%	$13,350	$80,100	
110.0	**Vehicles**						$0		$0		$0		$0
110.1		70.01	Vehicles	0	EA	$3,600,000	$0	25%	$0	5%	$0	$0	
110.2		70.07	Spare Parts (10%)	0	EA	$360,000	$0	25%	$0	5%	$0	$0	
120.0	**Right of Way**						$2,506,167		$0		$751,850		$3,258,017
120.1		60.01	ROW Encroachments and Partial Takes	2,070	SF	$35	$72,450	0%	$0	30%	$21,735	$94,185	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	37,820	SF	$45	$1,701,900	0%	$0	30%	$510,570	$2,212,470	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Western Terminus - At-grade

Length = 0.77 TK-mile
Cost/mile (millions)= $15.80

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	1	LS	$731,817	$731,817	0%	$0	30%	$219,545	$951,362	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$7,321,677		$1,613,196		$2,139,306		$11,074,178
			Unallocated Contingency (10%)										$1,107,418
			TOTAL COST										**$12,181,596**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$192,620						
		80.02	Final Design			6%	$288,931						
		80.03	Project Management for Design and Construction			5%	$240,776						
		80.04	Construction Administration & Management			8%	$385,241						
		80.05	Insurance			2%	$96,310						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$144,465						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$144,465						
		80.08	Start-up Costs & Agency Force Account Work			1%	$48,155						
		80.09	Art Program			1.5%	$72,233						
						33.5%	$1,613,196						

Draft

DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Western Terminus - At-grade (truncated)

Length = **0.14 TK-mile**
Cost/mile (millions)= **$17.54**

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$395,750		$132,576		$105,665		$633,992
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	430	TF	$275	$118,250	34%	$39,614	20%	$31,573	$189,437	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	300	TF	$275	$82,500	34%	$27,638	20%	$22,028	$132,165	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	0	EA	$175,000	$0	34%	$0	20%	$0	$0	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	1	EA	$195,000	$195,000	34%	$65,325	20%	$52,065	$312,390	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	0	TF	$1,000	$0	34%	$0	20%	$0	$0	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$56,460		$18,914		$18,844		$94,218
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	50	LF	$40	$2,000	34%	$670	25%	$668	$3,338	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	946	SF	$10	$9,460	34%	$3,169	25%	$3,157	$15,786	
20.7		40.06	Landscape Allowance	0	LS	$500,000	$0	34%	$0	25%	$0	$0	
20.8		40.07	Roadway Reconstruction	3,000	SF	$15	$45,000	34%	$15,075	25%	$15,019	$75,094	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	0	SF	$12	$0	34%	$0	25%	$0	$0	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$381,500		$127,803		$101,861		$611,163
30.1		40.06	Lighting Allowance	150	LF	$30	$4,500	34%	$1,508	20%	$1,202	$7,209	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	1	EA	$350,000	$350,000	34%	$117,250	20%	$93,450	$560,700	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	0	EA	$60,000	$0	34%	$0	20%	$0	$0	
30.6		50.02	Signing and Striping Allowance	0	LF	$15	$0	34%	$0	20%	$0	$0	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	450	LF	$60	$27,000	34%	$9,045	20%	$7,209	$43,254	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
40.0	**Utilities**						$52,500		$17,588		$21,026		$91,114
40.1		40.02	Water Line Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.2		40.02	Water Line Sleeving Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	
40.3		40.02	Sanitary Sewer Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	350	LF	$150	$52,500	34%	$17,588	30%	$21,026	$91,114	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Western Terminus - At-grade (truncated)

Length = 0.14 TK-mile
Cost/mile (millions)= $17.54

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$200,000		$67,000		$53,400		$320,400
60.1		20.01	Street Car Stop - Side Platform	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	1	EA	$200,000	$200,000	34%	$67,000	20%	$53,400	$320,400	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$164,250		$55,024		$54,818		$274,092
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	730	TF	$225	$164,250	34%	$55,024	25%	$54,818	$274,092	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$29,930		$10,027		$9,989		$49,946
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	730	TF	$41	$29,930	34%	$10,027	25%	$9,989	$49,946	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$50,000		$16,750		$13,350		$80,100
100.1		50.06	Ticket Vending - Assume on the Vehicles	0	EA	$53,000	$0	34%	$0	20%	$0	$0	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	1	EA	$50,000	$50,000	34%	$16,750	20%	$13,350	$80,100	
110.0	**Vehicles**						$0		$0		$0		$0
110.1		70.01	Vehicles	0	EA	$3,600,000	$0	25%	$0	5%	$0	$0	
110.2		70.07	Spare Parts (10%)	0	EA	$360,000	$0	25%	$0	5%	$0	$0	
120.0	**Right of Way**						$38,080		$0		$11,424		$49,504
120.1		60.01	ROW Encroachments and Partial Takes	1,088	SF	$35	$38,080	0%	$0	30%	$11,424	$49,504	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						Length =		0.14 TK-mile		
			Western Terminus - At-grade (truncated)						Cost/mile (millions)=		$17.54		
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$1,368,470		$445,681		$390,377		$2,204,528
			Unallocated Contingency (10%)										$220,453
			TOTAL COST										**$2,424,981**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$53,216						
		80.02	Final Design			6%	$79,823						
		80.03	Project Management for Design and Construction			5%	$66,520						
		80.04	Construction Administration & Management			8%	$106,431						
		80.05	Insurance			2%	$26,608						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$39,912						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$39,912						
		80.08	Start-up Costs & Agency Force Account Work			1%	$13,304						
		80.09	Art Program			1.5%	$19,956						
						33.5%	$445,681						

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Western Terminus - Elevated

Length = 0.23 TK-mile
Cost/mile (millions)= $52.11

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$930,925		$311,860		$248,557		$1,491,342
10.1		10.09	Trackway - Double Track - Direct Fixation	220	TF	$425	$93,500	34%	$31,323	20%	$24,965	$149,787	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	1,227	TF	$275	$337,425	34%	$113,037	20%	$90,092	$540,555	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	0	EA	$175,000	$0	34%	$0	20%	$0	$0	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	1	EA	$500,000	$500,000	34%	$167,500	20%	$133,500	$801,000	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	0	TF	$1,000	$0	34%	$0	20%	$0	$0	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$13,200		$4,422		$4,406		$22,028
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$9,000	34%	$3,015	25%	$3,004	$15,019	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	0	LF	$40	$0	34%	$0	25%	$0	$0	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	420	SF	$10	$4,200	34%	$1,407	25%	$1,402	$7,009	
20.7		40.06	Landscape Allowance	0	LS	$500,000	$0	34%	$0	25%	$0	$0	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	0	SF	$12	$0	34%	$0	25%	$0	$0	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$33,000		$11,055		$8,811		$52,866
30.1		40.06	Lighting Allowance	200	LF	$30	$6,000	34%	$2,010	20%	$1,602	$9,612	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	0	EA	$350,000	$0	34%	$0	20%	$0	$0	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	0	EA	$60,000	$0	34%	$0	20%	$0	$0	
30.6		50.02	Signing and Striping Allowance	0	LF	$15	$0	34%	$0	20%	$0	$0	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	450	LF	$60	$27,000	34%	$9,045	20%	$7,209	$43,254	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
40.0	**Utilities**						$52,500		$17,588		$21,026		$91,114
40.1		40.02	Water Line Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.2		40.02	Water Line Sleeving Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	
40.3		40.02	Sanitary Sewer Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	350	LF	$150	$52,500	34%	$17,588	30%	$21,026	$91,114	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Western Terminus - Elevated

Length = 0.23 TK-mile
Cost/mile (millions)= $52.11

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$4,700,000		$1,574,500		$1,882,350		$8,156,850
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	1	LS	$2,800,000	$2,800,000	34%	$938,000	30%	$1,121,400	$4,859,400	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	19,000	SF	$100	$1,900,000	34%	$636,500	30%	$760,950	$3,297,450	
60.0	**Stations**						$300,000		$100,500		$80,100		$480,600
60.1		20.01	Street Car Stop - Side Platform	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	2	EA	$150,000	$300,000	34%	$100,500	20%	$80,100	$480,600	
60.7		20.01	Street Car Stop at Terminus - Center Platform	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$321,075		$107,560		$107,159		$535,794
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	1,427	TF	$225	$321,075	34%	$107,560	25%	$107,159	$535,794	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$58,507		$19,600		$19,527		$97,634
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	1,427	TF	$41	$58,507	34%	$19,600	25%	$19,527	$97,634	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$50,000		$16,750		$13,350		$80,100
100.1		50.06	Ticket Vending - Assume on the Vehicles	0	EA	$53,000	$0	34%	$0	20%	$0	$0	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	1	EA	$50,000	$50,000	34%	$16,750	20%	$13,350	$80,100	
110.0	**Vehicles**						$0		$0		$0		$0
110.1		70.01	Vehicles	0	EA	$3,600,000	$0	25%	$0	5%	$0	$0	
110.2		70.07	Spare Parts (10%)	0	EA	$360,000	$0	25%	$0	5%	$0	$0	
120.0	**Right of Way**						$0		$0		$0		$0
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE										
			Western Terminus - Elevated							**Length =**	**0.23 TK-mile**		
										Cost/mile (millions)=	**$52.11**		
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$6,459,207		$2,163,834		$2,385,285		$11,008,327
			Unallocated Contingency (10%)										$1,100,833
			TOTAL COST										**$12,109,159**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$258,368						
		80.02	Final Design			6%	$387,552						
		80.03	Project Management for Design and Construction			5%	$322,960						
		80.04	Construction Administration & Management			8%	$516,737						
		80.05	Insurance			2%	$129,184						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$193,776						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$193,776						
		80.08	Start-up Costs & Agency Force Account Work			1%	$64,592						
		80.09	Art Program			1.5%	$96,888						
						33.5%	$2,163,834						

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Length = 1.82 TK-mile
Cost/mile (millions)= $22.34

PE ROW Segment

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$4,371,000		$1,464,285		$1,167,057		$7,002,342
10.1		10.09	Trackway - Double Track - Direct Fixation	350	TF	$425	$148,750	34%	$49,831	20%	$39,716	$238,298	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	200	TF	$425	$85,000	34%	$28,475	20%	$22,695	$136,170	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	7,135	TF	$425	$3,032,375	34%	$1,015,846	20%	$809,644	$4,857,865	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	1,245	TF	$275	$342,375	34%	$114,696	20%	$91,414	$548,485	
10.7		10.11	Trackway - Double Track - Ballasted	525	TF	$500	$262,500	34%	$87,938	20%	$70,088	$420,525	
10.8		10.12	Trackway-Special-25M Turnout	0	EA	$175,000	$0	34%	$0	20%	$0	$0	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	1	EA	$500,000	$500,000	34%	$167,500	20%	$133,500	$801,000	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	0	TF	$1,000	$0	34%	$0	20%	$0	$0	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$4,258,975		$1,426,757		$1,421,433		$7,107,165
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	5	AC	$30,000	$137,100	34%	$45,929	25%	$45,757	$228,786	
20.3		40.05	Chain Link Fence (H= 8')	2,100	LF	$20	$42,000	34%	$14,070	25%	$14,018	$70,088	
20.4		40.05	Concrete Curb	670	LF	$40	$26,800	34%	$8,978	25%	$8,945	$44,723	
20.5		40.05	PE ROW Security Wall (H= 8')	14,200	LF	$200	$2,840,000	34%	$951,400	25%	$947,850	$4,739,250	
20.6		40.06	Concrete Sidewalk	29,885	SF	$10	$298,850	34%	$100,115	25%	$99,741	$498,706	
20.7		40.06	Landscape Allowance	1	LS	$500,000	$500,000	34%	$167,500	25%	$166,875	$834,375	
20.8		40.07	Roadway Reconstruction	27,615.0	SF	$15	$414,225	34%	$138,765	25%	$138,248	$691,238	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	0	SF	$12	$0	34%	$0	25%	$0	$0	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$833,750		$279,306		$222,611		$1,335,668
30.1		40.06	Lighting Allowance	150	LF	$30	$4,500	34%	$1,508	20%	$1,202	$7,209	
30.2		50.01	Gated Crossing (Single)	4	EA	$200,000	$800,000	34%	$268,000	20%	$213,600	$1,281,600	
30.3		50.02	Traffic Signals - New (or full Replacement)	0	EA	$350,000	$0	34%	$0	20%	$0	$0	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	0	EA	$60,000	$0	34%	$0	20%	$0	$0	
30.6		50.02	Signing and Striping Allowance	150	LF	$15	$2,250	34%	$754	20%	$601	$3,605	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	450	LF	$60	$27,000	34%	$9,045	20%	$7,209	$43,254	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
40.0	**Utilities**						$619,500		$207,533		$248,110		$1,075,142
40.1		40.02	Water Line Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.2		40.02	Water Line Sleeving Allowance	120	LF	$150	$18,000	34%	$6,030	30%	$7,209	$31,239	
40.3		40.02	Sanitary Sewer Relocation Allowance	280	LF	$300	$84,000	34%	$28,140	30%	$33,642	$145,782	
40.4		40.02	Drainage Improvements - PE ROW	1	LS	$495,000	$495,000	34%	$165,825	30%	$198,248	$859,073	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	150	LF	$150	$22,500	34%	$7,538	30%	$9,011	$39,049	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						Length =		1.82 TK-mile		
			PE ROW Segment						Cost/mile (millions)=		$22.34		
Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	Structures						$2,701,000		$904,835		$1,081,751		$4,687,586
50.1		40.01	Santa Ana River Bridge - Demoliton	1	LS	$165,000	$165,000	34%	$55,275	30%	$66,083	$286,358	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	1	LS	$2,056,000	$2,056,000	34%	$688,760	30%	$823,428	$3,568,188	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	1	LS	$330,000	$330,000	34%	$110,550	30%	$132,165	$572,715	
60.0	Stations						$550,000		$184,250		$146,850		$881,100
60.1		20.01	Street Car Stop - Side Platform	4	EA	$100,000	$400,000	34%	$134,000	20%	$106,800	$640,800	
60.2		20.01	Street Car Stop - Center Platform	1	EA	$150,000	$150,000	34%	$50,250	20%	$40,050	$240,300	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	Operations Facility						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	Traction Power System						$2,269,800		$760,383		$757,546		$3,787,729
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	0	TF	$225	$0	34%	$0	25%	$0	$0	
80.5		50.04	Overhead Catenary System - Double Track	8,730	TF	$260	$2,269,800	34%	$760,383	25%	$757,546	$3,787,729	
90.0	Communications and Central Control						$357,930		$119,907		$119,459		$597,296
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	8,730	TF	$41	$357,930	34%	$119,907	25%	$119,459	$597,296	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	Fare Collection						$106,000		$35,510		$28,302		$169,812
100.1		50.06	Ticket Vending - Assume on the Vehicles	2	EA	$53,000	$106,000	34%	$35,510	20%	$28,302	$169,812	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	0	EA	$50,000	$0	34%	$0	20%	$0	$0	
110.0	Vehicles						$7,920,000		$1,980,000		$495,000		$10,395,000
110.1		70.01	Vehicles	2	EA	$3,600,000	$7,200,000	25%	$1,800,000	5%	$450,000	$9,450,000	
110.2		70.07	Spare Parts (10%)	2	EA	$360,000	$720,000	25%	$180,000	5%	$45,000	$945,000	
120.0	Right of Way						$0		$0		$0		$0
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						**Length =**		**1.82 TK-mile**		
			PE ROW Segment						**Cost/mile (millions)=**		**$22.34**		
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$23,987,955		$7,362,765		$5,688,118		$37,038,838
			Unallocated Contingency (10%)										$3,703,884
			TOTAL COST										**$40,742,722**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$879,136						
		80.02	Final Design			6%	$1,318,704						
		80.03	Project Management for Design and Construction			5%	$1,098,920						
		80.04	Construction Administration & Management			8%	$1,758,272						
		80.05	Insurance			2%	$439,568						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$659,352						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$659,352						
		80.08	Start-up Costs & Agency Force Account Work			1%	$219,784						
		80.09	Art Program			1.5%	$329,676						
						33.5%	$7,362,765						

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

PE ROW Segment

Length = **0.10 TK-mile**
Cost/mile (millions)= **$20.35**

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$349,375		$117,041		$93,283		$559,699
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	200	TF	$425	$85,000	34%	$28,475	20%	$22,695	$136,170	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	325	TF	$275	$89,375	34%	$29,941	20%	$23,863	$143,179	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	1	EA	$175,000	$175,000	34%	$58,625	20%	$46,725	$280,350	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	0	TF	$1,000	$0	34%	$0	20%	$0	$0	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$90,000		$30,150		$30,038		$150,188
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	1	AC	$30,000	$15,000	34%	$5,025	25%	$5,006	$25,031	
20.3		40.05	Chain Link Fence (H= 8')	100	LF	$20	$2,000	34%	$670	25%	$668	$3,338	
20.4		40.05	Concrete Curb	500	LF	$40	$20,000	34%	$6,700	25%	$6,675	$33,375	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	5,300	SF	$10	$53,000	34%	$17,755	25%	$17,689	$88,444	
20.7		40.06	Landscape Allowance	0	LS	$500,000	$0	34%	$0	25%	$0	$0	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	0	SF	$12	$0	34%	$0	25%	$0	$0	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$4,500		$1,508		$1,202		$7,209
30.1		40.06	Lighting Allowance	150	LF	$30	$4,500	34%	$1,508	20%	$1,202	$7,209	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	0	EA	$350,000	$0	34%	$0	20%	$0	$0	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	0	EA	$60,000	$0	34%	$0	20%	$0	$0	
30.6		50.02	Signing and Striping Allowance	0	LF	$15	$0	34%	$0	20%	$0	$0	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	0	LF	$60	$0	34%	$0	20%	$0	$0	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
40.0	**Utilities**						$0		$0		$0		$0
40.1		40.02	Water Line Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.2		40.02	Water Line Sleeving Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	
40.3		40.02	Sanitary Sewer Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

PE ROW Segment

Length = 0.10 TK-mile
Cost/mile (millions)= $20.35

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$555,000		$185,925		$148,185		$889,110
60.1		20.01	Street Car Stop - Side Platform	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	2	EA	$150,000	$300,000	34%	$100,500	20%	$80,100	$480,600	
60.7		20.01	Street Car Stop at Terminus - Center Platform	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
60.8		40.07	Park & Ride Surface	51	Spc	$5,000	$255,000	34%	$85,425	20%	$68,085	$408,510	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$118,125		$39,572		$39,424		$197,121
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	525	TF	$225	$118,125	34%	$39,572	25%	$39,424	$197,121	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$21,525		$7,211		$7,184		$35,920
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	525	TF	$41	$21,525	34%	$7,211	25%	$7,184	$35,920	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$0		$0		$0		$0
100.1		50.06	Ticket Vending - Assume on the Vehicles	0	EA	$53,000	$0	34%	$0	20%	$0	$0	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	0	EA	$50,000	$0	34%	$0	20%	$0	$0	
110.0	**Vehicles**						$0		$0		$0		$0
110.1		70.01	Vehicles	0	EA	$3,600,000	$0	25%	$0	5%	$0	$0	
110.2		70.07	Spare Parts (10%)	0	EA	$360,000	$0	25%	$0	5%	$0	$0	
120.0	**Right of Way**						$0		$0		$0		$0
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						Length =	0.10 TK-mile			
			PE ROW Segment						Cost/mile (millions)=	$20.35			
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$1,138,525		$381,406		$319,315		$1,839,246
			Unallocated Contingency (10%)										$183,925
			TOTAL COST										**$2,023,171**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$45,541						
		80.02	Final Design			6%	$68,312						
		80.03	Project Management for Design and Construction			5%	$56,926						
		80.04	Construction Administration & Management			8%	$91,082						
		80.05	Insurance			2%	$22,771						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$34,156						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$34,156						
		80.08	Start-up Costs & Agency Force Account Work			1%	$11,385						
		80.09	Art Program			1.5%	$17,078						
						33.5%	$381,406						

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						**Length =**		**1.81 TK-mile**		
			Raitt to Flower Segment						**Cost/mile (millions)=**		**$15.78**		
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
10.0	**Guideway Construction**						$4,221,000		$1,414,035		$1,127,007		$6,762,042
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	9,560	TF	$425	$4,063,000	34%	$1,361,105	20%	$1,084,821	$6,508,926	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	0	EA	$175,000	$0	34%	$0	20%	$0	$0	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	158	TF	$1,000	$158,000	34%	$52,930	20%	$42,186	$253,116	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$4,074,370		$1,364,914		$1,359,821		$6,799,105
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	0	LF	$40	$0	34%	$0	25%	$0	$0	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	2,371	SF	$10	$23,710	34%	$7,943	25%	$7,913	$39,566	
20.7		40.06	Landscape Allowance	0	LS	$500,000	$0	34%	$0	25%	$0	$0	
20.8		40.07	Roadway Reconstruction	20,724	SF	$15	$310,860	34%	$104,138	25%	$103,750	$518,748	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	311,650	SF	$12	$3,739,800	34%	$1,252,833	25%	$1,248,158	$6,240,791	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$1,322,000		$442,870		$352,974		$2,117,844
30.1		40.06	Lighting Allowance	0	LF	$30	$0	34%	$0	20%	$0	$0	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	1	EA	$350,000	$350,000	34%	$117,250	20%	$93,450	$560,700	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	0	EA	$60,000	$0	34%	$0	20%	$0	$0	
30.6		50.02	Signing and Striping Allowance	3,880	LF	$15	$58,200	34%	$19,497	20%	$15,539	$93,236	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	5,230	LF	$60	$313,800	34%	$105,123	20%	$83,785	$502,708	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	6	EA	$100,000	$600,000	34%	$201,000	20%	$160,200	$961,200	
40.0	**Utilities**						$3,305,000		$1,107,175		$1,323,653		$5,735,828
40.1		40.02	Water Line Relocation Allowance	3,075	LF	$300	$922,500	34%	$309,038	30%	$369,461	$1,600,999	
40.2		40.02	Water Line Sleeving Allowance	540	LF	$150	$81,000	34%	$27,135	30%	$32,441	$140,576	
40.3		40.02	Sanitary Sewer Relocation Allowance	360	LF	$300	$108,000	34%	$36,180	30%	$43,254	$187,434	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	1	LS	$2,193,500	$2,193,500	34%	$734,823	30%	$878,497	$3,806,819	
40.6		40.02	Other Utilities (including private) Relocation Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	

Draft

DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Raitt to Flower Segment

Length = 1.81 TK-mile
Cost/mile (millions)= $15.78

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$200,000		$67,000		$53,400		$320,400
60.1		20.01	Street Car Stop - Side Platform	2	EA	$100,000	$200,000	34%	$67,000	20%	$53,400	$320,400	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$2,151,000		$720,585		$717,896		$3,589,481
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	9,560	TF	$225	$2,151,000	34%	$720,585	25%	$717,896	$3,589,481	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$391,960		$131,307		$130,817		$654,083
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	9,560	TF	$41	$391,960	34%	$131,307	25%	$130,817	$654,083	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$0		$0		$0		$0
100.1		50.06	Ticket Vending - Assume on the Vehicles	0	EA	$53,000	$0	34%	$0	20%	$0	$0	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	0	EA	$50,000	$0	34%	$0	20%	$0	$0	
110.0	**Vehicles**						$0		$0		$0		$0
110.1		70.01	Vehicles	0	EA	$3,600,000	$0	25%	$0	5%	$0	$0	
110.2		70.07	Spare Parts (10%)	0	EA	$360,000	$0	25%	$0	5%	$0	$0	
120.0	**Right of Way**						$0		$0		$0		$0
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

Draft

DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						**Length =**		**1.81 TK-mile**		
			Raitt to Flower Segment						**Cost/mile (millions)=**		**$15.78**		
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$15,665,330		$5,247,886		$5,065,567		$25,978,783
			Unallocated Contingency (10%)										$2,597,878
			TOTAL COST										**$28,576,661**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$626,613						
		80.02	Final Design			6%	$939,920						
		80.03	Project Management for Design and Construction			5%	$783,267						
		80.04	Construction Administration & Management			8%	$1,253,226						
		80.05	Insurance			2%	$313,307						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$469,960						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$469,960						
		80.08	Start-up Costs & Agency Force Account Work			1%	$156,653						
		80.09	Art Program			1.5%	$234,980						
						33.5%	$5,247,886						

