City/Park STREETCAR Feasibility Study

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EXECUTIVE SUMMARY

The City/Park Streetcar Feasibility Study represents a partnership effort by the San Diego Metropolitan Transit System (MTS) and the many stakeholders who live, work, and play in Downtown San Diego and Balboa Park to determine the feasibility of a transit project connecting the two communities. The City/Park Streetcar would be the initial segment of an urban streetcar loop that is envisioned in the 2050 Regional Transportation Plan (2050 RTP) by the San Diego Association of Governments (SANDAG). This streetcar loop would eventually connect the neighborhoods of Downtown, Bankers Hill, Hillcrest, North Park, South Park, and Golden Hill.

Balboa Park is an iconic and historic destination that is popular among both locals and tourists. With approximately 14 million visitors per year, it is the nation's fourth-most-visited city park, hosting the San Diego Zoo as well as many other museums, landmarks, and cultural institutions.[1] In addition, the public institutions along Park Boulevard—which, as Balboa Park's central spine, serves as its primary access route from Downtown San Diego—share rich histories as some of the region's most important education and employment centers, to include San Diego High School, San Diego City College, and the Naval Medical Center San Diego. For this reason, the 1.5-mile Park Boulevard corridor was specifically named in the grant that funded this study as the preferred alignment corridor for a streetcar "starter line." Additionally, the Park Boulevard corridor conforms to the future streetcar network in the 2050 RTP. The California Department of Transportation and the San Diego Gas & Electric Company provided the grant to perform this study, and consultant Parsons Brinckerhoff assisted in its completion.

Streetcars are just one of many transportation options that may be offered in an urban community. Compared to other transit modes, streetcars typically are intended for local, short-distance circulation, and are effective at providing a sense of permanence and identity within a corridor. They are intended to promote walkability and livability within communities and encourage a "park once and walk" attitude. While streetcars have historically enjoyed popular sentiment among local residents and visitors, this does not always translate into sustainable ridership levels, as ridership can vary with a number of external factors. For the most part, smart-growth land use policies, "complete street" transportation policies, and development partnerships can greatly affect the ridership and ultimate success of streetcar lines.

This feasibility study sought to address the many opportunities and constraints that would affect streetcar service on Park Boulevard. Its analysis focused on:

- Assessing potential engineering issues related to existing infrastructure and site conditions;
- Identifying and evaluating available streetcar vehicles;
- Defining a streetcar alignment within the right-of-way of Park Boulevard;
- Generating potential ridership estimates and conceptual service characteristics;
- Developing conceptual capital, operating, and maintenance cost estimates; and
- Identifying a set of potential financing options.

This study represents the first step in the process of planning and constructing a streetcar line in the City of San Diego. At this time, no specific streetcar project has been initiated, no detailed planning or design work has been performed, and no funding sources have been committed. This report is summarized as follows:

Section 2: Existing Conditions – Section 2 describes the existing conditions in the study area corridor that would affect the planning and implementation of a streetcar system, including existing plans and policies, infrastructure, utilities, right-of-way constraints, parking, and potential environmental concerns. A careful survey of existing conditions, combined with the results of several stakeholder workshops and surveys, revealed several important factors that influenced the cost and overall feasibility of the alignment alternatives for the City/Park Streetcar. These included:

[1] "2011 City Park Facts," The Trust for Public Land, 2011.

- Required width necessary for project implementation, including possible impacts to the Park Boulevard right-of-way;
- Limitations of the Interstate 5 bridge;
- Height issues associated with the Prado Pedestrian Bridge spanning Park Boulevard;
- Potential changes to on-street and off-street parking facilities;
- Planned future pedestrian and bicycle facilities in the corridor;
- Planned future transit facilities in the corridor, including the Mid-City Rapid Bus, Mid-City Light-Rail Transit (LRT), and Downtown streetcar network; and
- Retention of the landscaped median on Park Boulevard through Balboa Park.

Section 3: Systems Requirements – Section 3 examines the design and engineering features necessary for a streetcar to operate in the Park Boulevard corridor. These include: right-of-way needs for the streetcar and LRT vehicles; proposed bicycle and pedestrian facilities in the corridor; individual station amenities including requirements for persons with disabilities; overhead catenary system and suspension poles; substation needs for the 1.5-mile alignment; the potential location of future substations as the network is expanded; and the maintenance and storage facility needs for this initial segment.

Section 4: Streetcar Vehicles – Section 4 surveys the different types and features of streetcar vehicles, including modern, historic, and replica cars. Due to the relatively straight alignment of the Park Boulevard study area, all vehicles reviewed could likely operate along the route without any problems; however, the eventual expansion of the line planned in the 2050 RTP may entail tighter turns that longer cars could have difficulty navigating. The assessment concluded that maximum design flexibility will be achieved with a vehicle that uses both sides for boarding, allows for bi-directional travel, and requires minimal track installation.

Additionally, the assessment determined that the selection of historic vehicles may require the use of modern vehicles in the corridor as well. This is due to the limited inventory and lengthy restoration time of historic cars combined with the increased demand that is projected to occur in the city’s streetcar network. Essentially, the modern vehicles could be used as the everyday “workhorses” in the corridor, with the historic cars operating when their aesthetic appeal would be most appreciated, such as during weekends or special events in Balboa Park.

Section 5: Operations Plan – Section 5 provides a sample plan for operating and maintaining the City/Park Streetcar, including vehicle requirements, schedule considerations, and operational costs. The corridor would have seven stations on Park Boulevard with a total of 2.4 track miles, would run daily on 15-minute frequencies (8:00 a.m. to 6:00 p.m.), and would provide point-to-point service between the City College Trolley Station and the San Diego Zoo. This type of operating plan would require up to four vehicles to operate in the corridor.

The operation and maintenance cost estimate assumes 7,215 annual revenue hours with an annual operating cost in the range of $1.0 million - $1.1 million in FY 2012 dollars. It should be noted that if a modern streetcar vehicle is selected other than the Siemens vehicle currently operated by MTS, the operations and maintenance costs could be higher due to new training and parts-acquisition needs.

Section 6: Alignment Concepts and Evaluation – This section provides five different alignment concepts for the Park Boulevard segment north of I-5, with each alignment option evaluated for its implementation feasibility. The evaluation considered the engineering, operational, cost feasibility, and other site conditions such as environmental issues and consistency with planning documents. The alternatives presented in this study were evaluated by the City/Park Streetcar Steering Committee and modified as new information and community input were received.

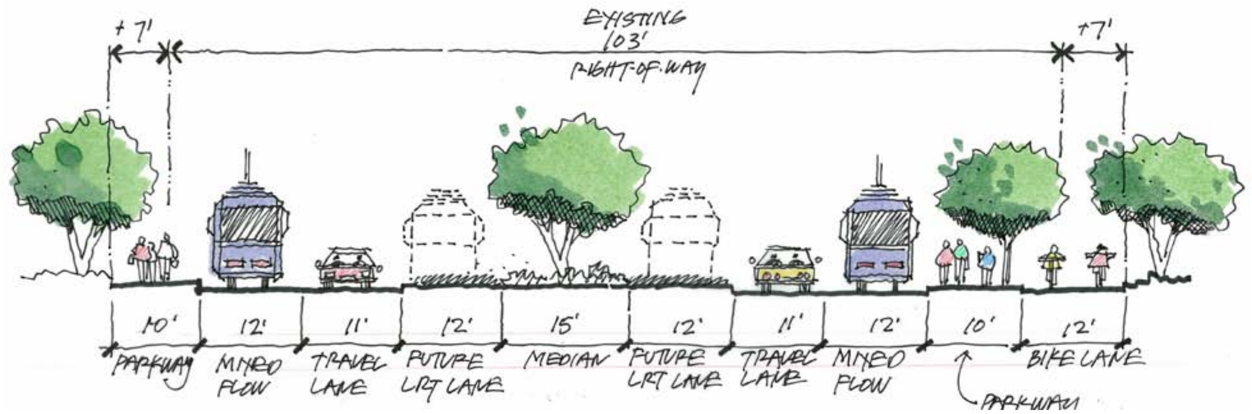
Each alignment concept describes the opportunities to best facilitate the streetcar and other design assumptions, which include the following:

- An “in-street” or mixed flow lanes for streetcars traveling in both directions;
- A new bicycle facility as defined in the City of San Diego Bicycle Master Plan;
- A future LRT right-of-way as described in the 2050 RTP;

- Pedestrian enhancements allowing for the implementation of the "Bay to Park" link on Park Boulevard; and
- Retention of the landscaped median north of Interstate 5 as the alignment travels through Balboa Park.

North of Interstate 5: Figure ES-1 shows the Option 4 alignment concept occurring north of the Interstate 5 Bridge. This option attained the highest score in the evaluation matrix. This is due primarily to its reservation of future LRT lanes by expanding the median, placement of a Class 1 bicycle lane on the west side of Park Boulevard (thus eliminating the conflicts between the cyclist and the streetcar), and a right-side running streetcar adjacent to the curb. The concept also provides for all the facilities outlined in the various applicable planning documents, and the additional right-of-way required is minimal, at only an additional seven feet on each side.

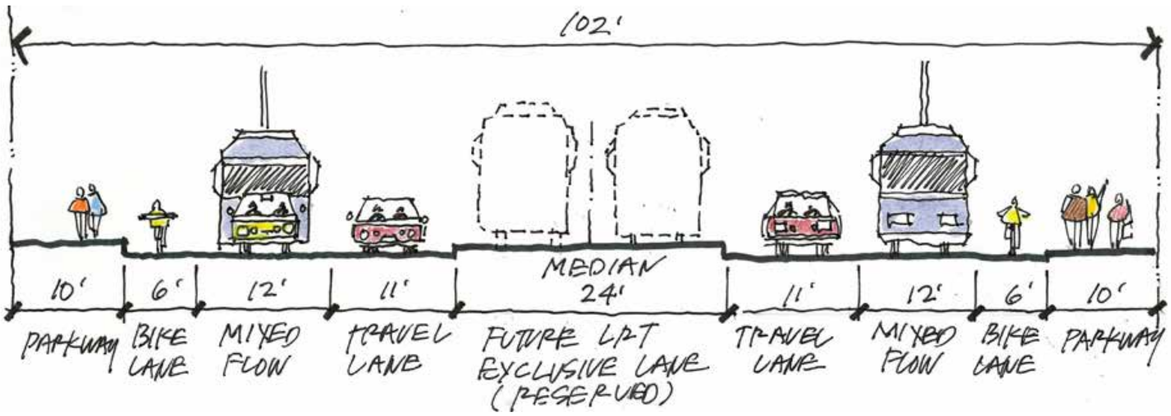
Figure ES-1: Option 4 Alignment Concept



Source: Parsons Brinckerhoff

South of Interstate 5: The right-of-way width remains consistent and only one alignment concept was defined south of the Interstate 5 Bridge. The cross-section for this portion of the Park Boulevard right-of-way can remain the same without any additional take for the proposed improvements. However, this design does require the elimination of all on-street parking in this portion of the corridor. A typical cross-section is shown in Figure ES-2.

Figure ES-2: South of Interstate 5 Alignment Concept



Source: Parsons Brinckerhoff

Section 7: Ridership Estimate – Ridership projections represent a reasonable estimate based on current and existing conditions. There is potential for ridership to increase beyond this level in the future due to the rising cost of car ownership, the adjacent smart-growth initiatives, the general attraction of rail-based transit to the public, and the numerous activity centers in the Downtown and Balboa Park areas. If the streetcar and other alternative-forms of transportation are given priority in the corridor, they have great potential to attract a whole new market of transit riders. Initial ridership projections for the streetcar are:

- Average Daily Ridership, Weekdays: 1,100
- Average Daily Ridership, Weekends: 1,800
- Average Total Ridership, Annual: 377,000

Section 8: Capital Cost – Capital costs for constructing the streetcar line have been estimated using an order-of-magnitude projection for the selected streetcar alignment. Costs were broken down into the following seven categories, corresponding with the Federal Transit Administration (FTA) Standard Cost Category format:

- Guideway and Track;
- Stations and Platforms;
- Support Facilities;
- Site Work and Special Conditions;
- Systems;
- Right-of-way, Land, and Existing Improvements; and
- Professional Services.

The total initial estimate for project construction (not including vehicles) is $68.2 million, while the estimated unit price of each vehicle (including restoration of historic vehicles) is between $850,000 and $3,600,000.

Construction costs are based on the reasonable assumption that the existing MTS LRT facility at 12th and Imperial Avenues has the storage, maintenance, and administrative capacity that the City/Park Streetcar would require. Future expansion of the streetcar system beyond the City/Park Streetcar alignment would require additional facilities to accommodate the additional vehicles and maintenance needs.

At this time, no cost for land acquisition is identified. Land acquisition typically is a major cost driver for rail transit projects due to high price of acquiring right-of-way. However, the City/Park Streetcar's alignment is situated almost entirely within public streets or other publicly owned parcels. In exchange for lower right-of way costs, there may be other administrative and environmental challenges pertaining to the appropriation of public land.

Section 9: Next Steps: Future Activities and Funding Sources – This feasibility study is the very beginning of the process to plan and implement the City/Park Streetcar. To move the project forward to realization, several additional steps will be required. These steps include; the identification of funding sources; further planning, design, and engineering work; environmental clearance; procurement of vehicles; and actual project construction. It is anticipated that this process would require approximately five years.

This section also identifies potential funding opportunities and requirements to prepare for the next steps of project development. Based on the current economic climate as well as the recent experiences of other cities with streetcars, the greatest potential to implement the City/Park Streetcar lies in securing funding from multiple sources. This would mean investigating all potential funding sources: local/regional agencies such as SANDAG and the City of San Diego, state funding programs for transportation, federal funding grants such as the FTA New Starts and Small Starts programs, and public-private partnerships.

In contrast to LRT projects, streetcars typically receive some operational and maintenance funding from diverse local sources, rather than relying solely on the transit agency or regional transit funds (such as revenue from the *TransNet* sales tax). This alleviates the potential conflict of redirecting transit dollars from currently operating transit service to a new streetcar service. Securing operating and maintenance dollars from a variety of sources therefore can increase the feasibility of a new streetcar project, and allow its construction to occur in a shorter timeframe than typical LRT projects.

Introduction

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1.0 INTRODUCTION

The San Diego Metropolitan Transit System (MTS) has prepared this feasibility study to analyze the challenges of implementing a streetcar line as an urban circulator in San Diego. The proposed alignment would run from Downtown to Balboa Park, covering a total length of 1.5 miles. Called the City/Park Streetcar, the service would be the first segment of an urban streetcar network that is planned in the 2050 Regional Transportation Plan (2050 RTP) by the San Diego Association of Governments (SANDAG).

The least challenging route for this short "starter line" would appear to utilize existing Park Boulevard right-of-way between the City College Trolley Station and the San Diego Zoo, serving San Diego City College, San Diego High School, Naval Medical Center San Diego, and many Balboa Park attractions along the way. Park Boulevard is also the former alignment of the historic Route 7 and Route 11 streetcars that ran to Balboa Park until 1949 (Figure 1-2); unfortunately, no infrastructure remains from these old lines.

Figure 1-1: Modern Streetcar in Seattle

Source: Parsons Brinckerhoff

The streetcar is one of many transit systems that SANDAG proposes in order to meet legally mandated emission-reduction targets in the coming decades. At this point, however, 2050 RTP funds are only planned to cover 10% of the streetcar's construction costs. In addition, the 2050 RTP does not fund operating costs after construction is complete. Once more funding sources can be identified, future planning and engineering efforts should build upon the assessment provided in this study.

The study's scope is limited to the 1.5-mile corridor of Park Boulevard between Broadway and Zoo Place (Figure 1-3). Unlike typical feasibility studies that evaluate several corridors, this study focuses solely on a Park Boulevard alignment in order to maximize access to Balboa Park and the many employment, educational, and recreational activity centers in the corridor.

Figure 1-2: Streetcar at Balboa Park Terminal Near Park Boulevard, c. 1915

Source: Richard V. Dodge, "Rails of the Silver Gate"

Figure 1-3: City/Park Streetcar Proposed Alignment and Station Locations

Source: Parsons Brinckerhoff

1.1 Study Funding and Guidance

MTS received grant funding from the California Department of Transportation (Caltrans) and the San Diego Gas & Electric Company to perform this study, and consultant Parsons Brinckerhoff assisted in its completion. The grant specifically identified Park Boulevard as the preferred alignment corridor.

To guide the study process and help define its objectives, MTS convened a Steering Committee of local stakeholders. The committee met three times in the period between April and October 2011. In addition, MTS facilitated several community outreach events to gather input from the public. The results of these proceedings are detailed in Appendix A.

1.2 Study Purpose and Objectives

The purpose of this study is to explore concepts and options for the City/Park Streetcar, to include an identification of challenges, constraints, and preferred solutions. It will provide MTS with the information necessary to determine whether the streetcar initiative should proceed beyond this initial study phase to the preliminary engineering and final design phases.

The specific objectives of this feasibility study are to:

- Identify and evaluate potential streetcar alignment concepts;
- Assess potential engineering issues related to existing infrastructure and site conditions;
- Identify and evaluate available streetcar vehicles;
- Generate potential ridership estimates and conceptual service characteristics; and
- Develop conceptual capital, operating, and maintenance cost estimates, and identify a set of potential financing options.

1.3 Need

This study of the feasibility of the City/Park Streetcar derives its need from a combination of factors, including recent evidence from peer cities of the unique benefits that streetcars can bring to dense urban areas and attractions. Downtown San Diego and Balboa Park provide several potential markets to serve. Finally, the current transit options serving the park are limited and relatively unpopular among visitors and other “riders of choice” who can opt for other modes.

1.3.1 Characteristics and Benefits of a Streetcar System

Streetcars are designed for short-distance trips, with relatively slow speeds and stations placed every few blocks. They complement and support existing modes of travel such as light-rail transit (LRT), local and rapid buses, bicycling, and walking.

Similar to LRT, streetcars typically are powered by electricity through overhead catenary wires. Unlike LRT systems, however, streetcars generally utilize smaller, single-car vehicles and are able to operate in mixed-flow traffic on city streets (Figure 1-4) rather than being limited to dedicated rights-of-way.

Figure 1-4: Streetcar in Mixed-Flow Traffic in Portland, OR

Source: Jeramey Jannene

This allows streetcars to occupy a relatively small footprint, making them significantly less expensive to build than LRT and ideal for dense urban areas.

With the ability to circulate efficiently within an urban area, streetcars can directly reduce the number of automobile trips taken. This contributes to reducing congestion, increasing transit ridership, and alleviating parking demand. Moreover, by encouraging pedestrian circulation, streetcar systems can enhance the safety and "sense of place" within an urban neighborhood. By combining the predictability of rail with a natural aesthetic appeal, streetcars also can encourage those less comfortable with riding a bus to take transit, thereby increasing ridership potential.

The benefits of streetcars are not limited solely to transportation. In many areas, streetcar systems have proven effective not just as mobility solutions, but also as investment-generating infrastructure that can catalyze urban economic revitalization. Some recent streetcar systems have even been constructed using large infusions of private capital on the basis that they would bring returns on real estate and development investments.

Several of the key streetcar characteristics include the following:

- Operates on fixed guideways – providing a visible and easy way to understand routing, less threatening to pedestrians, and attracts new or additional riders than bus routes;
- Short trips and frequent service – especially good application for point to point trips in dense urban environment and where headways of 10 to 15 minutes can be provided;
- Operates in mixed flow traffic – doesn't require a dedicated or exclusive guideways such as LRT systems;
- Simple design – streetcar stations are simple in design, modest in facilities, and can be shared with buses;
- More cost effective in urban areas – is typically less expensive when compared to other rail systems and are relatively easy and inexpensive to construct;
- Reduces traffic congestion and parking demand – for corridors with multiple activity centers, streetcars can elevate traffic and the need for off-street parking; and
- Attracts private funding – streetcars have attracted private funding both before and after implementation.

1.3.2 Current Transit Options

Bus service along Park Boulevard currently is provided by MTS Route 7, which begins on Broadway and continues to La Mesa (Figure 1-5). The most heavily used bus line in the San Diego region, Route 7 has a peak-period service frequency of 6 minutes, and off-peak headways of 10-15 minutes throughout the service day.

Figure 1-5: MTS Route 7 Buses Stopping at El Prado on Park Boulevard

Source: Parsons Brinckerhoff

Despite having such readily available transit service in the corridor, there is a common perception among the public that the bus lacks the permanence, identity, and aesthetic appeal that rail-based transit generally enjoys. This tends to discourage "choice riders"—those who are not dependent upon transit for mobility—from using the bus over their private automobiles.

Without popular transit options, public access to Balboa Park is overwhelmingly accomplished by automobile. A 2007 report by the Trust for Public Land assessed the modes of transportation for those visiting Balboa Park and found that public transit only brought an average of 5% of park visitors, with the majority instead arriving by private automobile.[1] Once in the park, many visitors also cited frustration with the lack of central parking, being forced instead to use larger satellite lots and take shuttle buses into the heart of the park. This indicates a large deficiency in the provision of transit service to Balboa Park and the potential for the City/Park Streetcar to encourage more transit-based visitation.

1.3.3 Potential Markets Served by the Streetcar

Several communities in San Diego have expressed interest in restoring streetcar service for the reasons noted above: to revitalize neighborhoods, spark private investment, reduce parking needs and traffic congestion, and generate interest in transit among a new market of potential riders. The 2050 RTP calls for several future streetcar lines in San Diego, including the neighborhoods of Downtown, Little Italy, and the historic “streetcar suburbs” of Mid-City that include North Park, Hillcrest, Bankers Hill, Golden Hill, and South Park.

Situated squarely in the middle of these city neighborhoods is Balboa Park (Figure 1-6), widely considered to be the cultural heart of San Diego. With 1,200 acres of natural habitats, open space, and cultural attractions, it is the nation’s fourth-most-visited city park.[2] One of the main arterials connecting downtown to Balboa Park is Park Boulevard, which provides access to the Central Mesa—where the majority of the park’s attractions are located—as well as the activities on the eastern and northern sides of the park.

Figure 1-6: Balboa Park Lily Pond and House of Hospitality

Source: Parsons Brinckerhoff

Compared to other major north-south roads in and around Balboa Park, Park Boulevard provides the closest pedestrian access to the San Diego Zoo, Naval Medical Center San Diego, and most of the park’s museums and institutions. A system with the permanence and reliability of a streetcar can be expected to encourage transit use significantly more than existing bus lines, particularly among park visitors and tourists who may be drawn to its visual appeal. As noted above, the combination of automobile dominance and parking frustration among park visitors opens up a strong potential market for the City/Park Streetcar to capture.

In addition, the southern portion of the proposed alignment falls within Downtown’s rapidly growing East Village neighborhood. This area features the types of dense, pedestrian-oriented land uses that are most conducive to a streetcar’s success. It also contains a connection to Blue and Orange Lines of the San Diego Trolley LRT system, from which transfers are likely to generate many streetcar trips. The City/Park Streetcar will work in tandem with local land use policy to encourage non-automobile circulation among residents and visitors alike.

[1] “The Soul of San Diego: Keeping Balboa Park Magnificent in its Second Century,” The Trust for Public Land, 2007.
[2] “2011 City Park Facts,” The Trust for Public Land, 2011.

1.4 History of Streetcars in San Diego

Figure 1-7: SD1 Streetcar on Broadway in San Diego, c. 1913

Source: San Diego Historical Society

An extensive streetcar system existed in San Diego throughout the late 19th and early 20th centuries (Figure 1-7), but ended service in 1949 when the last streetcar route was replaced by buses. Suburban development, shifting commercial and residential centers, right-of-way maintenance costs, and rising automobile ownership rendered the streetcars too expensive and inflexible to remain viable in post-war San Diego. Rubber-tired buses utilized existing city streets and had no direct right-of-way maintenance expenses. These buses could utilize new highways, and routes could be easily adjusted, modified or extended to accommodate a growing region. The bus system expanded geographically over the next several decades through both private and public ownership, even as its levels of ridership and productivity gradually fell.

By the 1970s, the shortcomings of the bus-only transit system had become evident. Buses did not have the capacity that larger rail vehicles could offer. Without their own rights-of-way, they became mired in traffic and suffered the same delays and unreliability as commuters in their own automobiles. And their great flexibility, a significant advantage in some ways, also made the bus system unappealing, unpredictable, and difficult to understand for potential new riders. To this end, in 1981 rail transit was reborn in San Diego with the opening of the San Diego Trolley LRT system. It utilized modern cars from Europe to offer fast, reliable, high-capacity service on the city's busiest transit corridors. Two additional light rail lines were added in the next 25 years, with a fourth line anticipated to be in service by 2018. The success of the San Diego Trolley has spawned similar LRT systems all over the United States.

In the 1990s, there was a resurgence of American downtowns and inner-suburbs, many of which had initially been developed around streetcar lines in the early 20th century. Residents of these areas, now larger in population and influenced by inadequate parking, congested roads, higher density, and a new environmental consciousness, began considering whether streetcars could again be a transportation solution in modern urban areas. Taking advantage of growing support across the nation, streetcars have recently experienced a renaissance in cities like Portland, Tampa, Seattle, Tucson, and Dallas. Today, as the City/Park Streetcar moves one step closer to implementation, San Diego is poised to join the trend.

1.5 Report Structure

This report is divided into the following sections:

- **Section 2: Existing Conditions.** Describes the existing conditions in the study area corridor that would affect the planning and the implementation of a streetcar system.
- **Section 3: Systems Requirements.** Examines the design and engineering features necessary for a streetcar to operate.
- **Section 4: Streetcar Vehicles.** Surveys the different types and features of streetcar vehicles, including modern, historic, and replica vehicles.
- **Section 5: Operations Plan.** Provides a sample plan for operating and maintaining the City/Park Streetcar, including scheduling considerations and vehicle requirements.
- **Section 6: Alignment Concepts and Evaluation.** Defines several design concepts, evaluates each concept, and provides recommendations.
- **Section 7: Ridership Estimate.** Projects ridership levels for the corridor.
- **Section 8: Capital Cost.** Provides an order-of-magnitude estimate of the initial capital cost for the selected streetcar alignment concept.
- **Section 9: Next Steps: Future Activities and Funding Sources.** Reviews the next steps to pursue as the project moves forward as well as potential funding opportunities.

The report also contains the following supplemental appendices:

- **Appendix A: Steering Committee and Community Outreach.** Summarizes the proceedings of the Steering Committee as well as the results of community outreach events.
- **Appendix B: Utility and Topographic Maps.** Provides detailed maps of utilities and topography for each segment of the proposed alignment.
- **Appendix C: Planned Bicycle Facilities.** Describes the Class II Bicycle Lanes that are recommended for Park Boulevard in the City of San Diego Bicycle Master Plan.
- **Appendix D: Alignment Concept Evaluation Matrix.** Evaluates each alignment concept against a range of criteria, and is the basis for most of the analysis in Section 6.
- **Appendix E: Planned Development at Park Boulevard and C Street.** Shows the approved development plan for a mixed-use residential project near the southern end of the proposed alignment.
- **Appendix F: Balboa Park Facility Operating Hours.** Contains a survey of operating hours for major Balboa Park facilities and other institutions in the alignment corridor.
- **Appendix G: Sample Scheduling and Operating Costs**. Contains a sample run-time matrix based on the operations plan in Section 5 and projected operating costs.

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Existing Conditions

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2.0 EXISTING CONDITIONS

The section of Park Boulevard under study, running from Downtown to Balboa Park, is a busy and important link in the region's transportation system. Not only does it provide primary access to Balboa Park for 14 million annual residents and visitors, but it is also a key arterial in the city's circulation system, providing a vital connection between Downtown and the densely populated neighborhoods of the Mid-City district. The section below examines the many features, facilities, and constraints that exist along Park Boulevard that would impact the construction and operation of the City/Park Streetcar.

2.1 Interstate 5 Bridge

Park Boulevard crosses Interstate 5 on a five-lane bridge built in 1962 (Figure 2-1). It is rated in good condition by the Federal Highway Administration's National Bridge Inventory, and currently carries an average of 22,000 vehicles per day. However, the bridge was not built to the load-bearing standards necessary to accommodate rail transit vehicles. In addition, it lacks the grounding elements necessary to control the stray current generated by the electric rail system. Without these special grounding connections to dissipate current, dangerous corrosion would begin to accumulate on the steel reinforcements within the bridge's concrete structure.

Figure 2-1: Interstate 5 Bridge

Source: Parsons Brinckerhoff

These factors make the existing bridge incompatible with the City/Park Streetcar, meaning that a new structure will be necessary to carry the streetcar over Interstate 5. However, with a future light-rail transit (LRT) line also planned for the same corridor by 2035 (see Section 2.11 below), it is likely that the bridge will need to be replaced by a more suitable structure in the coming decades anyway. Several options for this crossing are discussed in Section 6.5, ranging from construction of an entirely new bridge to a hybrid concept that leaves portions of the existing structure intact. Current California Department of Transportation (Caltrans) plans do not include any major work on or replacement of the bridge in the future.

2.2 Prado Pedestrian Bridge

A pedestrian bridge crosses Park Boulevard approximately 1,000 feet south of Zoo Place (Figure 2-2). The bridge connects Balboa Park's El Prado area, which constitutes the heart of the park, with the east side of park near the Rose Garden. This bridge is also located near the bus stops for MTS Route 7.

Currently, the bridge is not high enough to meet the 19-foot clearance requirement of the California Public Utility Commission (CPUC). The current clearance from the bottom of the bridge to the surface of the street is approximately 17 feet. Pursuant to CPUC requirements, this clearance issue will need to be addressed if an at-grade streetcar or light-rail transit (LRT) line is to be implemented in the corridor (see Section 2.11 below). In addition, pedestrian access from Park Boulevard to the bridge is not compliant with the accessibility requirements of the Americans with Disabilities Act (ADA).

This leaves three (3) possible options to deal with the pedestrian facility:

- Build an entirely new bridge (as defined in the Balboa Park Master Plan);

- Lower the street grade when constructing the streetcar improvements, which would also accommodate the future LRT systems; or
- Seek a variance from the CPUC to allow the current clearance height to remain.

Figure 2-2: Prado Pedestrian Bridge

Source: Parsons Brinckerhoff

Alternately, in lieu of the bridge, a pedestrian-activated, signalized crossing facility could be installed at grade across Park Boulevard. This would still require demolition of the bridge.

As noted earlier, the long-term plan for Balboa Park does call for the replacement of the pedestrian bridge during construction of the Park Boulevard Promenade, a pedestrian facility to the west of Park Boulevard. This project, which is discussed in more detail in Section 2.11 below, would also install a transit station under the new bridge's western side. As with the replacement of the Interstate 5 bridge, any costs associated with the replacement of the pedestrian bridge should be evaluated as longer-term investments that will reduce the implementation costs of future transit plans.

2.3 Land Use

The majority of the proposed streetcar alignment, from the Interstate 5 bridge north to Zoo Place, is surrounded by Balboa Park. Owned by the City of San Diego, this land is a public recreational facility and open space and is not zoned.

Immediately south of the Interstate 5 overpass, the proposed streetcar alignment falls entirely within the Centre City Planned District, a special zoning area designated in the Municipal Code. This district was established in order to facilitate implementation of the Downtown Community Plan, whose development plans are discussed later in Section 2.11. The majority of land bordering the proposed streetcar alignment in this area is comprised of the campuses of San Diego High School and San Diego City College, both publicly owned. As educational institutions, these campuses are zoned either as Public/Civic (for built areas) or Open Space (for greens and athletic fields). Most notably, the two blocks between Russ Boulevard and C Street to the east of Park Boulevard contain the City College's Park Boulevard Green, and are zoned as Open Space.

The five remaining city blocks at the southern end of the streetcar route are privately owned, and contain land uses generally considered to be "streetcar-oriented" due to their mixed-use, pedestrian-friendly characteristics.[1] With a compact nature that provides limited parking options, these urban zones generally discourage automobile use—and instead provide rich opportunities for transit to succeed.

Four of these mixed-use blocks are west of Park Boulevard and are zoned for Residential Emphasis, which dedicates land primarily for residential uses but also allows ground-floor commercial operations. This area contains a hotel, an auto-mechanic shop, several small parking lots, and the mixed-use residential complex known as the "Smart Corner" that also contains the City College Trolley Station. The remaining private block, between Broadway and C Street east of Park Boulevard, is zoned as a Neighborhood Mixed-Use Center. This designation allows for greater commercial use than the other blocks, and currently contains a restaurant, surface parking lot, and several smaller structures. Provided in Figure 2-3 is a map of the existing land uses within the corridor.

[1] "Street Smart: Streetcars and Cities in the Twenty-First Century," edited by Gloria Ohland and Shelley Poticha, 2007.

Figure 2-3: Existing Land Use Map

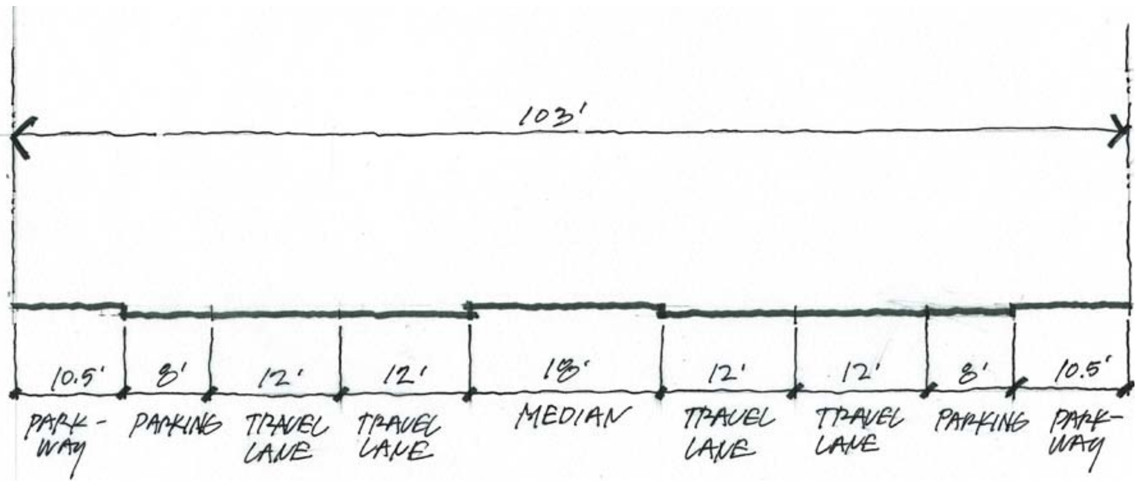
2.4 Park Boulevard Right-of-Way

The existing Park Boulevard right-of-way varies slightly throughout the proposed streetcar route and can be divided into three distinct segments:

2.4.1 North of Interstate 5 Bridge

The Park Boulevard right-of-way north of the Interstate 5 bridge is typically 103-feet wide, featuring a planted median flanked on either side by two general-purpose travel lanes, on-street parking (provided in most areas), and sidewalks with parkway as illustrated in Figure 2-4. In the Community Outreach and Steering Committee meetings, a strong desire was expressed to maintain the current width of the landscaped median through the Park.

Figure 2-4: Existing Cross Section of Park Boulevard, North of Interstate 5 Bridge



Source: Parsons Brinckerhoff

Figure 2-5: Park Boulevard-Looking North of the I-5 Bridge

Source: Parsons Brinckerhoff

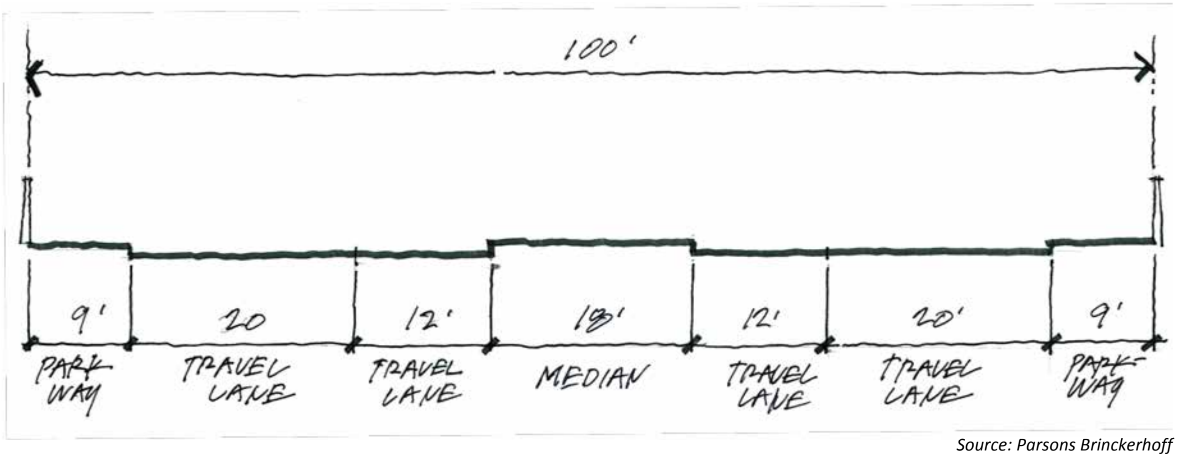
Figure 2-6: Park Boulevard-Looking North of the I-5 Bridge

Source: Parsons Brinckerhoff

2.4.2 Interstate 5 Bridge

The Interstate 5 bridge itself is 100-feet wide, featuring two general-purpose travel lanes in each direction, a paved median and pedestrian sidewalks as illustrated in Figure 2-7. On-street parking is not allowed on the bridge so the curbside travel lane is extra wide at 20-feet.

Figure 2-7: Existing Cross Section of Interstate 5 Bridge



Source: Parsons Brinckerhoff

Figure 2-8: Park Boulevard and I-5 Bridge-Looking North

Source: Parsons Brinckerhoff

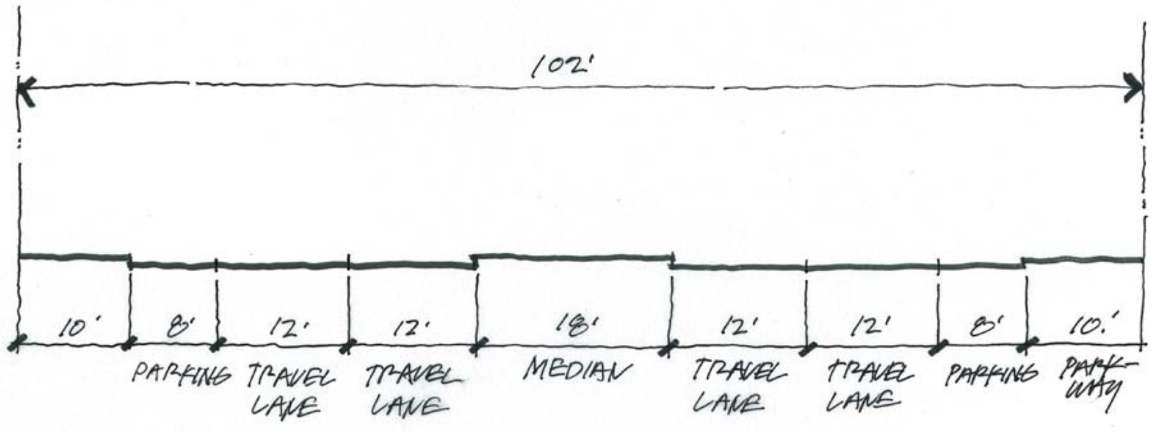
Figure 2-9: Park Boulevard and I-5 Bridge-Looking South

Source: Parsons Brinckerhoff

2.4.3 South of Interstate 5 Bridge

Between the Interstate 5 overpass and C Street in Downtown San Diego, the Park Boulevard right-of-way varies slightly, but is typically 102 feet wide as illustrated in Figure 2-10. Its features are not uniform, with medians and on-street parking in some parts, and expanded traffic lanes and widened sidewalks in others.

Figure 2-10: Existing Cross Section of Park Boulevard, South of Interstate 5 Bridge



Source: Parsons Brinckerhoff

Figure 2-11: Park Boulevard-Looking South past the I-5 Bridge

Source: Parsons Brinckerhoff

Figure 2-12: Park Boulevard-Looking North at B Street Intersection

Source: Parsons Brinckerhoff

2.5 Parking

Parking conditions along the proposed streetcar route are divided into on-street and off-street sections. Figure 2-14 and Figure 2-15 illustrate the parking facilities described below.

2.5.1 On-Street Parking

Park Boulevard contains on-street parking for approximately 318 cars along the 1.5-mile City/Park Streetcar route as illustrated in Figure 2-14. All spaces are open public parking, not delineated by stall markings or meters. From Interstate 5 north to Zoo Place, on-street parking on Park Boulevard consists of approximately:

- Southbound: 111 spaces
- Northbound: 105 spaces

South of Interstate 5 to Broadway, there are approximately:

- Southbound: 52 spaces
- Northbound: 50 spaces

Figure 2-13: On-Street Parking South of the Prado Pedestrian Bridge

Source: Parsons Brinckerhoff

Depending upon the lane-design options selected, it is possible that some or all of these on-street parking spaces may be eliminated. This would be necessary in order to accommodate the City/Park Streetcar and the other associated transportation improvements including; station platforms, Class II Bike Lanes and enhanced pedestrian facilities.

In general, a tradeoff will be required between accommodating more facilities (streetcar, on-street parking, vehicular traffic, bike lanes, pedestrian facilities, and future LRT) and minimizing expansion of the Park Boulevard right-of-way. These options are provided in Section 6.

2.5.2 Off-Street Parking

There are several off-street parking lots near the proposed streetcar route, most of which are located north of Interstate 5 in Balboa Park as illustrated in Figure 2-15. East of Park Boulevard, the Inspiration Point parking lot contains 1,090 parking stalls, including ADA and RV/Bus spaces. West of Park Boulevard, the lots at Carousel, Village Place, Pepper Grove, Organ Pavilion, Palisades, and Federal Building contain a combined 1,892 spaces. At the northern end of the proposed alignment, the San Diego Zoo parking lot is the park's largest, with space for 3,016 vehicles. However, while all of the parking lots within Balboa Park are open to the general public, the zoo parking lot is often near capacity due to zoo patrons, making it less opportune for general parking for park visitors.

South of Interstate 5, there is little off-street parking near the proposed streetcar alignment. The majority of parking spaces are in private lots, designated for patrons of local businesses and not open to public use. Similarly, parking facilities on the campuses of San Diego City College and San Diego High School are designated largely for permitted parking by faculty, students, and staff. Several blocks farther from the Park Boulevard alignment are multiple fee-based private lots that are open to the public, mainly in the East Village neighborhood. In 2009, the city-appointed Centre City Development Corporation (CCDC) issued its Comprehensive Parking Plan for Downtown San Diego to improve utilization of parking and encourage sustainability in the Downtown area. Presently, off-street parking in the East Village neighborhood is underutilized, only reaching 73% utilization at midday and 37% utilization in the evening (85% utilization is optimal based on industry standard). See Section 2.11 for more on the CCDC report.

Figure 2-14: Existing On-Street Parking

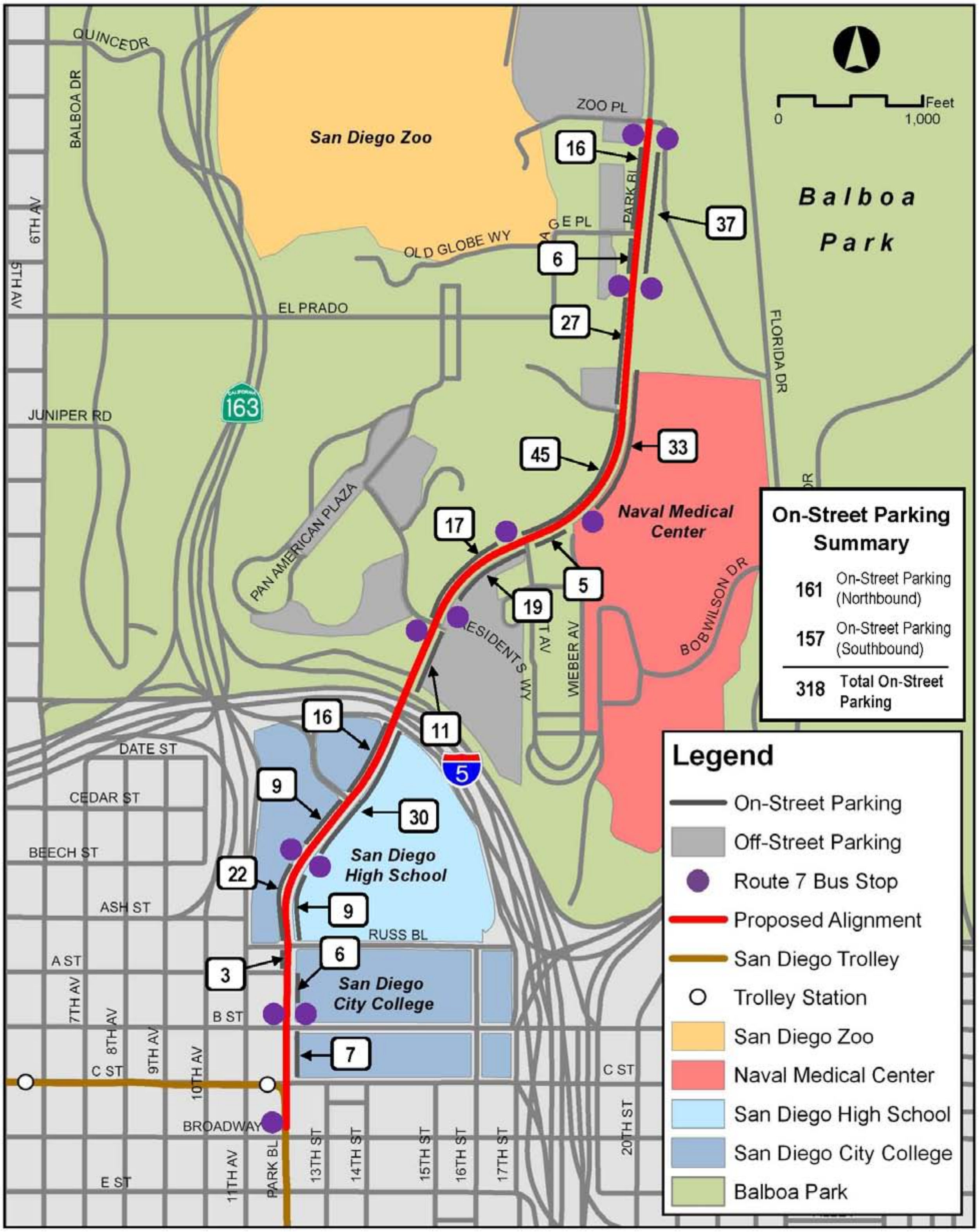
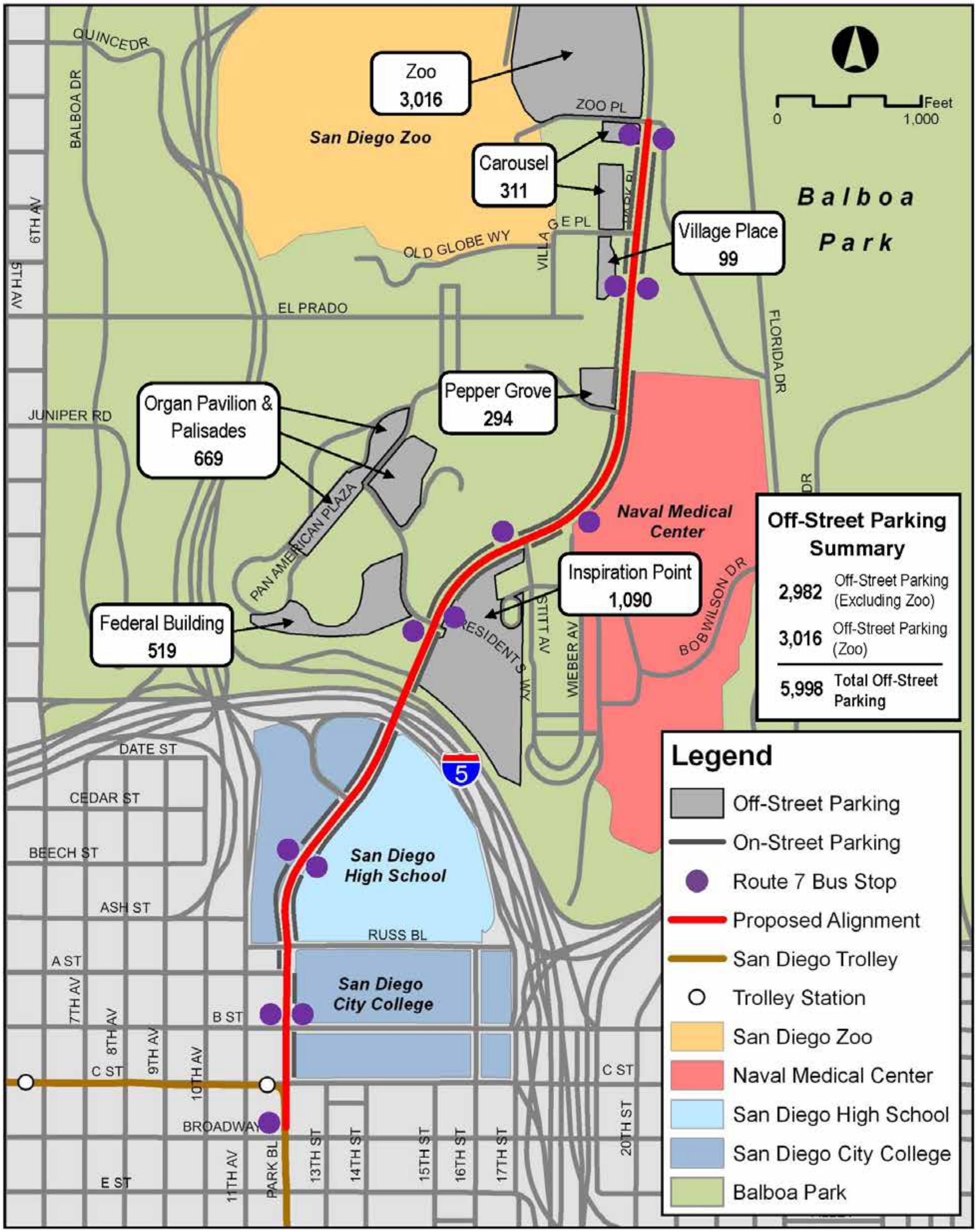


Figure 2-15: Existing Off-Street Parking



2.6 Transit Service

The Park Boulevard corridor is home to the region's busiest transit line, the Route 7 bus operated by Metropolitan Transit System (MTS). Connecting Downtown San Diego to Balboa Park, Mid-City, and La Mesa, Route 7 carried 3.8 million passengers and brought in revenues of $3.6 million in fiscal year 2011, substantially higher than any other transit line in the region.[2] It is also the region's most frequent transit service, running with a headway of six minutes between buses during peak periods, and no more than thirty minutes during off-peak times (Figure 2-16). Along the proposed alignment of the City/Park Streetcar between Broadway and Zoo Place, Route 7 currently features six stops in the northbound direction and seven stops in the southbound direction. Figure 2-15 depicts the existing station locations. For more detail on the existing bus services in the study area, see Section 5.1.

Figure 2-16: Route 7 Bus on Park Boulevard

Source: San Diego MTS

The San Diego Trolley LRT system connects to the proposed streetcar alignment at the City College Trolley Station, located between Broadway and C Street at the streetcar's southern terminus. Known as "Smart Corner" due to its mixed-use, transit-oriented design, this station serves the Blue and Orange Lines as well as twelve local and express bus routes. This connection at Smart Corner is expected to feed a large portion of the demand for the streetcar by providing an easy way for riders to transfer from other transit services.

2.7 Bicycle Facilities

The City of San Diego recently installed shared-lane markings along Park Boulevard to accommodate bicycle traffic in the right-hand vehicular lanes. Commonly known as "sharrows" (Figure 2-17), these markings establish a facility similar to a Class III Bicycle Route through Balboa Park.

However, this type of facility is not separated physically from vehicular traffic and represents a level of service below that defined for this corridor in the City's Bicycle Master Plan. See Section 2.11 below for more on the master plan and the specific improvements planned for the Park Boulevard corridor.

Figure 2-17: "Sharrow" Lane Marking

Source: Parsons Brinckerhoff

Beginning just north of Upas Street, approximately 2,000 feet north of Zoo Place, Park Boulevard contains recently installed Class II Bicycle Lanes.[3] While this is not immediately adjacent to the proposed streetcar alignment, any future bicycle facilities in the corridor should connect to these lanes.