Draft

DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						**Length =**		**2.63 TK-mile**		
			Downtown Segment - Alternative 1						**Cost/mile (millions)=**		**$29.93**		
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
10.0	**Guideway Construction**						$6,705,600		$2,246,376		$1,790,395		$10,742,371
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	13,912	TF	$425	$5,912,600	34%	$1,980,721	20%	$1,578,664	$9,471,985	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	1	EA	$175,000	$175,000	34%	$58,625	20%	$46,725	$280,350	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	618	TF	$1,000	$618,000	34%	$207,030	20%	$165,006	$990,036	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$5,680,600		$1,903,001		$1,895,900		$9,479,501
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	1,609	LF	$40	$64,360	34%	$21,561	25%	$21,480	$107,401	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	35,966	SF	$10	$359,660	34%	$120,486	25%	$120,037	$600,183	
20.7		40.06	Landscape Allowance	1	LS	$500,000	$500,000	34%	$167,500	25%	$166,875	$834,375	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	5,500	SF	$8	$44,000	34%	$14,740	25%	$14,685	$73,425	
21.1		40.07	Pavement Resurfacing	392,715	SF	$12	$4,712,580	34%	$1,578,714	25%	$1,572,824	$7,864,118	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$3,494,550		$1,170,674		$933,045		$5,598,269
30.1		40.06	Lighting Allowance	700	LF	$30	$21,000	34%	$7,035	20%	$5,607	$33,642	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	3	EA	$350,000	$1,050,000	34%	$351,750	20%	$280,350	$1,682,100	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	2	EA	$60,000	$120,000	34%	$40,200	20%	$32,040	$192,240	
30.6		50.02	Signing and Striping Allowance	10,714	LF	$15	$160,710	34%	$53,838	20%	$42,910	$257,457	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	10,714	LF	$60	$642,840	34%	$215,351	20%	$171,638	$1,029,830	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	15	EA	$100,000	$1,500,000	34%	$502,500	20%	$400,500	$2,403,000	
40.0	**Utilities**						$6,274,750		$2,102,041		$2,513,037		$10,889,829
40.1		40.02	Water Line Relocation Allowance	3,215	LF	$300	$964,500	34%	$323,108	30%	$386,282	$1,673,890	
40.2		40.02	Water Line Sleeving Allowance	1,200	LF	$150	$180,000	34%	$60,300	30%	$72,090	$312,390	
40.3		40.02	Sanitary Sewer Relocation Allowance	5,000	LF	$300	$1,500,000	34%	$502,500	30%	$600,750	$2,603,250	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	2,350	LF	$150	$352,500	34%	$118,088	30%	$141,176	$611,764	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 1

Length = **2.63 TK-mile**
Cost/mile (millions)= **$29.93**

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	1	LS	$3,277,750	$3,277,750	34%	$1,098,046	30%	$1,312,739	$5,688,535	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$1,400,000		$469,000		$373,800		$2,242,800
60.1		20.01	Street Car Stop - Side Platform	12	EA	$100,000	$1,200,000	34%	$402,000	20%	$320,400	$1,922,400	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	1	EA	$200,000	$200,000	34%	$67,000	20%	$53,400	$320,400	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$3,130,200		$1,048,617		$1,044,704		$5,223,521
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	13,912	TF	$225	$3,130,200	34%	$1,048,617	25%	$1,044,704	$5,223,521	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$570,392		$191,081		$190,368		$951,842
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	13,912	TF	$41	$570,392	34%	$191,081	25%	$190,368	$951,842	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$365,000		$122,275		$97,455		$584,730
100.1		50.06	Ticket Vending - Assume on the Vehicles	5	EA	$53,000	$265,000	34%	$88,775	20%	$70,755	$424,530	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	2	EA	$50,000	$100,000	34%	$33,500	20%	$26,700	$160,200	
110.0	**Vehicles**						$19,800,000		$4,950,000		$1,237,500		$25,987,500
110.1		70.01	Vehicles	5	EA	$3,600,000	$18,000,000	25%	$4,500,000	5%	$1,125,000	$23,625,000	
110.2		70.07	Spare Parts (10%)	5	EA	$360,000	$1,800,000	25%	$450,000	5%	$112,500	$2,362,500	
120.0	**Right of Way**						$0		$0		$0		$0
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						**Length =**		**2.63 TK-mile**		
			Downtown Segment - Alternative 1						**Cost/mile (millions)=**		**$29.93**		
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$47,421,092		$14,203,066		$10,076,205		$71,700,363
			Unallocated Contingency (10%)										$7,170,036
			TOTAL COST										**$78,870,399**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$1,695,888						
		80.02	Final Design			6%	$2,543,833						
		80.03	Project Management for Design and Construction			5%	$2,119,861						
		80.04	Construction Administration & Management			8%	$3,391,777						
		80.05	Insurance			2%	$847,944						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$1,271,916						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$1,271,916						
		80.08	Start-up Costs & Agency Force Account Work			1%	$423,972						
		80.09	Art Program			1.5%	$635,958						
						33.5%	$14,203,066						

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 1 (Design Option 1)

Length = 2.68 TK-mile
Cost/mile (millions)= $30.31

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$7,150,750		$2,395,501		$1,909,250		$11,455,502
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	14,150	TF	$425	$6,013,750	34%	$2,014,606	20%	$1,605,671	$9,634,028	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	1	EA	$175,000	$175,000	34%	$58,625	20%	$46,725	$280,350	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	962	TF	$1,000	$962,000	34%	$322,270	20%	$256,854	$1,541,124	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$5,894,296		$1,974,589		$1,967,221		$9,836,106
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	2,794	LF	$40	$111,760	34%	$37,440	25%	$37,300	$186,500	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	38,504	SF	$10	$385,040	34%	$128,988	25%	$128,507	$642,536	
20.7		40.06	Landscape Allowance	1	LS	$500,000	$500,000	34%	$167,500	25%	$166,875	$834,375	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	5,500	SF	$8	$44,000	34%	$14,740	25%	$14,685	$73,425	
21.1		40.07	Pavement Resurfacing	404,458	SF	$12	$4,853,496	34%	$1,625,921	25%	$1,619,854	$8,099,271	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$3,865,400		$1,294,909		$1,032,062		$6,192,371
30.1		40.06	Lighting Allowance	300	LF	$30	$9,000	34%	$3,015	20%	$2,403	$14,418	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	4	EA	$350,000	$1,400,000	34%	$469,000	20%	$373,800	$2,242,800	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	2	EA	$60,000	$120,000	34%	$40,200	20%	$32,040	$192,240	
30.6		50.02	Signing and Striping Allowance	11,152	LF	$15	$167,280	34%	$56,039	20%	$44,664	$267,983	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	11,152	LF	$60	$669,120	34%	$224,155	20%	$178,655	$1,071,930	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	15	EA	$100,000	$1,500,000	34%	$502,500	20%	$400,500	$2,403,000	
40.0	**Utilities**						$6,490,750		$2,174,401		$2,599,545		$11,264,697
40.1		40.02	Water Line Relocation Allowance	3,415	LF	$300	$1,024,500	34%	$343,208	30%	$410,312	$1,778,020	
40.2		40.02	Water Line Sleeving Allowance	1,320	LF	$150	$198,000	34%	$66,330	30%	$79,299	$343,629	
40.3		40.02	Sanitary Sewer Relocation Allowance	5,460	LF	$300	$1,638,000	34%	$548,730	30%	$656,019	$2,842,749	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	2,350	LF	$150	$352,500	34%	$118,088	30%	$141,176	$611,764	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 1 (Design Option 1)

Length = **2.68 TK-mile**
Cost/mile (millions)= **$30.31**

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40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$1,400,000		$469,000		$373,800		$2,242,800
60.1		20.01	Street Car Stop - Side Platform	12	EA	$100,000	$1,200,000	34%	$402,000	20%	$320,400	$1,922,400	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	1	EA	$200,000	$200,000	34%	$67,000	20%	$53,400	$320,400	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$3,183,750		$1,066,556		$1,062,577		$5,312,883
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	14,150	TF	$225	$3,183,750	34%	$1,066,556	25%	$1,062,577	$5,312,883	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$580,150		$194,350		$193,625		$968,125
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	14,150	TF	$41	$580,150	34%	$194,350	25%	$193,625	$968,125	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$365,000		$122,275		$97,455		$584,730
100.1		50.06	Ticket Vending - Assume on the Vehicles	5	EA	$53,000	$265,000	34%	$88,775	20%	$70,755	$424,530	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	2	EA	$50,000	$100,000	34%	$33,500	20%	$26,700	$160,200	
110.0	**Vehicles**						$19,800,000		$4,950,000		$1,237,500		$25,987,500
110.1		70.01	Vehicles	5	EA	$3,600,000	$18,000,000	25%	$4,500,000	5%	$1,125,000	$23,625,000	
110.2		70.07	Spare Parts (10%)	5	EA	$360,000	$1,800,000	25%	$450,000	5%	$112,500	$2,362,500	
120.0	**Right of Way**						$0		$0		$0		$0
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 1 (Design Option 1)

Length = **2.68 TK-mile**
Cost/mile (millions)= **$30.31**

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$48,730,096		$14,641,582		$10,473,035		$73,844,714
			Unallocated Contingency (10%)										$7,384,471
			TOTAL COST										**$81,229,185**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$1,748,249						
		80.02	Final Design			6%	$2,622,373						
		80.03	Project Management for Design and Construction			5%	$2,185,311						
		80.04	Construction Administration & Management			8%	$3,496,497						
		80.05	Insurance			2%	$874,124						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$1,311,186						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$1,311,186						
		80.08	Start-up Costs & Agency Force Account Work			1%	$437,062						
		80.09	Art Program			1.5%	$655,593						
						33.5%	$14,641,582						

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 1 (Design Option 2)

Length = **2.63 TK-mile**
Cost/mile (millions)= **$29.92**

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$6,705,600		$2,246,376		$1,790,395		$10,742,371
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	13,912	TF	$425	$5,912,600	34%	$1,980,721	20%	$1,578,664	$9,471,985	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	1	EA	$175,000	$175,000	34%	$58,625	20%	$46,725	$280,350	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	618	TF	$1,000	$618,000	34%	$207,030	20%	$165,006	$990,036	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$5,661,476		$1,896,594		$1,889,518		$9,447,588
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	1,579	LF	$40	$63,160	34%	$21,159	25%	$21,080	$105,398	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	44,916	SF	$10	$449,160	34%	$150,469	25%	$149,907	$749,536	
20.7		40.06	Landscape Allowance	1	LS	$500,000	$500,000	34%	$167,500	25%	$166,875	$834,375	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	5,500	SF	$8	$44,000	34%	$14,740	25%	$14,685	$73,425	
21.1		40.07	Pavement Resurfacing	383,763	SF	$12	$4,605,156	34%	$1,542,727	25%	$1,536,971	$7,684,854	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$3,494,550		$1,170,674		$933,045		$5,598,269
30.1		40.06	Lighting Allowance	700	LF	$30	$21,000	34%	$7,035	20%	$5,607	$33,642	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	3	EA	$350,000	$1,050,000	34%	$351,750	20%	$280,350	$1,682,100	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	2	EA	$60,000	$120,000	34%	$40,200	20%	$32,040	$192,240	
30.6		50.02	Signing and Striping Allowance	10,714	LF	$15	$160,710	34%	$53,838	20%	$42,910	$257,457	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	10,714	LF	$60	$642,840	34%	$215,351	20%	$171,638	$1,029,830	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	15	EA	$100,000	$1,500,000	34%	$502,500	20%	$400,500	$2,403,000	
40.0	**Utilities**						$6,274,750		$2,102,041		$2,513,037		$10,889,829
40.1		40.02	Water Line Relocation Allowance	3,215	LF	$300	$964,500	34%	$323,108	30%	$386,282	$1,673,890	
40.2		40.02	Water Line Sleeving Allowance	1,200	LF	$150	$180,000	34%	$60,300	30%	$72,090	$312,390	
40.3		40.02	Sanitary Sewer Relocation Allowance	5,000	LF	$300	$1,500,000	34%	$502,500	30%	$600,750	$2,603,250	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	2,350	LF	$150	$352,500	34%	$118,088	30%	$141,176	$611,764	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 1 (Design Option 2)

Length = 2.63 TK-mile
Cost/mile (millions)= $29.92

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	1	LS	$3,277,750	$3,277,750	34%	$1,098,046	30%	$1,312,739	$5,688,535	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$1,400,000		$469,000		$373,800		$2,242,800
60.1		20.01	Street Car Stop - Side Platform	12	EA	$100,000	$1,200,000	34%	$402,000	20%	$320,400	$1,922,400	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	1	EA	$200,000	$200,000	34%	$67,000	20%	$53,400	$320,400	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$3,130,200		$1,048,617		$1,044,704		$5,223,521
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	13,912	TF	$225	$3,130,200	34%	$1,048,617	25%	$1,044,704	$5,223,521	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$570,392		$191,081		$190,368		$951,842
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	13,912	TF	$41	$570,392	34%	$191,081	25%	$190,368	$951,842	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$365,000		$122,275		$97,455		$584,730
100.1		50.06	Ticket Vending - Assume on the Vehicles	5	EA	$53,000	$265,000	34%	$88,775	20%	$70,755	$424,530	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	2	EA	$50,000	$100,000	34%	$33,500	20%	$26,700	$160,200	
110.0	**Vehicles**						$19,800,000		$4,950,000		$1,237,500		$25,987,500
110.1		70.01	Vehicles	5	EA	$3,600,000	$18,000,000	25%	$4,500,000	5%	$1,125,000	$23,625,000	
110.2		70.07	Spare Parts (10%)	5	EA	$360,000	$1,800,000	25%	$450,000	5%	$112,500	$2,362,500	
120.0	**Right of Way**						$0		$0		$0		$0
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

Draft

DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 1 (Design Option 2)

Length = **2.63 TK-mile**
Cost/mile (millions)= **$29.92**

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$47,401,968		$14,196,659		$10,069,823		$71,668,450
			Unallocated Contingency (10%)										$7,166,845
			TOTAL COST										**$78,835,295**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$1,695,123						
		80.02	Final Design			6%	$2,542,685						
		80.03	Project Management for Design and Construction			5%	$2,118,904						
		80.04	Construction Administration & Management			8%	$3,390,247						
		80.05	Insurance			2%	$847,562						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$1,271,343						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$1,271,343						
		80.08	Start-up Costs & Agency Force Account Work			1%	$423,781						
		80.09	Art Program			1.5%	$635,671						
						33.5%	$14,196,659						

DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 1 (Design Option 3)

Length = **2.63 TK-mile**
Cost/mile (millions)= **$30.40**

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$6,705,600		$2,246,376		$1,790,395		$10,742,371
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	13,912	TF	$425	$5,912,600	34%	$1,980,721	20%	$1,578,664	$9,471,985	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	1	EA	$175,000	$175,000	34%	$58,625	20%	$46,725	$280,350	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	618	TF	$1,000	$618,000	34%	$207,030	20%	$165,006	$990,036	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$6,356,066		$2,129,282		$2,121,337		$10,606,685
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	2,651	LF	$40	$106,040	34%	$35,523	25%	$35,391	$176,954	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	60,087	SF	$10	$600,870	34%	$201,291	25%	$200,540	$1,002,702	
20.7		40.06	Landscape Allowance	2	LS	$500,000	$1,000,000	34%	$335,000	25%	$333,750	$1,668,750	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	5,500	SF	$8	$44,000	34%	$14,740	25%	$14,685	$73,425	
21.1		40.07	Pavement Resurfacing	383,763	SF	$12	$4,605,156	34%	$1,542,727	25%	$1,536,971	$7,684,854	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$3,494,550		$1,170,674		$933,045		$5,598,269
30.1		40.06	Lighting Allowance	700	LF	$30	$21,000	34%	$7,035	20%	$5,607	$33,642	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	3	EA	$350,000	$1,050,000	34%	$351,750	20%	$280,350	$1,682,100	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	2	EA	$60,000	$120,000	34%	$40,200	20%	$32,040	$192,240	
30.6		50.02	Signing and Striping Allowance	10,714	LF	$15	$160,710	34%	$53,838	20%	$42,910	$257,457	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	10,714	LF	$60	$642,840	34%	$215,351	20%	$171,638	$1,029,830	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	15	EA	$100,000	$1,500,000	34%	$502,500	20%	$400,500	$2,403,000	
40.0	**Utilities**						$6,274,750		$2,102,041		$2,513,037		$10,889,829
40.1		40.02	Water Line Relocation Allowance	3,215	LF	$300	$964,500	34%	$323,108	30%	$386,282	$1,673,890	
40.2		40.02	Water Line Sleeving Allowance	1,200	LF	$150	$180,000	34%	$60,300	30%	$72,090	$312,390	
40.3		40.02	Sanitary Sewer Relocation Allowance	5,000	LF	$300	$1,500,000	34%	$502,500	30%	$600,750	$2,603,250	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	2,350	LF	$150	$352,500	34%	$118,088	30%	$141,176	$611,764	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						**Length =**		**2.63 TK-mile**		
			Downtown Segment - Alternative 1 (Design Option 3)						**Cost/mile (millions)=**		**$30.40**		
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	1	LS	$3,277,750	$3,277,750	34%	$1,098,046	30%	$1,312,739	$5,688,535	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$1,400,000		$469,000		$373,800		$2,242,800
60.1		20.01	Street Car Stop - Side Platform	12	EA	$100,000	$1,200,000	34%	$402,000	20%	$320,400	$1,922,400	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	1	EA	$200,000	$200,000	34%	$67,000	20%	$53,400	$320,400	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$3,130,200		$1,048,617		$1,044,704		$5,223,521
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	13,912	TF	$225	$3,130,200	34%	$1,048,617	25%	$1,044,704	$5,223,521	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$570,392		$191,081		$190,368		$951,842
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	13,912	TF	$41	$570,392	34%	$191,081	25%	$190,368	$951,842	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$365,000		$122,275		$97,455		$584,730
100.1		50.06	Ticket Vending - Assume on the Vehicles	5	EA	$53,000	$265,000	34%	$88,775	20%	$70,755	$424,530	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	2	EA	$50,000	$100,000	34%	$33,500	20%	$26,700	$160,200	
110.0	**Vehicles**						$19,800,000		$4,950,000		$1,237,500		$25,987,500
110.1		70.01	Vehicles	5	EA	$3,600,000	$18,000,000	25%	$4,500,000	5%	$1,125,000	$23,625,000	
110.2		70.07	Spare Parts (10%)	5	EA	$360,000	$1,800,000	25%	$450,000	5%	$112,500	$2,362,500	
120.0	**Right of Way**						$0		$0		$0		$0
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE							Length =	2.63 TK-mile		
			Downtown Segment - Alternative 1 (Design Option 3)							Cost/mile (millions)=	$30.40		
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$48,096,558		$14,429,347		$10,301,642		$72,827,547
			Unallocated Contingency (10%)										$7,282,755
			TOTAL COST										**$80,110,302**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$1,722,907						
		80.02	Final Design			6%	$2,584,361						
		80.03	Project Management for Design and Construction			5%	$2,153,634						
		80.04	Construction Administration & Management			8%	$3,445,814						
		80.05	Insurance			2%	$861,454						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$1,292,180						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$1,292,180						
		80.08	Start-up Costs & Agency Force Account Work			1%	$430,727						
		80.09	Art Program			1.5%	$646,090						
						33.5%	$14,429,347						

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 2

Length = 3.12 TK-mile
Cost/mile (millions)= $31.54

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$9,817,250		$3,288,779		$2,621,206		$15,727,235
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	16,490	TF	$425	$7,008,250	34%	$2,347,764	20%	$1,871,203	$11,227,217	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	4	EA	$175,000	$700,000	34%	$234,500	20%	$186,900	$1,121,400	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	1	EA	$195,000	$195,000	34%	$65,325	20%	$52,065	$312,390	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	1,914	TF	$1,000	$1,914,000	34%	$641,190	20%	$511,038	$3,066,228	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$7,178,850		$2,404,915		$2,395,941		$11,979,706
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	0	LF	$40	$0	34%	$0	25%	$0	$0	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	31,623	SF	$10	$316,230	34%	$105,937	25%	$105,542	$527,709	
20.7		40.06	Landscape Allowance	0	LS	$500,000	$0	34%	$0	25%	$0	$0	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	571,885	SF	$12	$6,862,620	34%	$2,298,978	25%	$2,290,399	$11,451,997	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$5,138,675		$1,721,456		$1,372,026		$8,232,157
30.1		40.06	Lighting Allowance	200	LF	$30	$6,000	34%	$2,010	20%	$1,602	$9,612	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	6	EA	$350,000	$2,100,000	34%	$703,500	20%	$560,700	$3,364,200	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	4	EA	$60,000	$240,000	34%	$80,400	20%	$64,080	$384,480	
30.6		50.02	Signing and Striping Allowance	14,569	LF	$15	$218,535	34%	$73,209	20%	$58,349	$350,093	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	14,569	LF	$60	$874,140	34%	$292,837	20%	$233,395	$1,400,372	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	17	EA	$100,000	$1,700,000	34%	$569,500	20%	$453,900	$2,723,400	
40.0	**Utilities**						$4,718,875		$1,580,823		$1,889,909		$8,189,608
40.1		40.02	Water Line Relocation Allowance	2,500	LF	$300	$750,000	34%	$251,250	30%	$300,375	$1,301,625	
40.2		40.02	Water Line Sleeving Allowance	1,060	LF	$150	$159,000	34%	$53,265	30%	$63,680	$275,945	
40.3		40.02	Sanitary Sewer Relocation Allowance	4,060	LF	$300	$1,218,000	34%	$408,030	30%	$487,809	$2,113,839	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	1,800	LF	$150	$270,000	34%	$90,450	30%	$108,135	$468,585	

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SAFG Cost Workbook_with SCC summary_updated July 2012.xlsx
SHEET (Est F)

DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 2

Length = 3.12 TK-mile
Cost/mile (millions)= $31.54

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	1	LS	$2,321,875	$2,321,875	34%	$777,828	30%	$929,911	$4,029,614	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$1,450,000		$485,750		$387,150		$2,322,900
60.1		20.01	Street Car Stop - Side Platform	13	EA	$100,000	$1,300,000	34%	$435,500	20%	$347,100	$2,082,600	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	1	EA	$150,000	$150,000	34%	$50,250	20%	$40,050	$240,300	
60.7		20.01	Street Car Stop at Terminus - Center Platform	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$3,710,250		$1,242,934		$1,238,296		$6,191,480
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	16,490	TF	$225	$3,710,250	34%	$1,242,934	25%	$1,238,296	$6,191,480	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$676,090		$226,490		$225,645		$1,128,225
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	16,490	TF	$41	$676,090	34%	$226,490	25%	$225,645	$1,128,225	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$418,000		$140,030		$111,606		$669,636
100.1		50.06	Ticket Vending - Assume on the Vehicles	6	EA	$53,000	$318,000	34%	$106,530	20%	$84,906	$509,436	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	2	EA	$50,000	$100,000	34%	$33,500	20%	$26,700	$160,200	
110.0	**Vehicles**						$23,760,000		$5,940,000		$1,485,000		$31,185,000
110.1		70.01	Vehicles	6	EA	$3,600,000	$21,600,000	25%	$5,400,000	5%	$1,350,000	$28,350,000	
110.2		70.07	Spare Parts (10%)	6	EA	$360,000	$2,160,000	25%	$540,000	5%	$135,000	$2,835,000	
120.0	**Right of Way**						$3,013,125		$0		$903,938		$3,917,063
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						Length =		3.12 TK-mile		
			Downtown Segment - Alternative 2						Cost/mile (millions)=		$31.54		
Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	1	LS	$3,013,125	$3,013,125	0%	$0	30%	$903,938	$3,917,063	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$59,881,115		$17,031,177		$12,630,717		$89,543,009
			Unallocated Contingency (10%)										$8,954,301
			TOTAL COST										**$98,497,310**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$2,033,573						
		80.02	Final Design			6%	$3,050,360						
		80.03	Project Management for Design and Construction			5%	$2,541,967						
		80.04	Construction Administration & Management			8%	$4,067,147						
		80.05	Insurance			2%	$1,016,787						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$1,525,180						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$1,525,180						
		80.08	Start-up Costs & Agency Force Account Work			1%	$508,393						
		80.09	Art Program			1.5%	$762,590						
						33.5%	$17,031,177						

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 2 (Design Option 1)