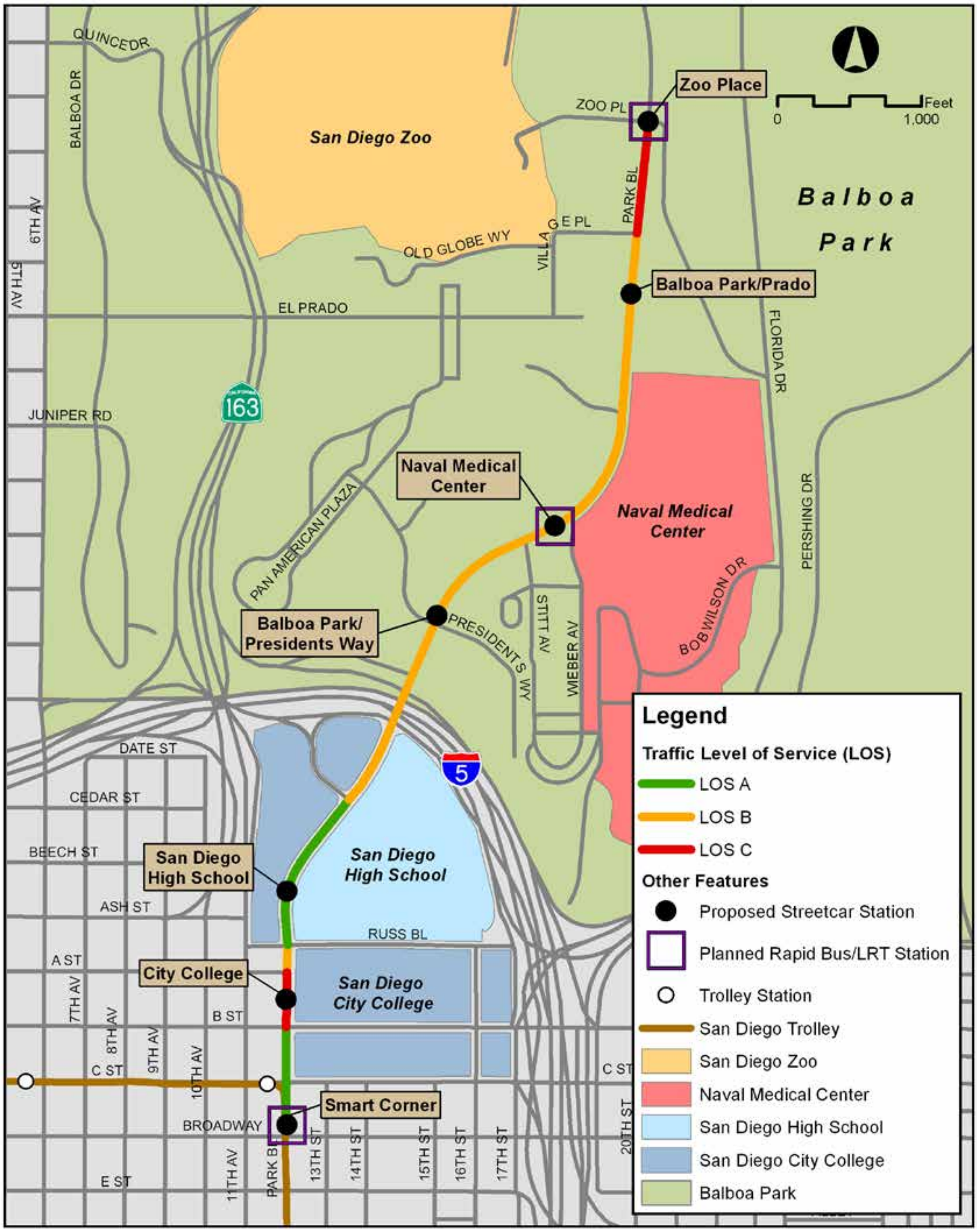
[2] SANDAG Coordinated Plan 2012-2016 (July 2012), Appendix C.

[3] A Class II Bicycle Lane is a portion of the roadway, generally five feet wide, that has been striped for bicycle use. It differs from a Class I Bicycle Path, which features complete physical separation from vehicular traffic, and a Class III Bicycle Route, which is a shared-use roadway that lacks any striping between bicycles and vehicular traffic.

2.8 Traffic

Traffic on Park Boulevard in the proposed streetcar alignment varies by segment, but overall the corridor is relatively uncongested. Daily traffic volumes do not come close to exceeding capacity in any segment, and all segments perform at Level of Service (LOS) C or better, with most at LOS A or B.[4] The lowest-performing segments are at both ends of the proposed streetcar line, in the vicinities of San Diego City College and Zoo Place. Figure 2-18 provides a summary of the daily LOS for the different segments of the Park Boulevard corridor.

Figure 2-18: Existing Traffic Conditions



Source: Parsons Brinckerhoff

[4] In traffic engineering terms, Levels of Service (LOS) A and B describe free-flow conditions, while LOS C describes near-free-flow conditions. The worst category is LOS F, which denotes extreme congestion.

2.9 Utilities

Utility constraints in the City/Park Streetcar alignment will play an important role in the final streetcar implementation. The underground utilities in the corridor consist primarily of water, electrical, sewer, drain, and fiber optic lines. Any utility relocation that occurs should consider the future LRT service in the corridor; by relocating utilities in a manner, that accommodates both the streetcar and LRT, future savings can be realized. Detailed maps of selected utilities are located in Appendix B.

2.9.1 Water

The water mains are the most prevalent utilities in the alignment, running under segments of Park Boulevard both north and south of Interstate 5 (see Appendix B). The mains are all 12 or 16 inches in diameter, which are required by city standards to be buried at depths of three to five feet below the surface.

2.9.2 Electrical

Electrical lines are also underground for the length of the corridor, and city engineering staff report that these lines are typically buried on the sides of the roadway adjacent to the curb. To obtain more specific locations for the power lines as this project moves forward, utility marking services will need be requested from the San Diego Gas and Electric Company.

2.9.3 Sewer

Aside from water and power, all other utility lines (sewer, storm drains, and fiber optic) are located in the alignment’s southern portion, between Russ Boulevard and Broadway. This four-block segment of Park Boulevard features a sewer main below the roadway, accessible via five manholes on the surface. The main diverges into a short eastern spur at A Street below the City College green. These lines, previously made of vitrified clay and concrete, are currently being replaced by polyvinyl chloride (PVC) plastic lines, a job that is expected to be complete by mid-2012.

2.9.4 Storm Drain

Additionally, a single drain pipe crosses Park Boulevard just north of Russ Boulevard, connecting San Diego High School’s drainage facilities to the larger network of drain piping west of Park Boulevard.

2.9.5 Fiber Optic

Finally, SANDAG staff has confirmed that there is a 72-strand fiber optic cable under Park Boulevard south of C Street, which constitutes the southernmost block of the proposed streetcar alignment. Relocation or modification of these utilities likely will be required in order for a streetcar system to be implemented in the corridor.

2.10 Topography

The proposed City/Park Streetcar alignment runs along some fairly steep terrain, most notably the ascent of Park Boulevard from Downtown San Diego to Balboa Park’s Central Mesa. In this area, from Russ Boulevard to the Interstate 5 overpass, Park Boulevard averages a grade of approximately 5%, which is the steepest in the study corridor. The topography levels off as the route proceeds north, reducing to approximately 1% as Park Boulevard approaches the intersection of Zoo Place.

The maps in Appendix B depict the average topography for all segments of the proposed route. As noted in Section 4, all of the streetcar vehicles under consideration have the ability to operate in roadways with maximum grades between 7% and 9%. Therefore, the existing grades within the corridor should not present any problems for the City/Park Streetcar. However, the existing road grades may play a role in the location of the substations within the corridor; it may be appropriate to place a substation near the steepest part of the corridor to better assist the streetcar in this area.

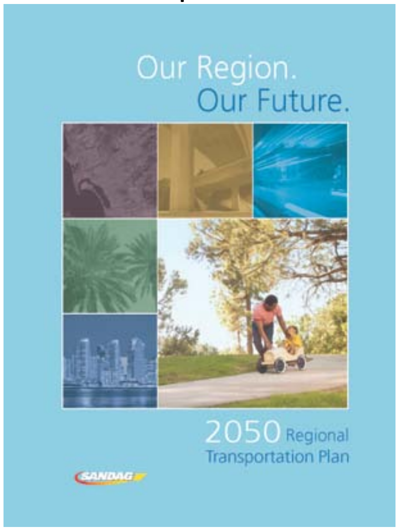
2.11 Planned Future Facilities

In addition to the existing conditions in the study area, many future facilities are already planned that must be considered when evaluating the City/Park Streetcar. These are not limited simply to transportation facilities, but also include development plans for the various properties and institutions in close proximity to the proposed alignment. The relevant planning documents are examined below.

2.11.1 2050 Regional Transportation Plan

The 2050 Regional Transportation Plan (2050 RTP) was adopted by SANDAG in October 2011 (Figure 2-19). It contains several planned services that are likely to affect the streetcar's alignment and operation.

Figure 2-19: SANDAG 2050 Regional Transportation Plan



Source: SANDAG

- **Streetcar Network**

The 2050 RTP contains plans for a streetcar network in the vicinity of Downtown San Diego, connecting it to the adjacent neighborhoods of Little Italy, Bankers Hill, Hillcrest, North Park, Golden Hill, and South Park. The City/Park Streetcar would represent the first segment of this network, and would later be expanded to form a loop around Balboa Park by extending north to Hillcrest and returning Downtown via University and Fourth and Fifth Avenues. The 2050 RTP anticipates this loop to begin full operation between 2020 and 2030.

- **Mid-City Rapid Bus**

Soon to accompany MTS Route 7 on Park Boulevard is the Mid-City Rapid Bus, scheduled to begin service in 2014 as part of the Early Action Program of the TransNet local sales tax. The service will connect Downtown San Diego to San Diego State University via Park Boulevard, El Cajon Boulevard, and College Avenue.

This new line will share Park Boulevard with Route 7 and operate in mixed-flow travel lanes. Unlike Route 7, however, the Mid-City Rapid Bus is designed as a high-frequency, limited-stop service that will stop three times along the proposed streetcar alignment: twice in Balboa Park (at Zoo Place and the Naval Medical Center) and once at the City College Trolley Station near the alignment's southern terminus (Figure 2-18). Route 7 still will remain in place to provide more localized service along Park Boulevard.

- **San Diego Trolley Mid-City LRT**

The Mid-City Rapid Bus eventually will be upgraded to a light-rail transit (LRT) line in the San Diego Trolley system. This new service will provide a faster link between Downtown, Mid-City, and San Diego State University using the same corridors, and the same station locations, as the Rapid Bus (Figure 2-18). Originally planned to open in 2050, construction of the line's southern segment—linking Downtown and Mid-City via Park and El Cajon Boulevards—was recently accelerated to 2035 after additional regional funds became available.[5] The second phase, still planned for 2050, will complete the LRT connection to San Diego State University.

With the Mid-City LRT line already programmed in the 2050 RTP, the City/Park Streetcar must be planned for long-term compatibility on Park Boulevard. This presents a challenge of space maximization on an already busy corridor: By 2035 Park Boulevard is expected to accommodate LRT service, local bus service, normal vehicular traffic, Class II Bike Lanes, enhanced pedestrian facilities, and streetcar service—all while minimizing any required expansion into existing areas of Balboa Park.

[5] These additional funds were the result of SANDAG's selection of a smaller-footprint alternative than originally envisioned for the I-5 North Coast Corridor highway project.

Discussion with the MTS operations division has already revealed a strong preference to align LRT facilities near the centerline of the roadway, in or adjacent to the current Park Boulevard median. This placement will minimize turning conflicts with vehicular traffic, but also limits the possible alignments of the

City/Park Streetcar even further. Section 6.3 evaluates several of the possible lane-design and alignment scenarios for this constrained corridor.

In addition, as noted in Section 2.1, the new LRT line will not be able to use the existing Interstate 5 bridge due to weight and stray-current restrictions. This will necessitate the construction of a new overpass, either as an addition to, or a replacement for, the existing structure. Because the City/Park Streetcar shares this same constraint, the options for bridge replacement should be evaluated with the needs of both the streetcar and the LRT line in mind.

2.11.2 City of San Diego Bicycle Master Plan

Adopted in June 2011, the most recent Bicycle Master Plan proposes major additions to the city's 500-mile network of bicycle facilities. The plan includes installation of Class II Bike Lanes on both sides of Park Boulevard between Broadway and Upas Street, a 1.9-mile segment that encompasses the entire proposed route of the City/Park Streetcar.[6]

This route is ranked seventh among the forty "high-priority" projects identified in the master plan based on an evaluation of demand levels, network gaps, implementation costs, and potential impacts to parking and right-of-way. The plan recommends fitting the new bike lanes into the existing Park Boulevard right-of-way by narrowing the raised median, then re-striping the vehicular lanes to be closer to centerline. Relevant excerpts of the plan, including maps, can be found in Appendix C.

All of the alignment concepts featured in this study are designed to accommodate the spatial requirements of an upgraded bicycle facility in the corridor, either Class I or Class II.

2.11.3 City of San Diego Balboa Park Master Plan

The Balboa Park Master Plan contains several sections that are relevant to the City/Park Streetcar, each of which is examined below. Broadly speaking, the plan is consistent with the streetcar proposal in its desire to improve public access to the park via non-automobile modes. However, the master plan also emphasizes the importance of preserving open park land from any further encroachment.

As discussed in Section 6, the City/Park Streetcar will almost certainly require the taking of at least some park land in order to widen the Park Boulevard right-of-way to accommodate all of the different facilities planned for the corridor. This encroachment will need to be justified in cost-benefit terms as a net benefit to the park, which results from the improved transit access to the park as well as the likely reduction of demand for parking and other automobile-related infrastructure.

- **Central Mesa Precise Plan**

The section of Balboa Park that surrounds the proposed streetcar alignment is known as the Central Mesa, which is the geographical and functional center of the park containing the majority of its attractions. The Central Mesa Precise Plan, adopted in 1992, outlines many objectives and policies for this important area, including goals for circulation, preservation, and land use.

Regarding circulation, the plan is very explicit in its desire to "create a pedestrian-oriented park environment" and "reduce the amount of vehicular traffic in the Central Mesa"; moreover, it seeks to "encourage the use of public transit as a primary means of access to the Central Mesa."[7] These goals are clearly consistent with the proposed City/Park Streetcar.

Like the master plan, however, the Central Mesa Precise Plan does emphasize the importance of preserving open space in the park, which once again may be inconsistent with the widening of Park

[6] A Class II Bike Lane is a portion of the roadway, generally five feet wide, that has been striped for bicycle use. It differs from a Class I Bike Path, which features complete physical separation from vehicular traffic, and a Class III Bike Route, which is a shared-use roadway that lacks any striping between bicycles and vehicular traffic.

[7] Balboa Park Central Mesa Precise Plan (1992), pp. 2, 193, 199.

Boulevard. This is mitigated, however, by the fact that implementation of the streetcar would encourage pedestrian and transit use to the park, thereby reducing the need for visitors to drive and park automobiles. The streetcar's role in fulfilling these "circulation" goals could outweigh concerns over the minor road expansion necessary for the streetcar implementation.

Another important planning consideration is the fact that much of the Central Mesa has been designated as a National Historic Landmark by the National Park Service. Resulting from Balboa Park's hosting of the 1915 Panama-California Exposition, this classification applies to the entire area that comprises the heart of the park, to include all of the buildings, plazas, and open spaces west of Park Boulevard and south of the San Diego Zoo.

Any expansion of the Park Boulevard right-of-way to accommodate the City/Park Streetcar, even if only by a few feet, therefore may encroach into this National Historic Landmark district; this may in turn trigger provisions of the National Historic Preservation Act requiring federal review and approval of projects. If an alignment option is selected that requires westward expansion of Park Boulevard, these potential impacts and the requirements for federal approval will need to be evaluated in greater depth.

- **Park Boulevard Promenade Amendment**

A 2003 addendum to the Central Mesa Precise Plan, the Park Boulevard Promenade Amendment is a plan to redevelop portions of Balboa Park adjacent to the San Diego Zoo. It calls for the construction of a pedestrian promenade parallel to Park Boulevard from the zoo entrance south to Plaza de Balboa, the expansion of zoo facilities into the current zoo parking lot, and the construction of an underground parking structure to replace the lost parking.

This proposal, with its focus on making the park areas adjacent to Park Boulevard more pedestrian-friendly, is broadly consistent with the proposed City/Park Streetcar. It also calls for the replacement of the Prado Pedestrian Bridge and the construction of a transit station at the bridge's western end; this could occur in tandem with the streetcar's construction, facilitating both projects as well as future plans for LRT service in the corridor.

The Park Boulevard Promenade Amendment also includes the installation of a pedestrian walkway and greenbelt between Park Boulevard and the former zoo parking lot. While the proposed streetcar alignment does not conflict with this because it is north of Zoo Place, future northward expansion of the streetcar line—planned in the 2050 RTP for implementation between 2020 and 2030—may present right-of-way constraints for this segment of Park Boulevard. When SANDAG begins planning for this expansion, it will need to work with the City of San Diego and the San Diego Zoo to resolve any potential conflicts.

- **Parking Management Action Plan**

The Parking Management Action Plan for Balboa Park, issued in 2006, resulted from a consultant study of the parking facilities in the park. It found that the parking supply is adequate to meet the demands of both visitors and employees of the park, but that the lots are utilized inefficiently. Specifically, it found that the central lots are often congested while satellite lots remain empty, largely the result of poor shuttle service and the tendency of employees to occupy the central lots prior to visitor arrivals. The study therefore recommended the segregation of employee parking and visitor parking, as well as the implementation of frequent shuttle services to increase utilization of the satellite lots.

As discussed above in Section 2.5, there are approximately 216 on-street parking spaces in Balboa Park along the proposed streetcar route. Depending upon the alignment concept selected for the streetcar, some or all of these may be eliminated. In addition, an expansion of the Park Boulevard right-of-way potentially could eliminate up to 75 off-street parking stalls in the Inspiration Point parking lot.

However, even if all of these on-street parking spaces were removed—a "worst case" scenario for parking impacts—the parking plan finds that the under-utilized parking areas in the Inspiration Point and Federal Building lots contain more than enough spaces to make up for this loss. In addition, it is anticipated that the existence of the City/Park Streetcar would reduce demand for parking, as some park and zoo visitors would choose this transit connection over driving.

2.11.4 San Diego City College Facilities Master Plan

In order to accommodate larger enrollments projected in the future, San Diego City College has ambitious long-term plans for growth. Its Facilities Master Plan, adopted in 2006, calls for substantial infill development within the existing campus, including the construction of new parking facilities, building expansions and renovations, and improvements to open-space areas. However, nearly all of these capital projects are proposed for the eastern and southern areas of campus, with few significant developments planned in close proximity to the proposed City/Park Streetcar route.

The only project directly relevant to the streetcar alignment is a proposed pedestrian bridge over Park Boulevard at Russ Boulevard, connecting the academic and athletic sectors of campus. As the plan exists now, the bridge would be built into an expanded administration building adjacent to the Park Boulevard Green. This project is part of the second phase of the facilities plan, which has not been assigned any specific timeframe and currently remains unfunded.

The Facilities Master Plan also emphasizes the importance of preserving areas of open space on campus, particularly the Park Boulevard Green. A potential expansion of the Park Boulevard right-of-way in this area—while not assessed to be necessary for the City/Park Streetcar (see Section 6)—would risk conflict with this master plan. But the document also prioritizes transit access as an important part of its transportation strategy, something the City/Park Streetcar would enhance.

2.11.5 City of San Diego Downtown Community Plan

The current Downtown Community Plan was produced by the Centre City Development Corporation (CCDC), a public, non-profit redevelopment agency that serves as the city-appointed community planning group for Downtown San Diego. While the CCDC has begun to dissolve its operations due to the elimination of California's redevelopment program, the Downtown Community Plan will remain in effect as the official city-adopted community plan for this district; future updates to the plan will be made by the city-appointed community planning group that succeeds CCDC.

Most recently updated in 2006, the plan envisions robust growth around the Park Boulevard corridor, with an emphasis on mixed-use, largely residential zoning and an increase in transit usage. The plan further identifies Park Boulevard as a future "Green Street" that will connect downtown parks, the waterfront, residential neighborhoods, and other activity areas. The City/Park Streetcar would directly further this goal by providing local residents with a strong transit connection to Balboa Park—and eventually to the neighborhoods of Hillcrest, Bankers Hill, and Mid-City, when the line is expanded as planned in the 2050 RTP.

- **Comprehensive Parking Plan for Downtown San Diego**

CCDC's Comprehensive Parking Plan for Downtown San Diego includes a complete inventory of on-street and off-street parking spaces by Downtown neighborhoods. The plan addresses the policy recommendations that were part of the approval of the Downtown Community Plan, emphasizing better utilization of existing parking areas as well as promoting sustainable transportation options. The goal of the plan is to promote walking, biking and the utilization of mass transit while balancing the needs of automobiles in the Downtown area.

In the plan, the East Village neighborhood is identified as an area that could augment the parking supply of Downtown with additional off-street parking facilities when necessary. Presently, on-street parking Downtown is underutilized, averaging between 38% and 48% utilization rates across all days and hours, with the East Village section averaging between 34% and 59% utilization. The plan recommends the implementation of a Demand Based Parking Management Program to utilize existing parking resources (both on- and off-street) more efficiently, as well as advocating for smart growth land-use policies in order to promote a more sustainable Downtown.

2.12 California Public Utility Commission Requirements

As the primary regulatory agency for railroads and other passenger transportation in the state, the California Public Utility Commission (CPUC) will play an important role in the design and approval of the City/Park Streetcar. The agency will be required to review and certify all streetcar plans for compliance with safety and engineering standards, applying the same regulations as those used on LRT projects.

These regulations—which the CPUC calls “general orders”—establish minimum standards for design elements such as:

- Right-of-way clearances;
- Guideway and track systems;
- Power systems;
- Signage and signaling;
- Emergency safeguards; and
- Vehicular and pedestrian crossings.

One possible obstacle to CPUC approval is the operation of the City/Park Streetcar in mixed-flow traffic, something that is unusual in California in the modern era (San Francisco’s many mixed-flow streetcar lines had their approval “grandfathered” by the CPUC due to age).

Some streetcar projects are moving forward in other California cities, but none has gone through the entire process with the CPUC at this time. While the mixed-flow issue is not expected to be a major problem, it is still likely to garner special attention from the agency due to its uniqueness.

Aside from alignment design standards, the CPUC also regulates the safety and crashworthiness of the streetcar vehicles themselves. This is discussed in greater detail in Section 4.2.

2.13 Summary

A survey of the existing conditions in the corridor revealed several important factors that will have a major influence on the feasibility and cost of the City/Park Streetcar. During the development and evaluation of the alignment concepts presented in Section 6, the following conditions were most relevant to the selection of alternatives:

- Required width for the project and impacts to the Park Boulevard right-of-way;
- Limitation of the Interstate 5 bridge;
- Height issues associated with the Prado Pedestrian Bridge;
- Potential impacts to on-street and off-street parking facilities;
- Providing for planned bicycle facilities; and
- Providing for future transit facilities planned in the study area by the 2050 RTP, including the Mid-City Rapid Bus, Mid-City LRT, and Downtown streetcar network.

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Systems Requirements

3

3.0 SYSTEMS REQUIREMENTS

Implementation of the City/Park Streetcar will require the evaluation of many specific constraints and existing conditions in the study area corridor. Some of these constraints will vary depending upon the selected alignment option as outlined in Section 6. However, most of the systems requirements to operate the streetcar will remain the same under all the options studied in this report.

3.1 Right-of-Way Needs

Since the streetcar will operate in a mixed flow travel lane, how the existing right-of-way functions will be important when designing the streetcar alignment options. If additional right-of-way is required to widen the Park Boulevard corridor north of Interstate 5, it will mean incursion into parts of Balboa Park.

Figure 3-1: Portland Streetcar in Mixed Flow Right-of-Way

Source: John Smatlak

Acquiring park land for transportation facilities must be approved by the San Diego City Council in accordance with the city's charter.[1] In addition, as discussed in Section 2.11, much of the park's Central Mesa to the west of Park Boulevard is federally designated as a National Historic Landmark. This designation could be an additional challenge as the project moves forward.

Finally, the elimination of park space may also present a challenge in the environmental review process, as the California Environmental Quality Act classifies any project that eliminates open space to have a potential "growth-inducing" impact.[2] These political and legal hurdles will be necessary to overcome under any alignment alternative.

South of I-5, the relevant portions of Park Boulevard are bounded by the campuses of San Diego High School and San Diego City College, as well as five (5) blocks of privately owned land. One of these blocks is the "Smart Corner" redevelopment project containing residential and office uses and a trolley station. While the campus land immediately adjacent to Park Boulevard is not heavily developed—much of it is a City College greenbelt—negotiations to take land from these entities would add substantial time and cost to the project. However, as discussed in Section 6.4, it should be possible for the streetcar alignment south of I-5 to fit into the existing Park Boulevard right-of-way.

3.2 Lane Design and Width

As noted in Section 2.11, Park Boulevard is planned as a multi-modal corridor whose uses continue to expand. The roadway currently accommodates multiple lanes of automobile traffic, along with buses, bicycles, pedestrians, and on-street parking. In the future it is expected to carry light-rail transit (LRT) as well, when the currently planned Mid-City Rapid Bus is replaced by a new line in the San Diego Trolley system.

With the addition of the City/Park Streetcar to the corridor—in addition to the dedicated Class II Bicycle Lanes that are proposed to come with it—there is no doubt that Park Boulevard presents a spatial design challenge.

[1] City of San Diego City Charter, Article V, Section 55.
[2] California Environmental Quality Act, Article 9, Section 15126.2(d).

The discussion and drawings in Section 6 depict the various lane arrangements under consideration. For the segment of Park Boulevard north of Interstate 5, five concepts are offered. The cross section of each concept varies depending upon the quantity and type of features provided; there is a general tradeoff required between keeping roadway lanes (including on-street parking) and preserving park space. However four of the five concepts studied featured the following common elements:

- Mixed-flow travel lane (for streetcar use): 12-foot minimum;
- General-purpose travel lane: 11-foot minimum;
- Class 2 bicycle lane: 6-foot minimum in each direction; or
- Class 1 bicycle path: 12-foot minimum (bidirectional);
- On-street parking: 8-foot minimum;
- Exclusive LRT travel lane: 12-foot minimum for one lane; or
- Exclusive LRT travel lanes: 24-foot minimum for two lanes.

3.3 Station Accommodations

Figure 3-2: Streetcar Station in Seattle

Source: Parsons Brinckerhoff

The stations should be easily recognizable, safe, easily maintained and also comply with the latest Americans with Disabilities Act (ADA) requirements. Figure 3-2 depicts a typical streetcar station in Seattle. At a minimum, each station will require a platform 100 feet long. While longer than a typical streetcar platform, this length preserves the flexibility to accommodate many vehicle types, including the new Siemens SD8 models currently being phased into the San Diego Trolley LRT system. While the selection of a smaller streetcar vehicle may allow for shorter platforms, keeping the platforms at 100 feet will enable the SD8 to be used if the need arises. A minimum platform width of 10 feet is recommended for all stations.

The station platform height should be a minimum of 8 inches from top-of-rail to allow for “low-floor” boarding, which provides for faster passenger loading and unloading than vehicles with high steps. This is the height of the platforms currently being constructed in the existing LRT system, which were built specifically for the SD8 vehicle and were limited to 8 inches due to freight requirements in the shared LRT/freight track corridors.

However, since freight traffic will not be using the streetcar corridors, a higher platform that allows for “level boarding” should be considered. Level boarding is generally the most preferred method of embarkation, especially for passengers using mobility aids like wheelchairs or walkers, because it offers the greatest speed and accessibility. It requires a platform height of 14 inches from top-of-rail. It should be noted, however, that more transitional area is needed with the level-boarding platforms to meet the existing surrounding grade.

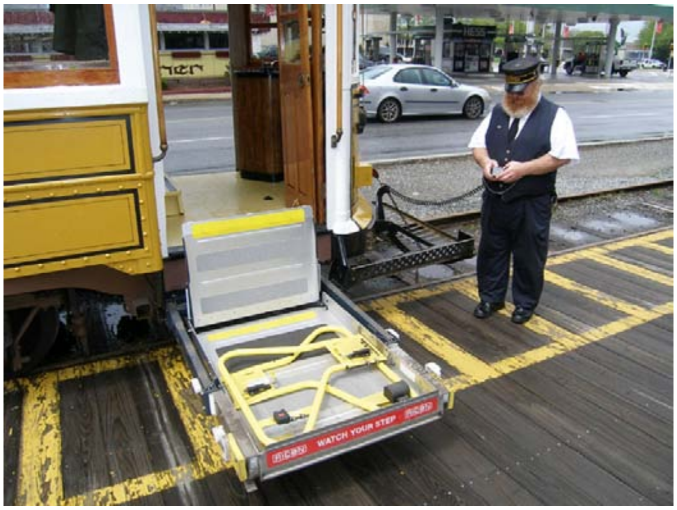
Discussions with MTS operations staff have concluded that each station should feature the standard accommodations that appear in the existing LRT stations. These include:

- Shelter;
- Informational kiosks and maps;
- Variable message signs (displaying next arrival times and other notifications);
- Ticket vending machine;
- Benches or leaning rails; and
- Trash receptacles.

As discussed in Section 8, the cost of these items will vary depending upon the specific design desired and products selected. In general, standardized "off-the-shelf" accommodations tend to be much less expensive than customized items, but customized items can add aesthetic and branding value to the streetcar corridor, something that may be desired for the Balboa Park environment.

Each station also will need to accommodate mobility-impaired riders in accordance with ADA. The law identifies numerous requirements that transit systems must meet in order to assure that transit is readily available to disabled individuals. Many of these are related to signage, ramps, and tactile surfaces for the platforms. For a streetcar system, however, the most difficult requirement to meet is often providing boarding accommodations for the vehicles themselves. Modern vehicles feature low-floor designs that make this significantly easier, but nearly all historic streetcars require climbing multiple stairs to board. While disabled boarding of these vintage cars can be accomplished by installing elevators or ramps on each station platform, it is instead recommended that on-car lifts be used (as shown in Figure 3-3). These devices, built into the vehicles themselves, will increase the flexibility of the entire system and decrease total station costs. The cost estimates in Section 8 therefore assume that any historic streetcars will be fitted with on-car lifts.

Figure 3-3: On-Car Lift on Historic Streetcar



Source: The Steel Rails Advocate

If historic streetcars are used for this project, their on-car lifts also will need to operate smoothly with the low-floor boarding platforms proposed for the stations. Currently, one historic PCC-class streetcar vehicle operates on the MTS Silver Line service in Downtown San Diego, and there are no problems running the lift at the existing platforms. It is anticipated that this lift will continue to function smoothly when all the LRT station platforms are raised to the low-floor boarding height of 8 inches above top-of-rail.

3.4 Catenary Wires and Suspension Poles

Overhead catenary wires, supported by drop suspension poles installed on the median or sides of the street, will deliver the necessary electrical power to the streetcar vehicles. Pole spacing and height are critical project elements when placing a new rail system into an existing urban environment. SANDAG design guidelines recommend pole spacing of approximately 90 feet, and pole heights of at least 19 feet to accommodate the vehicles' overhead pantographs. A 19-foot pole height is also a requirement of the California Public Utilities Commission.

Figure 3-4: Overhead Catenary System

Source: Parsons Brinckerhoff

North of Interstate 5, the Park Boulevard corridor is relatively undeveloped through Balboa Park. However, with highly developed conditions south of the I-5 overpass, placement of the poles could have impacts on existing above- and below-grade infrastructure. Most blocks contain utility boxes, street trees and other above-grade structures. Below grade, poles may have impacts on sewer, drainage, and water lines (see Section 2.9 for more on below-grade utilities). Future planning efforts will need to address specific locations for pole placement and their associated impacts on these utility features.

The catenary wires and suspension poles also could create visual impacts in the park environment. To minimize this impact, cantilevered poles can be used rather than "headspan" wires running across the entire street, as illustrated in Figure 3-4. In addition, using the catenary poles to hang streetlights, event banners or landscape features can help to reduce visual impacts.

Among the alignment concepts proposed for the segment north of Interstate 5 (Section 6.3), Options 1 and 2—in which the streetcars are placed in the right-side mixed-flow lanes, separated from the curb by a minimum of 14 feet (on-street parking and bike lane)—may present problems for side-mounted cantilevered poles due to the long overhangs required. Options 3 and 4 do not present the overhang problem, but as right-side-running options, wires and poles still would be required along both sides of Park Boulevard. In the left-side-running alignment of Concept 5, the median would be the most appropriate location for catenary poles, a single row of which could then be shared by streetcars running in both directions.

3.5 Substations

Substations play an important role for the electrical streetcar by providing a constant flow of power to the overhead wires. They need to be located in close proximity to the corridor, and on longer lines they are typically spaced 1 mile apart. The City/Park Streetcar alignment is only 1.5 miles long, greatly reducing the number of substations needed for the project. As such, a total of three substations will be enough to supply ample power to the line and provide redundancy in the event of failure. Generally, substations must be placed within 300 feet from the streetcar tracks.

Figure 3-5: Existing Substation at C Street and Park Boulevard

Source: Parsons Brinckerhoff

3.5.1 Existing Substation

There is already one operational substation at the City College Trolley Station, located at the northeast corner of Park Boulevard and C Street near the southern terminus of the streetcar line (Figure 3-6). The MTS operations division has confirmed that the City/Park Streetcar could take advantage of this existing facility, thereby reducing both the cost and the physical impacts of the project.

3.5.2 Additional Substations

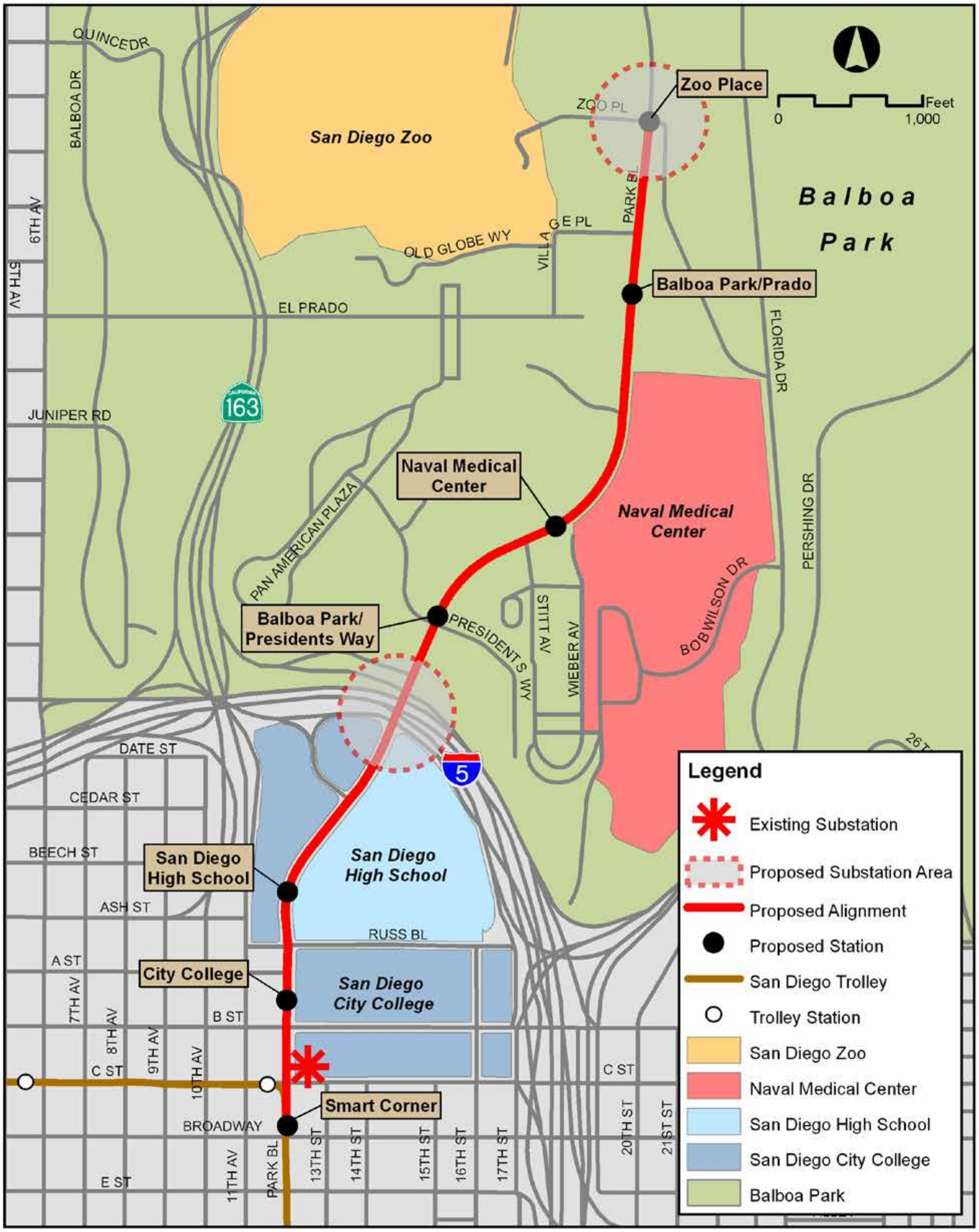
Two additional substations are recommended for this first phase. One could potentially to be located adjacent to the Interstate 5 overpass, either near San Diego High School to the south of the freeway, or near the Inspiration Point parking lot to the north of the freeway. Placement of the substation in either of these locations would be beneficial in assisting the streetcar in the steepest segment of the corridor.

Finally, one substation should be installed at the northern portion of the alignment. One potential location is the northwest corner of the intersection of Zoo Place and Park Boulevard (within the existing zoo parking lot). This would minimize the potential for visual and physical impacts to Balboa Park open space. However, specific placement of these substations will need to be studied further, utilizing a process that includes coordination and involvement with park officials and other stakeholders.

An evaluation of substation locations also must consider requirements for the initial installation of the structure, as well as future access and maintenance needs. Initial construction will require a crane to unload and place the substation, and future maintenance needs will require close vehicle access to the site. Both locations suggested above have those capabilities.

The size of a typical substation unit is 18 feet by 12 feet, and is 15 feet high. This size substation would require a base pad of 22 feet by 15 feet. In addition, the substations must be physically secure in order to avoid intrusion from the public, which will require either a locked outer shell or perimeter security fencing that can be accessed by maintenance staff.

Figure 3-6: Existing and Proposed Substation Locations



3.6 Turnaround Locations

Figure 3-7: Streetcar Turntable in Dallas

Source: McKinney Avenue Transit Authority

If a single-sided, single-ended vehicle is used—the historic PCC model is the only such vehicle under consideration—it will be necessary to build turnaround locations at each end of the line. On the north side, this could either mean building a turntable in a nearby corner of the zoo parking lot, or installing about 1500 feet of extra track to form a loop around Zoo Place. On the south end of the line, a turntable could be installed at the southeast corner of Park Boulevard and C Street, in what is now a surface parking lot for a restaurant; the turnaround track could circle around Park Boulevard, C Street, and Broadway in the vicinity of the City College Trolley Station. In general, the turntable option is recommended over installing turnaround track, as it takes up less room and allows for greater flexibility as a layover location. A turntable was recently constructed in Dallas for use on the M-Line streetcar project (Figure 3-7).

Because the single-ended vehicle requires additional track and/or turntable facilities, having turnaround locations on a streetcar line would increase its capital cost. This can be avoided if a modern vehicle (or even a historic vehicle that is double-sided and double-ended) is used. In addition, because future plans call for the extension of the streetcar line beyond the zoo, there is the possibility that the northern turnaround track and/or turntable eventually will become obsolete.

3.7 Maintenance and Storage Facilities

Figure 3-8: Existing Maintenance Facility at 12th and Imperial Aves.

Source: Parsons Brinckerhoff

An integral component of the streetcar system is its overnight storage facility and maintenance yard. Previously known as “car barns” or “trolley barns,” these facilities store the vehicles and provide a venue for periodic maintenance. It is anticipated that the restored historic cars will require the most maintenance, but all vehicles will need some degree of periodic upkeep as a result of daily use.

The size of the facility depends on the number of vehicles needed to serve the alignment’s length and schedule, while providing for a certain number of cars under maintenance. Given the overall alignment length and the preferred 15-minute peak frequency, it is determined in Section 5 that three or four cars will be needed to meet the peak-period demand loads.

In order to minimize the laying of additional track, the maintenance and storage facility should be in close proximity to the streetcar line. Fortunately, the MTS facility at 12th and Imperial Avenues is nearly ideal (Figure 3-8), as it is within one mile of the southern end of the alignment and reachable via existing LRT tracks on Park Boulevard. However, it is already an active LRT facility, and while it may be capable of handling this initial number of streetcars, capacity issues may arise as the streetcar network is expanded.

3.8 Mid-Block Crossovers

Mid-block crossovers are needed to provide a change of direction for streetcars that malfunction during the course of operations. These vehicles would need to return to the maintenance facility without going in the opposite direction of the traffic flow. The typical recommendation for crossovers is one for each 1.25 miles of track, but with a total alignment of only 1.5 miles, the City/Park Streetcar could avoid needing mid-block crossovers by utilizing crossovers that would already be installed at each end of the line.

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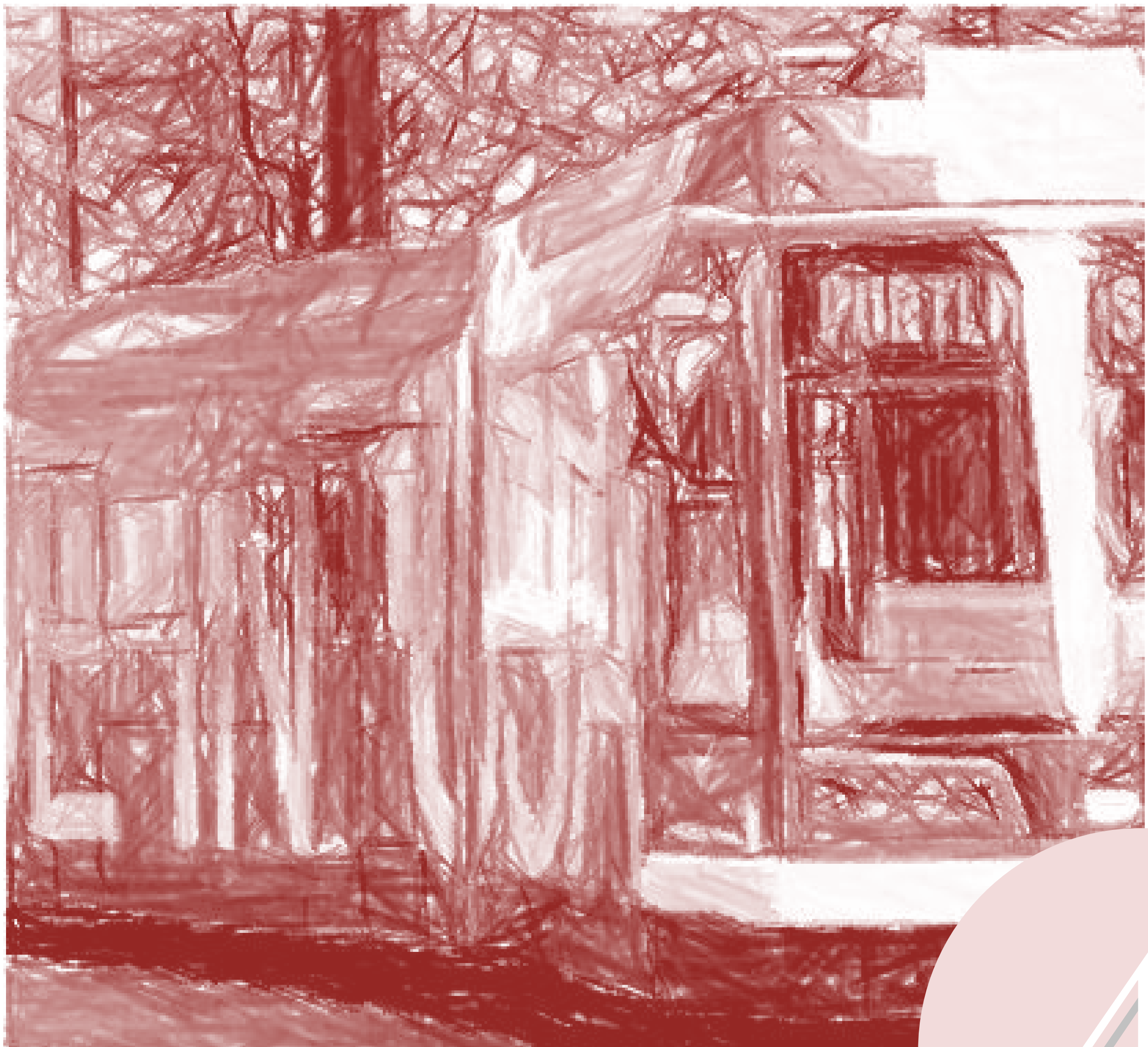


Streetcar Vehicles

4

4.0 STREETCAR VEHICLES

Figure 4-1: United Streetcar 100 Prototype in Portland, OR

Source: Parsons Brinckerhoff

Streetcars are an electric form of rail technology that have operated in cities for over 100 years, including an extensive system that existed in San Diego until the 1940s. Streetcars often serve as local circulators and connectors, and are compatible within the context of the urban fabric and the built environment. One of the primary qualities of streetcars is their ability to help shape compact, walkable communities by connecting major activity centers with high-quality transit service. Streetcars are generally focused on serving neighborhoods, rather than simply moving through them rapidly.

Streetcars typically include the following design and operating characteristics:

- In-street running (in shared lanes with autos, or sometimes grade-separated);
- Low travel speed (12 miles per hour or less);
- Frequent stops (between 0.1 and 0.3 miles apart); and
- Single-car operation.

Within these parameters, there are many different types and models of streetcar vehicles, each with its own advantages and drawbacks for system design and operation. This section will discuss the types of streetcars available, evaluating seven different models across three broad types of vehicles.

4.1 Vehicle Types

Streetcar vehicles currently used in North America and Europe generally consist of three types:

- Modern streetcars;
- Historic streetcars; and
- Replicas of historic streetcars.

Figure 4-2: Inekon Trio-12 Streetcar in Seattle

Source: Parsons Brinckerhoff

The most notable differences among these types of vehicles affecting customer service are the boarding characteristics and the vehicle floor height. Modern streetcars have low vehicle floors, allowing for low-floor or level boarding from stations or platforms.

Renovated historic streetcars and their replicas generally have a higher vehicle floor, requiring several steps to board the vehicle. When renovated historic streetcars or replicas are used, special provisions such as platform ramps or vehicle lifts must be provided to meet accessibility requirements of the Americans with Disabilities Act (ADA).

Mixing modern streetcars and historic streetcars on the same line within a network presents challenges of accommodating both low- and high-floor vehicles. These platform-boarding issues can be addressed if an on-car lift is installed in the historic vehicles. However, boarding times are extended whenever the lift is deployed for disabled passengers.

The following sections provide a brief overview of each of the vehicle types.

4.1.1 Modern Streetcars

Modern streetcars are new vehicles with updated designs. Modern vehicles generally resemble light-rail transit (LRT) vehicles due to their low-floor, articulated design, but are shorter and weigh less. Portland Streetcar was the first system in the U.S. to use a modern vehicle, selecting the American-made United Streetcar 100 (Figure 4-3). Modern streetcars are also now in operation in Seattle—primarily utilizing the Czech-made Inekon Trio-12 (Figure 4-4)—and are planned for procurement in Dallas, Tucson, and Washington, DC. Japanese manufacturer Kinkisharyo has also entered the growing market, recently introducing the ameriTRAM300 (Figure 4-5), which has not yet been employed in any streetcar systems.

The San Diego Trolley LRT system, operated by MTS, is currently converting its entire fleet to a modern vehicle that potentially could serve as both an LRT vehicle and a streetcar. This new vehicle, the Siemens SD8, is expected to be in exclusive operation on the San Diego Trolley by 2014 (Figure 4-6). A variant of this vehicle is currently being manufactured for use as a streetcar in downtown Atlanta.

Figure 4-3: United Streetcar 100 Modern Streetcar

Source: Parsons Brinckerhoff

Figure 4-4: Inekon Trio-12 Modern Streetcar

Source: Parsons Brinckerhoff

Figure 4-5: ameriTRAM 300 Modern Streetcar

Source: Kinkisharyo International

Figure 4-6: Siemens SD8 Modern Streetcar

Source: Parsons Brinckerhoff

4.1.2 Historic Streetcars

Historic streetcars are old, surviving vehicles of original streetcar systems. This vehicle type has two general designs: the trolley coach and the trolley car. The trolley coach is a newer class of vehicle that features the Presidents' Conference Committee (PCC) design, in which the body of the car more closely resembles a regular bus (Figure 4-7). The trolley car is the older, more traditional style of streetcar, exemplified by the San Diego Class 1 (SD1) model (Figure 4-8). The historic authenticity of these vehicles makes them popular, especially for tourism-focused systems. San Francisco's Municipal Transportation Agency has one of the most diverse collections of historic streetcar vehicles from around the world.

Figure 4-7: PCC Historic Streetcar in MTS Fleet

Source: San Diego MTS

Figure 4-8: San Diego Class 1 (SD1) Historic Streetcar

Source: Alexander Bevil

4.1.3 Replica Streetcars

Replica vehicles are new vehicles built to old designs (typically the trolley car design). These vehicles replicate the look of historic vehicles, but add modern features to improve safety, reliability, and comfort (such as door locks and air conditioning). Unlike historic vehicles, which require design modification, replica vehicles can be built with wheelchair lifts to comply with ADA requirements.

For cities that had or have an original system, replica vehicles can be customized to match original vehicle specifications (such as the seating style and arrangement, number of windows, exterior paint schemes, etc.), adding an additional layer of authenticity. Replica vehicles also can be built to meet existing streetcar or light-rail power requirements. Streetcars in Tampa and Little Rock, AR, for instance, use Birney-style replica vehicles manufactured by the Gomaco Trolley Company with the same power specifications as a modern vehicle (Figure 4-9).

Figure 4-9: Gomaco Birney Replica Streetcar

Source: Gomaco Corporation

These three vehicle types, represented by seven different models that are available today, are assessed in the sections below. Table 4-1 identifies the models and the cities that operate each.

Table 4-1: Vehicle Types

#	Vehicle Type	Example of Vehicle Model	Operating Cities	Image
1	Modern (United)	United Streetcar 100	Portland, OR (expected 2012)	Figure 4-3
2	Modern (Inekon)	Inekon Trio-12	Seattle, WA and Portland, OR	Figure 4-4
3	Modern (ameriTRAM)	ameriTRAM 300	None	Figure 4-5
4	Modern (Siemens)	Siemens SD8	San Diego, CA and Atlanta, GA	Figure 4-6
5	Historic (PCC)	San Diego Silver Line	San Diego, CA and San Francisco, CA	Figure 4-7
6	Historic (SD1)	San Diego Class 1	None (formerly San Diego, CA)	Figure 4-8
7	Replica	Gomaco Replica Birney	Tampa, FL and Little Rock, AR	Figure 4-9

4.2 Vehicle Specifications

Specifications for each vehicle type are described below, and summarized in Table 4-2.

4.2.1 Tracks and Power

All streetcar vehicles under consideration are able operate on a track gauge of 4.7 feet (4 feet 8.5 inches, measured between the inner sides of the rail heads). This relatively standard track measurement matches the existing MTS LRT lines, which will allow for compatibility between the new streetcars and the current system.

Similarly, all vehicles under consideration will be able to run on the existing LRT power system, which delivers a nominal power supply of 750-volt DC via overhead catenary. The historic vehicles, even if not originally built for this power system, could be outfitted to accept 750-volt DC during the restoration process.

4.2.2 Dimensions

As single, non-articulated cars, the historic and replica vehicles are considerably shorter than the modern options. The historic SD1 vehicle is the shortest of the five, at just under 44 feet in length. The historic PCC and replica vehicles are slightly longer, but neither exceeds fifty feet. Modern vehicles, by contrast, are a minimum of 66 feet in length, while the Siemens model is by far the longest at approximately 81 feet. Despite these variations, however, all vehicle lengths are compatible with the traffic requirements of the proposed streetcar line, as well as the rest of the MTS LRT system.

The widths of all vehicles are similar (8 to 9 feet), making them appropriate for any routes being considered. The vehicle heights vary from 10.3 feet to 13.0 feet (not including the variable heights of the overhead pantographs), with the replica and Siemens models standing tallest.

4.2.3 Curve Radius

Integrating the streetcar into the urban street system requires different design criteria than exclusive LRT lanes. One of the more limiting design factors for this integration is the turning radius needed to operate in city streets. Right-turn movements into right-side lanes require a fairly tight turning radius. Historic and replica vehicles, being shorter in length than their modern counterparts, have the greatest ability to make these tight turns. All three of the historic and replica vehicles surveyed here can negotiate curves with radii as small as 50 feet.

Table 4-2: Vehicle Specifications

#	Vehicle Type	Track Gauge (ft)	Minimum Curve Radius (ft)	Nominal Voltage (V DC)	Dimensions (ft)			Maximum Grade	Capacity*		Weight (lbs)	
					Length (ft)	Width (ft)	Height (Without Pantograph)				Empty Car	Loaded Car
1	Modern (United)	4.7	59.1	750	66.0	8.0	11.9	9%	115	Driver, 29 seated, 85 standing	63,800	89,980
2	Modern (Inekon)	4.7	59.1	750	66.0	8.1	11.4	8%	118	Driver, 27 seated, 90 standing	66,139	91,102
3	Modern (ameriTRAM)	4.7	59.1	750	81.4	8.5	13.0	9%	116	Driver, 28 seated, 87 standing	97,499	133,146
4	Modern (Siemens)	4.7	60.0	750	81.4	8.5	13.0	6%	160	Driver, 60 seated, 99 standing	97,499	133,146
5	Historic (PCC)	4.7	50.0	750**	48.4	8.3	10.3	> 7%	101	Driver, 45 seated, 55 standing	37,990	53,890
6	Historic (SD1)	4.7	50.0	750**	43.6	8.3	12.3	> 7%	91	Driver, 40 seated, 50 standing	18,500	32,969
7	Replica (Gomaco)	4.7	50.0	750**	49.8	10.0	13.2	> 7%	102	Driver, 48 seated, 53 standing	46,400	62,151

** Standing capacities are based upon a notional density of 4 passengers per square meter. Larger capacities may be realized by increasing density to 6 or 8 passengers per square meter. Additionally, seat configurations for LRT-style modern vehicles may be modified to accommodate more standing passengers.*
*** As refurbished and/or customized vehicles, the historic and replica types may be manufactured to meet the desired specifications.*

Modern vehicles require slightly wider turns, with all models featuring a minimum curve radius of approximately 60 feet as illustrated in Figure 4-10. It should be noted, however, that the Siemens vehicles currently being built for San Diego's LRT system feature a minimum curve radius of 82 feet. However, the manufacturer has indicated that any new vehicle orders could be modified to accommodate 60-foot curves to allow it to operate successfully in city streets.

Figure 4-10: Streetcar Right-Turn Movement

Source: Parsons Brinckerhoff

Due to the relatively straight alignment of the City/Park Streetcar, all vehicles under consideration (including the Siemens model in its original 82-foot configuration) can operate along the route without any problems. However, as discussed in Section 2.11, the SANDAG Regional Transportation Plan calls for future expansion of the City/Park Streetcar to the north, forming a loop around Balboa Park along University and Sixth Avenues. This future alignment likely will require turns tighter than 82 feet, although at this point no specific designs exist; further study will be required to determine these constraints as the system is expanded.

4.2.4 Capacity

Streetcar capacities vary by vehicle, and are broken down below according to the two primary types of passenger.