Length = **3.12 TK-mile**
Cost/mile (millions)= **$30.51**

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$9,817,250		$3,288,779		$2,621,206		$15,727,235
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	16,490	TF	$425	$7,008,250	34%	$2,347,764	20%	$1,871,203	$11,227,217	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	4	EA	$175,000	$700,000	34%	$234,500	20%	$186,900	$1,121,400	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	1	EA	$195,000	$195,000	34%	$65,325	20%	$52,065	$312,390	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	1,914	TF	$1,000	$1,914,000	34%	$641,190	20%	$511,038	$3,066,228	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$7,437,182		$2,491,456		$2,482,159		$12,410,797
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	0	LF	$40	$0	34%	$0	25%	$0	$0	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	27,581	SF	$10	$275,810	34%	$92,396	25%	$92,052	$460,258	
20.7		40.06	Landscape Allowance	0	LS	$500,000	$0	34%	$0	25%	$0	$0	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	596,781	SF	$12	$7,161,372	34%	$2,399,060	25%	$2,390,108	$11,950,540	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$5,488,675		$1,838,706		$1,465,476		$8,792,857
30.1		40.06	Lighting Allowance	200	LF	$30	$6,000	34%	$2,010	20%	$1,602	$9,612	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	7	EA	$350,000	$2,450,000	34%	$820,750	20%	$654,150	$3,924,900	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	4	EA	$60,000	$240,000	34%	$80,400	20%	$64,080	$384,480	
30.6		50.02	Signing and Striping Allowance	14,569	LF	$15	$218,535	34%	$73,209	20%	$58,349	$350,093	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	14,569	LF	$60	$874,140	34%	$292,837	20%	$233,395	$1,400,372	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	17	EA	$100,000	$1,700,000	34%	$569,500	20%	$453,900	$2,723,400	
40.0	**Utilities**						$4,718,875		$1,580,823		$1,889,909		$8,189,608
40.1		40.02	Water Line Relocation Allowance	2,500	LF	$300	$750,000	34%	$251,250	30%	$300,375	$1,301,625	
40.2		40.02	Water Line Sleeving Allowance	1,060	LF	$150	$159,000	34%	$53,265	30%	$63,680	$275,945	
40.3		40.02	Sanitary Sewer Relocation Allowance	4,060	LF	$300	$1,218,000	34%	$408,030	30%	$487,809	$2,113,839	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	1,800	LF	$150	$270,000	34%	$90,450	30%	$108,135	$468,585	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Downtown Segment - Alternative 2 (Design Option 1)

Length = **3.12 TK-mile**
Cost/mile (millions)= **$30.51**

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	1	LS	$2,321,875	$2,321,875	34%	$777,828	30%	$929,911	$4,029,614	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$1,450,000		$485,750		$387,150		$2,322,900
60.1		20.01	Street Car Stop - Side Platform	13	EA	$100,000	$1,300,000	34%	$435,500	20%	$347,100	$2,082,600	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	1	EA	$150,000	$150,000	34%	$50,250	20%	$40,050	$240,300	
60.7		20.01	Street Car Stop at Terminus - Center Platform	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$3,710,250		$1,242,934		$1,238,296		$6,191,480
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	16,490	TF	$225	$3,710,250	34%	$1,242,934	25%	$1,238,296	$6,191,480	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$676,090		$226,490		$225,645		$1,128,225
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	16,490	TF	$41	$676,090	34%	$226,490	25%	$225,645	$1,128,225	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$418,000		$140,030		$111,606		$669,636
100.1		50.06	Ticket Vending - Assume on the Vehicles	6	EA	$53,000	$318,000	34%	$106,530	20%	$84,906	$509,436	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	2	EA	$50,000	$100,000	34%	$33,500	20%	$26,700	$160,200	
110.0	**Vehicles**						$23,760,000		$5,940,000		$1,485,000		$31,185,000
110.1		70.01	Vehicles	6	EA	$3,600,000	$21,600,000	25%	$5,400,000	5%	$1,350,000	$28,350,000	
110.2		70.07	Spare Parts (10%)	6	EA	$360,000	$2,160,000	25%	$540,000	5%	$135,000	$2,835,000	
120.0	**Right of Way**						$0		$0		$0		$0
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						Length =	3.12 TK-mile			
			Downtown Segment - Alternative 2 (Design Option 1)						Cost/mile (millions)=	$30.51			
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$57,476,322		$17,234,968		$11,906,448		$86,617,738
			Unallocated Contingency (10%)										$8,661,774
			TOTAL COST										**$95,279,512**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$2,057,907						
		80.02	Final Design			6%	$3,086,860						
		80.03	Project Management for Design and Construction			5%	$2,572,383						
		80.04	Construction Administration & Management			8%	$4,115,813						
		80.05	Insurance			2%	$1,028,953						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$1,543,430						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$1,543,430						
		80.08	Start-up Costs & Agency Force Account Work			1%	$514,477						
		80.09	Art Program			1.5%	$771,715						
						33.5%	$17,234,968						

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Maintenance Facility - SARTC Site

Length = **0.00 TK-mile**
Cost/mile (millions)=

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$0		$0		$0		$0
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	0	EA	$175,000	$0	34%	$0	20%	$0	$0	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	0	TF	$1,000	$0	34%	$0	20%	$0	$0	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$0		$0		$0		$0
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	0	LF	$40	$0	34%	$0	25%	$0	$0	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	0	SF	$10	$0	34%	$0	25%	$0	$0	
20.7		40.06	Landscape Allowance	0	LS	$500,000	$0	34%	$0	25%	$0	$0	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	0	SF	$12	$0	34%	$0	25%	$0	$0	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$0		$0		$0		$0
30.1		40.06	Lighting Allowance	0	LF	$30	$0	34%	$0	20%	$0	$0	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	0	EA	$350,000	$0	34%	$0	20%	$0	$0	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	0	EA	$60,000	$0	34%	$0	20%	$0	$0	
30.6		50.02	Signing and Striping Allowance	0	LF	$15	$0	34%	$0	20%	$0	$0	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	0	LF	$60	$0	34%	$0	20%	$0	$0	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
40.0	**Utilities**						$0		$0		$0		$0
40.1		40.02	Water Line Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.2		40.02	Water Line Sleeving Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	
40.3		40.02	Sanitary Sewer Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Length = 0.00 TK-mile

Cost/mile (millions)=

Maintenance Facility - SARTC Site

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$0		$0		$0		$0
60.1		20.01	Street Car Stop - Side Platform	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$7,065,000		$2,366,775		$2,829,533		$12,261,308
70.1		30.03	Maintenance Facility Allowance	1	LS	$7,065,000	$7,065,000	34%	$2,366,775	30%	$2,829,533	$12,261,308	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$0		$0		$0		$0
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	0	TF	$225	$0	34%	$0	25%	$0	$0	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$1,898,182		$635,891		$633,518		$3,167,591
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	1	LS	$65,000	$65,000	34%	$21,775	25%	$21,694	$108,469	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	0	TF	$41	$0	34%	$0	25%	$0	$0	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	1	EA	$1,833,182	$1,833,182	34%	$614,116	25%	$611,824	$3,059,122	
100.0	**Fare Collection**						$575,000		$192,625		$153,525		$921,150
100.1		50.06	Ticket Vending - Assume on the Vehicles	0	EA	$53,000	$0	34%	$0	20%	$0	$0	
100.2		50.06	Ticket Vending - At maintenance facility	1	LS	$575,000	$575,000	34%	$192,625	20%	$153,525	$921,150	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	0	EA	$50,000	$0	34%	$0	20%	$0	$0	
110.0	**Vehicles**						$0		$0		$0		$0
110.1		70.01	Vehicles	0	EA	$3,600,000	$0	25%	$0	5%	$0	$0	
110.2		70.07	Spare Parts (10%)	0	EA	$360,000	$0	25%	$0	5%	$0	$0	
120.0	**Right of Way**						$14,312,440		$0		$4,293,732		$18,606,172
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						**Length =**		**0.00 TK-mile**		
			Maintenance Facility - SARTC Site						**Cost/mile (millions)=**				
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	95,832	SF	$45	$4,312,440	0%	$0	30%	$1,293,732	$5,606,172	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	1	LS	$10,000,000	$10,000,000	0%	$0	30%	$3,000,000	$13,000,000	
	TOTALS						$23,850,622		$3,195,291		$7,910,308		$34,956,221
			Unallocated Contingency (10%)										$3,495,622
			TOTAL COST										**$38,451,843**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$381,527						
		80.02	Final Design			6%	$572,291						
		80.03	Project Management for Design and Construction			5%	$476,909						
		80.04	Construction Administration & Management			8%	$763,055						
		80.05	Insurance			2%	$190,764						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$286,145						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$286,145						
		80.08	Start-up Costs & Agency Force Account Work			1%	$95,382						
		80.09	Art Program			1.5%	$143,073						
						33.5%	$3,195,291						

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Maintenance Facility - Raitt Site

Length = 0.00 TK-mile
Cost/mile (millions)=

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$0		$0		$0		$0
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	0	EA	$175,000	$0	34%	$0	20%	$0	$0	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	0	TF	$1,000	$0	34%	$0	20%	$0	$0	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$0		$0		$0		$0
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	0	LF	$40	$0	34%	$0	25%	$0	$0	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	0	SF	$10	$0	34%	$0	25%	$0	$0	
20.7		40.06	Landscape Allowance	0	LS	$500,000	$0	34%	$0	25%	$0	$0	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	0	SF	$12	$0	34%	$0	25%	$0	$0	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$0		$0		$0		$0
30.1		40.06	Lighting Allowance	0	LF	$30	$0	34%	$0	20%	$0	$0	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	0	EA	$350,000	$0	34%	$0	20%	$0	$0	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	0	EA	$60,000	$0	34%	$0	20%	$0	$0	
30.6		50.02	Signing and Striping Allowance	0	LF	$15	$0	34%	$0	20%	$0	$0	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	0	LF	$60	$0	34%	$0	20%	$0	$0	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
40.0	**Utilities**						$0		$0		$0		$0
40.1		40.02	Water Line Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.2		40.02	Water Line Sleeving Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	
40.3		40.02	Sanitary Sewer Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	

Draft

DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Maintenance Facility - Raitt Site

Length = 0.00 TK-mile
Cost/mile (millions)=

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$0		$0		$0		$0
60.1		20.01	Street Car Stop - Side Platform	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$7,065,000		$2,366,775		$2,829,533		$12,261,308
70.1		30.03	Maintenance Facility Allowance	1	LS	$7,065,000	$7,065,000	34%	$2,366,775	30%	$2,829,533	$12,261,308	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$0		$0		$0		$0
80.1		50.03	Traction Power Substation	0	EA	$1,040,000	$0	34%	$0	25%	$0	$0	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	0	LS	$65,500	$0	34%	$0	25%	$0	$0	
80.4		50.04	Overhead Catenary System	0	TF	$225	$0	34%	$0	25%	$0	$0	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$1,898,182		$635,891		$633,518		$3,167,591
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	1	LS	$65,000	$65,000	34%	$21,775	25%	$21,694	$108,469	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	0	TF	$41	$0	34%	$0	25%	$0	$0	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	1	EA	$1,833,182	$1,833,182	34%	$614,116	25%	$611,824	$3,059,122	
100.0	**Fare Collection**						$575,000		$192,625		$153,525		$921,150
100.1		50.06	Ticket Vending - Assume on the Vehicles	0	EA	$53,000	$0	34%	$0	20%	$0	$0	
100.2		50.06	Ticket Vending - At maintenance facility	1	LS	$575,000	$575,000	34%	$192,625	20%	$153,525	$921,150	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	0	EA	$50,000	$0	34%	$0	20%	$0	$0	
110.0	**Vehicles**						$0		$0		$0		$0
110.1		70.01	Vehicles	0	EA	$3,600,000	$0	25%	$0	5%	$0	$0	
110.2		70.07	Spare Parts (10%)	0	EA	$360,000	$0	25%	$0	5%	$0	$0	
120.0	**Right of Way**						$6,604,480		$0		$1,981,344		$8,585,824
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

		Santa Ana and Garden Grove Fixed Guideway											
			ORDER OF MAGNITUDE ESTIMATE						**Length =**		**0.00 TK-mile**		
			Maintenance Facility - Raitt Site						**Cost/mile (millions)=**				
Line NO.	**Base**	**Code**	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Extension**	**E&A %**	**E&A**	**Cont%**	**Allocated Contingency**	**Detail Total**	**Summary Total**
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	104,544	SF	$45	$4,704,480	0%	$0	30%	$1,411,344	$6,115,824	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	1	LS	$1,900,000	$1,900,000	0%	$0	30%	$570,000	$2,470,000	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$16,142,662		$3,195,291		$5,597,920		$24,935,873
			Unallocated Contingency (10%)										$2,493,587
			TOTAL COST										**$27,429,460**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$381,527						
		80.02	Final Design			6%	$572,291						
		80.03	Project Management for Design and Construction			5%	$476,909						
		80.04	Construction Administration & Management			8%	$763,055						
		80.05	Insurance			2%	$190,764						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$286,145						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$286,145						
		80.08	Start-up Costs & Agency Force Account Work			1%	$95,382						
		80.09	Art Program			1.5%	$143,073						
						33.5%	$3,195,291						

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Common Elements (Vehicles, TPS, Fare Collection, and Corrossion Control)

Length = **0.00 TK-mile**

Cost/mile (millions)=

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
10.0	**Guideway Construction**						$0		$0		$0		$0
10.1		10.09	Trackway - Double Track - Direct Fixation	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.2		10.10	Trackway -Single Track (Two-Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.3		10.10	Trackway - Single Couplet (One Way) - Paved	0	TF	$425	$0	34%	$0	20%	$0	$0	
10.4		10.10	Trackway - Double Track - Paved	0	TF	$800	$0	34%	$0	20%	$0	$0	
10.5		10.11	Trackway -Single Track (Two-Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.6		10.11	Trackway - Single Couplet (One Way) - Ballasted	0	TF	$275	$0	34%	$0	20%	$0	$0	
10.7		10.11	Trackway - Double Track - Ballasted	0	TF	$500	$0	34%	$0	20%	$0	$0	
10.8		10.12	Trackway-Special-25M Turnout	0	EA	$175,000	$0	34%	$0	20%	$0	$0	
10.9		10.12	Turnout Ballasted	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
11.0		10.12	#6 Double Crossover	0	EA	$500,000	$0	34%	$0	20%	$0	$0	
11.1		10.12	Trackway - Special Crossing	0	EA	$195,000	$0	34%	$0	20%	$0	$0	
11.2		10.13	Visual, Sound and Vibration Mitigation Allowance (Rad <200')	0	TF	$1,000	$0	34%	$0	20%	$0	$0	
11.3		40.04	Environmental mitigation, e.g.wetland, historic/archeologic, parks (allowance)	0	LS	$2,000,000	$0	34%	$0	20%	$0	$0	
11.4		40.05	Ballast Curb	0	LF	$60	$0	34%	$0	20%	$0	$0	
20.0	**Civil Construction**						$0		$0		$0		$0
20.1		40.01	Embankment (Compacted Fill)	0	CY	$18	$0	34%	$0	25%	$0	$0	
20.2		40.01	Clearing & Grubbing	0	AC	$30,000	$0	34%	$0	25%	$0	$0	
20.3		40.05	Chain Link Fence (H= 8')	0	LF	$20	$0	34%	$0	25%	$0	$0	
20.4		40.05	Concrete Curb	0	LF	$40	$0	34%	$0	25%	$0	$0	
20.5		40.05	PE ROW Security Wall (H= 8')	0	LF	$200	$0	34%	$0	25%	$0	$0	
20.6		40.06	Concrete Sidewalk	0	SF	$10	$0	34%	$0	25%	$0	$0	
20.7		40.06	Landscape Allowance	0	LS	$500,000	$0	34%	$0	25%	$0	$0	
20.8		40.07	Roadway Reconstruction	0	SF	$15	$0	34%	$0	25%	$0	$0	
20.9		40.07	New Roadway Construction	0	SF	$18	$0	34%	$0	25%	$0	$0	
21.0		40.07	Reconstruct Existing Driveways and Parking	0	SF	$8	$0	34%	$0	25%	$0	$0	
21.1		40.07	Pavement Resurfacing	0	SF	$12	$0	34%	$0	25%	$0	$0	
30.0	**Traffic Signals, Signing, Striping & Lighting**						$0		$0		$0		$0
30.1		40.06	Lighting Allowance	0	LF	$30	$0	34%	$0	20%	$0	$0	
30.2		50.01	Gated Crossing (Single)	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
30.3		50.02	Traffic Signals - New (or full Replacement)	0	EA	$350,000	$0	34%	$0	20%	$0	$0	
30.4		50.02	Traffic Signals - Modified	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
30.5		50.02	Traffic Signals - Add New Transit Phase	0	EA	$60,000	$0	34%	$0	20%	$0	$0	
30.6		50.02	Signing and Striping Allowance	0	LF	$15	$0	34%	$0	20%	$0	$0	
30.7		50.02	Pedestrian Signal or Gate	0	EA	$80,000	$0	34%	$0	20%	$0	$0	
30.8		50.02	Temporary Traffic Control	0	LF	$60	$0	34%	$0	20%	$0	$0	
30.9		50.02	Traffic Signal Pole Relocation/ Mast Arm Height Adjustment Allowance	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
40.0	**Utilities**						$0		$0		$0		$0
40.1		40.02	Water Line Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.2		40.02	Water Line Sleeving Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	
40.3		40.02	Sanitary Sewer Relocation Allowance	0	LF	$300	$0	34%	$0	30%	$0	$0	
40.4		40.02	Drainage Improvements - PE ROW	0	LS	$495,000	$0	34%	$0	30%	$0	$0	
40.5		40.02	Drainage Improvements - Raitt St to Flower St	0	LS	$2,193,500	$0	34%	$0	30%	$0	$0	
40.6		40.02	Other Utilities (including private) Relocation Allowance	0	LF	$150	$0	34%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Common Elements (Vehicles, TPS, Fare Collection, and Corrossion Control)

Length = **0.00 TK-mile**

Cost/mile (millions)=

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
40.7		40.02	Drainage Improvements - Santa Ana Blvd. / 4th Street Couplet	0	LS	$3,277,750	$0	34%	$0	30%	$0	$0	
40.8		40.02	Drainage Improvements - Santa Ana & 5th Street/ Civic Center Couplet	0	LS	$2,321,875	$0	34%	$0	30%	$0	$0	
50.0	**Structures**						$0		$0		$0		$0
50.1		40.01	Santa Ana River Bridge - Demoliton	0	LS	$165,000	$0	34%	$0	30%	$0	$0	
50.2		40.05	Westminster Ave - Single Span Bridge - Tied Arch	0	LS	$2,800,000	$0	34%	$0	30%	$0	$0	
50.3		40.05	Santa Ana River Bridge	0	LS	$2,056,000	$0	34%	$0	30%	$0	$0	
50.4		40.05	Santa Ana River Bridge - Ornamental Steal	0	LS	$330,000	$0	34%	$0	30%	$0	$0	
50.5		40.05	Retaining Walls	0	SF	$100	$0	34%	$0	30%	$0	$0	
60.0	**Stations**						$0		$0		$0		$0
60.1		20.01	Street Car Stop - Side Platform	0	EA	$100,000	$0	34%	$0	20%	$0	$0	
60.2		20.01	Street Car Stop - Center Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.3		20.01	Enhanced Station Amenities Allowance	0	LS	$50,000	$0	34%	$0	20%	$0	$0	
60.4		20.01	Pedestrian Access Ramps	0	SF	$15	$0	34%	$0	20%	$0	$0	
60.5		20.01	Pedestrian Stairs	0	SF	$30	$0	34%	$0	20%	$0	$0	
60.6		20.01	Street Car Stop at Terminus - Side Platform	0	EA	$150,000	$0	34%	$0	20%	$0	$0	
60.7		20.01	Street Car Stop at Terminus - Center Platform	0	EA	$200,000	$0	34%	$0	20%	$0	$0	
60.8		40.07	Park & Ride Surface	0	Spc	$5,000	$0	34%	$0	20%	$0	$0	
70.0	**Operations Facility**						$0		$0		$0		$0
70.1		30.03	Maintenance Facility Allowance	0	LS	$7,065,000	$0	34%	$0	30%	$0	$0	
70.2		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
70.3		0.00	0	0	LS	$0	$0	34%	$0	30%	$0	$0	
80.0	**Traction Power System**						$5,265,500		$1,763,943		$1,757,361		$8,786,803
80.1		50.03	Traction Power Substation	5	EA	$1,040,000	$5,200,000	34%	$1,742,000	25%	$1,735,500	$8,677,500	
80.2		50.03	Ttraction Power Substation - Elevated Western Terminus	0	EA	$676,500	$0	34%	$0	25%	$0	$0	
80.3		50.03	Corrossion Protection	1	LS	$65,500	$65,500	34%	$21,943	25%	$21,861	$109,303	
80.4		50.04	Overhead Catenary System	0	TF	$225	$0	34%	$0	25%	$0	$0	
80.5		50.04	Overhead Catenary System - Double Track	0	TF	$260	$0	34%	$0	25%	$0	$0	
90.0	**Communications and Central Control**						$0		$0		$0		$0
90.1		50.05	Communications	0	TF	$0	$0	34%	$0	25%	$0	$0	
90.2		50.05	Radios	0	LS	$65,000	$0	34%	$0	25%	$0	$0	
90.3		50.05	Signal/Substation Buildings	0	EA	$200,000	$0	34%	$0	25%	$0	$0	
90.4		50.05	Interlocking Signal Controls	0	TF	$41	$0	34%	$0	25%	$0	$0	
90.5		50.05	Signal Allowance in Special	0	RF	$250	$0	34%	$0	25%	$0	$0	
90.6		50.05	Interlocking Signal Controls (Maintenance Facility)	0	EA	$1,833,182	$0	34%	$0	25%	$0	$0	
100.0	**Fare Collection**						$0		$0		$0		$0
100.1		50.06	Ticket Vending - Assume on the Vehicles	0	EA	$53,000	$0	34%	$0	20%	$0	$0	
100.2		50.06	Ticket Vending - At maintenance facility	0	LS	$575,000	$0	34%	$0	20%	$0	$0	
100.3		50.06	Ticket Vending - Termnial Stations (2) and Downtown Area (1)	0	EA	$50,000	$0	34%	$0	20%	$0	$0	
110.0	**Vehicles**						$0		$0		$0		$0
110.1		70.01	Vehicles	0	EA	$3,600,000	$0	25%	$0	5%	$0	$0	
110.2		70.07	Spare Parts (10%)	0	EA	$360,000	$0	25%	$0	5%	$0	$0	
120.0	**Right of Way**						$0		$0		$0		$0
120.1		60.01	ROW Encroachments and Partial Takes	0	SF	$35	$0	0%	$0	30%	$0	$0	
120.2		60.01	Western Terminus - Right-of-way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	

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DEIS Concept Plans
Capital Cost Estimate

Santa Ana and Garden Grove Fixed Guideway

ORDER OF MAGNITUDE ESTIMATE

Common Elements (Vehicles, TPS, Fare Collection, and Corrossion Control)

Length = **0.00 TK-mile**
Cost/mile (millions)=

Line NO.	Base	Code	Description	Quantity	Unit	Unit Cost	Extension	E&A %	E&A	Cont%	Allocated Contingency	Detail Total	Summary Total
120.3		60.01	Raitt Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.4		60.01	SARTC Maint Facility Allowance - Right of Way Acquisition Allowance	0	SF	$45	$0	0%	$0	30%	$0	$0	
120.5		60.01	Civic Center Bike Lane ROW Acquisition Allowance	0	LS	$3,013,125	$0	0%	$0	30%	$0	$0	
120.6		60.02	Western Terminus - Cost to Relocate Allowance	0	LS	$731,817	$0	0%	$0	30%	$0	$0	
120.7		60.02	Raitt Maint Facility Allowance - Cost to Relocate	0	LS	$1,900,000	$0	0%	$0	30%	$0	$0	
120.8		60.02	SARTC Maint Facility Allowance - Cost to Relocate Allowance	0	LS	$10,000,000	$0	0%	$0	30%	$0	$0	
	TOTALS						$5,265,500		$1,763,943		$1,757,361		$8,786,803
			Unallocated Contingency (10%)										$878,680
			TOTAL COST										**$9,665,483**
	Professional Services - E&A SCC 10-50 (Reflected in Totals Above)												
		80.01	Preliminary Engineering			4%	$210,620						
		80.02	Final Design			6%	$315,930						
		80.03	Project Management for Design and Construction			5%	$263,275						
		80.04	Construction Administration & Management			8%	$421,240						
		80.05	Insurance			2%	$105,310						
		80.06	Legal, Permits, Review Fees by other agencies, etc.			3%	$157,965						
		80.07	Surveys, Testing, Investigation, Inspection			3%	$157,965						
		80.08	Start-up Costs & Agency Force Account Work			1%	$52,655						
		80.09	Art Program			1.5%	$78,983						
						33.5%	$1,763,943						

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Santa Ana and Garden Grove Fixed Guideway Corridor

APPENDIX C
Order of Magnitude Cost by Permutation

CORDOBA CORPORATION

SANTA ANA AND GARDEN GROVE FIXED GUIDEWAY PROJECT
Conceptual Design Cost Estimate
Western Terminus Elevated Option