- **General Passengers**

Modern vehicles offer the greatest capacities, with room for approximately 115 seated and standing passengers in three models and nearly 160 passengers in the Siemens vehicle. The historic PCC and replica vehicles can accommodate large numbers of passengers as well (about 100 seated and standing), despite being at least 18 feet shorter than most modern cars. The historic SD1 vehicle has the smallest capacity, at 90 passengers plus the operator.

These capacity differences are unlikely to have major consequences under normal operating conditions, as the everyday demand for streetcar service is not likely to exceed the capacity of even the smallest vehicle. However, the additional capacity of larger vehicles may be appreciated during special events in the park, or even during higher-demand times in the normal operating day—such as closing times of the San Diego Zoo or San Diego High School—when a more spacious vehicle could provide a more comfortable ride for passengers.

The recent study used as the basis for the Balboa Park Parking Management Action Plan (discussed in Section 2.11) found that parking availability is lowest—and thus demand for the park highest—on eight or nine days per year, many of which fall on summer weekends. These few periods present the greatest likelihood that a smaller streetcar vehicle could reach capacity. An increase in service frequency could alleviate capacity issues during those special events, provided there is a sufficient quantity of vehicles available. Vehicle quantity requirements and ridership projections are discussed further in Section 5 and Section 7, respectively.

- **Passengers with Wheelchairs, Strollers, and Carts**

Passengers with wheelchairs, strollers, and carts have special needs on transit vehicles, not just for boarding but also for space while onboard. Modern vehicles feature low floors and no steps, making boarding possible without on-car lifts. They generally also provide more space inside for wheelchairs and other special-needs cargo. By contrast, most historic and replica vehicles require special lifts for boarding these items and provide fewer spaces onboard. This means that historic or replica vehicles could reach their maximum capacities for these special-needs passengers during high-demand periods.

In the first eleven months of 2011, the MTS LRT system recorded 3,457 instances—or approximately 2% of total trips—in which a wheelchair customer was unable to board a train because the vehicle was at its maximum wheelchair capacity. All but two of these "pass-ups" occurred on the Blue or Orange Lines, which have older high-floor cars with fewer wheelchair spaces. In these situations, the wheelchair customer was refused boarding and forced to wait for the next train.

MTS does not currently record "pass-ups" on the Green Line, which uses newer low-floor vehicles (an older model of the Siemens SD8) with four wheelchair spaces per car rather than two or three. However, MTS estimates that there are minimal, if any, "pass-ups" with these modern vehicles.

4.2.5 Weight

Owing to their increased size and technology, modern vehicles are substantially heavier than the other streetcar models. The Siemens vehicle, an outlier in most categories, stands out as the heaviest, weighing approximately 46 tons empty. The other modern vehicles range between 32 and 35 tons. Among the smaller vehicles, the historic PCC and replica models range between 19 and 24 tons, respectively, while the historic SD1 car is by far the lightest at just under 10 tons. By comparison, the standard 40-foot bus used in the MTS fleet, the New Flyer C40LF, weighs in at 16 tons (Figure 4-11).

Figure 4-11: New Flyer C40LF Bus in MTS Fleet

Source: San Diego MTS

The primary constraint related to vehicle weight is the Interstate 5 Bridge, which currently lacks the structural capacity to support streetcar service. Built in 1962, the bridge will need major modifications or replacement in order to carry the added loads of streetcar vehicles and infrastructure.

Vehicle weight may therefore play a role in the selection of bridge alternatives. However, the SANDAG Regional Transportation Plan calls for the eventual installation of a full light-rail transit (LRT) line along Park Boulevard, which will have much greater weight requirements. It is recommended, therefore, that any bridge modification be engineered to support both streetcar and LRT service combined. This is further discussed in Section 6.

Vehicle weight also affects the amount of power required to operate the streetcar service, with heavier vehicles drawing the most power. Due to the shortness of the line and its single-car operation, it is anticipated that there will be more than enough power available to operate any vehicle currently under consideration.

4.2.6 Crashworthiness Requirements

Regulations of the California Public Utility Commission (CPUC) require modern streetcars and LRT vehicles to adhere to certain physical standards in both construction and operation. One such standard is the vehicle's crashworthiness, measured by the strength of its major structural components to withstand a longitudinal force applied to the vehicle's front end (commonly referred to as the vehicle's "buff strength"). The CPUC dictates that a vehicle's buff strength must exceed twice its unloaded weight.

However, it is not uncommon for the CPUC to grant waivers for this requirement. Both San Diego and Sacramento, for example, have recently received waivers for their LRT vehicles (to include the Siemens SD7 used in San Diego, a longer variant of the Siemens SD8 vehicle under consideration here). Among the modern vehicles considered in this study, neither the Siemens nor the Inekon models adhere to the CPUC crashworthiness requirement. It is unknown whether the United or ameriTRAM models would meet this requirement, as they are not used in any California cities. Regardless, it is anticipated that a waiver from the CPUC will be a viable option for the City/Park Streetcar.

Vehicles built before 1956 are exempt from these standards, meaning that neither historic vehicle under consideration would be subject to CPUC requirements.

4.3 Directional and Access Capabilities

The type of vehicle selected for the City/Park Streetcar will play an important in the design, cost, and future flexibility of the system. Some of the most influential vehicle characteristics are the quantity and location of the vehicle's operating cabs, passenger doors, and facilities for the disabled, as these factors define many of the constraints in station design, track placement, and end-of-line treatments. These directional and access characteristics for each vehicle type are discussed below and summarized in Table 4-3.

Table 4-3: Vehicle Direction and Access

#	Vehicle Type	Cabs	Doors	ADA Access
1	Modern (United)	Double-Ended	Double-Sided	Yes
2	Modern (Inekon)	Double-Ended	Double-Sided	Yes
3	Modern (ameriTRAM)	Double-Ended	Double-Sided	Yes
4	Modern (Siemens)	Double-Ended	Double-Sided	Yes
5	Historic (PCC)	Single-Ended	Single-Sided	ADA Design Required
6	Historic (SD1)	Double-Ended	Double-Sided	ADA Design Required
7	Replica (Gomaco)	Double-Ended	Double-Sided	ADA Design Required

4.3.1 Cabs

Nearly all vehicle types are bi-directional with double-ended cabs, which allow for the maximum amount of operational flexibility. At the end of the line, operators of these vehicles simply switch from one cab end to the other, commencing service in the opposite direction without having to turn the vehicle around or move it from its layover position.

The historic PCC vehicles have a single-ended cab only, which presents a unique and potentially costly constraint: When the vehicle reaches the end of the line, it must be turned around using additional track or a turntable before it can commence service in the opposite direction. Use of these vehicles would therefore require special facilities at both ends of the line. This is of particular concern on the line's north end, where future plans call for an extension to University Avenue that will then travel west and return downtown via Sixth Avenue; once built, this future loop would render a turntable, or about 1500 feet of turnaround track, mostly unusable (though it could be used as a short-line terminal during special events).

4.3.2 Doors

Most vehicle types have doors on both sides of the vehicle (double-sided). While passenger access at individual stations is generally limited to one side, having double-sided doors offers more station-siting flexibility, as the stations along one line may be placed on either side of the street (in the median or near the curb) as design needs dictate.

The historic PCC vehicles only have doors on the right side of the car, placed in the front and middle (similar to a traditional bus). With this vehicle, therefore, stations could be placed only on the right (curb) side of the street, creating a major limitation in the alignment options for the line.

Compared to the historic and replica vehicles, modern vehicles generally have wider doors and allow for greater accessibility. All modern cars under consideration feature between two and four doors on each side of the vehicle.

4.3.3 ADA Access

Historic and replica vehicles require either on-car lifts or high station platforms to meet ADA access requirements. This means that design modifications to either the vehicle or the station must be made in order to comply with the law. The cost of including a wheelchair lift on a vehicle can be high. Additionally, the bulky design of stations with high platforms can interfere with existing sidewalks, create incompatibilities with other lines in the system, and cause other siting issues.

Figure 4-12: Low-Floor Boarding in Seattle

Source: Parsons Brinckerhoff

With a low-floor design, modern streetcar vehicles do not require wheelchair lifts or high platforms (Figure 4-12). When combined with a simple boarding platform that is eight inches above top-of-rail (similar to the platforms currently used on the MTS trolley lines), modern vehicles can provide near-level boarding for wheelchairs and other mobility devices.

This greatly improves the speed of boarding and disembarking for all passengers. Additionally, wheelchair riders can be accommodated on modern vehicles with minimal impact to overall vehicle capacity (compared to the historic and replica vehicle types, which must devote considerable floor space to wheelchairs and their securements).

4.4 Compatibility with San Diego Trolley

The City/Park Streetcar system should be designed to be compatible with the existing LRT system. As such, vehicle compatibility with existing MTS trolley tracks and supporting facilities—including power, operations and maintenance—is a priority.

4.4.1 Tracks and Power

As noted in Section 4.2 above, all vehicles under consideration will be able to operate on the current MTS tracks and power system. Some models, however (particularly the replica and some modern vehicles), may need to be specifically ordered to ensure these specifications are integrated into the design of the vehicle.

4.4.2 Operations and Maintenance

The modern Siemens vehicle would integrate best with the current system, as that same car is currently being phased into exclusive use on the entire MTS LRT system. (The ongoing Trolley Renewal project will outfit all LRT lines with the new Siemens cars by mid-2014.) This would allow for savings in both operations and maintenance costs, as personnel training could be minimized—both for drivers as well as maintenance workers—and parts inventories could be integrated into the existing MTS system.

In addition, MTS currently owns and operates one historic PCC vehicle, which is used on the limited-day Silver Line loop service downtown. Several more vehicles—and therefore several more operators and maintenance workers, as well as an expanded parts inventory—would be needed if this vehicle were selected for regular use on the City/Park Streetcar. Overall, however, this would require less new training and parts acquisition than a vehicle not currently owned by MTS.

All of the other vehicles will require MTS to develop new competencies in operations and maintenance, to include personnel training as well as expanded capabilities in parts storage and fabrication.

4.5 Availability

Both the modern and replica vehicles are available for order from their manufacturers. In addition, the Siemens vehicle is already in use on the San Diego Trolley system, having been phased into operation beginning in late 2011; dozens more are currently under construction and are expected to be delivered in 2012 and 2013 (Figure 4-13). Selecting this vehicle therefore could allow the City/Park Streetcar to begin operation before the procurement of dedicated vehicles. In addition, MTS could potentially piggy-back on Atlanta's streetcar vehicle contract, which could reduce both the cost per vehicle and the total acquisition time.

Figure 4-13: Siemens SD8 Modern Streetcar Assembly Line

Source: Parsons Brinckerhoff

The two historic vehicles have limited availabilities. MTS already owns one working PCC model, used on its weekend-only Silver Line service. Five additional vehicles are available from a local preservation group, but are in need of full restoration before they can be deployed. As noted in Section 4.6 below, this restoration is expected to cost approximately $850,000 per vehicle.

The historic SD1 vehicle is in even shorter supply, with one partially restored and two unrestored vehicles available locally. This low inventory could create difficulties for the City/Park Streetcar, as the operations plan calls for at least four vehicles to be available if the historic option is chosen (see Section 5.4). Use of the SD1 vehicles therefore would require augmentation from other vehicles, such as historic PCC cars or the Siemens SD8 vehicles currently being phased into the LRT system.

4.6 Reliability

Streetcar vehicles vary in terms of reliability, with each type offering a different combination of maintenance requirements and proven track records.

4.6.1 Modern

Modern vehicles generally feature high levels of reliability, which typically also are backed by contractual warrantees from manufacturers. This is a major advantage of modern vehicles compared to historic cars, whose obsolescence places all risk of mechanical problems on the operating agency.

Despite their limited deployment due to newness, the modern vehicles that are in the field have demonstrated high reliability. MTS has used a longer variant of the Siemens vehicle on its LRT system for over six years, with no major problems and excellent support from the manufacturer; similar reliability can thus be expected from the new model. Similarly, there have been no significant reports of problems with the Inekon Trio-12 vehicle, in service in both Seattle and Portland.

Two of the modern vehicles, however, have unproven track records. The United Streetcar 100 is a relatively new prototype, and the first to be manufactured in the U.S. in several decades. It utilizes the design of the Škoda 10T streetcar but sources the majority of its parts from U.S. suppliers to comply with federal "Buy America" provisions. The original prototype car, delivered to the Portland Streetcar system in 2009, is not yet in operation due to propulsion problems encountered during testing. Its Škoda-built propulsion control system is now being replaced by an American system, and all future models will feature either the American system or an Austrian-built system. Both Portland Streetcar and the city of Tucson, Arizona, have placed orders for more United vehicles, but none are expected to be delivered until late 2012.

Figure 4-14: Historic PCC Streetcar in Restoration

Source: Parsons Brinckerhoff

The modern ameriTRAM vehicle is even newer, with no vehicles currently operating in any U.S. or foreign system. However, Japanese manufacturer Kinki Sharyo is a well established producer of rail vehicles with considerable experience in the field, so it is reasonable to expect a high level of reliability and support with the ameriTRAM line.

4.6.2 Historic

While historic vehicles generally pose greater risk of mechanical problems than modern vehicles, they still can be operated and maintained reliably with proper care. San Francisco's impressive collection of historic streetcars—with over 30 vehicles in service and many more currently undergoing restoration—provides a model for running a vintage fleet.

One key to having such an effective maintenance program for older vehicles is ensuring that there is ample staff trained to work on them. To maintain its current PCC vehicle, MTS has already trained five workers, and fortunately has found that the required skills transfer relatively easily from the existing LRT fleet. This indicates that in-house maintenance capabilities can be developed for historic vehicles without a substantial cost commitment.

The availability of parts is another important element of maintenance on vintage vehicles. MTS is currently establishing a supplier network for its PCC car, drawing from vendors of used parts as well as firms that produce modern upgrades of original equipment. In addition, the MTS machine shop is capable of fabricating many smaller parts internally. This type of arrangement is recommended if the City/Park Streetcar program places historic vehicles in service.

Figure 4-15: Replica Birney Streetcar Assembly Line

Source: Gomaco Corporation

4.6.3 Replica

Despite their resemblance to older vehicles, replica streetcars are new vehicles that come directly from the assembly line (Figure 4-15). This means that they employ the newest technology, parts, and safety features in their designs, while simply retaining the aesthetic value and "look" of the vintage cars they are built to represent.

Like modern vehicles, replicas generally come with contractual guarantees of reliability from their manufacturers. These assure the purchaser that, in the event of non-routine equipment problems during the early life of the vehicle (a period typically defined contractually), the manufacturer can be expected to perform the necessary repairs at little or no cost to the purchaser.

4.7 Cost

Vehicle costs vary widely by type and are summarized below. Further evaluation of vehicle and system costs can be found in Section 8.

4.7.1 Modern

Modern vehicles generally cost $3-4 million each. The following is an overview of the vehicle prices, based on recent orders:

- In 2009 MTS ordered 57 Siemens SD8 vehicles for its existing LRT lines, at a cost of about $3.6 million each.
- The United Streetcar 100 costs around $3.5 million (based on recent orders in Portland and Tucson), while the Inekon Trio-12 is estimated at $3.6 million (based on a recent order in Seattle).
- The price of the new ameriTRAM 300, meanwhile, has not yet been announced, but it is expected to be in the same range.

4.7.2 Historic

Historic vehicles often can be cheap to purchase, as most costs are associated with the subsequent restoration process. The PCC vehicle, which has a rich history in San Diego, was reborn locally in 2011 when MTS procured a restored model for its commemorative Silver Line service (Figure 4-16). The volunteer organization that led the refurbishment estimated the cost to be around $850,000.

Figure 4-16: Historic PCC Streetcar on the MTS Silver Line

Source: Parsons Brinckerhoff

Similar costs are estimated for the acquisition and restoration of the SD1 vehicle; however, as with the PCC model, MTS would need to negotiate specific costs with the vehicles' current owner.

Moreover, while the SD1 vehicle is double-sided and double-ended, in order to use it as a true bi-directional streetcar it will require the installation of two ADA-compliant lifts: one for each side of the vehicle. This can be expected to add significantly to the restoration cost and potentially reduce seating capacity.

In addition, because the supply of historic vehicles is limited and their conditions vary, the actual restoration cost is likely to be different for each vehicle. For any supply of historic cars, it is reasonable to expect that the "easiest" restorations—that is, the cars in the best condition needing the fewest major repairs—will be completed first. This means that restoration costs are likely to increase with each successive vehicle, with the highest-cost restorations coming as the inventory of historic cars depletes.

Finally, unlike with modern vehicles, the costs of these historic streetcars are not likely to come with any assurances of reliability; all future repair costs as the vehicles age, including the procurement of spare parts, would rest with MTS. Therefore, while their initial purchase price may be appealing, historic vehicles could result in higher maintenance costs over the long run.

4.7.3 Replica

The cost of replica vehicles varies depending upon the specific design features selected. Gomaco, a leading replica manufacturer, has recently produced its Birney-class streetcars for systems in Tampa, FL, and Little Rock, AR, at a cost of approximately $900,000 each. This cost includes the installation of ADA-compliant on-car lifts as well as modern features like air conditioning and electronic information displays.

Gomaco has indicated that a major factor that keeps its manufacturing costs low is the use of reconditioned trucks in the undercarriages of its replica vehicles. These reconditioned parts, mostly obtained from old European cars, result in significant cost savings when compared to modern vehicles. Despite these reconditioned components, however, the company still backs its products with contractual warrantees of reliability for at least one year.

4.8 Summary

The capabilities and limitations of the City/Park Streetcar will greatly depend upon the type of vehicle selected. Given the different constraints of the Park Boulevard corridor, including future plans to run LRT service alongside the streetcar, maximum design flexibility will be achieved with an alignment that uses multiple boarding sides, allows for bi-directional travel, and features minimal track installation. Table 4-4 below summarizes the relative advantages of each vehicle type.

While the historic vehicles possess aesthetic and nostalgic value, their use would also limit the flexibility, capacity, and speed of the line. This is particularly true for the historic PCC vehicle, due to its uni-directional nature and one-sided door design.

The historic SD1 and replica vehicles do not possess these directional and access constraints, but they are limited to capacities of about 100 passengers or fewer, making them the smallest vehicles under consideration. This may present crowding problems during holidays and special events.

One possible alternative in the vehicle plan may be to use a combination of historic and modern vehicles on the City/Park Streetcar, changing the vehicles as demands dictate. Like the MTS Silver Line, the streetcar could keep several vintage vehicles in inventory to use during special occasions or events, but could also utilize modern vehicles as the everyday “workhorses” on the route.

This would protect the historic vehicles from the heavy wear and tear of constant use, while keeping them available for special occasions—such as festivals in Balboa Park or the zoo—when their aesthetic value would be most appreciated. Such a plan would be especially feasible if the Siemens vehicle were chosen as the modern alternative. This would allow for the same vehicle to be used in both the LRT fleet and the City/Park Streetcar, thereby taking advantage of interchangeability between the two services.

Table 4-4: Streetcar Vehicles Summary of Relative Advantages

	Modern (United)	Modern (Inekon)	Modern (ameriTRAM)	Modern (Siemens)	Historic (PCC)	Historic (SD1)	Replica
Capacity	High	High	High	High	Low	Low	Low
ADA Accessibility	High	High	High	High	Low	Low	Low
Availability	High	High	High	High	Medium	Low	High
Reliability	High	High	High	High	Low	Low	High
Cost: Procurement	Low	Low	Low	Low	High	High	High
Cost: Operations and Maintenance	Medium	Medium	Medium	High	Medium	Low	Low
Cost: System Design	Low	Low	Low	Low	High	Low	Low
Branding	Low	Low	Low	Medium	High	High	High

Legend: *High: Vehicle has relative advantage in this category*
Low: Vehicle has little or no relative advantage in this category

Operations Plan

5

5.0 OPERATIONS PLAN

This section will examine the various route and scheduling options considered for the City/Park Streetcar, followed by a discussion of the vehicle quantity requirements for each type of vehicle.

5.1 Existing Services

The two community areas included in this feasibility study are Downtown and Balboa Park, both of which are well served by existing transit connections. These services are described below, with the routes closest to Balboa Park summarized in Table 5-1.

5.1.1 Downtown

Figure 5-1: City College Trolley Station ("Smart Corner")

Source: Parsons Brinckerhoff

The Downtown area near the proposed streetcar alignment is served primarily by the City College Trolley Station, a transit hub and mixed-use development often referred to as the "Smart Corner" (Figure 5-1). Located at the intersection of Park Boulevard and Broadway, this station provides connections to the San Diego Trolley LRT Blue and Orange Lines, as well as MTS Bus Routes 2, 5, 7, 15, 20, 210, 810, 820, 850, 860, 929, and 992. Two blocks farther west, MTS Bus Routes 30, 50, 150, 901, and 923 also provide service. As one of the primary hubs of transit service in the region, "one-seat" service is available between this area and a wide range of locations, including San Ysidro, Escondido, Santee, La Jolla, and Mira Mesa. Over 90% of the points within the MTS system are accessible from here via trips that require either zero or only one transfer between services.

5.1.2 Balboa Park

Balboa Park's main visitor and cultural attractions are in the western half of the park, primarily within the area known as the Central Mesa. This area is bordered by Park Boulevard to the east and State Route 163 to the west, and features numerous museums, plazas, and recreation areas, as well as the San Diego Zoo.

Park Boulevard is the closest arterial road to the Central Mesa, with the majority of cultural facilities lying to its west. Transit service in this area currently consists of the MTS Route 7 bus, operating between Downtown San Diego and La Mesa via Broadway, Park Boulevard, and University Avenue. Route 7 is the region's most-used bus line, carrying approximately 12,000 riders on an average weekday and over 3.5 million passengers annually. In addition to trips attracted to Balboa Park, the economically diverse neighborhoods of Hillcrest, North Park, and City Heights also generate substantial ridership on the line. Route 7 operates seven days per week, between approximately 5 a.m. and 2 a.m. Its service frequency is a mere six minutes during peak hours, 12-15 minutes at other times during the day, and no more than 30 minutes during late-night hours.

Beginning in 2013, the Mid-City Rapid Bus route will also begin service on Park Boulevard. Like Route 7, the Mid-City Rapid's course will run from Downtown through Balboa Park, Hillcrest, North Park, and City Heights, but it will use El Cajon Boulevard rather than University Avenue, and it will terminate at San Diego State University. The route features new, articulated buses and new amenities such as passenger stations and transit-signal priority along El Cajon Boulevard. The Balboa Park portion of Park Boulevard is not slated for any capital improvements in the initial phase of the Mid-City Rapid project. However, there will be standard street-side bus stops for the route at the Zoo Place, the Naval Medical Center San Diego, and the City College Trolley Station. The line will operate seven days per week, approximately 5 a.m. to 1 a.m., with a 15-minute frequency for most of the day and a 10-minute frequency in both directions during weekday peak hours.

The less-developed eastern half of Balboa Park includes Florida Canyon, Morley Field athletic facilities, and the Balboa Park Golf Course. The closest existing transit access this section of the park is either Route 7 on Park Boulevard to the west, or Route 2 on 30th Street several blocks east of the park.

5.1.3 Bankers Hill

West of the Central Mesa, the Sixth Avenue side of Balboa Park includes playgrounds, picnic areas, and other recreational facilities. Across Sixth Avenue from the park is the mixed-use, medium-density residential, commercial, and office neighborhood of Bankers Hill. Bankers Hill was one of San Diego's earliest suburbs, and horse-car lines on First and Fifth Streets as early as 1886 were among the first transit services in the city.

Current MTS transit service in Bankers Hill consists of three bus lines: Routes 3, 11, and 120. Routes 3 and 120 use Fourth and Fifth Avenues (for southbound and northbound travel, respectively), while Route 11 operates in both directions on First Avenue north of Hawthorn Street. Route 3 connects the Euclid Trolley Station in Southeast San Diego and the UCSD Medical Center in Hillcrest, primarily via Ocean View Boulevard and 4th/5th avenues. It operates seven days per week, approximately 5 a.m. to midnight. Route 120 is a limited-stop route, with stops near central Balboa Park at Laurel Street, and serves Downtown, Hillcrest, Mission Valley, Linda Vista, Serra Mesa, and Kearny Mesa. Route 120 operates seven days per week, with 15-minute weekday frequency and 30-minute frequency on weekends and holidays through this area. Route 11 operates in the area seven days per week as well, with service every 15 minutes on weekdays, every 30 minutes on Saturdays, and every 60 minutes on Sundays. It connects the Downtown area with SDSU, Kensington, Normal Heights, University Heights, and Hillcrest to the north, as well as the Southeast San Diego neighborhoods of Logan Heights, Southcrest, Lincoln Park, Skyline, and Bay Terraces.

Table 5-1: Basic Service Characteristics of Transit Near Balboa Park

Route	Alignment	Approx. Weekday Span	Approx. Saturday Span	Approx. Sunday Span	Weekday Frequency	Saturday Frequency	Sunday Frequency
3	4th/5th Aves.	5 a.m. – 12 a.m.	5 a.m. – 12 a.m.	6 a.m. – 8 p.m.	15 min.	30 min.	60 min.
7	Park Blvd.	5 a.m. – 2 a.m.	5 a.m. – 1 a.m.	6 a.m. – 11 p.m.	12 min./ 6 min. (pk)	15 min.	15 min.
11	1st Ave.	5 a.m. – 11 p.m.	5 a.m. – 11 p.m.	6 a.m. – 10 p.m.	15 min.	30 min.	60 min.
120	4th/5th Aves.	5 a.m. – 12 a.m.	6 a.m. – 10 p.m.	6 a.m. – 10 p.m.	15 min.	30 min.	30 min.
Mid-City Rapid Bus*	Park Blvd.	5 a.m. – 1 a.m.	5 a.m. – 1 a.m.	5 a.m. – 1 a.m.	15 min./ 10 min. (pk)	15 min.	15 min.
City/Park Streetcar**	Park Blvd.	8 a.m. – 6 p.m.	8 a.m. – 6 p.m.	8 a.m. – 6 p.m.	15 min.	15 min.	15 min.

** Service begins in 2014*

*** As proposed in this City/Park Streetcar Feasibility Study*

5.2 Route Options

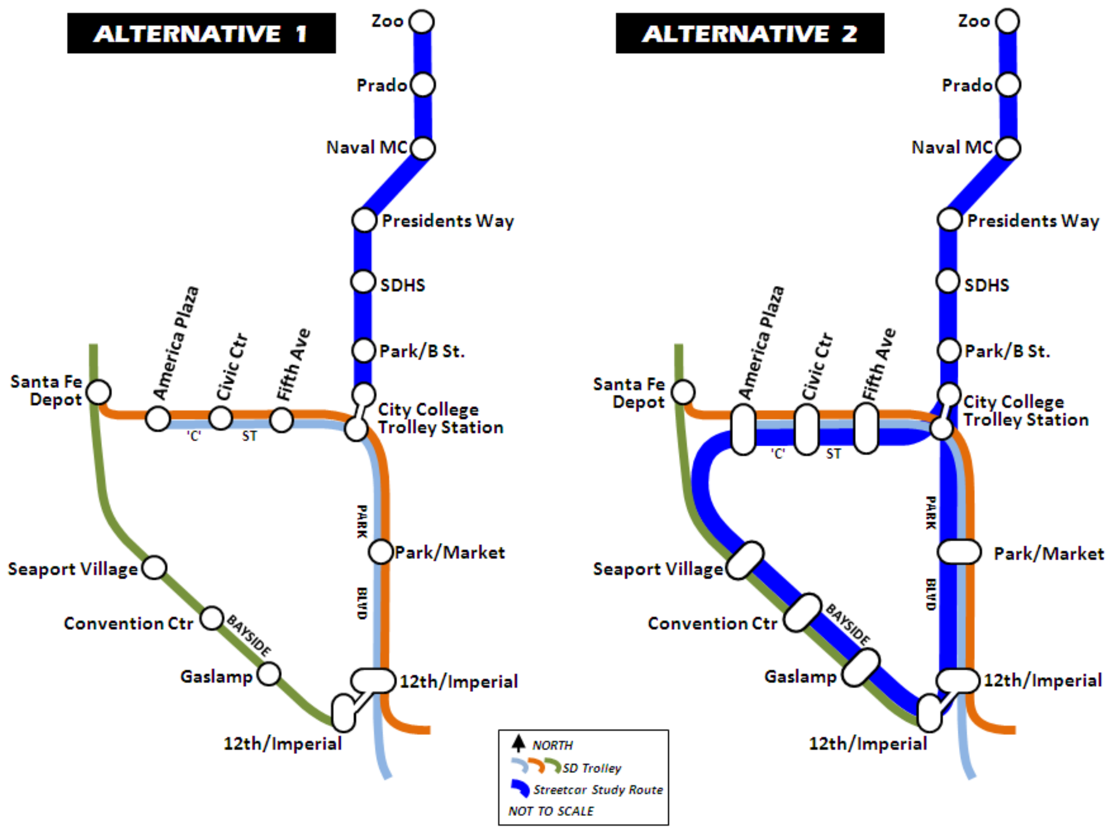
Two major routing options were initially reviewed in this operating plan. Both of these utilize Park Boulevard as the backbone of the route, meeting the intent of the funding grant and minimizing the complexity of the project development. These options are illustrated in Figure 5-2 and described in detail below.

5.2.1 Alternative 1: Park Boulevard Only

The first option studied was a point-to-point route between the City College Trolley Station and the San Diego Zoo, traveling along Park Boulevard between Broadway and Zoo Place. The streetcar would simply operate back-and-forth service between these two terminals, with a track connection to the San Diego Trolley LRT system at Park Boulevard and Broadway. This would enable the streetcars to travel to and from the storage and maintenance facility at 12th and Imperial Avenues, eliminating the need to build separate storage facilities for this initial segment. (Future streetcar extensions with greater fleet and maintenance requirements could require an additional yard and shops in the future.) A turntable or a short loop could be built at both ends of the line to accommodate a single-sided, single-ended vehicle if necessary.

The track connection required to operate this first option would be a single track element linking the Park Boulevard streetcar facility with the northbound light rail tracks. Discussions with MTS staff revealed that the existing intersection at Park Boulevard and Broadway was too complex to handle a track connection with the southbound tracks. Therefore, streetcars traveling south back to the storage facility would need to operate on the northbound LRT tracks along Park Boulevard until they reach the crossover located south of F Street. The limited number of these "deadhead trips" (typically only at the beginning and end of the service day) would likely make this achievable without significant disruption in the LRT service schedule.

Figure 5-2: Route Alternatives Studied



Source: San Diego MTS

5.2.2 Alternative 2: Park Boulevard and Trolley Loop

The second option adds the existing Downtown LRT loop onto the preceding route option to form a "lollipop" configuration. The streetcar would start at Zoo Place, operate to the City College Trolley Station, then join the Downtown LRT loop (traveling in either direction) until it returned to City College, then return back to Zoo Place. If necessary to accommodate a single-sided, single-ended vehicle, a loop or turntable would only be required at the north end, as the downtown loop would serve to re-orient the vehicle. However, not having a turnaround option at or near the City College Trolley Station limits the ability to operate short line, tripper, or special-event trains. The operating cost of this option also would be much higher due to the longer length of the route, although ridership and revenue potential would also be greater.

Figure 5-3: San Diego Trolley Approaching the Broadway Wye

Source: Parsons Brinckerhoff

This second option has greater implications for required trackwork and connections. In addition to the Park Boulevard connection to the existing northbound LRT track, a similar connection would need to be made to the westbound light rail tracks along C Street. Given the narrow width of C Street between 11th Avenue and Park Boulevard, additional right-of-way may be necessary to complete the curve, and one of the two lanes of eastbound traffic along C Street would probably need to be removed.

A clockwise rotation around the Downtown LRT loop, on which the historic Silver Line trolley currently operates, would require interruption of the light rail service in two locations on either side of City College Trolley Station: once when entering the loop and once when exiting the loop. In both places, LRT service would need to pause while the streetcar operated contraflow on the tracks between the connection trackage and the nearest crossover. A counterclockwise rotation around the Downtown loop would reduce the LRT interruption to one instance—on 12th Avenue just north of Imperial Avenue—where the streetcar would transition from the third (westernmost) track to the northbound track.

Under this route option, the streetcar also would interrupt future LRT Green Line service at the Broadway Wye, located adjacent to the Santa Fe Depot (Figure 5-3). In either direction, this interruption would occur routinely throughout the streetcar's service day. A final complication of this route is the America Plaza Trolley Station, which in 2012 temporarily will house the terminus of the LRT Blue Line on one track, while allowing the LRT Orange Line to travel through on the second track. The streetcar therefore would need to dovetail with both the Orange and Green Lines to make this route option viable.

5.2.3 Selected Route

Ultimately, the complications of the Downtown LRT loop, including the cost of the additional trackage and crossovers (and potentially right-of-way), the threading of the streetcar into the LRT schedule, and the potential for disruption of regular LRT service, led this study in the direction of the first route option. That option, with the simple point-to-point service between City College Trolley Station and the San Diego Zoo, is therefore the primary route examined in this study.

5.3 Scheduling

The selected operations schedule will contribute to both the costs and the benefits of the City/Park Streetcar. Longer hours and greater frequency provide choice benefits to riders, but can come with heavy costs—not just in operational costs from more service hours, but also in capital costs through the number of vehicles required.

5.3.1 Span of Service

The Park Boulevard corridor in the study area will be served by the existing MTS Route 7 bus and the upcoming Mid-City Rapid Bus (scheduled to begin service in 2013). Both of these transit options will have an extensive span of service, from before 5:00 a.m. until after midnight. Since the City/Park Streetcar would be an overlay service that would complement the other routes, it is not critical that the streetcar service provide complete coverage during the span of activities along the route. This provides an opportunity to conserve financial resources and reduce operating cost by concentrating streetcar service only during the hours when the greatest ridership is likely to occur.

Figure 5-4: MTS Route 7 Bus Serving Park Boulevard

Source: Parsons Brinckerhoff

For the purposes of cost estimating and scheduling, this study projects an operating span of approximately 8:00 a.m. to 6:00 p.m. Based on a survey of nearby institutions and attractions (detailed in Appendix F), this span will cover the operating hours of most Balboa Park attractions, the San Diego Zoo during winter hours, and the regular hours of San Diego High School. While San Diego City College and the Zoo's summer hours are more extensive, it is assumed based on current Route 7 ridership trends that most of the demand for these institutions also falls within the proposed operating hours.

These proposed hours would not limit the City/Park Streetcar from extending its service day during special events. Building upon a successful implementation, there could also be a future desire to extend the span seasonally, taking advantage of evening concerts at the Spreckels Organ Pavilion, San Diego Zoo's Nighttime Zoo program, and the longer daylight hours that occur during summer months. Extended seasonal hours likely would require additional operating subsidies, as transit ridership tends to drop significantly in the hours after sunset. With adequate marketing and accurate demand forecasts, however, it is possible that some special-event service could reach or exceed full cost recovery, requiring no further subsidy to operate.

5.3.2 Frequency of Service

The base schedule assumes a fifteen-minute service frequency on all days of service. MTS considers this to be the minimum frequency required for a "frequent" service, and appropriate for the level of investment required of rail infrastructure. It matches the current base schedule for all three San Diego Trolley LRT lines, which means that transfers can be well coordinated and scheduled.

Given current levels of demand, the City/Park Streetcar's ridership goals will probably require that it absorb some demand from the Route 7 local bus service, which operates on a 12-minute base weekday headway, with 6-minute headways during peak hours. Given that the streetcar project in this study is already a complete overlay of existing Route 7, but substantially shorter, it will need to offer an attractive frequency to draw passengers off the more-frequent local bus service. At fifteen minutes, the attraction of the rail vehicle will bring new passengers, as well as encourage existing bus passengers to use the line.

At thirty minutes, there would be 2.5 Route 7 buses passing for every streetcar, a major deterrent to streetcar ridership. Further, the entire distance between City College and the San Diego Zoo is only 1.5 miles, just over a thirty-minute walk for most people. The streetcar will need to offer a frequency competitive to walking.

The streetcar line is operable with a 30-minute frequency, which could be done during extended evening hours or other times when ridership could be expected to be less ad-hoc. Also, an extended route through downtown that utilizes any portion of the Trolley loop would need to be dovetailed into existing Trolley schedules. The higher the frequency, the more disruption to LRT service could be anticipated, as well as greater traffic impacts from the additional service.

5.3.3 Running Times

MTS possesses a large amount of bus run-time data in the study corridor from existing Route 7 service. The proposed streetcar alignment along Park Boulevard has the same number of stops as the current bus route and follows nearly the same alignment. Therefore, the existing Route 7 run times were used as an initial basis for streetcar scheduling.

A run-time survey from several hundred Route 7 trips in February and March 2011 was used to create a draft run-time matrix for the City/Park Streetcar. Since Park Boulevard currently operates with few traffic-related delays, it is not expected that any traffic impact, positive or negative, would significantly alter running times from the current situation. However, some minor differences can be expected in the run times between local-bus service and streetcars. The characteristics of each service that can improve or deteriorate performance are shown in Table 5-2.

Table 5-2: Factors that Can Affect Streetcar Performance Relative to Bus Route 7

Factors that Could ***Increase*** Streetcar Running Times Over Route 7	Factors that Could ***Reduce*** Streetcar Running Times Over Route 7
The streetcars vehicles may accelerate and operate at slightly slower speeds, especially if historic cars are used.	An off-board ticket sales and a proof-of-payment system could reduce dwell times at stations over the pay-as-you-enter system on MTS buses.
Less frequency than the existing bus routes, if matched by increased ridership, could raise dwell times for boarding and alighting. This could be mitigated or worsened by the vehicle selected (high- vs. low-floor, number of doors, etc.).	The addition of streetcar service, plus Mid-City Rapid, would increase capacity on this corridor. So current corridor passenger loads would be spread among more vehicles. (This could also lower dwell and running times for Route 7.)
Wheelchair lifts in a historic car would add loading and unloading time over the current low-floor bus ramps.	The simpler and more easily understood route network of a rail line could reduce dwell time associated with passenger inquiries.
New priority treatments required at signalized intersections will increase signal cycle times.	The implementation of signal priority measures and the proposed reduction of cross traffic could increase speed for all traffic on Park Boulevard.
MTS could opt to reduce Route 7 stops along Park Boulevard when the streetcar is operating, to prevent duplicative service and reduce running times on Route 7.	If there is no requirement for wheelchair securement (as on the Trolley), time savings could be achieved over bus service, on which the driver manually secures wheelchairs.
Installation of new pedestrian grade crossing at the Balboa Park/Prado station location	Removal of traffic signal and intersection at Inspiration Point Way.

With the many factors above likely to cancel each other out, the existing Route 7 run times offer a good basis upon which to build a potential streetcar schedule. Of course, the vehicle type that is selected also will impact the running time; a single-ended car requires a turnaround loop or turntable on each end, while a double-ended car requires the operator to change cabs at each end of the line. To account these turnaround times, and to err on the side of caution, a slight buffer is built into the initial streetcar schedules for the purposes of calculating operating factors. Because of the cycle time on the route, that buffer has no material effect on the operating cost or vehicle requirement in this case.

A sample run-time scheduling matrix is included in Appendix G.

5.4 Vehicle Requirement

Figure 5-5: Vehicle Assembly

Source: Parsons Brinckerhoff

Aside from the issue of the final vehicle selection, a minimum number of vehicles necessary to operate the service must be established. This includes the base number of vehicles needed to operate the schedule, plus spares required for maintenance needs.

The draft schedules have a round-trip run time ranging from 20 to 23 minutes, including a short 1-3 minute break at the north end, which would be used to turn a car around or reverse direction. A recovery and layover period of 7-10 minutes at the southern end creates a clean 30-minute total cycle time. Therefore, to achieve a fifteen-minute service frequency, two vehicles would be needed to operate the schedule.

In some rail systems, "dropbacks" are used to reduce the in-service vehicle requirement and the vehicle storage space required at the terminals. In a dropback system, the vehicle turns around immediately at the terminal, while the driver stays for a recovery period. The previous driver picks up the vehicle for its next trip. This differs from most bus systems, in which the driver stays with the vehicle through an entire shift, and the vehicle has a recovery and layover period along with the driver. However, the draft schedules made for this study do not include dropbacks because the estimated layover time is shorter than the headway, so there would be no savings in the vehicle quantity required.

In addition to the maximum number vehicles required to operate the service, a certain number of cars must be available as spares for maintenance, repairs, cleaning, and training purposes. For bus operations, the Federal Transit Administration (FTA) enforces a maximum spare ratio of twenty percent. Because rail systems are so individual and have unique operating characteristics, the FTA has no universal guideline for a rail spare ratio. However, the spare figure chosen must have a reasonable rationale set forth in a fleet management plan. Smaller systems of fewer than 10 or 20 vehicles typically have higher spare ratios because there are fewer overall cars to draw from for spare purposes.

As shown in Table 5-3, the type of vehicle chosen will have a significant impact on the spare ratio necessary. A new, modern vehicle with readily available parts will require fewer spares than a historic vehicle with lower dispatch reliability and parts that may need to be custom-fabricated. If the system is built to be compatible with a modern LRT car, then one of the new SD8 vehicles in the San Diego Trolley system could be used as a spare buffer. At this time, however, MTS's trolley fleet management plan does not include a streetcar system. One spare car would likely be sufficient for a modern streetcar system, and two spare cars is probably prudent for a historic system in which vehicles may be out of service for extended periods of time.

For a modern system on this alignment and two vehicles in maximum service, one spare car leads to a spare ratio of 50%. Depending upon the dispatch reliability of the actual vehicle chosen, the system could probably be expanded for one or two more vehicles in maximum service without the need to purchase an additional spare. Similarly, a historic system potentially could be expanded into a system of three or four cars in maximum service without acquiring additional spare vehicles, although this would also depend upon the reliability of the fleet.

Table 5-3: Projected Vehicle Quantity Requirements

Vehicle Type	Maximum Vehicles in Service	Spares	Spare Ratio
Modern or Replica	2 (up to 4)	1	50% (up to 25%)
Historic	2 (up to 4)	2	100% (up to 50%)

5.5 Operations and Maintenance Cost Estimate

The discussion of a transit project's cost most often revolves around the capital cost: the process and expense to design and build the necessary facilities and structures, procure real estate for right-of-way, and buy equipment and rolling stock. No less critical to a successful project is an in-depth look at the on-going operating costs of a project once it is implemented. These are the recurring expenses to pay drivers, mechanics, supervisors, and management; maintain vehicles and facilities; clean stations; buy fuel and electricity; and provide security. Transit operating costs are the sum of:

- Variable costs, such as driver wages, vehicle maintenance, and fuel (or electric power). Variable costs rise and fall directly according to the exact amount of service provided; and
- On-going overhead costs such as accounting, insurance, marketing, human resource management, and facilities maintenance. Changes in overhead costs are incremental, and are less affected by minor adjustments in service levels.

When estimating potential costs for a future service, the decision to use a variable or an overhead rate (or a combination of the two) depends on the amount and characteristics of the service. Some questions that typically define the decision include:

- Can the service be accommodated with existing manpower?
- Is this a new mode within the system?
- Are there additional passenger facilities to maintain?
- Are new structures, right-of-way, or facilities required to accommodate the service?
- Does the level or complexity of the added service require new or additional management positions?
- Are the vehicle models to be used already operated in the fleet?

Not all expenses can be classified cleanly as fixed or variable costs; most exist on a sliding scale that requires additional analysis of the exact service being proposed. For example, adding a low number of miles to an existing route may require more drivers, but no more mechanics or management. Adding a few more miles could require an additional mechanic, but still no added management staff. For estimating costs on a new project, generally a conservative approach is taken to ensure that all potential operating costs are covered within the estimate.

The City/Park Streetcar project would represent a new mode for MTS. While its operational characteristics are similar to light rail, acquiring a new and different fleet of vehicles raises the possibility of new and distinct facilities, parts inventories, and maintenance staff and training. However, as noted in Section 4.4, cost efficiencies would be realized with the selection of the Siemens SD8 modern streetcar vehicle, as it is the same model being phased into operation across the entire San Diego Trolley LRT system.

Additionally, there are twelve new station platforms proposed for the City/Park Streetcar, all of which will require periodic maintenance, service, cleaning, and security. For these reasons, fully allocated costs, including full overhead, are assumed for these operating cost estimating purposes.

The operating plan in this feasibility study contemplates a seven-day-a-week operation, with service at 15-minute headways between 8:00 a.m. and 6:00 p.m. A total of 40 round trips would be operated each day (10 hours x 4 trips/hour). With a 20-23 minute round-trip running time, this schedule requires two vehicles in operation all day to cover the scheduled service. This study suggests the same schedule every day (weekdays and weekends) due to of the nature of Balboa Park traffic and demands. Under the proposed schedule, all trips are three-mile round trips, beginning and ending at the City College Trolley Station (Park Boulevard and C Street).

The time and mileage from the first passenger stop of the day for each car until the last passenger stop of the day for each car is the *revenue* time and mileage. The *total* time and mileage adds the “pull-in” and “pull-out” trips between the storage facility barn and the first and last stops, plus the driver’s sign-in and sign-out time. Operating costs for transit are broken down into a unit rate, per certain measurements. Typically these are costs per mile or per hour, either revenue or total, depending upon the nature of the operation and the primary cost drivers for the service.

A table of operating statistics for the City/Park Streetcar, as well as a comparison of the streetcar service and the existing San Diego Trolley service, are included in Appendix G.

MTS has extensive experience and cost models for modern bus and light rail service. However, San Diego has not operated streetcar service since 1949. (While the Silver Line uses a streetcar vehicle in a single-car consist, it uses existing light rail right-of-way, stations, and facilities.)

The cost model for this feasibility study uses the San Diego Trolley fully-allocated rate to estimate the annual operating cost. The following notes and assumptions are made:

- The three-to-four cars required for this City/Park Streetcar segment could be accommodated within the existing San Diego Trolley property, so it is not anticipated that a new division or property would be required. Future streetcar extensions beyond this project very likely will require additional property and maintenance facilities, as well as additional track to access those facilities.
- For directly operated service, wages are a primary driver of cost, so MTS uses a per-hour rate for estimating operating costs. San Diego Trolley service is directly operated, with its drivers, mechanics, and management being employees of MTS. MTS uses a revenue-hour rate by loading the costs beyond revenue service into the revenue rate.

  This cost estimate assumes operation by San Diego Trolley, for easier integration and sharing of facilities as well as the labor pool. Rail service could be contracted (as is the case with North County Transit District’s rail operations), although there are challenges and complications in operating both contracted and directly-operated service (and two different contractors) out of the same facility.
- An FY2012 cost structure was used for these estimates; approximately three percent per year can be added to the rate for an opening year update.

Some savings could be achieved by sharing additional overhead with San Diego Trolley. However, the Trolley overhead is spread among over seven million annual revenue car miles, so the percentage of the fully allocated rate that is fixed overhead is relatively small.

In FY2012, MTS budgeted $148.74 per revenue hour (fully allocated) for Trolley light-rail service. (A summary of MTS costs for different modes is included in Appendix G.) MTS informally polled three other cities that operate streetcar service, all of which are in a similar range: Kenosha, WI ($120/revenue hour); Portland, OR ($140/revenue hour); and Seattle, WA ($150-$160/revenue hour). The FTA’s National

Transit Database added the streetcar as a separate mode beginning in report year 2011, so once that data are available (likely in early-to-mid 2013), a more extensive and vetted cost comparison that includes all U.S. streetcar systems will be possible.

Using MTS rates and the assumed 7,215 annual revenue hours, an annual operating cost range of $1.0 million - $1.1 million could be expected (FY 2012 dollars). There is significant room for variability if the starting date is delayed, as variables such as electricity costs and labor contracts would be unknown at this time. Other items that could affect the ultimate operating cost include the levels of station maintenance, system security, and fare enforcement to be provided; responsibilities for maintenance of shared bridge structures, roadways, medians, bicycle facilities, parkways, and landscaping; and the streetcar vehicles chosen, which will vary in efficiency and maintenance requirements.

Alignment Concepts

6

6.0 ALIGNMENT CONCEPTS AND EVALUATION

The City/Park Streetcar is just one of many transportation elements anticipated for Park Boulevard. As discussed in many policy documents and expressed at several of the community outreach sessions, there are high expectations for Park Boulevard to be transformed into a major multi-modal corridor in the future. The vision for Park Boulevard is more as a "complete street" corridor than its current condition: a four-lane major collector dominated by automobile usage and on-street parking. As the corridor's transportation facilities continue to grow, it is paramount that the selected alignments be safe for all intended users within the public right-of-way.

Figure 6-1: Park Boulevard near San Diego High School

Source: Parsons Brinckerhoff

This section first outlines the reasons for the selection of Park Boulevard as the sole alignment corridor, and then evaluates five different concepts for lane design within the selected alignment.

6.1 Selection of Park Boulevard Alignment

MTS desired to study the feasibility of a short "starter line" for streetcars between downtown, Balboa Park, and the San Diego Zoo, which will serve as the precursor to a larger streetcar network envisioned in the SANDAG 2050 Regional Transportation Plan (2050 RTP).

6.1.1 Advantages of Park Boulevard

The least-challenging route would appear to utilize existing Park Boulevard right-of-way between the City College Trolley Station and the San Diego Zoo, serving San Diego City College, San Diego High School, Naval Medical Center San Diego and various Balboa Park destinations along the way. Unfortunately, no infrastructure remains from the historic streetcar service that operated here until 1949.

The advantages of the Park Boulevard alignment are that it serves major regional destinations of interest to both local residents and millions of visitors, it provides a short connection between downtown and these locations, most of the adjoining land is publicly owned, and there are few traffic, utility, or development conflicts. The disadvantages are that there is little connection to residential areas and few opportunities for private investment along the route. However, the eventual continuation of this line north into Hillcrest and North Park or south into Downtown or the East Village—as programmed in the 2050 RTP—provides many potential development opportunities for the future.

When the streetcars last ran along this alignment in the late 1940s, they did so in their own right-of-way, located just east of Park Boulevard. Since that time, the roadway has been realigned, the Central Mesa of the park has been redeveloped, and the streetcar trestles and station infrastructure have been removed. The ability to create a new exclusive right-of-way through existing parkland, much of it now developed with gardens, mature trees, and museums, is unfeasible. After considering the low feasibility of these other approaches, MTS and the Steering Committee decided early in the study that the focus would be on utilizing the existing Park Boulevard right-of-way for as much of the line's length as possible.

With the majority of the streetcar alignment decided to be along Park Boulevard, the Steering Committee then evaluated the feasibility of bringing the line's northern end even closer to the center of the park, in order to serve major park attractions more directly. During an April 2011 workshop, only three of the 16 committee members indicated that bringing streetcars into the center of the park (via Presidents Way) was a priority. The same number of members also prioritized maintaining the current number of on-street parking spaces in the corridor. Many more members placed a priority on maintaining the historical character of Balboa Park, which would preclude the streetcar from deviating beyond the Park Boulevard corridor. Not only does this mimic the previous streetcar alignment, but also minimizes the potential disruption to other historic elements within the park.

In addition, a majority of committee members prioritized having an alignment that would be conducive to future expansion to the nearby neighborhoods. Routing the streetcar away from Park Boulevard and through the center of the park would lengthen the travel time and would negatively affect future expansion plans. This alignment could also potentially remove some existing parking areas to make way for track and station footprints and disturb the historical character of the park's center, which has never had direct streetcar service in the past.

6.1.2 Starting and Ending Points

The City College Trolley Station, located between C Street and Broadway (Figure 6-2), is a natural southern terminus for this streetcar alignment. It is a strong hub for MTS services, offering connections with two San Diego Trolley LRT lines and twelve local and express bus routes.

Figure 6-2: City College Trolley Station

Source: Parsons Brinckerhoff

In addition, the streetcar tracks can tie in to the larger LRT network at this point, in order to facilitate storage and maintenance needs as well as the potential for extended services in the future.

To reach this southern terminal, the streetcar would pass by many Balboa Park destinations in addition to Naval Medical Center San Diego, San Diego City College, and San Diego High School. All of these facilities are considered major trip generators for existing transit services in the area.

While this southern terminal will limit the penetration of the City/Park Streetcar into the Downtown area, future opportunities to extend the system is still available. As noted previously, this "starter line" is likely to be part of the larger streetcar system envisioned in the 2050 RTP. Moreover, a key advantage of stopping this line on the edge of Downtown is that it greatly reduces the complexity of the project, decreasing the planning and infrastructure costs and increasing the likelihood of implementation.

The entrance to the San Diego Zoo, located at Zoo Place, is a logical northern terminus for a streetcar line in Balboa Park. The zoo is the single largest trip generator in the park, with an annual attendance of over three million. Other institutions north of the zoo—Roosevelt Middle School, the Blind Community Center, and the War Memorial Building—are not likely to generate enough regular ridership on their own to justify the cost of additional tracks and stations for this initial phase. In addition, the zoo features a very large parking lot at Zoo Place, the corner of which could house the streetcar's end-of-line infrastructure, thus preserving as much "green" open space in the park as possible.

6.1.3 Other Reviewed Alignments

Two other streetcar routes serving Balboa Park also were initially reviewed. While ruled out of this study, they may be worthy of further analysis in future studies.

- **Presidents Way Spur**

An optional streetcar spur along Presidents Way between Park Boulevard and Pan American Plaza (Figure 6-3), was drafted for future analysis. The "spur" alignment was only reviewed conceptual and was not included in the overall feasibility study. It was envisioned a single track operating in a new median of Presidents Way with a station at the north end of Pan American Plaza, just south of the House of Pacific Relations cottages.

Figure 6-3: Looking East on Presidents Way

Source: Parsons Brinckerhoff

Existing on-street parking along Presidents Way likely would need to be removed in order to accommodate the tracks without widening the roadway. The turnaround at Pan American Plaza could be a small turnaround loop, a turntable, or even a simple track-end if a double-ended, double-sided vehicle were used.

Selection of the best option would depend upon the type of vehicle used and the space available, the evaluation of which would be part of a future study. The stub would connect to the City/Park Streetcar at the intersection of Park Boulevard and Presidents Way, which likely would require some widening of Presidents Way and reconfiguration of the traffic signaling system.