Description	IOS OPTIONS											
	SARTC MAINTENANCE FACILIY						RAITT MAINTENANCE FACILITY					
	ALT 1- Opt 1- Scenario A	ALT 1- Opt 2- Scenario A	ALT 1- Opt 1- Scenario B	ALT 1- Opt 1- Scenario C	ALT 2-Opt 1	ALT 2-Opt 2	ALT 1- Opt 1- Scenario A	ALT 1- Opt 2- Scenario A	ALT 1- Opt 1- Scenario B	ALT 1- Opt 1- Scenario C	ALT 2-Opt 1	ALT 2-Opt 2
Guideway Construction	$11,275,975	$11,721,125	$11,275,975	$11,275,975	$14,387,625	$14,387,625	$11,275,975	$11,721,125	$11,275,975	$11,275,975	$14,387,625	$14,387,625
Civil Construction	$9,844,970	$10,058,666	$9,825,846	$10,520,436	$11,343,220	$11,601,552	$9,844,970	$10,058,666	$9,825,846	$10,520,436	$11,343,220	$11,601,552
Traffic Signals, Signing, Striping & Lighting	$4,821,050	$5,191,900	$4,821,050	$4,821,050	$6,465,175	$6,815,175	$4,821,050	$5,191,900	$4,821,050	$4,821,050	$6,465,175	$6,815,175
Utilities	$9,579,750	$9,795,750	$9,579,750	$9,579,750	$8,023,875	$8,023,875	$9,579,750	$9,795,750	$9,579,750	$9,579,750	$8,023,875	$8,023,875
Structures	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Stations	$2,155,000	$2,155,000	$2,155,000	$2,155,000	$2,205,000	$2,205,000	$2,155,000	$2,155,000	$2,155,000	$2,155,000	$2,205,000	$2,205,000
Operations Facility	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000
Traction Power System	$10,664,825	$10,718,375	$10,664,825	$10,664,825	$11,244,875	$11,244,875	$10,664,825	$10,718,375	$10,664,825	$10,664,825	$11,244,875	$11,244,875
Communications and Central Control	$2,882,059	$2,891,817	$2,882,059	$2,882,059	$2,987,757	$2,987,757	$2,882,059	$2,891,817	$2,882,059	$2,882,059	$2,987,757	$2,987,757
Fare Collection	$940,000	$940,000	$940,000	$940,000	$993,000	$993,000	$940,000	$940,000	$940,000	$940,000	$993,000	$993,000
Vehicles	$19,800,000	$19,800,000	$19,800,000	$19,800,000	$23,760,000	$23,760,000	$19,800,000	$19,800,000	$19,800,000	$19,800,000	$23,760,000	$23,760,000
Right of Way	$14,312,440	$14,312,440	$14,312,440	$14,312,440	$17,325,565	$14,312,440	$6,604,480	$6,604,480	$6,604,480	$6,604,480	$9,617,605	$6,604,480
SUBTOTAL[(1)]	$93,341,069	$94,650,073	$93,321,945	$94,016,535	$105,801,092	$103,396,299	$85,633,109	$86,942,113	$85,613,985	$86,308,575	$98,093,132	$95,688,339
E&A (33.5%)												
Preliminary Engineering (4%)	$2,960,190	$3,012,550	$2,959,425	$2,987,209	$3,297,875	$3,322,208	$2,960,190	$3,012,550	$2,959,425	$2,987,209	$3,297,875	$3,322,208
Final Design (6%)	$4,440,285	$4,518,825	$4,439,137	$4,480,813	$4,946,812	$4,983,312	$4,440,285	$4,518,825	$4,439,137	$4,480,813	$4,946,812	$4,983,312
Project Management for Design and Construction (5%)	$3,700,237	$3,765,688	$3,699,281	$3,734,011	$4,122,344	$4,152,760	$3,700,237	$3,765,688	$3,699,281	$3,734,011	$4,122,344	$4,152,760
Construction Administration & Management (8%)	$5,920,380	$6,025,100	$5,918,850	$5,974,417	$6,595,750	$6,644,416	$5,920,380	$6,025,100	$5,918,850	$5,974,417	$6,595,750	$6,644,416
Insurance (2%)	$1,480,095	$1,506,275	$1,479,712	$1,493,604	$1,648,937	$1,661,104	$1,480,095	$1,506,275	$1,479,712	$1,493,604	$1,648,937	$1,661,104
Legal, Permits, Review Fees by other agencies, etc. (3%)	$2,220,142	$2,259,413	$2,219,569	$2,240,406	$2,473,406	$2,491,656	$2,220,142	$2,259,413	$2,219,569	$2,240,406	$2,473,406	$2,491,656
Surveys, Testing, Investigation, Inspection (3%)	$2,220,142	$2,259,413	$2,219,569	$2,240,406	$2,473,406	$2,491,656	$2,220,142	$2,259,413	$2,219,569	$2,240,406	$2,473,406	$2,491,656
Start-up Costs & Agency Force Account Work (1%)	$740,047	$753,138	$739,856	$746,802	$824,469	$830,552	$740,047	$753,138	$739,856	$746,802	$824,469	$830,552
Art Program (1.5%)	$1,110,071	$1,129,706	$1,109,784	$1,120,203	$1,236,703	$1,245,828	$1,110,071	$1,129,706	$1,109,784	$1,120,203	$1,236,703	$1,245,828
E&A SUBTOTAL	$24,791,591	$25,230,107	$24,785,184	$25,017,872	$27,619,702	$27,823,493	$24,791,591	$25,230,107	$24,785,184	$25,017,872	$27,619,702	$27,823,493
Allocated Contingency Subtotal	$25,128,756	$25,525,586	$25,122,374	$25,354,193	$27,683,268	$26,958,999	$22,816,368	$23,213,198	$22,809,986	$23,041,805	$25,370,880	$24,646,611
Unallocated Contingency Subtotal (10%]	$14,326,142	$14,540,577	$14,322,950	$14,438,860	$16,110,406	$15,817,879	$13,324,107	$13,538,542	$13,320,915	$13,436,825	$15,108,371	$14,815,844
TOTAL COST	**$157,587,558**	**$159,946,343**	**$157,552,453**	**$158,827,460**	**$177,214,468**	**$173,996,670**	**$146,565,175**	**$148,923,960**	**$146,530,070**	**$147,805,077**	**$166,192,085**	**$162,974,287**
Length of Alignment (tk ft)	23997	$24,235	$23,997	$23,997	$26,575	$26,575	$23,997	$24,235	$23,997	$23,997	$26,575	$26,575
Cost Per Track Mile (in millions)	$34.67	$35	$35	$35	$35	$35	$32	$32	$30.35	$33	$33	$32

(1) Unit costs are based on 2011 construction costs from projects of a similar nature

SANTA ANA AND GARDEN GROVE FIXED GUIDEWAY PROJECT
Conceptual Design Cost Estimate
Western Terminus Elevated Option

Description	WESTERN TERMINUS ELEVATED OPTION											
	SARTC MAINTENANCE FACILIY						RAITT MAINTENANCE FACILITY					
	ALT 1- Opt 1- Scenario A	ALT 1- Opt 2- Scenario A	ALT 1- Opt 1- Scenario B	ALT 1- Opt 1- Scenario C	ALT 2-Opt 1	ALT 2-Opt 2	ALT 1- Opt 1- Scenario A	ALT 1- Opt 2- Scenario A	ALT 1- Opt 1- Scenario B	ALT 1- Opt 1- Scenario C	ALT 2-Opt 1	ALT 2-Opt 2
Guideway Construction	$16,228,525	$16,673,675	$16,228,525	$16,228,525	$19,340,175	$19,340,175	$16,228,525	$16,673,675	$16,228,525	$16,228,525	$19,340,175	$19,340,175
Civil Construction	$14,027,145	$14,240,841	$14,008,021	$14,702,611	$15,525,395	$15,783,727	$14,027,145	$14,240,841	$14,008,021	$14,702,611	$15,525,395	$15,783,727
Traffic Signals, Signing, Striping & Lighting	$5,683,300	$6,054,150	$5,683,300	$5,683,300	$7,327,425	$7,677,425	$5,683,300	$6,054,150	$5,683,300	$5,683,300	$7,327,425	$7,677,425
Utilities	$10,251,750	$10,467,750	$10,251,750	$10,251,750	$8,695,875	$8,695,875	$10,251,750	$10,467,750	$10,251,750	$10,251,750	$8,695,875	$8,695,875
Structures	$7,401,000	$7,401,000	$7,401,000	$7,401,000	$7,401,000	$7,401,000	$7,401,000	$7,401,000	$7,401,000	$7,401,000	$7,401,000	$7,401,000
Stations	$2,450,000	$2,450,000	$2,450,000	$2,450,000	$2,500,000	$2,500,000	$2,450,000	$2,450,000	$2,450,000	$2,450,000	$2,500,000	$2,500,000
Operations Facility	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000
Traction Power System	$13,137,575	$13,191,125	$13,137,575	$13,137,575	$13,717,625	$13,717,625	$13,137,575	$13,191,125	$13,137,575	$13,137,575	$13,717,625	$13,717,625
Communications and Central Control	$3,276,971	$3,286,729	$3,276,971	$3,276,971	$3,382,669	$3,382,669	$3,276,971	$3,286,729	$3,276,971	$3,276,971	$3,382,669	$3,382,669
Fare Collection	$1,096,000	$1,096,000	$1,096,000	$1,096,000	$1,149,000	$1,149,000	$1,096,000	$1,096,000	$1,096,000	$1,096,000	$1,149,000	$1,149,000
Vehicles	$27,720,000	$27,720,000	$27,720,000	$27,720,000	$31,680,000	$31,680,000	$27,720,000	$27,720,000	$27,720,000	$27,720,000	$31,680,000	$31,680,000
Right of Way	$14,312,440	$14,312,440	$14,312,440	$14,312,440	$17,325,565	$14,312,440	$6,604,480	$6,604,480	$6,604,480	$6,604,480	$9,617,605	$6,604,480
SUBTOTAL(1)	$122,649,706	$123,958,710	$122,630,582	$123,325,172	$135,109,729	$132,704,936	$114,941,746	$116,250,750	$114,922,622	$115,617,212	$127,401,769	$124,996,976
E&A (33.5%)												
Preliminary Engineering (4%)	$4,052,153	$4,104,513	$4,051,388	$4,079,172	$4,389,838	$4,414,171	$4,052,153	$4,104,513	$4,051,388	$4,079,172	$4,389,838	$4,414,171
Final Design (6%)	$6,078,230	$6,156,770	$6,077,083	$6,118,758	$6,584,757	$6,621,257	$6,078,230	$6,156,770	$6,077,083	$6,118,758	$6,584,757	$6,621,257
Project Management for Design and Construction (5%)	$5,065,192	$5,130,642	$5,064,235	$5,098,965	$5,487,298	$5,517,714	$5,065,192	$5,130,642	$5,064,235	$5,098,965	$5,487,298	$5,517,714
Construction Administration & Management (8%)	$8,104,307	$8,209,027	$8,102,777	$8,158,344	$8,779,676	$8,828,343	$8,104,307	$8,209,027	$8,102,777	$8,158,344	$8,779,676	$8,828,343
Insurance (2%)	$2,026,077	$2,052,257	$2,025,694	$2,039,586	$2,194,919	$2,207,086	$2,026,077	$2,052,257	$2,025,694	$2,039,586	$2,194,919	$2,207,086
Legal, Permits, Review Fees by other agencies, etc. (3%)	$3,039,115	$3,078,385	$3,038,541	$3,059,379	$3,292,379	$3,310,629	$3,039,115	$3,078,385	$3,038,541	$3,059,379	$3,292,379	$3,310,629
Surveys, Testing, Investigation, Inspection (3%)	$3,039,115	$3,078,385	$3,038,541	$3,059,379	$3,292,379	$3,310,629	$3,039,115	$3,078,385	$3,038,541	$3,059,379	$3,292,379	$3,310,629
Start-up Costs & Agency Force Account Work (1%)	$1,013,038	$1,026,128	$1,012,847	$1,019,793	$1,097,460	$1,103,543	$1,013,038	$1,026,128	$1,012,847	$1,019,793	$1,097,460	$1,103,543
Art Program (1.5%)	$1,519,557	$1,539,193	$1,519,271	$1,529,689	$1,646,189	$1,655,314	$1,519,557	$1,539,193	$1,519,271	$1,529,689	$1,646,189	$1,655,314
E&A SUBTOTAL	$33,936,784	$34,375,300	$33,930,378	$34,163,065	$36,764,895	$36,968,686	$33,936,784	$34,375,300	$33,930,378	$34,163,065	$36,764,895	$36,968,686
Allocated Contingency Subtotal	$32,882,845	$33,279,675	$32,876,462	$33,108,281	$35,437,356	$34,713,087	$30,570,457	$30,967,287	$30,564,074	$30,795,893	$33,124,968	$32,400,699
Unallocated Contingency Subtotal (10%)	$18,946,933	$19,161,369	$18,943,742	$19,059,652	$20,731,198	$20,438,671	$17,944,899	$18,159,334	$17,941,707	$18,057,617	$19,729,163	$19,436,636
TOTAL COST	**$208,416,268**	**$210,775,054**	**$208,381,164**	**$209,656,170**	**$228,043,178**	**$224,825,380**	**$197,393,885**	**$199,752,671**	**$197,358,781**	**$198,633,788**	**$217,020,796**	**$213,802,997**
Length of Alignment (tk ft)	34329	34567	$34,329	$34,329	36907	36907	34329	34567	$34,329	$34,329	36907	36907
Cost Per Track Mile (in millions)	$32.06	$32.20	$32.05	$32.25	$32.62	$32.16	$30.36	$30.51	$30.35	$30.55	$31.05	$30.59

(1) Unit costs are based on 2011 construction costs from projects of a similar nature

SANTA ANA AND GARDEN GROVE FIXED GUIDEWAY PROJECT
Conceptual Design Cost Estimate
Western Terminus At-Grade Option

Description	WESTERN TERMINUS AT-GRADE OPTION											
	SARTC MAINTENANCE FACILIY						RAITT MAINTENANCE FACILITY					
	ALT 1- Opt 1- Scenario A	ALT 1- Opt 2- Scenario A	ALT 1- Opt 1- Scenario B	ALT 1- Opt 1- Scenario C	ALT 2-Opt 1	ALT 2-Opt 2	ALT 1- Opt 1- Scenario A	ALT 1- Opt 2- Scenario A	ALT 1- Opt 1- Scenario B	ALT 1- Opt 1- Scenario C	ALT 2-Opt 1	ALT 2-Opt 2
Guideway Construction	$17,712,650	$18,157,800	$17,712,650	$17,712,650	$20,824,300	$20,824,300	$17,712,650	$18,157,800	$17,712,650	$17,712,650	$20,824,300	$20,824,300
Civil Construction	$14,652,045	$14,865,741	$14,632,921	$15,327,511	$16,150,295	$16,408,627	$14,652,045	$14,865,741	$14,632,921	$15,327,511	$16,150,295	$16,408,627
Traffic Signals, Signing, Striping & Lighting	$6,069,450	$6,440,300	$6,069,450	$6,069,450	$7,713,575	$8,063,575	$6,069,450	$6,440,300	$6,069,450	$6,069,450	$7,713,575	$8,063,575
Utilities	$10,251,750	$10,467,750	$10,251,750	$10,251,750	$8,695,875	$8,695,875	$10,251,750	$10,467,750	$10,251,750	$10,251,750	$8,695,875	$8,695,875
Structures	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000
Stations	$2,610,000	$2,610,000	$2,610,000	$2,610,000	$2,660,000	$2,660,000	$2,610,000	$2,610,000	$2,610,000	$2,610,000	$2,660,000	$2,660,000
Operations Facility	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000
Traction Power System	$13,476,875	$13,530,425	$13,476,875	$13,476,875	$14,056,925	$14,056,925	$13,476,875	$13,530,425	$13,476,875	$13,476,875	$14,056,925	$14,056,925
Communications and Central Control	$3,338,799	$3,348,557	$3,338,799	$3,338,799	$3,444,497	$3,444,497	$3,338,799	$3,348,557	$3,338,799	$3,338,799	$3,444,497	$3,444,497
Fare Collection	$1,096,000	$1,096,000	$1,096,000	$1,096,000	$1,149,000	$1,149,000	$1,096,000	$1,096,000	$1,096,000	$1,096,000	$1,149,000	$1,149,000
Vehicles	$27,720,000	$27,720,000	$27,720,000	$27,720,000	$31,680,000	$31,680,000	$27,720,000	$27,720,000	$27,720,000	$27,720,000	$31,680,000	$31,680,000
Right of Way	$16,818,607	$16,818,607	$16,818,607	$16,818,607	$19,831,732	$16,818,607	$9,110,647	$9,110,647	$9,110,647	$16,818,607	$12,123,772	$9,110,647
SUBTOTAL[(1)]	$123,512,176	$124,821,180	$123,493,052	$124,187,642	$135,972,199	$133,567,406	$115,804,216	$117,113,220	$115,785,092	$124,187,642	$128,264,239	$125,859,446
E&A (33.5%)												
Preliminary Engineering (4%)	$3,986,405	$4,038,766	$3,985,640	$4,013,424	$4,324,090	$4,348,424	$3,986,405	$4,038,766	$3,985,640	$4,013,424	$4,324,090	$4,348,424
Final Design (6%)	$5,979,608	$6,058,148	$5,978,461	$6,020,136	$6,486,135	$6,522,635	$5,979,608	$6,058,148	$5,978,461	$6,020,136	$6,486,135	$6,522,635
Project Management for Design and Construction (5%)	$4,983,007	$5,048,457	$4,982,051	$5,016,780	$5,405,113	$5,435,530	$4,983,007	$5,048,457	$4,982,051	$5,016,780	$5,405,113	$5,435,530
Construction Administration & Management (8%)	$7,972,811	$8,077,531	$7,971,281	$8,026,848	$8,648,181	$8,696,847	$7,972,811	$8,077,531	$7,971,281	$8,026,848	$8,648,181	$8,696,847
Insurance (2%)	$1,993,203	$2,019,383	$1,992,820	$2,006,712	$2,162,045	$2,174,212	$1,993,203	$2,019,383	$1,992,820	$2,006,712	$2,162,045	$2,174,212
Legal, Permits, Review Fees by other agencies, etc. (3%)	$2,989,804	$3,029,074	$2,989,230	$3,010,068	$3,243,068	$3,261,318	$2,989,804	$3,029,074	$2,989,230	$3,010,068	$3,243,068	$3,261,318
Surveys, Testing, Investigation, Inspection (3%)	$2,989,804	$3,029,074	$2,989,230	$3,010,068	$3,243,068	$3,261,318	$2,989,804	$3,029,074	$2,989,230	$3,010,068	$3,243,068	$3,261,318
Start-up Costs & Agency Force Account Work (1%)	$996,601	$1,009,691	$996,410	$1,003,356	$1,081,023	$1,087,106	$996,601	$1,009,691	$996,410	$1,003,356	$1,081,023	$1,087,106
Art Program (1.5%)	$1,494,902	$1,514,537	$1,494,615	$1,505,034	$1,621,534	$1,630,659	$1,494,902	$1,514,537	$1,494,615	$1,505,034	$1,621,534	$1,630,659
E&A SUBTOTAL	$33,386,146	$33,824,662	$33,379,739	$33,612,427	$36,214,256	$36,418,048	$33,386,146	$33,824,662	$33,379,739	$33,612,427	$36,214,256	$36,418,048
Allocated Contingency Subtotal	$32,636,865	$33,033,695	$32,630,482	$32,862,302	$35,191,377	$34,467,108	$30,324,477	$30,721,307	$30,318,094	$32,862,302	$32,878,989	$32,154,720
Unallocated Contingency Subtotal (10%]	$18,953,519	$19,167,954	$18,950,327	$19,066,237	$20,737,783	$20,445,256	$17,951,484	$18,165,919	$17,948,293	$19,066,237	$19,735,748	$19,443,221
			$0	$0								
TOTAL COST	**$208,488,705**	**$210,847,491**	**$208,453,601**	**$209,728,607**	**$228,115,615**	**$224,897,817**	**$197,466,322**	**$199,825,108**	**$197,431,218**	**$198,706,225**	**$217,093,233**	**$213,875,434**
Length of Alignment (tk ft)	37174	37412	$37,174	$37,174	39752	39752	37174	37412	$37,174	$37,174	39752	39752
Cost Per Track Mile (in millions)	$29.61	$29.76	$29.61	$29.79	$30.30	$29.87	$28.05	$28.20	$28.04	$29.79	$28.84	$28.41

(1) Unit costs are based on 2011 construction costs from projects of a similar nature

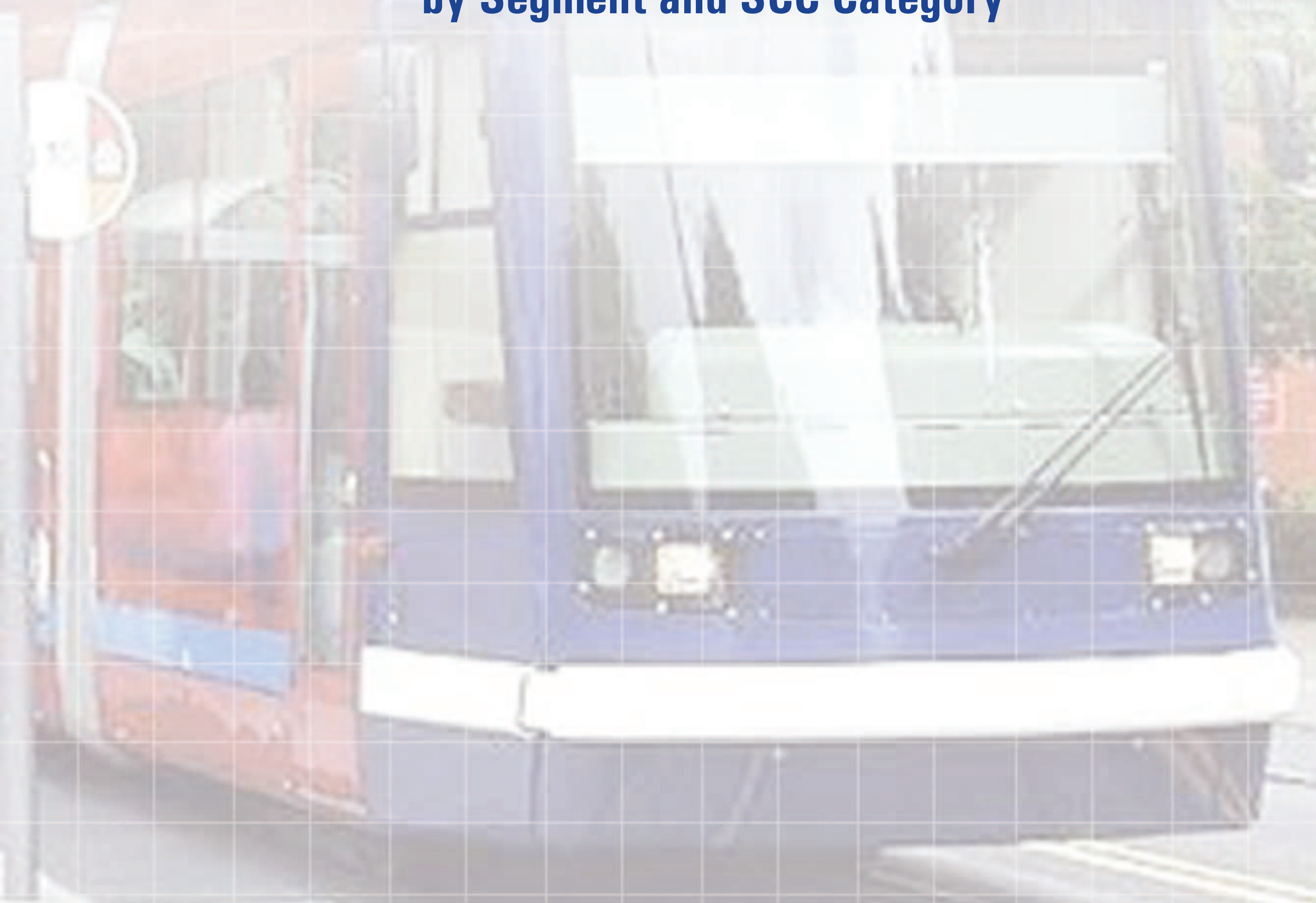
SANTA ANA AND GARDEN GROVE FIXED GUIDEWAY PROJECT
Conceptual Design Cost Estimate
Western Terminus At-Grade Truncated Option