- **Bankers Hill and Hillcrest**

Bankers Hill and Hillcrest are the neighborhoods immediately to the west and the north of Balboa Park, featuring large residential populations and several major activity centers. A streetcar route from Downtown into these areas, likely along Fourth and Fifth Avenues, would serve many people who live beyond practical walking distance to a Park Boulevard alignment, but it would also force park visitors to walk relatively far to reach many of the park's most popular attractions: The Plaza de Panama in the center of Balboa Park is about one half-mile from Sixth Avenue, while the San Diego Zoo entrance is nearly one mile away. Such a route, while useful for Bankers Hill and Hillcrest residents traveling Downtown, is unlikely to generate significant ridership among Balboa Park visitors.

Figure 6-4: Cabrillo Bridge, c. 1915

Source: Library of Congress

One possible alternative is to keep the Park Boulevard alignment as proposed and simply extend the line further to the west (via Presidents Way), through the park and into Bankers Hill and then north to Hillcrest. This would open up a new market of Bankers Hill and Hillcrest residents not served by a streetcar on Park Boulevard. However, it also would present significant challenges, mostly due to the historic Cabrillo Bridge connecting the heart of the park to Sixth Avenue (Figure 6-4).

While a full assessment of the bridge will require the inputs of structural engineers, a preliminary look at it during this study indicates that it is probably unable to support the tracks, vehicles, catenary infrastructure, and stray currents of an electric rail system. Additionally, the Cabrillo Bridge is listed on the National Register of Historic Places; because it has never been a streetcar route, the approval of such character-altering improvements would be complicated by its historic designation.

Although these two route alternatives are not feasible within the scope of this study, both the 2050 RTP and the forthcoming update to the Uptown Community Plan are expected to include some type of streetcar system running through Bankers Hill and Hillcrest. Eventually, as programmed in the 2050 RTP, such a streetcar could connect with the City/Park Streetcar via University Avenue to the north and Downtown to the south, creating a large loop surrounding Balboa Park. As the City/Park Streetcar moves forward, a feasibility study similar to this one should be undertaken regarding a larger loop alternative.

6.2 Alignment Concepts

This section provides an overview of the five different concepts for the streetcar alignment within the right-of-way of Park Boulevard (Figure 6-5). A brief feasibility evaluation for each of these concepts is provided after their descriptions.

Under all concepts, the proposed streetcar would be an "in-street" operation, travelling in both directions on Park Boulevard, with seven station locations within the corridor.

Figure 6-5: Park Boulevard near Village Drive

Source: Parsons Brinckerhoff

As noted earlier, the corridor study area is located on Park Boulevard from Zoo Place to Broadway, a length of approximately 1.5 miles (Figure 6-6). To develop the conceptual options it was important to establish several baseline assumptions for the placement of the different proposed facilities besides the streetcar. These assumptions are based on the existing conditions assessment, discussions with the MTS operations division, current policy documents, community meetings, City of San Diego staff meetings and others. Each concept describes the opportunities to best facilitate the streetcar and these other design assumptions, which include the following:

- An "in-street" alignment for streetcars traveling in both directions;
- A new bicycle facility as defined in the City of San Diego Bicycle Master Plan;
- A future light-rail transit (LRT) right-of-way as described in the SANDAG 2050 RTP;
- Pedestrian enhancements allowing for the implementation of the "Bay to Park" link on Park Boulevard; and
- Retention of the landscaped median north of the Interstate 5 Bridge as the alignment travels through Balboa Park.

Figure 6-6: City/Park Streetcar Proposed Alignment and Station Locations

Source: Parsons Brinckerhoff

Although initially this study was not intended to address all of these "future" facilities, the potential constraints they pose to the City/Park Streetcar made consideration of them essential in designing the alignment concepts. Therefore, this study does address the spatial requirements and special needs for these additional facilities to fit within the corridor. As future engineering studies move forward for the streetcar, accommodation of these additional features will need to be considered.

Typically, significant savings can be realized by maintaining the existing curbs, gutters, sidewalks and other "in-street" infrastructure. Retrofitting within the built environment of the corridor rather than requiring all new construction would be preferable. It should be noted, however, that all of the options provided here require additional right-of-way through the Balboa Park portion of the corridor. The amount of the additional right-of-way is dependent upon how the features are addressed. Therefore, a simple retrofit of the existing right-of-way within Park Boulevard is not possible as currently envisioned.

The solutions discussed in this section are separated into four different areas within the Park Boulevard corridor. These are:

- **North of Interstate 5 to Zoo Place** – This is the segment of the corridor traveling through Balboa Park. There are five options illustrated in this section;
- **South of Interstate 5 to C Street** – There is only one option for this segment since the proposed improvements can be accommodated within the existing right-of-way;
- **Interstate 5 Bridge** – Again, only one option is provided at this location due to the cost and structural implications to the existing facilities; and
- **Ends of the Line** – Several options are illustrated for each end-of-line area, both the north end at Zoo Place and the south end near C Street.

This evaluation of options is slightly different from typical streetcar feasibility studies. In this study, the evaluation is not reviewing several different corridors with different lengths, activity centers, station locations, ridership potential, and economic opportunities. Rather, the study is focused on the options for track placement within a single corridor, the physical ability to accommodate all the transportation facilities proposed for the corridor, and the potential impacts to adjacent features within the corridor.

After each concept is described, a short "Evaluation" summary is provided highlighting the special considerations of each. The entire Evaluation Matrix is provided in Appendix D and gives a complete overview of the implementation evaluation and corridor issues for each option based on:

- **Engineering Issues** – This includes existing bridge issues, existing utilities, and right-of-way requirements;
- **Operational Issues** – This includes on-street parking conflicts, vehicle conflicts, as well as future systems integration;
- **Cost Issues** – This includes capital cost, operational cost and cost effectiveness; and
- **Other Issues** – This includes environmental constraints, consistency with planning documents, and complete-street opportunities.

6.3 Concepts: North of Interstate 5 to Zoo Place

Below are five options reviewed for this portion of the project corridor. The right-of-way section in this portion of Park Boulevard varies slightly, but is generally 103 feet in width as illustrated in each of the alignment figures below. This includes two travel lanes in each direction, on-street parking, a landscaped median, and parkways with sidewalks.

6.3.1 Option 1

Option 1 provides for streetcar operation in two directions in mixed-flow lanes closest to the curb. On-street parking removal is expected to be minimal, as the streetcar would travel through Balboa Park in the first travel lane rather than the curb/parking lane. Station stops or platforms would be provided at seven different locations, and the on-street parking would be removed only at these locations.

Figure 6-7: Typical Rail Flange Gap

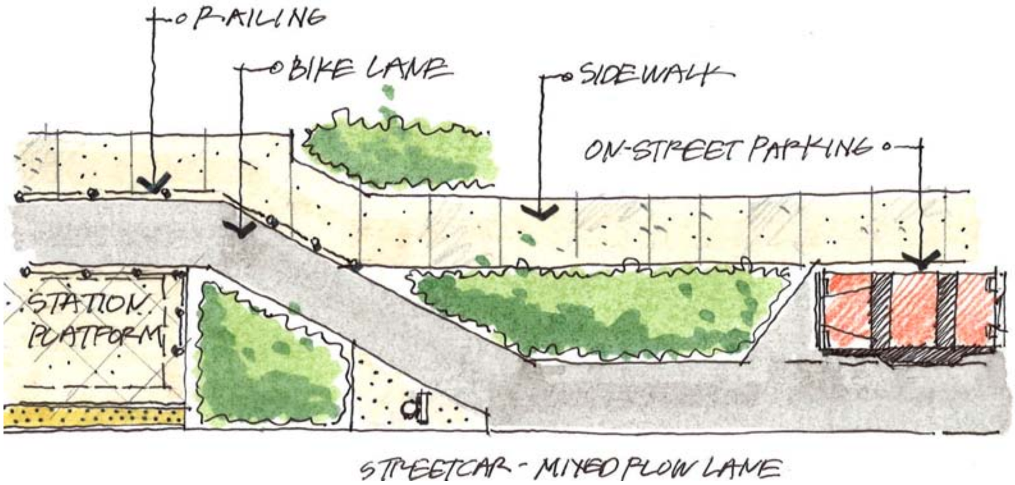
Source: Parsons Brinckerhoff

A Class II Bike Lane is located between the on-street parking and the mixed-flow travel lane in which the streetcar operates. It is generally questioned whether bicycle facilities are compatible with streetcar tracks. The relationship of rails and cyclist is a hazardous one and there are no guidelines by the City of San Diego, SANDAG or MTS on how best to address this issue. This co-relationship has the potential to present safety risks, as bicycle tires (especially skinny-tired road bikes) can get caught in the flange gap (Figure 6-7) of the tracks if a cyclist swerves quickly to avoid an obstacle, including an open car door.

While this streetcar study never intended to “design” bicycle facilities, it has however attempted to address the issue in each of the design options. Streetcar routes and bicycle routes are frequently sited on the same classification of streets and the streetcar-planning process often fails to plan early for the purpose of joint use.

This same bicycle alignment used in Option 1 is also present in Options 2 and 3. In addition, when approaching a station platform, the bike lanes needs to transition behind the platform. This transition avoids conflicts between cyclists and passengers boarding the streetcar (Figure 6-8 and Figure 6-9).

Figure 6-8: Conceptual Bicycle Lane Transition at Station Platform



Source: Parsons Brinckerhoff

This type of transition is a solution used in other cities (Portland), but the steep grade of Park Boulevard could present safety risks for bicyclists traveling downward at high speeds. However, while this type of bike lane design at these "downhill" stations is not optimal, it is a starting point for discussion that needs to be explored as a potential solution as the project moves forward.

Figure 6-9: Bicycle Lane Behind Platform

Source: Parsons Brinckerhoff

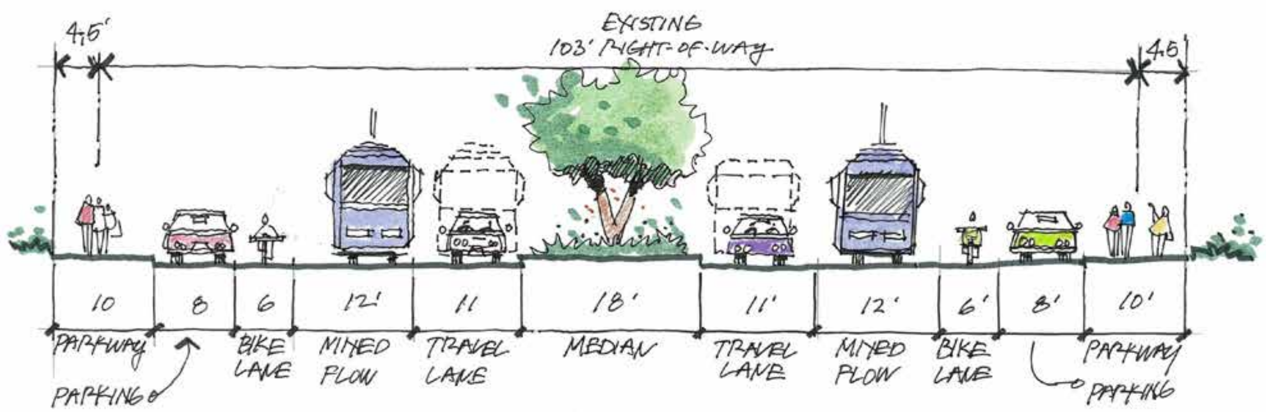
Additionally, in this concept, the far-left travel lanes would transition into exclusive LRT lanes when the planned Mid-City LRT line is built. This placement of the LRT lanes is the same in Options 1 through 4, as this was the preferred location that emerged in discussions with the MTS operations division. Most notably, this location for the LRT reduces the number of turn-movement conflicts at intersections.

The entire right-of-way requires a total of 112 feet, 9 feet greater than the existing right-of-way. Figure 6-10 depicts a typical Option 1 cross-section configuration, and includes the following:

- Two (2) 12-foot mixed-flow travel lanes in which the streetcars operate;
- Two (2) 11-foot general-purpose travel lanes, transitioning later into exclusive LRT lanes;
- Two (2) 6-foot Class II Bike Lanes;
- On-street parking retained on both sides of Park Boulevard;
- Two (2) 10-foot parkways for pedestrians; and
- One (1) 18-foot landscaped median.

Evaluation: Third Place. This concept provides all the design features required in policy documents, but is severely impacted in the future when two of the general-purpose lanes are transitioned for exclusive LRT use. With the inclusion of the LRT lanes, Park Boulevard would leave only one travel lane in each direction, which is intended to be mixed-flow for both the streetcar and other general-purpose vehicles. As the evaluation matrix in Appendix D shows, this option scores well under the engineering criteria but fares poorly when considering operational requirements. Overall, Option 1 places third out of the five options reviewed.

Figure 6-10: Option 1 Alignment Concept



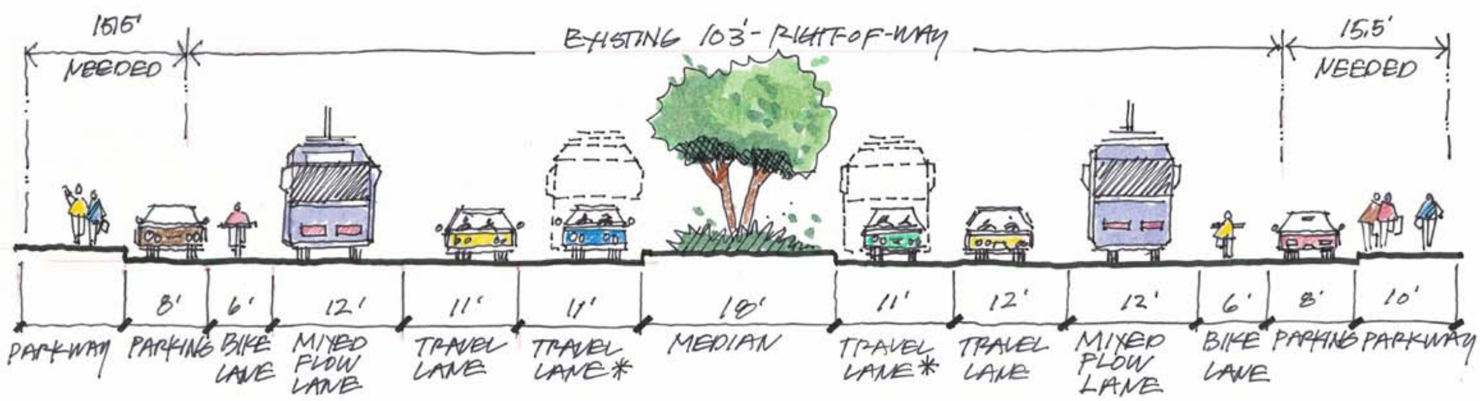
Source: Parsons Brinckerhoff

6.3.2 Option 2

Option 2 recognizes the diminished lanes of Option 1, provides for an additional travel lane, and retains the on-street parking. The bike lane is placed between the streetcar lane and the on-street parking, which presents the same safety issues identified for Option 1 above. This option requires an extra 31 feet of right-of-way to permit the new travel lanes, for a total of 134 feet. Of all the options, this presents the widest "footprint." As illustrated in Figure 6-11, these new travel lanes would later transition into the exclusive Mid-City LRT lanes. The cross-section for Option 2 includes the following:

- Two (2) 12-foot mixed-flow travel lanes in which the streetcars operate;
- Two (2) 11-foot general-purpose travel lanes;
- Two (2) 11-foot general-purpose travel lanes, transitioning later into exclusive LRT lanes;
- Two (2) 6-foot Class II Bike Lanes;
- On-street parking retained on both sides of Park Boulevard;
- Two (2) 10-foot parkways for pedestrians; and
- One (1) 18-foot landscaped median.

Figure 6-11: Option 2 Alignment Concept



Source: Parsons Brinckerhoff

Evaluation: Fourth Place. This concept provides all of the design features required in policy documents, with the addition of two general-purpose lanes that will transition into exclusive LRT lanes. The 134-foot width is the widest of all the concepts, requiring an additional 31 feet of encroachment into the park. It should also be noted that, similar to Option 1, the relationship between the bike lanes and the streetcar is not optimal, as it would require bicyclists ride next to the streetcar tracks and continue to transition behind the station platforms. Option 2 scores poorly in the engineering issues and fairly well in the operational issues. The overall ranking for this option is fourth out of the five options studied.

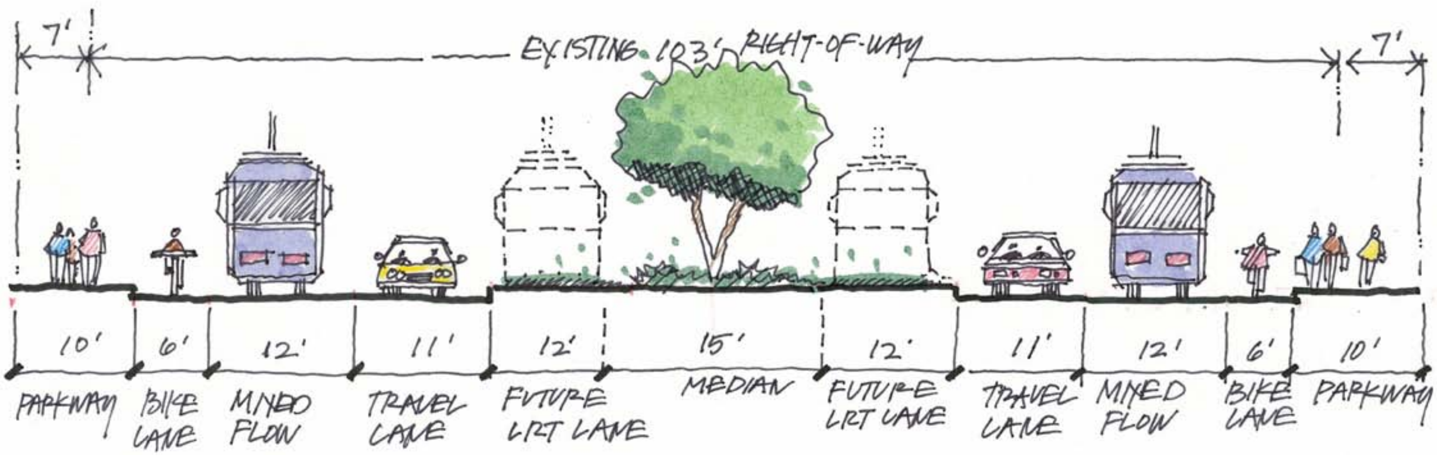
6.3.3 Option 3

As illustrated in Figure 6-12, Option 3 provides for future LRT lanes by widening the landscaped median to 39 feet and eliminating on-street parking. This option requires an extra 14 feet of right-of-way to permit the wider median and the bike lanes, for a total right-of-way of 117 feet. The streetcar is in the nearside right lane, and in the future the median would be reduced to allow for exclusive Mid-City LRT lanes.

In this option, the bike lanes are adjacent to the streetcar lanes, which presents the same risks identified for Options 1 and 2: adjacent track hazards and lane transitions behind station platforms. The typical configuration for Option 3 includes the following features:

- Two (2) 12-foot mixed-flow travel lanes in which the streetcars operate;
- Two (2) 11-foot general-purpose travel lanes;
- Two (2) 6-foot Class II bike lanes;
- On-street parking eliminated on both sides of Park Boulevard;
- Two (2) 10-foot parkways for pedestrians; and
- One (1) 39-foot landscaped median, later to be reduced to 15 feet in order to accommodate two (2) 12-foot LRT lanes.

Figure 6-12: Option 3 Alignment Concept



Source: Parsons Brinckerhoff

Evaluation: Second Place. This option has one of the highest scores because of its minimal take of additional right-of-way and limited operational issues. Similar to Options 1 and 2, the transitioning of the bike lanes behind station platforms could present a safety issue in downhill situations when cyclists can achieve high speeds. In this corridor, several of the stations would be in these “downhill” locations. In flat corridors or even in uphill conditions, transitioning behind the station does not present an issue. This option places well in most of the matrix categories, but it falls short primarily because of the elimination of the on-street parking and the relationship of the Class II Bike Lanes to the station platforms. Overall, this option is ranked second among the five alternatives.

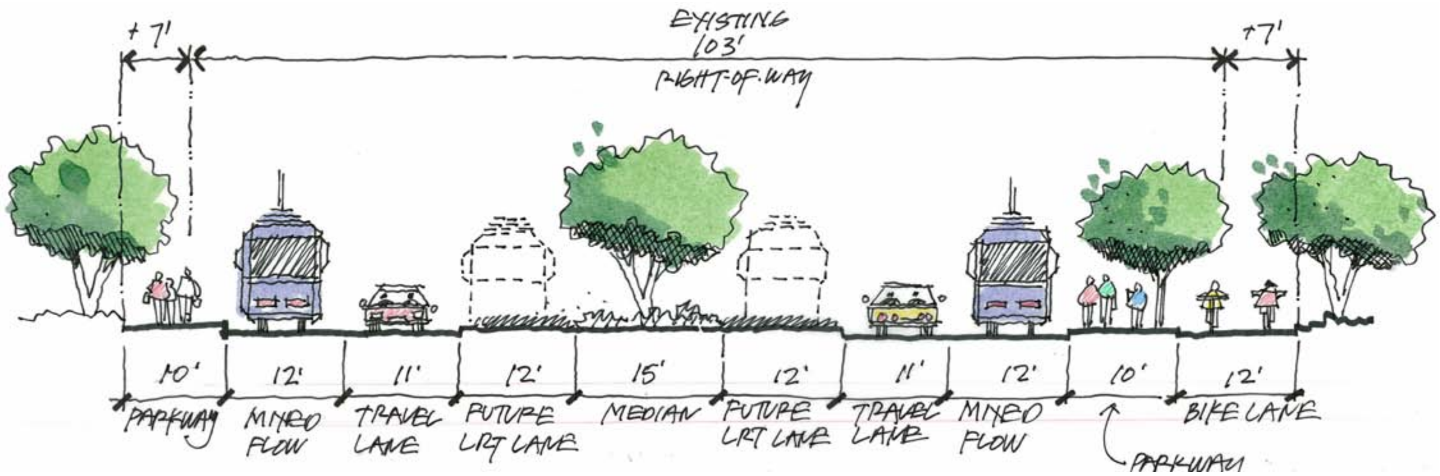
6.3.4 Option 4

By including a Class I Bike Path on the west side of Park Boulevard, Option 4 acknowledges the safety issue associated with placing Class II Bike Lanes adjacent to the rail tracks. In addition, this option addresses the challenge for cyclists traveling downhill, at potentially high speeds, to transition behind the station platforms. By providing the Class I Bike Path it also eliminates the separation of the streetcar platforms from the pedestrian sidewalks, as shown in Figure 6-8.

This option also provides an expanded median that allows for the future LRT to be located in exclusive lanes. This option requires the addition of 14 feet to the existing right-of-way, for a total of 117 feet. As illustrated in Figure 6-13, the typical cross-section would include the following:

- Two (2) 12-foot mixed-flow travel lanes in which the streetcars operate;
- Two (2) 11-foot general-purpose travel lanes;
- One (1) 12-foot Class I Bike Path (Multi-purpose path) on the west side of Park Boulevard;
- Two (2) 10-foot parkways for pedestrians;
- On-street parking eliminated on both sides of Park Boulevard; and
- One (1) 39-foot landscaped median, later to be reduced to 15 feet in order to accommodate two (2) 12-foot LRT lanes.

Figure 6-13: Option 4 Alignment Concept



Source: Parsons Brinckerhoff

Evaluation: **First Place!** This option attained the highest score on the evaluation matrix. This is due primarily to the placement of a Class I Bike Path on the west side of Park Boulevard, thus eliminating the conflicts between the cyclist and the streetcar. The option also provides for all the facilities outlined in planning documents, and the extra right-of-way required is modest, at only an additional 14 feet primarily for the addition of a Class I Bike Path.

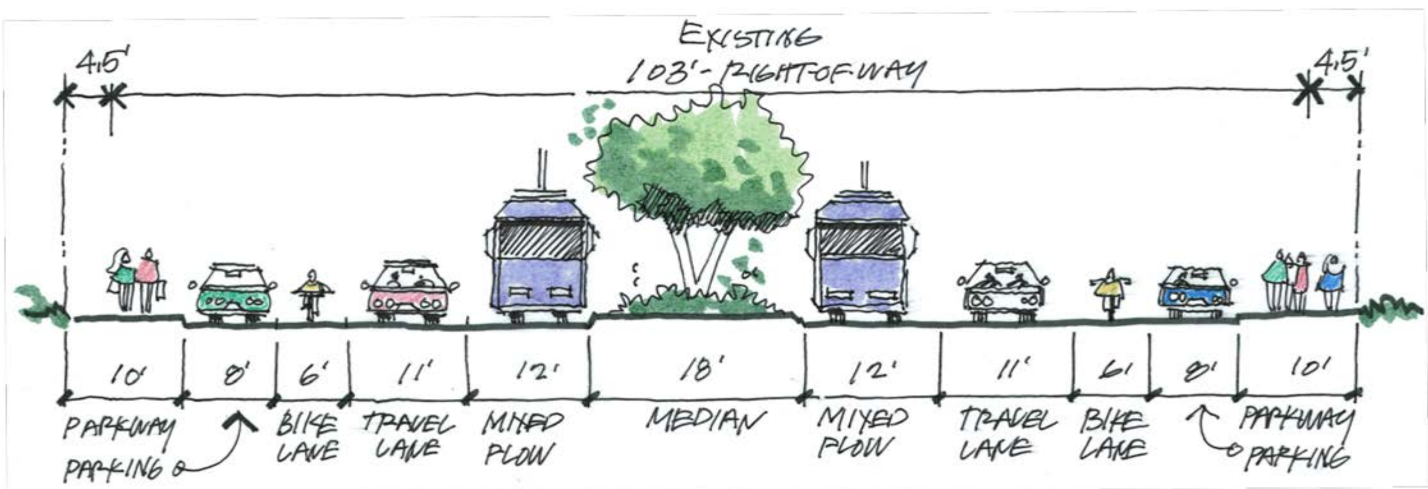
6.3.5 Option 5

The primary distinction of Option 5 is that it does not provide for the future Mid-City LRT. Rather, the right-of-way allows only for the streetcar in mixed-flow lanes adjacent to the landscape median. This “center-running” configuration would require the station platforms within the median. However, both streetcars (operating in opposite directions) could share the station. Additionally, the safety issues of the Class II Bike Lanes—having them adjacent to the streetcar tracks as well as requiring the transition behind station platforms—are eliminated.

This concept also retains the existing on-street parking. The existing right-of-way of 103 feet would be widened by 4.5 feet on each side, for a total of 112 feet. As illustrated in Figure 6-14, the typical cross-section would include the following:

- Two (2) 12-foot mixed-flow travel lanes in which the streetcars operate;
- Two (2) 11-foot general-purpose travel lanes;
- Two (2) 6-foot Class II Bike Lanes;
- On-street parking retained on both sides of Park Boulevard;
- Two (2) 10-foot parkways for pedestrians; and
- One (1) 18-foot landscaped median.

Figure 6-14: Option 5 Alignment Concept



Source: Parsons Brinckerhoff

Evaluation: Fifth Place. This option scores the lowest in the feasibility matrix, primarily because the design does not accommodate the future Mid-City LRT within the proposed right-of-way. While Option 5 does have some operational advantages, such as reducing the conflicts for bicyclists and right-turn movements, it is not consistent with planning documents and does not allow for all of the expected transit modes in the corridor.