Description	WESTERN TERMINUS AT-GRADE TRUNCATED OPTION											
	SARTC MAINTENANCE FACILIY						RAITT MAINTENANCE FACILITY					
	ALT 1- Opt 1- Scenario A	ALT 1- Opt 2- Scenario A	ALT 1- Opt 1- Scenario B	ALT 1- Opt 1- Scenario C	ALT 2-Opt 1	ALT 2-Opt 2	ALT 1- Opt 1- Scenario A	ALT 1- Opt 2- Scenario A	ALT 1- Opt 1- Scenario B	ALT 1- Opt 1- Scenario C	ALT 2-Opt 1	ALT 2-Opt 2
Guideway Construction	$15,693,350	$16,138,500	$15,693,350	$15,693,350	$18,805,000	$18,805,000	$15,693,350	$16,138,500	$15,693,350	$15,693,350	$18,805,000	$18,805,000
Civil Construction	$14,070,405	$14,284,101	$14,051,281	$14,745,871	$15,568,655	$15,826,987	$14,070,405	$14,284,101	$14,051,281	$14,745,871	$15,568,655	$15,826,987
Traffic Signals, Signing, Striping & Lighting	$6,031,800	$6,402,650	$6,031,800	$6,031,800	$7,675,925	$8,025,925	$6,031,800	$6,402,650	$6,031,800	$6,031,800	$7,675,925	$8,025,925
Utilities	$10,251,750	$10,467,750	$10,251,750	$10,251,750	$8,695,875	$8,695,875	$10,251,750	$10,467,750	$10,251,750	$10,251,750	$8,695,875	$8,695,875
Structures	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000	$2,701,000
Stations	$2,350,000	$2,350,000	$2,350,000	$2,350,000	$2,400,000	$2,400,000	$2,350,000	$2,350,000	$2,350,000	$2,350,000	$2,400,000	$2,400,000
Operations Facility	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000	$7,065,000
Traction Power System	$12,980,750	$13,034,300	$12,980,750	$12,980,750	$13,560,800	$13,560,800	$12,980,750	$13,034,300	$12,980,750	$12,980,750	$13,560,800	$13,560,800
Communications and Central Control	$3,248,394	$3,258,152	$3,248,394	$3,248,394	$3,354,092	$3,354,092	$3,248,394	$3,258,152	$3,248,394	$3,248,394	$3,354,092	$3,354,092
Fare Collection	$1,096,000	$1,096,000	$1,096,000	$1,096,000	$1,149,000	$1,149,000	$1,096,000	$1,096,000	$1,096,000	$1,096,000	$1,149,000	$1,149,000
Vehicles	$27,720,000	$27,720,000	$27,720,000	$27,720,000	$31,680,000	$31,680,000	$27,720,000	$27,720,000	$27,720,000	$27,720,000	$31,680,000	$31,680,000
Right of Way	$14,350,520	$14,350,520	$14,350,520	$14,350,520	$17,363,645	$14,350,520	$6,642,560	$6,642,560	$6,642,560	$6,642,560	$9,655,685	$6,642,560
SUBTOTAL[(1)]	$117,558,969	$118,867,973	$117,539,845	$118,234,435	$130,018,992	$127,614,199	$109,851,009	$111,160,013	$109,831,885	$110,526,475	$122,311,032	$119,906,239
E&A (33.5%)												
Preliminary Engineering (4%)	$3,847,001	$3,899,361	$3,846,236	$3,874,019	$4,184,686	$4,209,019	$3,847,001	$3,899,361	$3,846,236	$3,874,019	$4,184,686	$4,209,019
Final Design (6%)	$5,770,501	$5,849,041	$5,769,354	$5,811,029	$6,277,028	$6,313,528	$5,770,501	$5,849,041	$5,769,354	$5,811,029	$6,277,028	$6,313,528
Project Management for Design and Construction (5%)	$4,808,751	$4,874,201	$4,807,795	$4,842,524	$5,230,857	$5,261,274	$4,808,751	$4,874,201	$4,807,795	$4,842,524	$5,230,857	$5,261,274
Construction Administration & Management (8%)	$7,694,001	$7,798,722	$7,692,471	$7,748,039	$8,369,371	$8,418,038	$7,694,001	$7,798,722	$7,692,471	$7,748,039	$8,369,371	$8,418,038
Insurance (2%)	$1,923,500	$1,949,680	$1,923,118	$1,937,010	$2,092,343	$2,104,509	$1,923,500	$1,949,680	$1,923,118	$1,937,010	$2,092,343	$2,104,509
Legal, Permits, Review Fees by other agencies, etc. (3%)	$2,885,250	$2,924,521	$2,884,677	$2,905,514	$3,138,514	$3,156,764	$2,885,250	$2,924,521	$2,884,677	$2,905,514	$3,138,514	$3,156,764
Surveys, Testing, Investigation, Inspection (3%)	$2,885,250	$2,924,521	$2,884,677	$2,905,514	$3,138,514	$3,156,764	$2,885,250	$2,924,521	$2,884,677	$2,905,514	$3,138,514	$3,156,764
Start-up Costs & Agency Force Account Work (1%)	$961,750	$974,840	$961,559	$968,505	$1,046,171	$1,052,255	$961,750	$974,840	$961,559	$968,505	$1,046,171	$1,052,255
Art Program (1.5%)	$1,442,625	$1,462,260	$1,442,338	$1,452,757	$1,569,257	$1,578,382	$1,442,625	$1,462,260	$1,442,338	$1,452,757	$1,569,257	$1,578,382
E&A SUBTOTAL	$32,218,630	$32,657,147	$32,212,224	$32,444,912	$35,046,741	$35,250,532	$32,218,630	$32,657,147	$32,212,224	$32,444,912	$35,046,741	$35,250,532
Allocated Contingency Subtotal	$30,887,936	$31,284,766	$30,881,554	$31,113,373	$33,442,448	$32,718,179	$28,575,548	$28,972,378	$28,569,166	$28,800,985	$31,130,060	$30,405,791
Unallocated Contingency Subtotal (10%)	$18,066,554	$18,280,989	$18,063,362	$18,179,272	$19,850,818	$19,558,291	$17,064,519	$17,278,954	$17,061,327	$17,177,237	$18,848,783	$18,556,256
TOTAL COST	**$198,732,089**	**$201,090,875**	**$198,696,985**	**$199,971,992**	**$218,359,000**	**$215,141,202**	**$187,709,707**	**$190,068,492**	**$187,674,602**	**$188,949,609**	**$207,336,617**	**$204,118,819**
Length of Alignment (tk ft)	33832	34070	$33,832	$33,832	36410	36410	33832	34070	$33,832	$33,832	36410	36410
Cost Per Track Mile (in millions)	$31.02	$31.16	$31.01	$31.21	$31.67	$31.20	$29.29	$29.46	$29.29	$29.49	$30.07	$29.60

(1) Unit costs are based on 2011 construction costs from projects of a similar nature

Santa Ana and Garden Grove Fixed Guideway Corridor

APPENDIX D
Order of Magnitude Cost Summaries by Segment and SCC Category



CORDOBA CORPORATION

OCTA

DOWNTOWN ORANGE COUNTY SANTA ANA

GARDEN GROVE

SANTA ANA AND GARDEN GROVE FIXED GUIDEWAY PROJECT
Conceptual Design Cost Estimate
Summary by Segment and by SCC Categries

Description	WESTERN TERMINUS			PE ROW Segment	PE ROW-IOS	Raitt to Flower Segment	DOWNTOWN SEG - ALT 1				DOWNTOWN SEG - ALT 2		MAINTENANCE FACILITY		COMMON ELEMENTS INCLUDE TPS AND CORROSION CONTROL	Common Elements[3]
	At Grade	At Grade (Truncated)	Elevated[1]				Alt 1- Opt 1- Scenario A	Alt 1- Option 2- Scenario A	Alt 1- Option 1- Scenario B	Alt 1- Option 1- Scenario C	Alt 2[2]- Option 1	Alt 2- Option 2[2]	SARTC	Raitt		
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**$3,059,868**	**$501,415**	**$1,179,482**	**$5,538,057**	**$442,658**	**$5,348,007**	**$8,495,995**	**$9,060,000**	**$8,495,995**	**$8,495,995**	**$12,438,456**	**$12,438,456**	**$0**	**$0**		**$0**
10.01 Guideway: At-grade exclusive right-of-way																
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)																
10.03 Guideway: At-grade in mixed traffic																
10.04 Guideway: Aerial structure																
10.05 Guideway: Built-up fill																
10.06 Guideway: Underground cut & cover																
10.07 Guideway: Underground tunnel																
10.08 Guideway: Retained cut or fill																
10.09 Track: Direct fixation	$0	$0	$118,465	$188,466	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		$0
10.10 Track: Embedded	$1,152,463	$0	$0	$3,949,714	$107,695	$5,147,821	$7,491,264	$7,619,421	$7,491,264	$7,491,264	$8,879,453	$8,879,453	$0	$0		$0
10.11 Track: Ballasted	$626,468	$254,350	$427,517	$766,377	$113,238	$0	$0	$0	$0	$0	$0	$0	$0	$0		$0
10.12 Track: Special (switches, turnouts)	$633,500	$247,065	$633,500	$633,500	$221,725	$0	$221,725	$221,725	$221,725	$221,725	$1,133,965	$1,133,965	$0	$0		$0
10.13 Track: Vibration and noise dampening	$647,437	$0	$0	$0	$0	$200,186	$783,006	$1,218,854	$783,006	$783,006	$2,425,038	$2,425,038	$0	$0		$0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**$253,400**	**$253,400**	**$380,100**	**$696,850**	**$380,100**	**$253,400**	**$1,773,800**	**$1,773,800**	**$1,773,800**	**$1,773,800**	**$1,837,150**	**$1,837,150**	**$0**	**$0**		**$0**
20.01 At-grade station, stop, shelter, mall, terminal, platform	$253,400	$253,400	$380,100	$696,850	$380,100	$253,400	$1,773,800	$1,773,800	$1,773,800	$1,773,800	$1,837,150	$1,837,150	$0	$0		$0
20.02 Aerial station, stop, shelter, mall, terminal, platform																
20.03 Underground station, stop, shelter, mall, terminal, platform																
20.04 Other stations, landings, terminals: Intermodal, ferry, trolly, etc.																
20.05 Joint development																
20.06 Automobile parking multi-story structure																
20.07 Elevators, escalators																
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$9,894,533**	**$9,894,533**		**$0**
30.01 Administration Building: Office, sales, storage, revenue counting																
30.02 Light Maintenance Facility																
30.03 Heavy Maintenance Facility	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$9,894,533	$9,894,533		$0
30.04 Storage or Maintenance of Way Building																
30.05 Yard and Yard Track																
40 SITEWORK & SPECIAL CONDITIONS	**$1,295,823**	**$154,531**	**$6,681,084**	**$10,336,470**	**$448,824**	**$10,062,843**	**$16,390,895**	**$16,963,216**	**$16,365,388**	**$17,291,797**	**$16,191,178**	**$16,535,728**	**$0**	**$0**		**$0**
40.01 Demolition, Clearing, Earthwork	$14,405	$0	$12,004	$413,940	$20,006	$0	$0	$0	$0	$0	$0	$0	$0	$0		$0
40.02 Site Utilities, Utility Relocation	$73,526	$73,526	$73,526	$867,610	$0	$4,628,653	$8,787,787	$9,090,295	$8,787,787	$8,787,787	$6,608,784	$6,608,784	$0	$0		$0
40.03 Haz. Mat'l, contam'd soil removal/mitigation, ground water treatments																
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		$0
40.05 Site structures including retaining walls, sound walls	$22,674	$2,668	$6,582,350	$7,431,280	$29,343	$0	$85,840	$149,060	$84,240	$141,431	$0	$0	$0	$0		$0
40.06 Pedestrian / bike access and accommodation, landscaping	$185,189	$18,319	$13,204	$1,071,168	$76,390	$31,623	$1,173,179	$1,191,825	$1,292,549	$2,161,767	$429,374	$375,464	$0	$0		$0
40.07 Automobile, bus, van accessways including roads, parking lots	$1,000,030	$60,019	$0	$552,473	$323,085	$5,402,568	$6,344,089	$6,532,035	$6,200,812	$6,200,812	$9,153,019	$9,551,480	$0	$0		$0
40.08 Temporary Facilities and other indirect costs during construction																
50 SYSTEMS	**$1,593,874**	**$799,997**	**$603,826**	**$4,689,697**	**$186,258**	**$5,066,647**	**$9,799,107**	**$10,368,615**	**$9,799,107**	**$9,799,107**	**$12,882,986**	**$13,326,436**	**$3,260,225**	**$3,260,225**		**$7,022,861**
50.01 Train control and signals	$0	$0	$0	$1,013,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		$0
50.02 Traffic signals and crossing protection	$489,252	$477,659	$34,209	$37,060	$0	$1,674,974	$4,400,988	$4,886,059	$4,400,988	$4,400,988	$6,503,099	$6,946,549	$0	$0		$0
50.03 Traction power supply: substations	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		$7,022,861
50.04 Traction power supply: catenary and third rail	$880,775	$219,068	$428,234	$3,027,346	$157,549	$2,868,896	$4,174,904	$4,246,327	$4,174,904	$4,174,904	$4,948,546	$4,948,546	$0	$0		$0
50.05 Communications	$160,497	$39,919	$78,034	$477,389	$28,709	$522,777	$760,760	$773,775	$760,760	$760,760	$901,735	$901,735	$2,531,700	$2,531,700		$0
50.06 Fare collection system and equipment	$63,350	$63,350	$63,350	$134,302	$0	$0	$462,455	$462,455	$462,455	$462,455	$529,606	$529,606	$728,525	$728,525		$0
50.07 Central Control																
CONSTRUCTION SUBTOTAL (10-50)	**$6,202,965**	**$1,709,343**	**$8,844,492**	**$21,261,073**	**$1,457,840**	**$20,730,897**	**$36,459,797**	**$38,165,631**	**$36,434,291**	**$37,360,700**	**$43,349,770**	**$44,137,770**	**$13,154,758**	**$13,154,758**		**$7,022,861**
60 ROW, LAND, EXISTING IMPROVEMENTS	**$3,258,017**	**$49,504**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$3,917,063**	**$0**	**$18,606,172**	**$8,585,824**		**$0**
60.01 Purchase or lease of real estate	$2,306,655	$49,504	$0	$0	$0	$0	$0	$0	$0	$0	$3,917,063	$0	$5,606,172	$6,115,824		$0

SANTA ANA AND GARDEN GROVE FIXED GUIDEWAY PROJECT

Conceptual Design Cost Estimate

Summary by Segment and by SCC Categries

Description	WESTERN TERMINUS			PE ROW Segment	PE ROW-IOS	Raitt to Flower Segment	DOWNTOWN SEG - ALT 1				DOWNTOWN SEG - ALT 2		MAINTENANCE FACILITY		Common Elements(3)
	At Grade	At Grade (Truncated)	Elevated(1)				Alt 1- Opt 1- Scenario A	Alt 1- Option 2- Scenario A	Alt 1- Option 1- Scenario B	Alt 1- Option 1- Scenario C	Alt 2(2)- Option 1	Alt 2- Option 2(2)	SARTC	Raitt	
60.02 Relocation of existing households and businesses	$951,362	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$13,000,000	$2,470,000	$0
70 VEHICLES (number)	**$0**	**$0**	**$0**	**$8,415,000**	**$0**	**$0**	**$21,037,500**	**$21,037,500**	**$21,037,500**	**$21,037,500**	**$25,245,000**	**$25,245,000**	**$0**	**$0**	**$0**
70.01 Light Rail	$0	$0	$0	$7,650,000	$0	$0	$19,125,000	$19,125,000	$19,125,000	$19,125,000	$22,950,000	$22,950,000	$0	$0	$0
70.02 Heavy Rail															
70.03 Commuter Rail															
70.04 Bus															
70.05 Other															
70.06 Non-revenue venhicles															
70.07 Spare parts	$0	$0	$0	$765,000	$0	$0	$1,912,500	$1,912,500	$1,912,500	$1,912,500	$2,295,000	$2,295,000	$0	$0	$0
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	**$1,613,196**	**$445,681**	**$2,163,834**	**$7,362,765**	**$381,406**	**$5,247,886**	**$14,203,066**	**$14,641,582**	**$14,196,659**	**$14,429,347**	**$17,031,177**	**$17,234,968**	**$3,195,291**	**$3,195,291**	**$1,763,943**
80.01 Preliminary Engineering	$192,620	$53,216	$258,368	$879,136	$45,541	$626,613	$1,695,888	$1,748,249	$1,695,123	$1,722,907	$2,033,573	$2,057,907	$381,527	$381,527	$210,620
80.02 Final Design	$288,931	$79,823	$387,552	$1,318,704	$68,312	$939,920	$2,543,833	$2,622,373	$2,542,685	$2,584,361	$3,050,360	$3,086,860	$572,291	$572,291	$315,930
80.03 Project Management for Design and Construction	$240,776	$66,520	$322,960	$1,098,920	$56,926	$783,267	$2,119,861	$2,185,311	$2,118,904	$2,153,634	$2,541,967	$2,572,383	$476,909	$476,909	$263,275
80.04 Construction Administration & Management	$385,241	$106,431	$516,737	$1,758,272	$91,082	$1,253,226	$3,391,777	$3,496,497	$3,390,247	$3,445,814	$4,067,147	$4,115,813	$763,055	$763,055	$421,240
80.05 Professional Liability and other Non-Construction Insurance	$96,310	$26,608	$129,184	$439,568	$22,771	$313,307	$847,944	$874,124	$847,562	$861,454	$1,016,787	$1,028,953	$190,764	$190,764	$105,310
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.	$144,465	$39,912	$193,776	$659,352	$34,156	$469,960	$1,271,916	$1,311,186	$1,271,343	$1,292,180	$1,525,180	$1,543,430	$286,145	$286,145	$157,965
80.07 Surveys, Testing, Investigation, Inspection	$144,465	$39,912	$193,776	$659,352	$34,156	$469,960	$1,271,916	$1,311,186	$1,271,343	$1,292,180	$1,525,180	$1,543,430	$286,145	$286,145	$157,965
80.08 Start up	$48,155	$13,304	$64,592	$219,784	$11,385	$156,653	$423,972	$437,062	$423,781	$430,727	$508,393	$514,477	$95,382	$95,382	$52,655
80.09 Art Program	$72,233	$19,956	$96,888	$329,676	$17,078	$234,980	$635,958	$655,593	$635,671	$646,090	$762,590	$771,715	$143,073	$143,073	$78,983
Subtotal (10-80)	**$11,074,178**	**$2,204,528**	**$11,008,327**	**$37,038,838**	**$1,839,246**	**$25,978,783**	**$71,700,363**	**$73,844,714**	**$71,668,450**	**$72,827,547**	**$89,543,009**	**$86,617,738**	**$34,956,221**	**$24,935,873**	**$8,786,803**
90 UNALLOCATED CONTINGENCY	**$1,107,418**	**$220,453**	**$1,100,833**	**$3,703,884**	**$183,925**	**$2,597,878**	**$7,170,036**	**$7,384,471**	**$7,166,845**	**$7,282,755**	**$8,954,301**	**$8,661,774**	**$3,495,622**	**$2,493,587**	**$878,680**
Subtotal (10-90)	**$12,181,596**	**$2,424,981**	**$12,109,159**	**$40,742,722**	**$2,023,171**	**$28,576,661**	**$78,870,399**	**$81,229,185**	**$78,835,295**	**$80,110,302**	**$98,497,310**	**$95,279,512**	**$38,451,843**	**$27,429,460**	**$9,665,483**
100 FINANCE CHARGES															
Total Summary Cost (10-100)	**$12,181,596**	**$2,424,981**	**$12,109,159**	**$40,742,722**	**$2,023,171**	**$28,576,661**	**$78,870,399**	**$81,229,185**	**$78,835,295**	**$80,110,302**	**$98,497,310**	**$95,279,512**	**$38,451,843**	**$27,429,460**	**$9,665,483**

FOOTNOTES:

(1) Estimate includes cost of one additional TPS Station

(2) Estimate includes the cost of one additional vehicle

(3) Common Elements includes Vehicles, TPS, Fare Collection, and Corrosion Control

(4) Unit costs are based on 2011 construction costs from projects of a similar nature

ASSUMPTIONS: See Capital Cost Estimate Tech Report for information on assumptions

ALTERNATIVE DESCRIPTIONS:

Alt 1 - Option 1 - Scenario A	Santa Ana Blvd and 4th Street couplet with access through Sascer Park (conversion of parking on southside of 4th Street from angled to parallel)
Alt 1 - Option 2 - Scenario A	Santa Ana Blvd and 4th Street couplet with Sascer Park avoidance (conversion of parking on southside of 4th Street from angled to parallel)
Alt 1 - Option 1 - Scenario B	Santa Ana Blvd and 4th Street couplet with removal of parking on southside of 4th Street only
Alt 1 - Scenario C	Santa Ana Blvd and 4th Street couplet with removal of parking on northside and southside of 4th Street
Alt 2 - Option 1	Civic Center Drive and Santa Ana Blvd/5th Street couplet with Bike Path ROW impacts on Civic Center Drive
Alt 2 - Option 2	Civic Center Drive and Santa Ana Blvd/5th Street couplet with limited Bike Path ROW impacts on Civic Center Drive

APPENDIX D: Operations and Maintenance Cost Estimates and Methodology

Operations and Maintenance Cost Estimates and Methodologies

in support of the

SANTA ANA AND GARDEN GROVE FIXED GUIDEWAY CORRIDOR STUDY

Santa Ana Regional Transportation Center (SARTC) to Harbor Boulevard

Prepared for
City of Santa Ana
in cooperation with
City of Garden Grove
Orange County Transportation Authority

Prepared by
Cordoba Corporation
2677 North Main Street, Suite 240
Santa Ana, CA 92705

March 15, 2012

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1. INTRODUCTION

This technical memorandum documents the methodology and results for estimating the operating and maintenance (O&M) costs for the Santa Ana-Garden Grove Fixed Guideway Project. O&M cost estimates have been prepared for the Transportation System Management (TSM) alternative and each of the two Streetcar alternatives using the methodologies described in this technical memorandum, and based on O&M cost information obtained from the Orange County Transportation Authority (OCTA) and other agencies nationwide that operate streetcar systems.

1.1 Purpose

As described by the Federal Transit Administration (FTA), the projection of O&M costs is an important part of project planning. O&M cost projections are important for two reasons:

- Cost Effectiveness Measures. The projection of design-year O&M costs is a critical input to the determination of the New Starts measures of cost effectiveness.
- Financial Planning. The projections of annual O&M costs are vital to the development of financial plans that cover multiple years of construction and operations of the project.

The FTA requires the use of a resource-driven allocated cost model for O&M costing in a New Starts project. Resource-driven models assign specific costs to specific service characteristics (e.g., train operator costs assigned to annual revenue train-hours). Costs for that particular item (e.g., train operators) are then determined by each alternative's service characteristics (e.g., annual revenue train hours). The Santa Ana-Garden Grove Fixed Guideway Project is not yet in the FTA Major Capital Investments (Section 5309 – New Starts & Small Starts) program. However, the proposed O&M cost methodology has been defined in a manner that is consistent with FTA New Starts requirements.

1.3 Project Description

The purpose of the Santa Ana and Garden Grove Fixed Guideway project is to address the mobility needs of residents, workers, and visitors traveling to, from and within the study area by providing direct, more frequent, and more reliable public transportation service. A "fixed guideway" refers to any transit service that uses exclusive or controlled rights-of-way or rails.

A key aspect of the project is to improve livability and walkability within the communities that comprise this transit corridor, which links the cities of Santa Ana and Garden Grove. The localities recognize that livability is dependent on integrating transportation solutions with sound land use decisions, economic development, and housing opportunities. The cities of Santa Ana and Garden Grove have thus taken active steps to promote transit-oriented types of development and have targeted these efforts within the corridor. As currently envisioned, the project would involve a major investment in transportation infrastructure that would, in turn, reinforce economic development policies and initiatives within the corridor study area in a manner that is both environmentally responsible and sustainable.

The proposed project would operate in an east-west direction along a four-mile transit corridor through central Orange County and would provide direct access from the Santa Ana Regional Transportation Center (SARTC) to Santa Ana's downtown area and Civic Center district where city, county, state and federal government offices and courthouses are located. It would connect neighborhoods to the west of the Civic Center, which are currently underserved by public transit with access to education and employment opportunities, goods and services. It would also provide access to several redeveloping, transit-oriented areas within both cities.

1.4 Corridor Study Area

The Santa Ana and Garden Grove Fixed Guideway Corridor is located in central Orange County within the cities of Santa Ana and Garden Grove. The Fixed Guideway Corridor encompasses the SARTC/Metrolink Station as well as a portion of the Pacific Electric Right-of-Way (PE ROW), which was formerly used for streetcar operations between Los Angeles and Santa Ana (see Figure 1-1).

The corridor study area is generally defined by Westminster Avenue/17th Street on the north, Harbor Boulevard on the west, 1st Street on the south and Grand Avenue on the east (see Figure 1-2).

Figure 1-1: Location Map

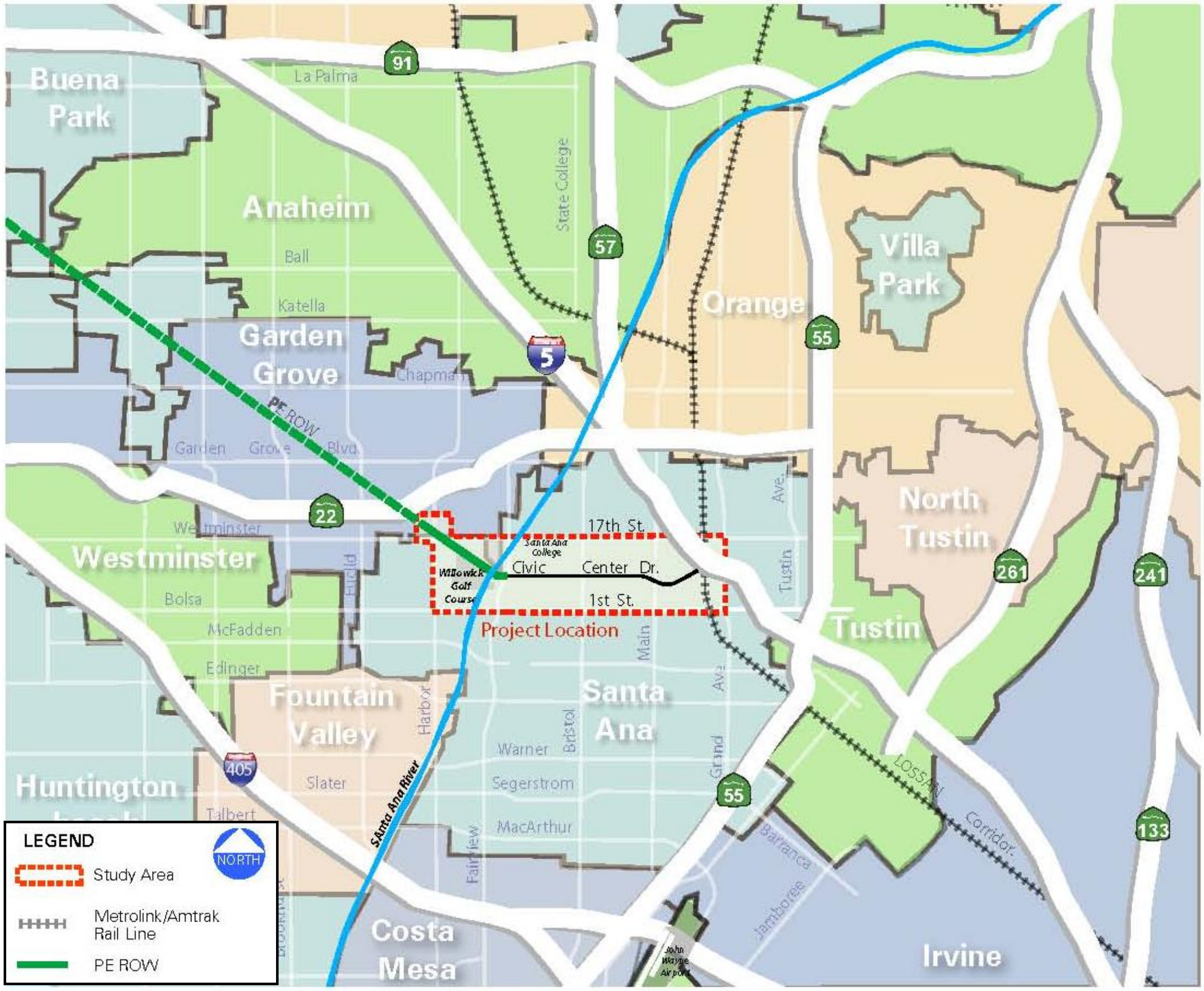


Figure 1-2: Study Area

LEGEND

- Study Area
- Metrolink/Amtrak Rail Line
- PE ROW

2. DETAILED DEFINITION OF ALTERNATIVES

The Reduced Set of Alternatives for the Santa Ana-Garden Grove Fixed Guideway Project consists of:

- No Build Alternative
- TSM Alternative
- Streetcar Alternative 1 (Santa Ana Boulevard and 4th Street Couplet)
- Streetcar Alternative 2 (Santa Ana Boulevard/5th Street and Civic Center Drive Couplet)

2.1 No Build Alternative

The No Build Alternative includes existing conditions as well as conditions that would be reasonably expected to occur in the foreseeable future without implementation of the proposed Project. Conditions in the foreseeable future (through planning horizon year 2035) include other projects that (1) have environmental analysis approved by an implementing agency and (2) have a funding source identified for implementation. The No Build Alternative provides the basis for comparing future conditions resulting from other alternatives proposed by the Project.

Other projects in the foreseeable future fall within two basic classifications: (1) transit improvements and (2) roadway improvements.

2.1.1 Transit Improvements

The Orange County Transportation Authority (OCTA), Metrolink, and Amtrak, all provide transit service within the study area. This service consists of both local bus service and commuter passenger rail. Through their long-term planning efforts, these transit operators have defined a number of transit improvements that are anticipated to be in place by the year 2035. These consist of modest improvements/adjustments to existing local bus routes; expanded Metrolink service, and three, new bus rapid transit (BRT) routes. Future transit improvements that relate to the study area and that are included in the No Build Alternative are listed in Table 2-1.

2.1.2 Roadway Improvements

The City of Santa Ana has plans to improve and add capacity to two key roadways in the direct vicinity of the study area. These projects are considered to be part of the No Build Alternative and are described as follows:

- Bristol Street Widening: The Bristol Street Widening project will widen Bristol Street from four to six lanes between Warner Avenue and Memory Lane.
- Grand Avenue Widening: The Grand Avenue Widening project will widen Grand Avenue from four to six lanes between First Street and 17th Street.

Table 2-1: Future Transit Network - Changes between Existing Conditions and the No Build Alternative

OPERATOR	ROUTE GROUP NO.	ROUTE ID AND DESCRIPTION	EXISTING		NO BUILD	
			PEAK HEADWAY (MIN)	OFF-PEAK HEADWAY (MIN)	PEAK HEADWAY (MIN)	OFF-PEAK HEADWAY (MIN)
OCTA	Local – 43	Harbor Blvd.	15	15	20	20
OCTA	Local – 43	Harbor Blvd. - Short-turn[1] (Disneyland to Sunflower)	--	--	40	40
OCTA	Local – 47	Fairview-Anaheim	15	15	15	15
OCTA	Local – 51	Flower	30	45	30	45
OCTA	Local – 53	Main - Short turn	18	18	15	15
OCTA	Local – 53	Main (Costa Mesa-Santa Ana-Orange)	30	36	30	36
OCTA	Local – 55	Santa Ana Civic Center to Newport Beach	20	30	20	30
OCTA	Local – 56	Garden Grove - La Veta	40	40	40	40
OCTA	Local – 57	State College - Bristol Short turn	18	30	60	60
OCTA	Local – 57	State College - Bristol	33	24	20	20
OCTA	Local – 59	Grand-Glassell-Kraemer - Short turn	22	54	15	45
OCTA	Local – 59	Grand-Glassell-Kraemer	--	64	--	60
OCTA	Local – 60	Westminster/Seventeenth	19	21	30	30
OCTA	Local – 60	Westminster/Seventeenth - Short turn (SARTC to Santa Ana College)	21	28	30	60
OCTA	Local – 64	Bolsa-First	45	--	45	--
OCTA	Local – 64	Bolsa-First Short turn	20	17	20	17
OCTA	Local - 83	Laguna Hills-Disneyland	30	30	30	30
OCTA	Local - 83	Laguna Hills-Flower (SA) - Short turn	40		40	

OPERATOR	ROUTE GROUP NO.	ROUTE ID AND DESCRIPTION	EXISTING		NO BUILD	
			PEAK HEADWAY (MIN)	OFF-PEAK HEADWAY (MIN)	PEAK HEADWAY (MIN)	OFF-PEAK HEADWAY (MIN)
OCTA	Community – 145	Santa Ana to Costa Mesa (via Raitt St./Greenville St./ Fairview St.)	45	45	45	45
OCTA	Intracounty Express –206	Santa Ana to Lake Forest Express (via 5 Fwy.)	60	--	60	--
Contractor	StationLink – 462	SARTC to Civic Center (via Santa Ana Blvd./Civic Center Dr.)	19	--	20	--
Contractor	StationLink – 463	SARTC to Hutton Centre (via Grand Ave.)	23	--	25	--
Contractor	StationLink – 464	SARTC to Costa Mesa (via 5 Fwy./55 Fwy./Sunflower Ave.)	19	--	20	--
OCTA	Intercounty Express – 757	Pomona to Santa Ana Express (via 57 Fwy.)	90	--	90	--
OCTA	BRT – Harbor Line	Harbor Blvd. BRT	--	--	10	15
OCTA	BRT – Westminster/17th St.	Westminster/Seventeenth St. BRT	--	--	10	15
OCTA	BRT – Westminster/17th St. East Line	Westminster/Seventeenth BRT East (SARTC to Tustin - Short turn)	--	--	20	30
OCTA	BRT – Bristol Line	State College Bristol BRT	--	--	10	15
Metrolink	Commuter Rail – OC Line	Los Angeles to Oceanside	30	120+	20	120+
Metrolink	Commuter Rail – IEOC Line	San Bernardino to Oceanside	40	120+	30	120+
Amtrak	Intercity Rail – Pacific Surfliner	San Luis Obispo to San Diego	60	120+	60	120+

Source: Cordoba Corporation / Cambridge Systematics, Inc., May 2011.

Note: [1]Short turn trips do not offer service along the entire length of a route and either (1) do not start at the beginning of the route or (2) do not go to the end of the route.

2.2 Transportation System Management Alternative

In keeping with federal guidance, a Transportation System Management (TSM) Alternative has been defined. The TSM Alternative represents the best that can be done for mobility, given the existing transportation infrastructure, without construction of major new transportation facilities or physical capacity improvements. As such, the TSM Alternative provides the baseline against which the Build Alternatives (i.e., those alternatives that would entail a major investment) are compared. The TSM Alternative emphasizes low cost (i.e., small physical improvements) and operational efficiencies such as focused traffic engineering actions, expanded bus service, and improved access to transit services.

Within the study area, in addition to improvements over existing conditions contained in the No Build Alternative, the TSM Alternative includes modifications and enhancements to selected bus routes in the study area; intersection/signal improvements; and bus stop amenity upgrades. Table 2-2 highlights the proposed improvements to transit services that are included in the TSM Alternative. Figure 2-1 is a map of the proposed routes for the TSM bus network enhancements.

In addition to the transit network improvements described in Table 2-2, the following system operational improvements are also included in the TSM Alternative:

- Traffic signal timing improvements at select congested locations along Santa Ana Boulevard and Civic Center Drive to provide for enhanced east-west bus flow.
- Real-time bus schedule information at high-volume transit stops (e.g. Flower Street and 6th Street area, Santa Ana Boulevard and Main Street).
- Improvements to transit stop amenities (benches, shelters, kiosks, sidewalk connections, etc.) along Santa Ana Boulevard and Main Street corridors.
- Improvements to bicycle and pedestrian circulation to promote safe, convenient and attractive connectivity between transit system and surrounding neighborhoods and activity centers.

2.3 Build Alternatives

Two Build Alternatives have been identified for detailed environmental evaluation. Both of these alternatives would involve the construction and operation of a four-mile, streetcar transit system between SARTC and Harbor Boulevard on city streets and within the Pacific Electric (PE) right-of-way (ROW). As such, the Build Alternatives have many attributes in common, in terms of their overall project description. The principal differences between the two Build Alternatives are the alignments that the streetcar would follow through the downtown area within the City of Santa Ana. The two Build Alternatives are:

- Streetcar 1 (Santa Ana Boulevard and 4th Street Couplet)
- Streetcar 2 (Santa Ana Boulevard/5th Street and Civic Center Drive Couplet).

Table 2-2: Future Transit Network - Changes between the No Build and TSM Alternatives

OPERATOR	ROUTE GROUP NO.	ROUTE ID AND DESCRIPTION	NO BUILD		TSM		
			PEAK HEADWAY (MIN)	OFF-PEAK HEADWAY (MIN)	PEAK HEADWAY (MIN)	OFF-PEAK HEADWAY (MIN)	NOTES
OCTA	Local – 55	Santa Ana Civic Center to Newport Beach	20	30	15	20	Improve frequency
OCTA	Local – 64 Overlay[1]	Huntington Beach to Tustin (via Bolsa Ave./First St.)	--	--	20	17	Add service overlay along First Street with service to SARTC.
OCTA	Local – 64 Short Turn	Huntington Beach to Tustin (via Bolsa Ave./First St.)	20	17	20	17	No change from No Build
OCTA	Intercounty Express –206	Santa Ana to Lake Forest Express (via 5 Fwy.)	60	--	30	--	Improve frequency
Contractor	StationLink – 462[1]	SARTC to Civic Center (via Santa Ana Blvd/Civic Center Dr.)	20	--	15	15	Expand hours of operation; add reverse peak direction service; and add off-peak service
Contractor	StationLink – 463	SARTC to Hutton Centre (via Grand Ave.)	25	--	20	--	Improve frequency
OCTA	Intercounty Express – 757	Pomona to Santa Ana Express (via 57 Fwy.)	90	--	60	--	Improve frequency
OCTA	Go Local – XXX[1]	New TSM Route from SARTC to Harbor (via Civic Center Dr./Bristol St./Seventeenth St.)	--	--	10	10	Adds new route

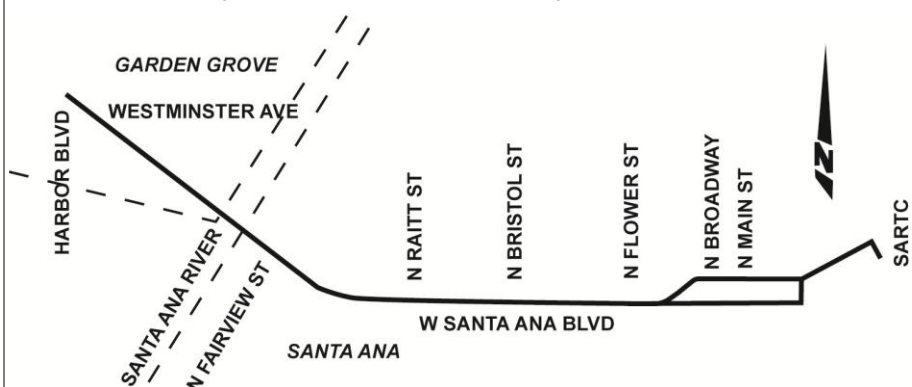
Source: Cordoba Corporation / Cambridge Systematics, Inc., May 2011.
Note: [1]Timed-transfer operations along First St., Santa Ana Blvd. and Civic Center Dr. to enhance connections to north-south service, including future BRT routes along Harbor Blvd. and Bristol St.

Figure 2-1: Transportation System Management (TSM) Alternative

2.3.1 Streetcar 1 (Santa Ana Boulevard and 4th Street Couplet)

Table 2-3 provides a summary description of the key physical and operational attributes of Streetcar 1 (Santa Ana Boulevard and 4th-Street Couplet). Figure 2-2 provides a conceptual illustration of the alignment for Streetcar 1 relative to the existing street network within the study area.

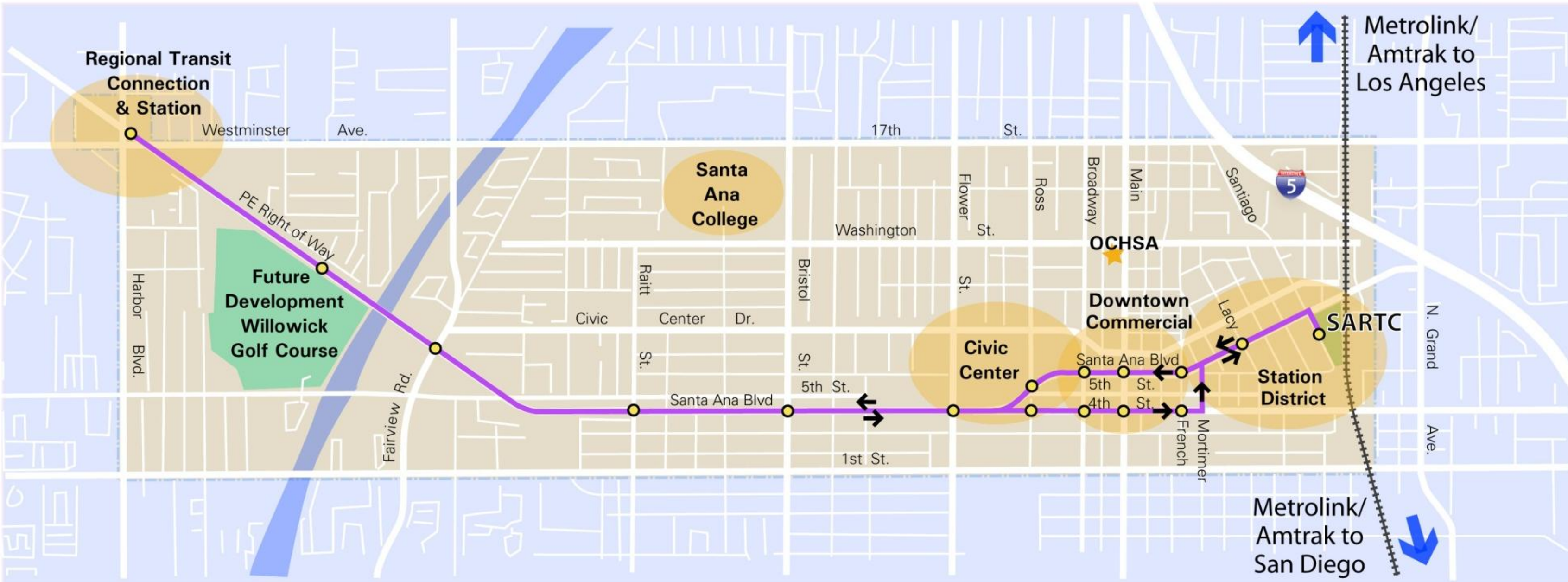
Table 2-3: Key Physical and Operational Attributes of Streetcar 1

<table>
<tr><th>KEY ATTRIBUTES</th><th colspan="2">DESCRIPTIONS</th></tr>
<tr><td>Transit Mode</td><td colspan="2">Streetcar</td></tr>
<tr><td>Termini</td><td colspan="2">Western Terminus: Harbor Blvd.
Eastern Terminus: SARTC</td></tr>
<tr><td>Alignment Description</td><td colspan="2">Routing by Segment:
• *PE ROW*, from Harbor Blvd. to Raitt St.: streetcars operate at-grade, bi-directionally, in exclusive ROW.
• *Santa Ana Blvd.*, from Raitt St. to Ross St: streetcars operate in the street, at grade, bi-directionally, along with mixed-flow traffic.
• *4th St./Santa Ana Blvd. Couplet*, from Ross St. to Mortimer St.: streetcars operate in the street, at grade, one-way, along with mixed-flow traffic.
• *Santa Ana Blvd.*, from Mortimer St. to SARTC: streetcars operate in the street, at grade, bi-directionally, along with mixed-flow traffic.

</td></tr>
<tr><td>Length of Alignment.</td><td colspan="2">4.1 miles (Harbor Blvd. to SARTC)</td></tr>
<tr><td rowspan="2">Stations
(12 Stations)</td><td colspan="2">1. Harbor Blvd. and Westminster Ave.
2. Willowick
3. Fairview St. and PE ROW
4. Raitt St. and Santa Ana Blvd.
5. Bristol St. and Santa Ana Blvd.
6. Flower St. and Santa Ana Blvd.</td></tr>
<tr><td>*Couplet Section (Eastbound)*
7. Sasscer Park
8. Broadway and 4th St.
9. Main St. and 4th St.
10. French St. and 4th St.</td><td>*Couplet Section (Westbound)*
7. Ross St. and Santa Ana Blvd.
8. Broadway and Santa Ana Blvd.
9. Main St. and Santa Ana Blvd.
10. French St. and Santa Ana Blvd.</td></tr>
</table>

KEY ATTRIBUTES	DESCRIPTIONS
	11. Lacy St. and Santa Ana Blvd. 12. SARTC
Alignment Design Options	Western Terminus (Harbor Blvd. and Westminster Ave.): • At Grade Option • Elevated Option • Truncated At-Grade Option
	Santa Ana River Crossing: • Bridge Replacement Option • Bridge Avoidance Option A • Bridge Relocation Option • Bridge Avoidance Option B
	Sasscer Park: • Option 1A (Direct Route) • Option 1B (Curved Route)
	4th Street Parking Scenarios: • Scenario A: South Side Parallel • Scenario B: South Side Removal • Scenario C: South Side and North Side Removal
Headways	Peak: 10 minutes (6:00 a.m. to 6:00 p.m.) Off-Peak: 15 minutes (after 6:00 p.m.)
Hours of Operation (in revenue service)	Monday – Thursday: 6:00 a.m. to 11:00 p.m. (17 hours) Friday and Saturday: 6:00 a.m. to 1:00 a.m. (19 hours) Sunday: 7:00 a.m. to 10:00 p.m. (15 hours)
Transit Vehicle	Streetcar – Vehicle type selection has yet to be determined. The two classifications under consideration include: • Classic Modern Streetcar (e.g., United Streetcar Portland vehicle) • CPUC Compliant Streetcar (e.g., Siemens S70)
Power Source	Electric, Overhead Contact System, Traction Power Substations
Operations and Maintenance Facility Sites	Two Candidate Sites: • Site A: South of SARTC, bordered by 4th St., 6th St., Poinsettia St. and Metrolink tracks. • Site B: West of Raitt St., between the PE ROW and 5th St.
Major Bicycle and Pedestrian Features	• Sidewalk and pedestrian improvements in the vicinity of proposed station platforms. • 4th St.: In conjunction with on-street parking modifications, widen sidewalks on 4th St. between Ross St. and French St.: – Scenario A: On south side by 8 ft. for a total width of 20 ft. – Scenario B: On south side by 16 ft. for a total width of 28 ft. – Scenario C: On both sides by 16 ft. for a total width of 28 ft.

Source: Cordoba Corporation, Conceptual Design Plans, July 2011

Figure 2-2: Streetcar 1 Alignment



NORTH

LEGEND

Streetcar 1

Proposed Stop

Future Extension to Metro East Mixed-Use Development

Study Area

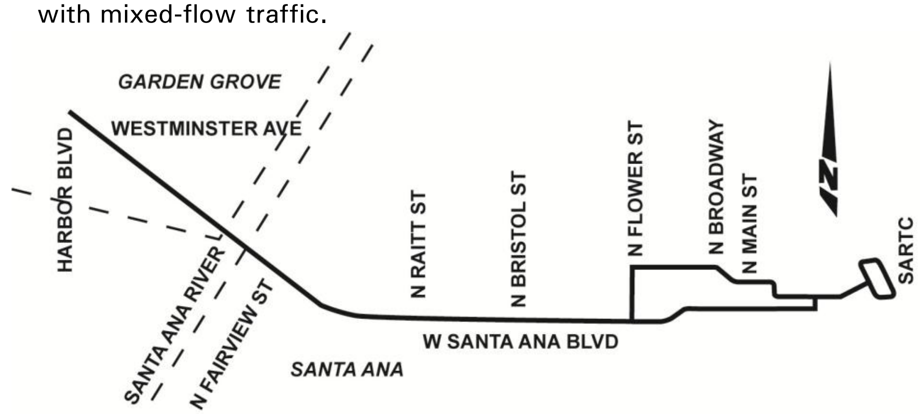
Alternative 1 Design Option 1
Sasscer Park mitigation

2.3.2 Streetcar 2 (Santa Ana Boulevard/5th Street / Civic Center Drive Couplet)

Table 2-2-4 provides a summary description of the key physical and operational attributes of Streetcar 2. Figure 2-3 provides a conceptual illustration of the alignment for Streetcar 2 relative

to the existing street network within the study area.

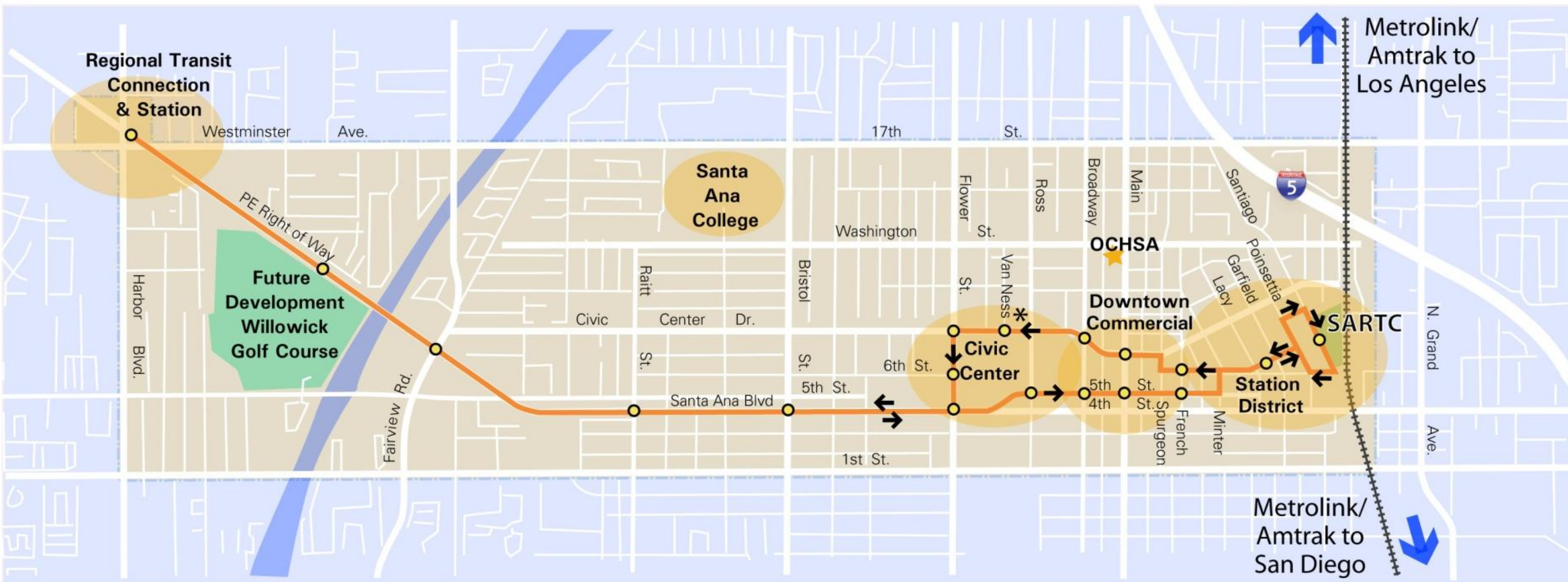
Table 2-2-4: Key Physical and Operational Attributes of Streetcar 2

<table>
<tr><th>KEY ATTRIBUTES</th><th colspan="2">DESCRIPTIONS</th></tr>
<tr><td>Transit Mode</td><td colspan="2">Streetcar</td></tr>
<tr><td>Termini</td><td colspan="2">• Western Terminus: Harbor Blvd.
• Eastern Terminus: SARTC</td></tr>
<tr><td>Alignment Description</td><td colspan="2">• PE ROW, from Harbor Blvd. to Raitt St.: streetcars operate at-grade, bi-directionally, in exclusive ROW.
• Santa Ana Blvd., from Raitt St. to Flower St.: streetcars operate in the street, at-grade, bi-directionally, along with mixed-flow traffic.
• Santa Ana Blvd./5th St. and Civic Center Dr. Couplet, from Flower St. to Minter St.: streetcars operate in the street, at-grade, one-way, along with mixed-flow traffic.
• 6th St./Brown St., from Minter St. to Poinsettia St.: streetcars operate in the street, at grade, bi-directionally, along with mixed-flow traffic.
• Poinsettia St./Santa Ana Blvd. /Santiago St./6th St. (SARTC Loop): streetcars operate in a one-way loop, in the street, at-grade, along with mixed-flow traffic.

</td></tr>
<tr><td>Length of Alignment</td><td colspan="2">4.5 miles (Harbor Blvd. to SARTC)</td></tr>
<tr><td rowspan="2">Stations
(13 Stations)</td><td colspan="2">1. Harbor Blvd. and Westminster Ave.
2. Willowick
3. Fairview St. and PE ROW
4. Raitt St. and Santa Ana Blvd.
5. Bristol St. and Santa Ana Blvd.</td></tr>
<tr><td>Couplet Section (Eastbound)
6. Flower St. and Santa Ana Blvd.
7. ----------
8. Ross St. and Santa Ana Blvd.
9. Broadway and 5th St.</td><td>Couplet Section (Westbound)
6. Flower St. and 6th St.
7. Flower St. and Civic Center Dr.
8. Van Ness Ave. and Civic Center Dr.
9. Broadway and Civic Center Dr.</td></tr>
</table>

	10. Main St. and 5th St. 11. French St. and 5th St.	10. Main St. and Civic Center Dr. 11. French St. and Santa Ana Blvd.
	12. Brown Street and Porter Street 13. SARTC	
Alignment Design Options	Western Terminus (Harbor Blvd. and Westminster Ave.) • At-Grade Option • Elevated Option • Truncated At-Grade Option	
	Santa Ana River Crossing • Bridge Replacement Option • Bridge Avoidance Option A	• Bridge Relocation Option • Bridge Avoidance Option B
	Civic Center Drive • Option 2A (Parking Removal and Additional Right-of-Way) • Option 2B (Reduce Number of Westbound of Travelled Lanes)	
Headways	Peak: 10 minutes (6:00 a.m. to 6:00 p.m.) Off-Peak: 15 minutes (after 6:00 p.m.)	
Hours of Operation (in revenue service)	Monday – Thursday: 6:00 a.m. to 11:00 p.m. (17 hours) Friday and Saturday: 6:00 a.m. to 1:00 a.m. (19 hours) Sunday: 7:00 a.m. to 10:00 p.m. (15 hours)	
Transit Vehicle	Streetcar – Vehicle type selection has yet to be determined. The two classifications under consideration include: • Classic Modern Streetcar (e.g., United Streetcar Portland vehicle) • CPUC Compliant Streetcar (e.g., Siemens S70)	
Power Source	Electric, Overhead Contact System, Traction Power Substations	
Operations and Maintenance Facility Sites	Two Candidate Sites: • **Site A:** South of SARTC, bordered by 4th St., 6th St., Poinsettia St., and the Metrolink tracks. • **Site B:** West of Raitt St., between the PE ROW and 5th St.	
Major Bicycle and Pedestrian Features	• Sidewalk and pedestrian improvements in the vicinity of proposed station platforms. • Civic Center Drive: Provide sufficient street width on Civic Center Drive between Flower Street and Spurgeon Street to support the City's planned development of a striped bike lane on each side of the street.	

Source: Cordoba Corporation, Conceptual Design Plans, July 2011

Figure 2-3: Streetcar 2 Alignment



NORTH

LEGEND

- Streetcar 2
- Proposed Stop
- Future Extension to Metro East Mixed-Use Development
- Study Area
- * Civic Center station/stop on Civic Center Drive is located at Van Ness in Design Option 1 and at Ross Street in Design Option 2

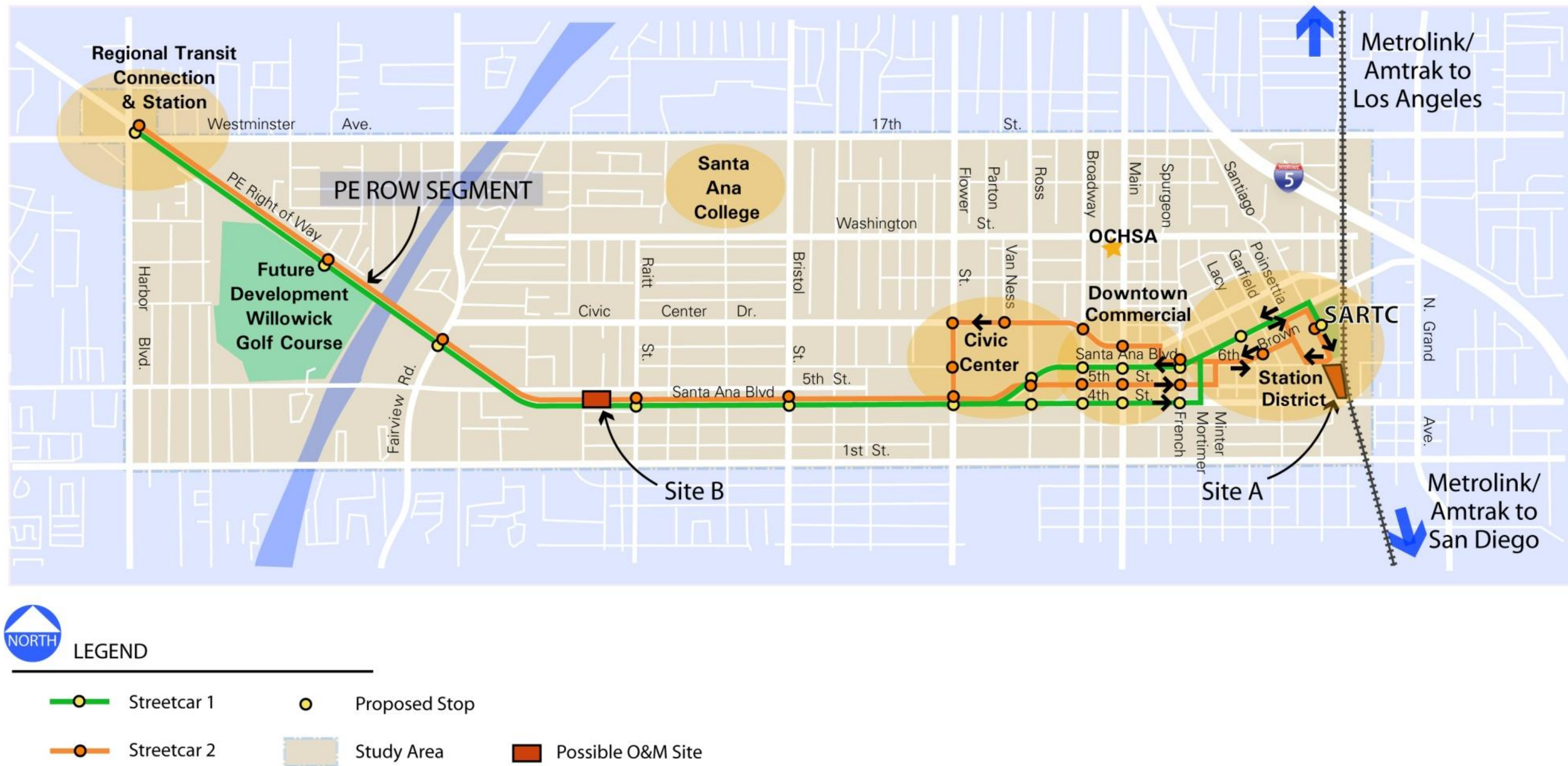
2.4 Operations and Maintenance Facility

Both Streetcar 1 and 2 would require the construction of a streetcar maintenance and operations facility. An operations and maintenance facility is a stand-alone building which would meet the maintenance, repair, operational and storage needs of the proposed streetcar system. The maintenance and operations facility accommodates daily and routine vehicle inspections, interior/exterior cleaning of the streetcars, preventative (scheduled) maintenance, unscheduled maintenance, and component change-outs. The proposed facility would also provide a venue for rebuilding components, and for long-term component repair for the streetcars.

The site for the maintenance and operations facility would need to accommodate a building that houses both maintenance and administrative functions; provides for off-street employee parking; and provides for various functions such as outside storage of system components, vehicle washing, and local requirements for landscaping and screening. For a more detailed discussion of these facilities and their functions refer to the *Draft Conceptual Design Technical Report*, January 2012.

Currently, two candidate maintenance and operations facility sites have been identified for either Streetcar 1 or Streetcar 2. See Figure 2-4 for the approximate locations of these sites.

Figure 2-4: Candidate Locations for Operations & Maintenance Facilities



3. DESCRIPTION OF THE O&M COST ESTIMATING MODEL

The O&M Cost Estimating model is a single Excel sheet that projects annual O&M cost based on the following parameters and calculations:

1. Operating Cost per Revenue Vehicle Hour in 2011 dollars: This information was obtained from OCTA for FY 2010-2011 bus operations. Operating Cost per Revenue Vehicle Hour for Streetcar was derived from Portland and Seattle bus/streetcar O&M cost/hour ratios applied to OCTA bus cost/hour,
2. Peak and off-peak frequency per hou: This is represented as the headway between cars, in minutes.
3. Peak and off-peak round trip cycle time: This is defined as the two-way running times plus end terminal layover/recovery times. Cycle time divided by headway defines the number of vehicles in service.
4. Round trip miles: For Route 64 and StationLink Route 462, this information was scaled from aerial mapping based on the current route maps (effective October 9, 2011). For the proposed new route between SARTC and Harbor Boulevard, round trip miles were scaled from aerial mapping.
5. Average peak and off-peak speed: For Route 64 and StationLink Route 462, peak and off-peak speeds were calculated based on current schedules (effective October 9, 2011). For the proposed new route, speeds were estimated based on current schedules for buses operating along the same roadways used by the new route, peak and off-peak speed surveys along the route and the number of planned stops. For the streetcar alternatives, peak and off-peak speeds were obtained from an operations simulation model.
6. Peak and off-peak vehicles required: These were e4stimated by dividing the cycle time by the headway. The number is expressed as an integer c=since there cannot be partial vehicles in service. The estimate does not include maintenance and reserve "spare" vehicles.[1]
7. Estimates O&M cost for one peak or off-peak hour: This is calculated as the O&M cost per hour times the number of peak and off-peak vehicles required.
8. Factors to estimate peak and off-peak hours per day: The factor was developed based on the conceptual operating plans, including hours of operations (peak and off-peak) for each alternative.

[1] Fleet = cars in service + spares. Calculate spares as 20% of cars in service, or a minimum of 2 spare cars.

9. Operating cost annualization factor: This represents equivalent weekdays per year, calculated to account for variations in operating hours on weekends and holidays. It is not a uniform across alternatives.
10. Estimated annual O&M cost: It is calculated as ((O&M cost per peak hour x peak hours per day) + (O&M cost per off-peak hour x off-peak hours per day)) x annualization factor.

The spreadsheet model requires only a few parameters about the planned system and service, and a single unit cost. Thus, it can be employed to quickly generate order-of-magnitude O&M estimates for a range of proposed alternative alignments and service levels.

3.1 Bus O&M Cost Methodology

The Santa Ana-Garden Grove Fixed Guideway TSM Alternative is comprised of modifications to existing bus service and the addition of a new bus route. The TSM bus costs were estimated based on current transit cost information provided by OCTA. Table 3-1 summarizes direct and indirect costs for fixed route bus service directly operated by OCTA, and fixed route service that Is contracted out by OCTA for fiscal year 2010-2011.

Table 3-1: OCTA Transit Financial and Operational Statistics (Fiscal year 2010-2011)

	DIRECTLY OPERATED FIXED ROUTE	CONTRACTED FIXED ROUTE	TOTAL
Annual Revenue Vehicle Hours (RVH)	1,411,595	140,363	1,551,958
Annual Revenue Vehicle Miles (RVM)	17,013,197	2,139,864	19,153,061
Peak vehicles	329	105	434
COST			
Direct	108,391,514	10,949,604	119,341,118
Indirect	60,933,371	590,657	61,524,028
Total Cost	**169,324,885**	**11,540,261**	**180,865,146**
COST PER REVENUE VEHICLE HOUR			
Direct	76.79	78.01	76.90
Indirect	43.17	4.21	39.64
Total Cost	**119.95**	**82.22**	**116.54**
COST PER REVENUE VEHICLE MILE			
Direct	6.37	5.12	6.23
Indirect	3.58	0.28	3.21
Total Cost	**9.95**	**5.39**	**9.44**

Source: *Orange County Transit Authority Fiscal Year 2010-2011 Year-End Transit Financial and Operations Statistics, OCTA*

The O&M cost projection for the TSM Alternative was prepared using an Excel spreadsheet model that incorporated information from Table 3-1, most notably, the cost per revenue vehicle hour, and the operating characteristics of the various components of the TSM Alternative. Table 3-2 summarizes the operating characteristics assumed for each of the transit components of the TSM Alternative.

Table 3-2: TSM Alternative Components' Operating Characteristics

	NEW ROUTE	STATIONLINK 462	ROUTE 64 OVERLAY
Headways	10/15	15/15	15/20
Cycle (Peak/Off-Peak, Mins)	71/53	29/23	167/134
Round Trip Miles	11.4	3.3	28.1
Vehicles Used (Peak/Off-Pk)	8/4	2/2	12/7
O&M $/Hr (Peak/Off-Peak)	$1,152/$576	$164/$164	$1,439/$840
Weekday Hrs (Peak/Off-Pk):			
Operating Hours	12/5	7/5	12/5
Vehicle Hours	96/20	14/10	144/35
Annualization Factor	303.0	260.0	345.5

3.2 Streetcar O&M Cost Methodology

The O&M cost projections for the streetcar alternatives were prepared using the same Excel spreadsheet model that was used for the TSM Alternative. Operating Cost per Revenue Hour (OM$/Rev Hr) was derived from historical Portland and Seattle bus-to-streetcar O&M cost per revenue vehicle hour ratios. These ratios were averaged and applied to the OCTA bus cost per revenue vehicle hour as shown in Table 3-3.

Table 3-3: Operating Cost per Revenue Vehicle Hour for Santa Ana-Garden Grove Fixed Guideway

	OPERATING COST PER REVENUE VEHICLE HOUR (2011 $S)	
	2008	2011
Portland Streetcar	$192.18	$198.14
Portland Bus (Tri-Met)	$121.05	
Bus-to-Streetcar Cost Factor	**1.59**	
Seattle Streetcar	$218.25	$225.00
Seattle Bus (King Co Metro)	$142.61	
Bus-to-Streetcar Cost Factor	**1.53**	
Orange Co. Bus (OCTA)	$112.24	$119.95
Avg. Bus-to-Streetcar Cost Factor	1.56	
Santa Ana-Garden Grove Streetcar Cost Factor	$175.09	**$187.12**

Peak and off-peak round trip cycle time (CT) and round trip miles (RTM) were obtained from the *Santa Ana Streetcar Operations Simulations* (LTK Engineering, December 2011) and associated pro forma operating timetables.

3.2.1 Streetcar Operating Parameters

The following are the operating parameters for each streetcar alternative, and their associated initial operating segments (IOS) for which O&M costs have been estimated.

PARAMETER	STREETCAR 1	STREETCAR 1 IOS	STREETCAR 2	STREETCAR 2 IOS
Headway	10/15	10/15	10/15	10/15
Cycle (Peak/Off-Peak, Mins)	52/45	39/33	64/56	50/41
Round Trip Miles	8.2	4.4	9.0	4.9
Vehicles Used (Peak/Off-Pk)	6/3	4/3	7/4	5/3
O&M $/Hr (Peak/Off-Peak)	$1,123/$561	$748/$561	$1,310/$748	$936/$561
Weekday Hrs (Peak/Off-Pk):				
Operating Hours	12/5	12/5	12/5	12/5
Vehicle Hours	72/15	48/15	84/20	60/15
Annualization Factor	303.0	339.2	314.0	318.2

3.3 Summary of O&M Cost Projections

The results of the O&M cost model are presented in Table 3-4. The worksheets for each of the alternatives are included in Appendix A.

Table 3-4: Estimated Operations and Maintenance Costs (2011 $)

	TSM	TSM - SARTC TO HARBOR ROUTE ONLY	STREETCAR 1	STREETCAR 2	STREETCAR 1 IOS	STREETCAR 2 IOS
Annual Revenue Miles	1,061,590	419,120	332,015	363,459	213,127	209,976
Annual Revenue Hours	105,664	35,152	26,364	32,656	21,372	23,868
Peak Vehicles	22	8	6	7	4	5
O&M Costs	**$13,282,258**	**$5,059,779**	**$4,933,284**	**$6,110,656**	**$4.0M**	**$4,466,228**
Cost per Rev. Mile	$12.51	$12.07	$14.86	$16.81	$18.76	$21.27
Cost per Rev. Hour	$125.70	$143.94	$187.12	$187.12	$187.12	$187.12

APPENDIX A: O&M Cost Estimate Worksheets

3/29/2012

Annual Estimated Operating and Maintenance Costs (2011$)

TSM - 3 Routes

TSM Elements	Operating Cost per Hour[1]	Peak Frequency per Hour[2]	Off-Peak Frequency per Hour[2]	Peak Roundtrip Runtime (min)[3]	Off-Peak Roundtrip Runtime (min)[4]	Roundtrip Miles[5]	Avg Peak Speed (mph)[6]	Avg Off-Peak Speed (mph)[7]	Peak Vehicles Required[8]	Off-Peak Vehicles Required[9]	Estimated O&M Cost per One Peak Hour[10]	Estimated O&M Cost per One Off-Peak Hour[11]	Factor to Estimate Peak Hours per Day[12]	Factor to Estimate Off-Peak Hours per Day[13]	Operating Cost Annualization Factor[14]	Estimated Annual O&M Cost[15]
Route: New TSM Route																
	$143.94	10	15	71	53	11.4	10.4	13.0	8	4	$1,152	$576	12	5	303.0	$5,059,779

Begin Service	End Service	Headways Peak/Off-Peak	Service Hours Peak/Off-Peak	Service Hours Total		Peak Rev Hours	Peak Veh in Service	Peak Veh Rev Hour	Off-Peak Rev Hours	Off-Peak Veh in Service	Off-Peak Veh Rev Hour	Total Veh Rev Hr/Day	Total Veh Rev Hr/Wk
6:00 AM	11:00 PM	10/15	12/ 5	17	**Weekdays**	12	8	96	5	4	20	116	464
6:00 AM	1:00 AM	--/15'	--/16	19	**Saturdays**			0	19	4	76	76	152
7:00 AM	10:00 PM	--/15'	--/15	15	**Sundays**			0	15	4	60	60	60
												Total Veh Rev Hours/Week	676

Note: NTD figure shown. OCTA regular, fixed-route bus ops. cost/vehicle revenue hour of $115 in FY '07-'08 dollars was used in BRAVO BRT cost estimates.

Total Veh Rev Hours/Year 35,152

Based on FY2010-11 data from OCTA showing regular fixed route bus ops cost/vehicle revenue hour at $119.95

Total Est Annual O&M Cost $5,059,779

	Peak Veh Rev Miles	Off-Peak Veh Rev Miles	Weekly	
Wkday	998	260	6292	
Sat		988	988	
Sun		780	780	
TOTAL			8060	419120

Check: $5,059,779

Veh Rev Hours/Year * Ops Cost/Veh Rev Hours

Annualization Factor 303.0

TSM Elements	Operating Cost per Hour	Peak Frequency per Hour	Off-Peak Frequency per Hour	Peak Roundtrip Runtime (min)	Off-Peak Roundtrip Runtime (min)	Roundtrip Miles	Avg Peak Speed (mph)	Avg Off-Peak Speed (mph)	Peak Vehicles Required	Off-Peak Vehicles Required	Estimated O&M Cost per One Peak Hour	Estimated O&M Cost per One Off-Peak Hour	Factor to Estimate Peak Hours per Day	Factor to Estimate Off-Peak Hours per Day	Operating Cost Annualization Factor	Estimated Annual O&M Cost
Route: StationLink 462																
To be added to existing 462 service	$82.22	15	15	29	23	3.3	8.6	11	2	2	$164.44	$164.44	7	5	260.0	$513,053

Begin Service	End Service	Headways Peak/Off-Peak	Service Hours Peak/Off-Peak	Service Hours Total		Peak Rev Hours	Peak Veh in Service	Peak Veh Rev Hour	Off-Peak Rev Hours	Off-Peak Veh in Service	Off-Peak Veh Rev Hour	Total Veh Rev Hr/Day	Total Veh Rev Hr/Wk
9:00 AM	11:00 PM	15/15	7/5	12	**Weekdays**	7	2	14	5	2	10	24	120
					Saturdays			0	0	2	0	0	0
					Sundays			0	0	2	0	0	0
												Total Veh Rev Hours/Week	120

Total Veh Rev Hours/Year 6,240

Total Est Annual O&M Cost $513,053

	Peak Veh Rev Miles	Off-Peak Veh Rev Miles	Weekly	
Wkday	120	110	1152	
Sat		0	0	
Sun		0	0	
TOTAL			1152	59904

Check: $513,053

Veh Rev Hours/Year * Ops Cost/Veh Rev Hours

Annualization Factor 260.0

TSM Elements	Operating Cost per Hour	Peak Frequency per Hour	Off-Peak Frequency per Hour	Peak Roundtrip Runtime (min)	Off-Peak Roundtrip Runtime (min)	Roundtrip Miles	Avg Peak Speed (mph)	Avg Off-Peak Speed (mph)	Peak Vehicles Required	Off-Peak Vehicles Required	Estimated O&M Cost per One Peak Hour	Estimated O&M Cost per One Off-Peak Hour	Factor to Estimate Peak Hours per Day	Factor to Estimate Off-Peak Hours per Day	Operating Cost Annualization Factor	Estimated Annual O&M Cost
Route: Overlay to Route 64																
Larwin Sq - Edwards/Bolsa via SARTC	$119.95	15	20	167	134	28.1	10.8	13.6	12	7	$1,439.40	$839.65	12	6	345.5	$7,709,426

Begin Service	End Service	Headways Peak/Off-Peak	Service Hours Peak/Off-Peak	Service Hours Total		Peak Rev Hours	Peak Veh in Service	Peak Veh Rev Hour	Off-Peak Rev Hours	Off-Peak Veh in Service	Off-Peak Veh Rev Hour	Total Veh Rev Hr/Day	Total Veh Rev Hr/Wk
6:00 AM	11:00 PM	15/20	12/5	18	**Weekdays**	12	12	144	5	7	35	179	895
6:00 AM	11:00 PM	15/30	12/5	18	**Saturdays**	12	12	144	5	7	35	179	179
6:00 AM	10:00 PM	15/30	10/6	16	**Sundays**	10	12	120	6	7	42	162	162
												Total Veh Rev Hours/Week	1,236

Total Veh Rev Hours/Year 64,272

Total Est Annual O&M Cost $7,709,426

Check: $7,709,426

Veh Rev Hours/Year * Ops Cost/Veh Rev Hours

	Peak Veh Rev Miles	Off-Peak Veh Rev Miles	Weekly	
Wkday	1,555	476	10,156	
Sat	1,555	476	476	
Sun	1,296	571	571	
TOTAL			11,203	582,566

Annualization Factor 345.5

TSM- TOTAL EST. ANNUAL O&M COST $13,282,258

105,664

1,061,590

$12.51

[1] ***Operating cost per hour*** *- Used $119.95 per revenue hour cost for OCTA fixed route service, $82.22 per hour for contracted services based on OCTA data for FY 2010-11. Fixed route service rate of $119.95 was increased by 20% to account for higher costs associated with BRT service (more elaborate station/stops, specialized vehicles, etc.)*

[2] ***Frequency per hour*** *- Based on peak and off-peak headways as documented in the Project Description*

[3] ***Peak roundtrip runtime -*** *Time in minutes from route end to route end and back during peak hours. Does not include any layover time - derived from OCTA Bus Book, October 2011*

[4] ***Off-peak roundtrip runtime -*** *Time in minutes from route end to route end and back during peak hours. Does not include any layover time - derived from OCTA Bus Book, October 2011*

[5] ***Roundtrip miles -*** *Miles from route end to route end and back. Scaled from aerial maps.*

[6] ***Average peak speed -*** *Average miles per hour over the full route length during peak hours. Derived from route length and peak hour runtime.*

[7] ***Average off-peak speed -*** *Average miles per hour over the full route length during off-peak hours. Derived from route length and off-peak hour runtime.*

[8] ***Peak vehicles required -*** *The number of transit vehicles required to complete the roundtrip at the frequency noted during peak hours.*

[9] ***Off-peak vehicles required -*** *The number of transit vehicles required to complete the roundtrip at the frequency noted during off-peak hours.*

[10] ***Estimated O&M cost per one peak hour -*** *Cost in 2011 dollars to operate the number of peak-hour vehicles required for one hour.*

[11] ***Estimated O&M cost per one off-peak hour -*** *Cost in 2011 dollars to operate the number of off-peak vehicles required for one hour.*

[12] ***Factor to estimate peak hours per day*** *- An estimate of the number of hours of transit service that would be provided at peak-hour headways.*

[13] ***Factor to estimate off-peak hours per day*** *- An estimate of the number of hours of transit service that would be provided at off-peak headways.*

[14] ***Operating cost annualization factor*** *- Factor to escalate a single day to annual. It is less than 365 to account for a lower level of service typically provided on weekends and holidays.*

[15] ***Estimated annual O&M cost*** *- Result of multiplying the annualization factor by the peak and off-peak hourly cost times hours in a day.*

2/8/2012

Annual Estimated Operating and Maintenance Costs (2011$)

Streetcar 1 with 10-minute Extended Peak Headways & 15-minute Off-Peak Headways

Santa Ana Streetcar	Operating Cost per Hour[1]	Capacity per Vehicle [2]	Peak Frequency per Hour[3]	Off-Peak Frequency per Hour[3]	Peak Roundtrip Runtime (min)[4]	Off-Peak Roundtrip Runtime (min)[5]	Roundtrip Miles[6]	Avg Peak Speed (mph)[7]	Avg Off-Peak Speed (mph)[8]	Peak Vehicles Required[9]	Off-Peak Vehicles Required[10]	Estimated O&M Cost per One Peak Hour[11]	Estimated O&M Cost per One Off-Peak Hour[12]	Factor to Estimate Peak Hours per Day[13]	Factor to Estimate Off-Peak Hours per Day[14]	Operating Cost Annualization Factor[15]	Estimated Annual O&M Cost[16]
with 10 min. headways, extended peak wkdys 15 min. headways, off-peak wkdys 15 min. headways, Saturdays 15 min. headways, Sundays & holidays																	
Route: Santa Ana Streetcar	$187.12	90	10	15	52	45	8.2	11.6	13.9	6	3	$1,123	$561	12	5	303.0	$4,933,284

Operating Costs per Revenue Hour	2008	2011
Using Bus-to-Streetcar Cost Factor		
Portland (TriMet) Bus	$121.05	
Bus-to-Streetcar Cost Factor	1.59	
Portland Streetcar	**$192.18**	**$198.14**
(King Co Metro) Bus	$142.61	
Bus-to-Streetcar Cost Factor	1.53	
Seattle Streetcar	**$218.25**	**$225.00**
Orange Co (OCTA) Bus	$112.24	$119.95
Avg. Bus-to-Streetcar Cost Factor	1.56	1.56
Santa Ana Streetcar	**$175.09**	**$187.12**

Begin Service	End Service	Headways Peak/Off-Peak	Service Hours Peak/Off-Peak	Service Hours Total
6:00 AM	11:00 PM	10'/15'	12/ 5	17
6:00 AM	1:00 AM	--/15'	--/16	19
7:00 AM	10:00 PM	--/15'	--/15	15

	Peak Rev Hours	Peak Veh in Service	Peak Veh Rev Hour	Off-Peak Rev Hours	Off-Peak Veh in Service	Off-Peak Veh Rev Hour	Total Veh Rev Hr/Day	Total Veh Rev Hr/Wk
Weekdays	12	6	72	5	3	15	87	348
Saturdays			0	19	3	57	57	114
Sundays			0	15	3	45	45	45
							Total Veh Rev Hours/Week	507
							Total Veh Rev Hours/Year	26,364

Note: NTD figure shown. OCTA regular, fixed-route bus ops. cost/vehicle revenue hour of $115 in FY '07-'08 dollars was used in BRAVO BRT cost estimates.

Based on FY2010-11 data from OCTA showing regular fixed route bus ops cost/vehicle revenue hour at $119.95

Assumes 4 week days with 17 service hours; 2 Saturadays (Friday & Saturday) with 19 service hours (til 1:00 am) & Sunday with 15 service hours

Total Est Annual O&M Cost **$4,933,284**

Check: $4,933,284

Veh Rev Hours/Year * Ops Cost/Veh Rev Hours

303.0

[1] ***Operating cost per hour*** *- Used $187.12 per revenue hour cost for Santa Ana streetcar based on OCTA data for FY 2010-11. Applied an average of the bus-to-streetcar cost factor for Portland Streetcar/Seattle Streetcar to the Orange County bus costs. Includes data from FTA - National Transit Database and from direct sources.*

[2] ***Capacity per vehicle*** *- Based on 80% of design capacity by vehicle type. Assumes single-car Inekon Portland-style streetcar.*

[3] ***Frequency per hour*** *- Based on 10-minute peak/15-minute off peak service plan discussions (provided by Bob Post-URS).*

[4] ***Peak roundtrip runtime -*** *Time in minutes from route end to route end and back during peak hours. Does not include any layover time - derived from Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[5] ***Off-peak roundtrip runtime -*** *Time in minutes from route end to route end and back during off-peak hours. 20% less than peak hour roundtrip runtime where operating in mixed traffic. 10% less where operating partially exclusively.*

[6] ***Roundtrip miles -*** *Miles from route end to route end and back. Derived from Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[7] ***Average peak speed -*** *Average miles per hour over the full route length during peak hours. Derived from route length and peak hour runtime.*

[8] ***Average off-peak speed -*** *Average miles per hour over the full route length during off-peak hours. Derived from route length and off-peak hour runtime.*

[9] ***Peak vehicles required -*** *The number of transit vehicles required to complete the roundtrip at the frequency noted during peak hours. Confirmed by Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[10] ***Off-peak vehicles required -*** *The number of transit vehicles required to complete the roundtrip at the frequency noted during off-peak hours. Confirmed by Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[11] ***Estimated O&M cost per one peak hour -*** *Cost in 2011 dollars to operate the number of peak-hour vehicles required for one hour.*

[12] ***Estimated O&M cost per one off-peak hour -*** *Cost in 2011 dollars to operate the number of off-peak vehicles required for one hour.*

[13] ***Factor to estimate peak hours per day*** *- An estimate of the number of hours of transit service that would be provided at peak-hour headways.*

[14] ***Factor to estimate off-peak hours per day*** *- An estimate of the number of hours of transit service that would be provided at off-peak headways.*

[15] ***Operating cost annualization factor*** *- Factor to escalate a single day to annual. It is less than 365 to account for a lower level of service typically provided on weekends and holidays.*

[16] ***Estimated annual O&M cost*** *- Result of multiplying the annualization factor by the peak and off-peak hourly cost times hours in a day.*

Peak Off-Peak Weekly

2/8/2012

Annual Estimated Operating and Maintenance Costs (2011$)

Streetcar 2 with 10-minute Extended Peak Headways & 15-minute Off-Peak Headways

Santa Ana Streetcar	Operating Cost per Hour[1]	Capacity per Vehicle[2]	Peak Frequency per Hour[3]	Off-Peak Frequency per Hour[3]	Peak Roundtrip Runtime (min)[4]	Off-Peak Roundtrip Runtime (min)[5]	Roundtrip Miles[6]	Avg Peak Speed (mph)[7]	Avg Off-Peak Speed (mph)[8]	Peak Vehicles Required[9]	Off-Peak Vehicles Required[10]	Estimated O&M Cost per One Peak Hour[11]	Estimated O&M Cost per One Off-Peak Hour[12]	Factor to Estimate Peak Hours per Day[13]	Factor to Estimate Off-Peak Hours per Day[14]	Operating Cost Annualization Factor[15]	Estimated Annual O&M Cost[16]
with 10 min. headways, extended peak wkdys 15 min. headways, off-peak wkdys 15 min. headways, Saturdays 15 min. headways, Sundays & holidays																	
Route: Santa Ana Streetcar	$187.12	90	10	15	64	56	9	10.2	12.2	7	4	$1,310	$748	12	5	314.0	$6,110,656

Operating Costs per Revenue Hour	2008	2011
Using Bus-to-Streetcar Cost Factor		
Portland (TriMet) Bus	$121.05	
Bus-to-Streetcar Cost Factor	1.59	
Portland Streetcar	**$192.18**	**$198.14**
(King Co Metro) Bus	$142.61	
Bus-to-Streetcar Cost Factor	1.53	
Seattle Streetcar	**$218.25**	**$225.00**
Orange Co (OCTA) Bus	$112.24	$119.95
Avg. Bus-to-Streetcar Cost Factor	1.56	1.56
Santa Ana Streetcar	**$175.09**	**$187.12**

	Begin Service	End Service	Headways Peak/Off-Peak	Service Hours Peak/Off-Peak	Service Hours Total
Weekdays	6:00 AM	11:00 PM	10'/15'	12/ 5	17
Saturdays	6:00 AM	1:00 AM	--/15'	--/19	19
Sundays	7:00 AM	10:00 PM	--/15'	--/15	15

	Peak Rev Hours	Peak Veh in Service	Peak Veh Rev Hour	Off-Peak Rev Hours	Off-Peak Veh in Service	Off-Peak Veh Rev Hour	Total Veh Rev Hr/Day	Total Veh Rev Hr/Wk
Weekdays	12	7	84	5	4	20	104	416
Saturdays			0	19	4	76	76	152
Sundays			0	15	4	60	60	60
Total Veh Rev Hours/Week								628
Total Veh Rev Hours/Year								32,656

Note: NTD figure shown. OCTA regular, fixed-route bus ops. cost/vehicle revenue hour of $115 in FY '07-'08 dollars was used in BRAVO BRT cost estimates.

Based on FY2010-11 data from OCTA showing regular fixed route bus ops cost/vehicle revenue hour at $119.95

Total Est Annual O&M Cost	**$6,110,656**

Check: $6,110,656

Veh Rev Hours/Year * Ops Cost/Veh Rev Hours

314.0

[1] ***Operating cost per hour*** *- Used $187.12 per revenue hour cost for Santa Ana streetcar. Applied an average of the bus-to-streetcar cost factor for Portland Streetcar/Seattle Streetcar to the Orange County bus costs*
Includes data from FTA - National Transit Database and from direct sources. Used 3.1 percent annual inflation rate to escalate 2008 dollars to 2009.

[2] ***Capacity per vehicle*** *- Based on 80% of design capacity by vehicle type. Assumes single-car Inekon Portland-style streetcar.*

[3] ***Frequency per hour*** *- Based on 10-minute peak/15-minute off peak service plan discussions (provided by Bob Post-URS).*

[4] ***Peak roundtrip runtime -*** *Time in minutes from route end to route end and back during peak hours. Does not include any layover time - derived from Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[5] ***Off-peak roundtrip runtime -*** *Time in minutes from route end to route end and back during off-peak hours. 20% less than peak hour roundtrip runtime where operating in mixed traffic. 10% less where operating partially exclusively.*

[6] ***Roundtrip miles -*** *Miles from route end to route end and back. Derived from Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[7] ***Average peak speed -*** *Average miles per hour over the full route length during peak hours. Derived from route length and peak hour runtime.*

[8] ***Average off-peak speed -*** *Average miles per hour over the full route length during off-peak hours. Derived from route length and off-peak hour runtime.*

[9] ***Peak vehicles required -*** *The number of transit vehicles required to complete the roundtrip at the frequency noted during peak hours. Confirmed by Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[10] ***Off-peak vehicles required -*** *The number of transit vehicles required to complete the roundtrip at the frequency noted during off-peak hours. Confirmed by Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[11] ***Estimated O&M cost per one peak hour -*** *Cost in 2011 dollars to operate the number of peak-hour vehicles required for one hour.*

[12] ***Estimated O&M cost per one off-peak hour -*** *Cost in 2011 dollars to operate the number of off-peak vehicles required for one hour.*

[13] ***Factor to estimate peak hours per day*** *- An estimate of the number of hours of transit service that would be provided at peak-hour headways.*

[14] ***Factor to estimate off-peak hours per day*** *- An estimate of the number of hours of transit service that would be provided at off-peak headways.*

[15] ***Operating cost annualization factor*** *- Factor to escalate a single day to annual. It is less than 365 to account for a lower level of service typically provided on weekends and holidays.*

[16] ***Estimated annual O&M cost*** *- Result of multiplying the annualization factor by the peak and off-peak hourly cost times hours in a day.*

	Peak	Off-Peak	Weekly
Weekday	857	244	4,403

2/8/2012

Annual Estimated Operating and Maintenance Costs (2011$)

Streetcar 1 IOS with 10-minute Extended Peak Headways & 15-minute Off-Peak Headways

Santa Ana Streetcar with 10 min. headways, extended peak wkdys; 15 min. headways, off-peak wkdys; 15 min. headways, Saturdays; 15 min. headways, Sundays & holidays	Operating Cost per Hour[1]	Capacity per Vehicle [2]	Peak Frequency per Hour[3]	Off-Peak Frequency per Hour[3]	Peak Roundtrip Runtime (min)[4]	Off-Peak Roundtrip Runtime (min)[5]	Roundtrip Miles[6]	Avg Peak Speed (mph)[7]	Avg Off-Peak Speed (mph)[8]	Peak Vehicles Required[9]	Off-Peak Vehicles Required[10]	Estimated O&M Cost per One Peak Hour[11]	Estimated O&M Cost per One Off-Peak Hour[12]	Factor to Estimate Peak Hours per Day[13]	Factor to Estimate Off-Peak Hours per Day[14]	Operating Cost Annualization Factor[15]	Estimated Annual O&M Cost[16]
Route: Santa Ana Streetcar	$187.12	90	10	15	39	33	4.4	8.8	11.0	4	3	$748	$561	12	5	339.2	$3,999,171

Operating Costs per Revenue Hour	2008	2011
Using Bus-to-Streetcar Cost Factor		
Portland (TriMet) Bus	$121.05	
Bus-to-Streetcar Cost Factor	1.59	
Portland Streetcar	**$192.18**	**$198.14**
(King Co Metro) Bus	$142.61	
Bus-to-Streetcar Cost Factor	1.53	
Seattle Streetcar	**$218.25**	**$225.00**
Orange Co (OCTA) Bus	$112.24	$119.95
Avg. Bus-to-Streetcar Cost Factor	1.56	1.56
Santa Ana Streetcar	**$175.09**	**$187.12**

	Begin Service	End Service	Headways Peak/Off-Peak	Service Hours Peak/Off-Peak	Service Hours Total
Weekdays	6:00 AM	11:00 PM	10'/15'	12/ 5	17
Saturdays	6:00 AM	1:00 AM	--/15'	--/16	19
Sundays	7:00 AM	10:00 PM	--/15'	--/15	15

	Peak Rev Hours	Peak Veh in Service	Peak Veh Rev Hour	Off-Peak Rev Hours	Off-Peak Veh in Service	Off-Peak Veh Rev Hour	Total Veh Rev Hr/Day	Total Veh Rev Hr/Wk
Weekdays	12	4	48	5	3	15	63	252
Saturdays			0	19	3	57	57	114
Sundays			0	15	3	45	45	45
							Total Veh Rev Hours/Week	411
							Total Veh Rev Hours/Year	21,372

Note: NTD figure shown. OCTA regular, fixed-route bus ops. cost/vehicle revenue hour of $115 in FY '07-'08 dollars was used in BRAVO BRT cost estimates.

Based on FY2010-11 data from OCTA showing regular fixed route bus ops cost/vehicle revenue hour at $119.95

Total Est Annual O&M Cost **$3,999,171**

Check: $3,999,171

Veh Rev Hours/Year * Ops Cost/Veh Rev Hours

[1] ***Operating cost per hour*** *- Used $187.12 per revenue hour cost for Santa Ana streetcar based on OCTA data for FY 2010-11. Applied an average of the bus-to-streetcar cost factor for Portland Streetcar/Seattle Streetcar to the Orange County bus costs. Includes data from FTA - National Transit Database and from direct sources.*

[2] ***Capacity per vehicle*** *- Based on 80% of design capacity by vehicle type. Assumes single-car Inekon Portland-style streetcar.*

[3] ***Frequency per hour*** *- Based on 10-minute peak/15-minute off peak service plan discussions (provided by Bob Post-URS).*

339.2

[4] ***Peak roundtrip runtime -*** *Time in minutes from route end to route end and back during peak hours. Does not include any layover time - derived from Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[5] ***Off-peak roundtrip runtime -*** *Time in minutes from route end to route end and back during off-peak hours. 20% less than peak hour roundtrip runtime where operating in mixed traffic. 10% less where operating partially exclusively.*

[6] ***Roundtrip miles -*** *Miles from route end to route end and back. Derived from Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[7] ***Average peak speed -*** *Average miles per hour over the full route length during peak hours. Derived from route length and peak hour runtime.*

[8] ***Average off-peak speed -*** *Average miles per hour over the full route length during off-peak hours. Derived from route length and off-peak hour runtime.*

[9] ***Peak vehicles required -*** *The number of transit vehicles required to complete the roundtrip at the frequency noted during peak hours. Confirmed by Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[10] ***Off-peak vehicles required -*** *The number of transit vehicles required to complete the roundtrip at the frequency noted during off-peak hours. Confirmed by Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[11] ***Estimated O&M cost per one peak hour -*** *Cost in 2011 dollars to operate the number of peak-hour vehicles required for one hour.*

[12] ***Estimated O&M cost per one off-peak hour -*** *Cost in 2011 dollars to operate the number of off-peak vehicles required for one hour.*

[13] ***Factor to estimate peak hours per day*** *- An estimate of the number of hours of transit service that would be provided at peak-hour headways.*

[14] ***Factor to estimate off-peak hours per day*** *- An estimate of the number of hours of transit service that would be provided at off-peak headways.*

[15] ***Operating cost annualization factor*** *- Factor to escalate a single day to annual. It is less than 365 to account for a lower level of service typically provided on weekends and holidays.*

[16] ***Estimated annual O&M cost*** *- Result of multiplying the annualization factor by the peak and off-peak hourly cost times hours in a day.*

	Peak	Off-Peak	Weekly
Weekday	422	165	2,350

2/8/2012

Annual Estimated Operating and Maintenance Costs (2011$)

Streetcar 2 IOS with 10-minute Extended Peak Headways & 15-minute Off-Peak Headways

Santa Ana Streetcar
with
10 min. headways, extended peak wkdys
15 min. headways, off-peak wkdys
15 min. headways, Saturdays
15 min. headways, Sundays & holidays

	Operating Cost per Hour[1]	Capacity per Vehicle[2]	Peak Frequency per Hour[3]	Off-Peak Frequency per Hour[3]	Peak Roundtrip Runtime (min)[4]	Off-Peak Roundtrip Runtime (min)[5]	Roundtrip Miles[6]	Avg Peak Speed (mph)[7]	Avg Off-Peak Speed (mph)[8]	Peak Vehicles Required[9]	Off-Peak Vehicles Required[10]	Estimated O&M Cost per One Peak Hour[11]	Estimated O&M Cost per One Off-Peak Hour[12]	Factor to Estimate Peak Hours per Day[13]	Factor to Estimate Off-Peak Hours per Day[14]	Operating Cost Annualization Factor[15]	Estimated Annual O&M Cost[16]
Route: Santa Ana Streetcar	$187.12	90	10	15	50	41	4.9	7.7	10.0	5	3	$936	$561	12	5	318.2	$4,466,228

Operating Costs per Revenue Hour	2008	2011
Using Bus-to-Streetcar Cost Factor		
Portland (TriMet) Bus	$121.05	
Bus-to-Streetcar Cost Factor	1.59	
Portland Streetcar	**$192.18**	**$198.14**
(King Co Metro) Bus	$142.61	
Bus-to-Streetcar Cost Factor	1.53	
Seattle Streetcar	**$218.25**	**$225.00**
Orange Co (OCTA) Bus	$112.24	$119.95
Avg. Bus-to-Streetcar Cost Factor	1.56	1.56
Santa Ana Streetcar	**$175.09**	**$187.12**

	Begin Service	End Service	Headways Peak/Off-Peak	Service Hours Peak/Off-Peak	Service Hours Total
Weekdays	6:00 AM	11:00 PM	10'/15'	12/ 5	17
Saturdays	6:00 AM	1:00 AM	--/15'	--/19	19
Sundays	7:00 AM	10:00 PM	--/15'	--/15	15

	Peak Rev Hours	Peak Veh in Service	Peak Veh Rev Hour	Off-Peak Rev Hours	Off-Peak Veh in Service	Off-Peak Veh Rev Hour	Total Veh Rev Hr/Day	Total Veh Rev Hr/Wk
Weekdays	12	5	60	5	3	15	75	300
Saturdays			0	19	3	57	57	114
Sundays			0	15	3	45	45	45
Total Veh Rev Hours/Week								459

Note: NTD figure shown. OCTA regular, fixed-route bus ops. cost/vehicle revenue hour of $115 in FY '07-'08 dollars was used in BRAVO BRT cost estimates.

Based on FY2010-11 data from OCTA showing regular fixed route bus ops cost/vehicle revenue hour at $119.95

Total Veh Rev Hours/Year 23,868

Total Est Annual O&M Cost **$4,466,228**

Check: $4,466,228
Veh Rev Hours/Year * Ops Cost/Veh Rev Hours

[1] ***Operating cost per hour*** *- Used $187.12 per revenue hour cost for Santa Ana streetcar. Applied an average of the bus-to-streetcar cost factor for Portland Streetcar/Seattle Streetcar to the Orange County bus costs Includes data from FTA - National Transit Database and from direct sources. Used 3.1 percent annual inflation rate to escalate 2008 dollars to 2009.*

[2] ***Capacity per vehicle*** *- Based on 80% of design capacity by vehicle type. Assumes single-car Inekon Portland-style streetcar.*

[3] ***Frequency per hour*** *- Based on 10-minute peak/15-minute off peak service plan discussions (provided by Bob Post-URS).*

[4] ***Peak roundtrip runtime -*** *Time in minutes from route end to route end and back during peak hours. Does not include any layover time - derived from Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[5] ***Off-peak roundtrip runtime -*** *Time in minutes from route end to route end and back during off-peak hours. 20% less than peak hour roundtrip runtime where operating in mixed traffic. 10% less where operating partially exclusively.*

Annualization Factor 318.2

[6] ***Roundtrip miles -*** *Miles from route end to route end and back. Derived from Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

[7] ***Average peak speed -*** *Average miles per hour over the full route length during peak hours. Derived from route length and peak hour runtime.*

[8] ***Average off-peak speed -*** *Average miles per hour over the full route length during off-peak hours. Derived from route length and off-peak hour runtime.*

[9] ***Peak vehicles required -*** *The number of transit vehicles required to complete the roundtrip at the frequency noted during peak hours. Confirmed by Santa Ana Streetcar Fleet Size Estimation and Operations Plan.*

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[15] ***Operating cost annualization factor*** *- Factor to escalate a single day to annual. It is less than 365 to account for a lower level of service typically provided on weekends and holidays.*

[16] ***Estimated annual O&M cost*** *- Result of multiplying the annualization factor by the peak and off-peak hourly cost times hours in a day.*

	Peak	Off-Peak	Weekly
Weekday	462	150	2,448
Sat		570	1,140
Sun		450	450