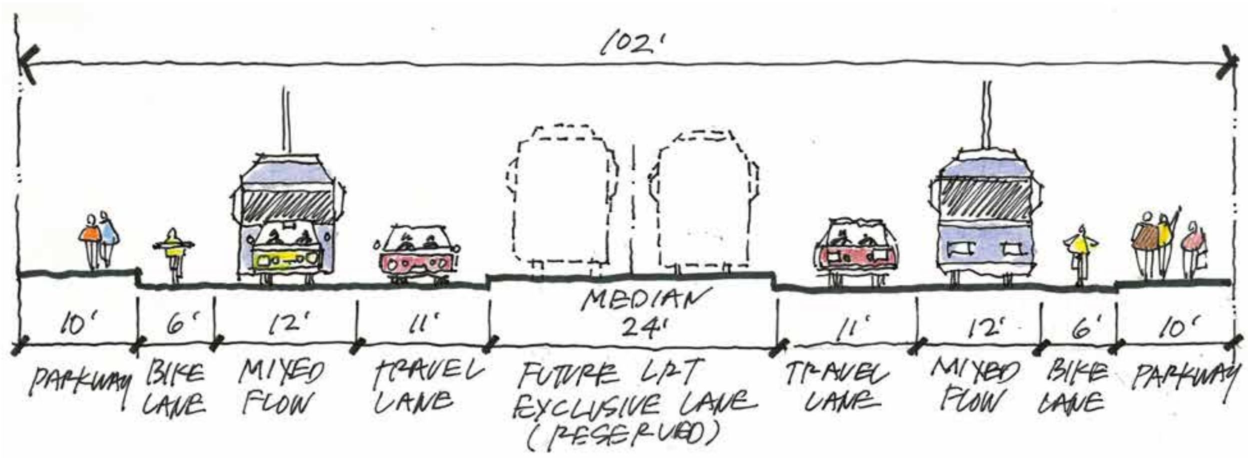
6.4 Concept: South of Interstate 5 to C Street

South of the Interstate 5 Bridge, the right-of-way is fairly consistent with a typical width of 102 feet until reaching C Street. The cross-section for this portion of the Park Boulevard right-of-way can remain the same without any additional take for the proposed improvements. However, this design does require the elimination of all on-street parking in this portion of the corridor. As illustrated in Figure 6-15, the typical cross-section would include the following:

- Two (2) 12-foot mixed-flow travel lanes in which the streetcars operate;
- Two (2) 11-foot general-purpose travel lanes;
- Two (2) Class II Bike Lanes;
- On-street parking eliminated on both sides of Park Boulevard (approximately 102 spaces);
- Two (2) 10-foot parkways for pedestrians; and
- One (1) 24-foot landscaped median, transitioning later into two (2) 12-foot LRT lanes.

In the near term, prior to the arrival of the Mid-City LRT, the center median can be landscaped. Additionally, there are no LRT stations planned in this portion of the corridor so there is no need to widen the median to accommodate a station platform.

Figure 6-15: South of Interstate 5 Alignment Concept



Source: Parsons Brinckerhoff

6.5 Concept: Interstate 5 Bridge

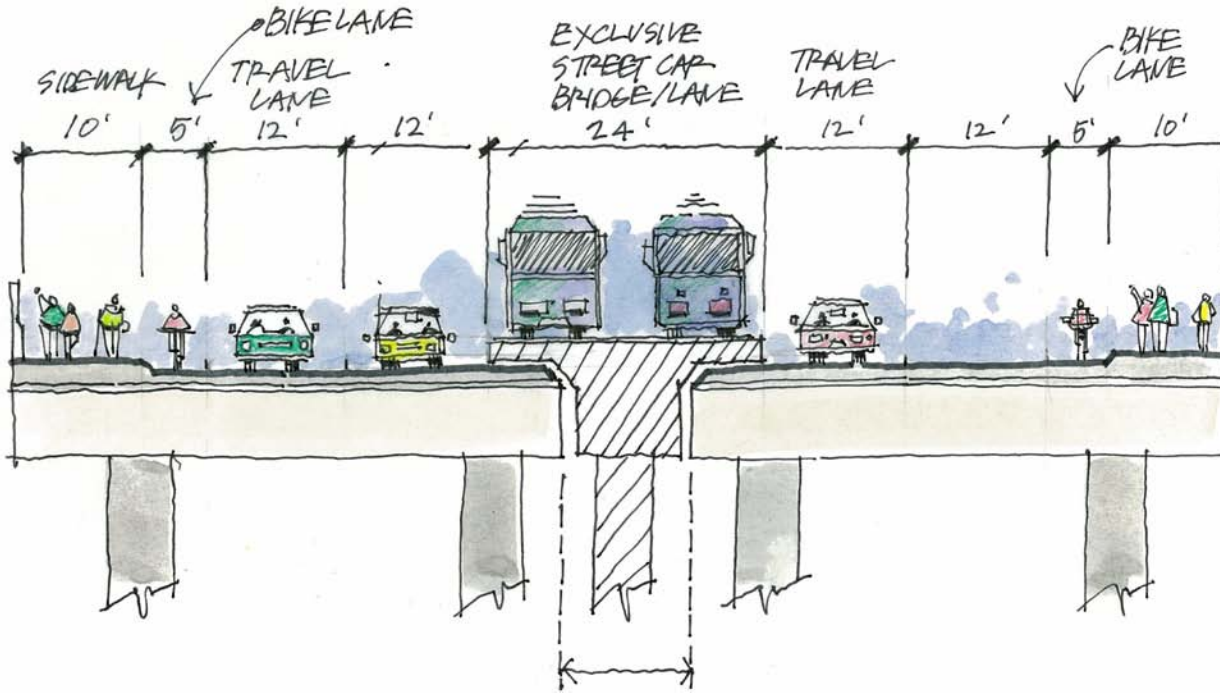
Based on an initial evaluation of the Interstate 5 Bridge, constructed in 1962, the bridge does not have the structural capacity to handle the proposed streetcar facilities. Additionally, the bridge does not have the ability to address the stray current that is associated with electric rail vehicles. After numerous discussions, it was determined that a "bridge within a bridge" might be a solution that would allow for the streetcar to operate over Interstate 5 without having to construct an entirely new facility.

The premise of the "bridge within a bridge" is to construct a new bridge facility within the footprint of the existing bridge. This would require the removal of the middle portion of the bridge (the area between the two inside piers) and then the construction of a new bridge that is designed to structurally support the streetcars and dissipate the stray current. This concept is illustrated in cross-section in Figure 6-16.

In order to facilitate this concept, the streetcar would need to transition into and out of the bridge median. This would occur on the north end at Presidents Way (Figure 6-17). From Presidents Way the streetcar would travel in a dedicated median to the bridge (Figure 6-18), then transition back to the right-side mixed-flow lanes south of the bridge at a signalized intersection (Figure 6-19).

This bridge re- design does have some cost implications (see Section 8) and further research will be needed to determine cost effectiveness. In addition, the design does not provide a future solution for the Mid-City LRT. At the time the LRT is constructed, it may be necessary to replace the remaining bridge structure. Therefore, there may be merit in simply replacing the entire bridge at the time the streetcar is implemented, designing it to accommodate both the City/Park Streetcar and the Mid-City LRT.

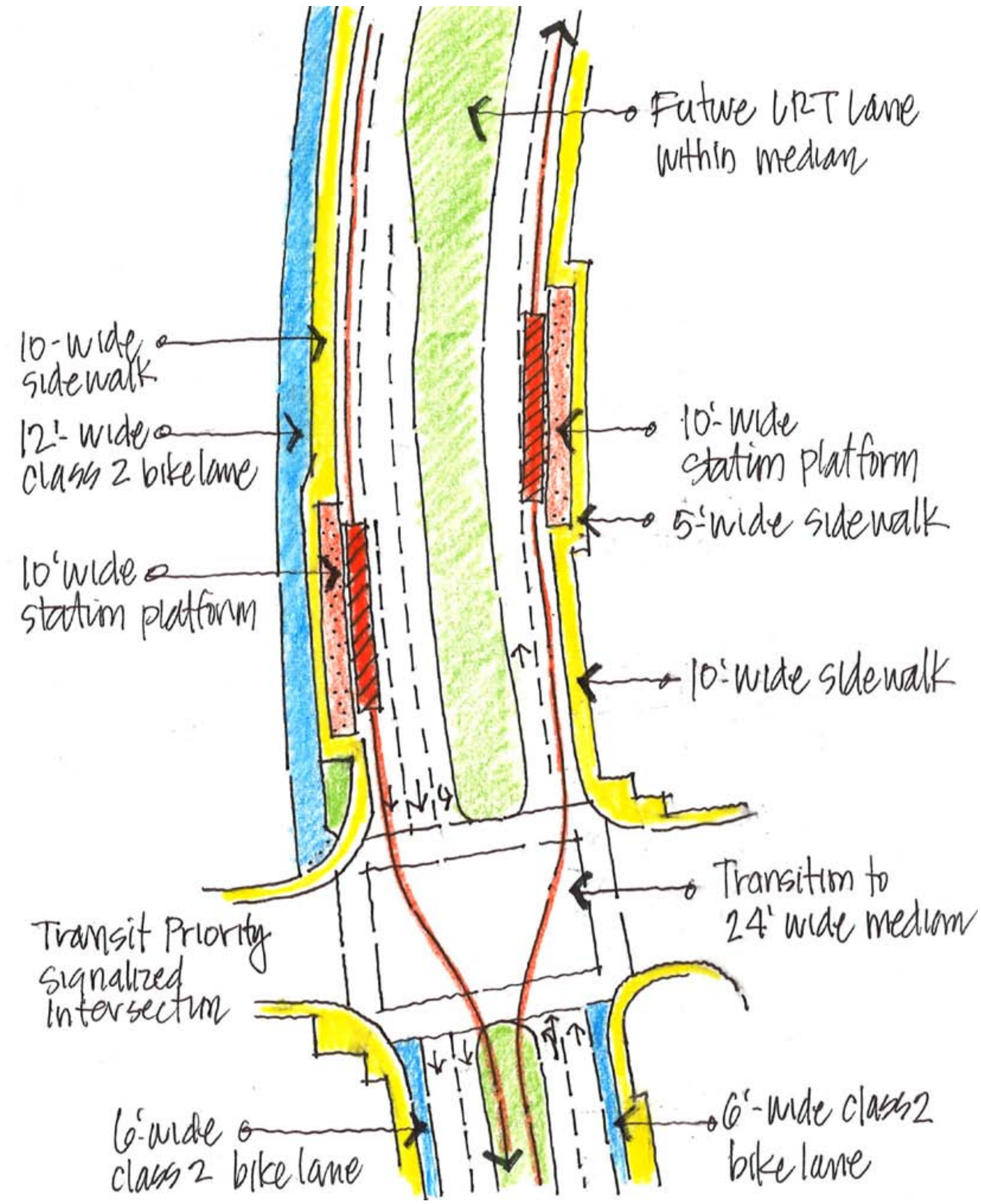
Figure 6-16: Interstate 5 Bridge Alignment Concept



Source: Parsons Brinckerhoff

At the Presidents Way intersection, the southbound running streetcar would leave the station platform with the aid of transit priority signal and transition into the center median toward the Interstate 5 Bridge. The median is an exclusive travel lane for streetcars. The northbound running streetcar, again with the aid of transit priority signal, would transition out of the center median into the mixed flow lane and stop at the far side station platform. In addition, the Class I Bike Path southbound lane comes to an end and transitions to the Class II Bike Lane south of Presidents Way. The northbound cyclist is required to make a left turn and transition to the Class I Bike Path.

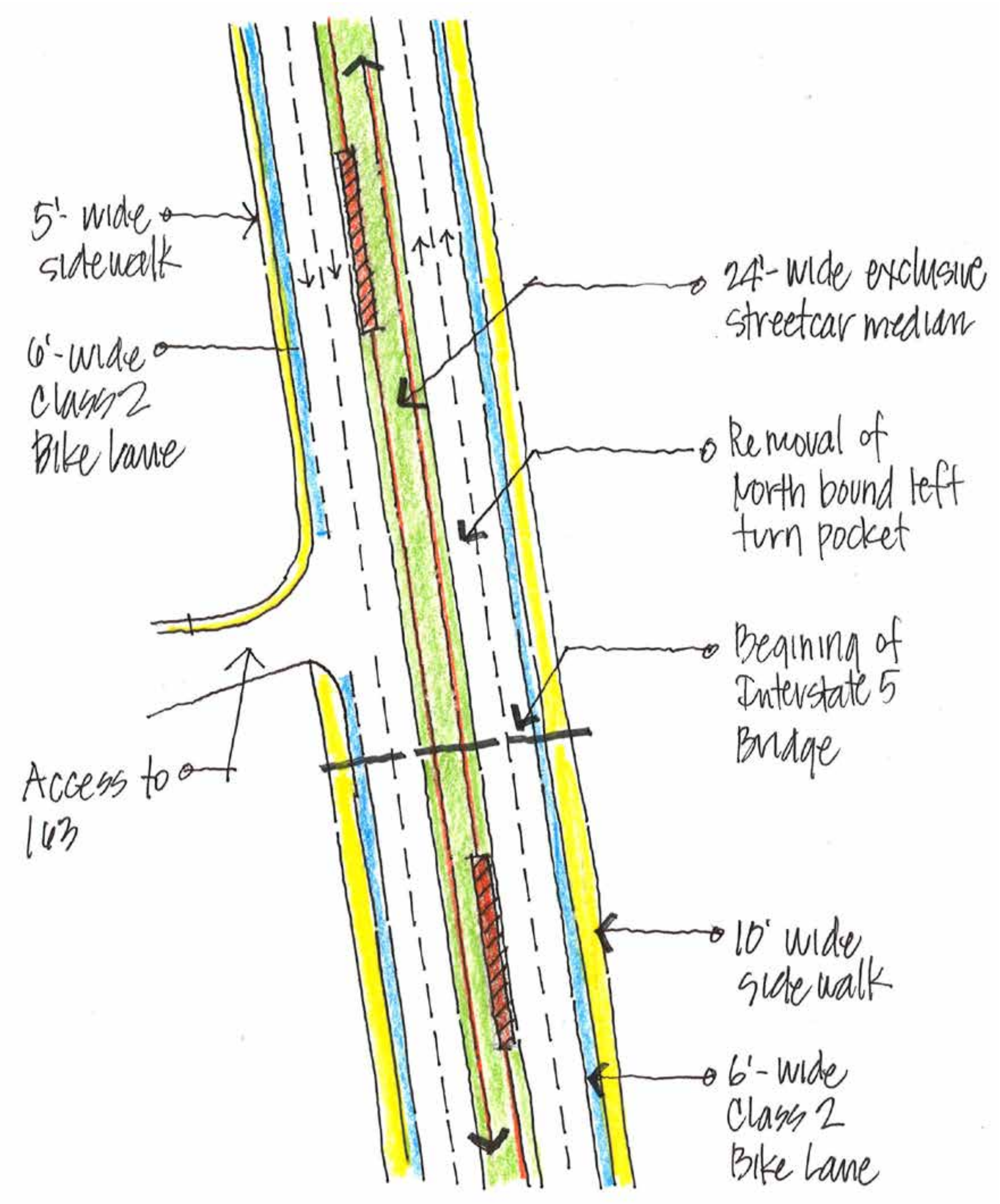
Figure 6-17: Presidents Way Intersection - North Transition to Median-Running Alignment



Source: Parsons Brinckerhoff

The streetcar continues to travel in exclusive median lanes over the “new” bridge at Interstate 5. This exclusive median requires the closure of the existing left turn pocket for the northbound traffic. This section also has a Class II Bike Lane on both sides and there is no on-street parking provided.

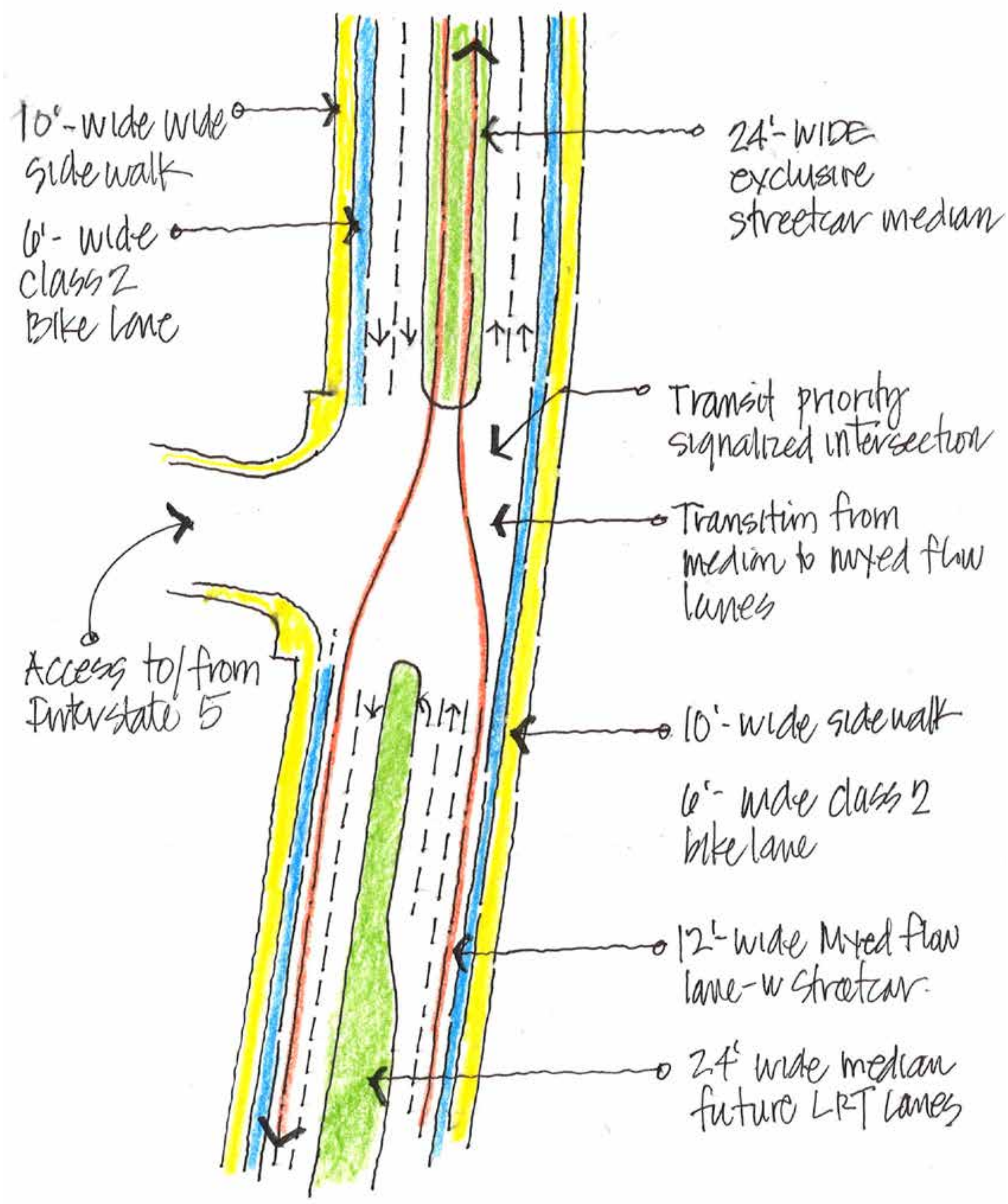
Figure 6-18: North Approach to Interstate 5 Bridge



Source: Parsons Brinckerhoff

At this location, the streetcar transitions into or out of the exclusive median lanes depending on the direction the streetcar is traveling. In both cases, the use of transit priority signals will be required at the signalized intersection serving the on-off ramps for Interstate 5. The Class II Bike Lane continues in both directions.

Figure 6-19: South Transition to Side-Running Alignment



Source: Parsons Brinckerhoff

6.6 Concepts: End of Line

In the future, as programmed in SANDAG's 2050 RTP, this streetcar service will extend into a broader network loop serving the communities of North Park, Bankers Hill, Hillcrest and Mission Hills. However, in this initial phase, the streetcar project is only 1.5 miles in length and requires turnaround points at both ends of the alignment. One turnaround would be at the north end, at the intersection with Zoo Place, and the second turnaround would be at the southern terminus, located near C Street.

The turnaround design will depend upon the vehicle selected to serve the corridor. A double-ended, double-sided vehicle will present different constraints and capabilities than a single-ended, single-sided vehicle, and both types are under consideration for the City/Park Streetcar. (See Section 4 for a more detailed description of vehicle types.) The following section provides for a brief overview of how the "end of line" can be accommodated.

6.6.1 North Terminal: Zoo Place

The streetcar's northern terminus is located at Zoo Place, and presents several design options. The following options are dependent on the type of vehicle chosen for the project.

- **Double-Sided / Double-Ended Vehicles**

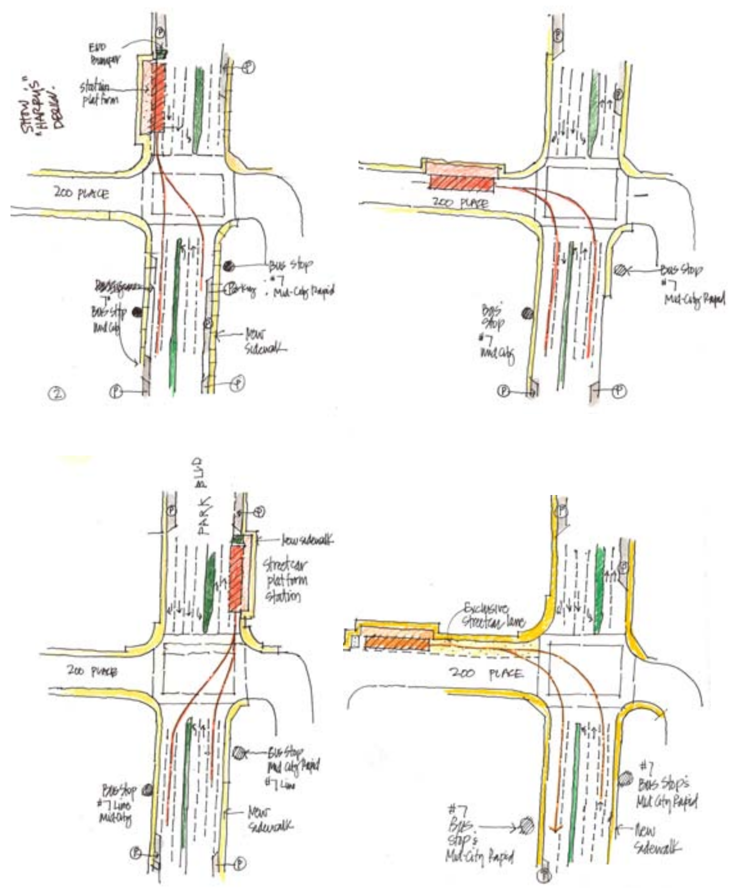
Multiple options were studied at Zoo Place to determine the best possible solution for a turnaround accommodating a double-sided, double-ended vehicle. These options are illustrated in Figure 6-20.

It was determined that the most viable alternative is to provide a far-side station at the northeast corner of the Zoo Place and Park Boulevard intersection.

In this option, the station platform would need to be outside the two travel lanes, as illustrated in Figure 6-21. The streetcar would "lay-over" at this location and then would return southbound with the help of signal priority treatment at the intersection.

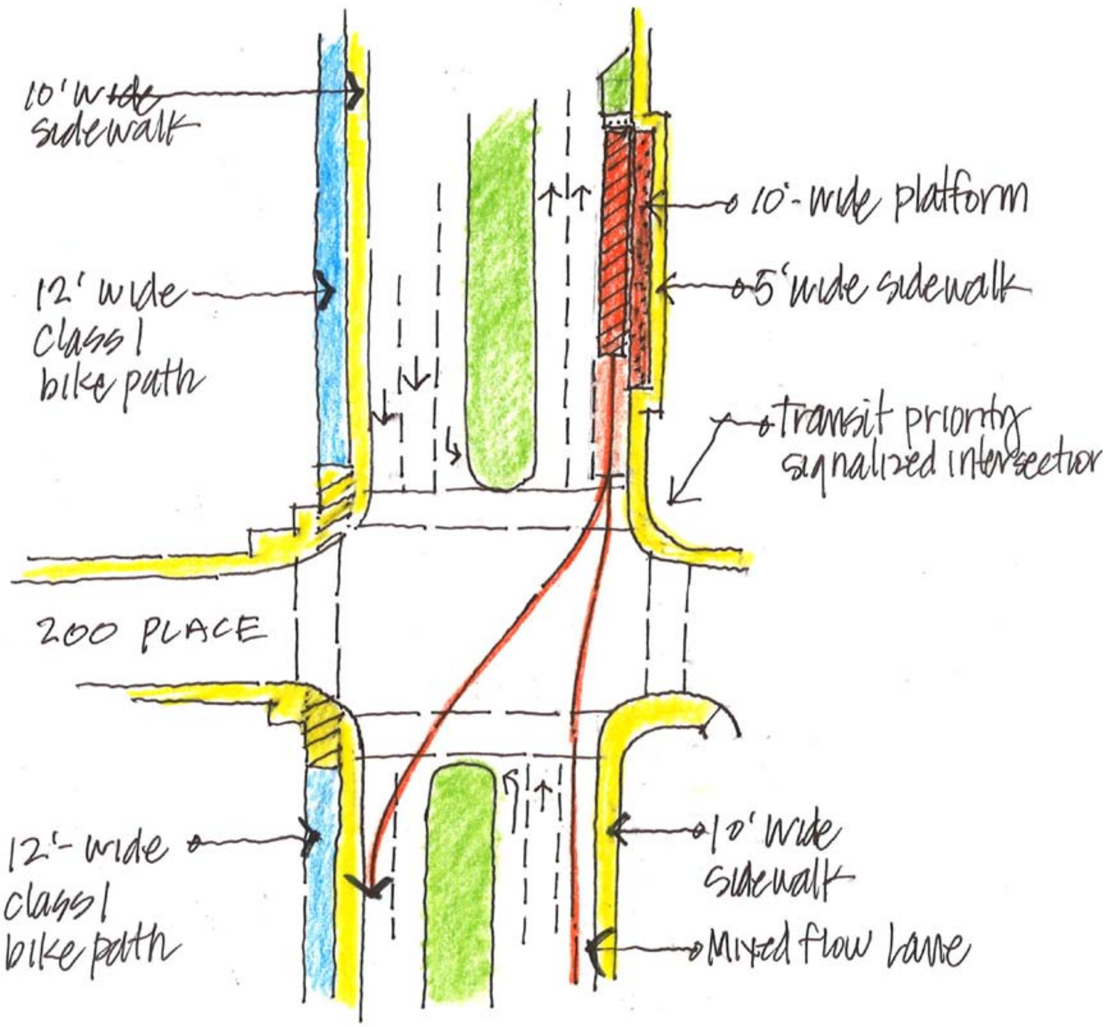
The Class I Bicycle Path is located on the west side of Park Boulevard. Additionally, the center median has been reduced in width to allow for a left-turn pocket .

Figure 6-20: Options Studied for North Terminal Platform



Source: Parsons Brinckerhoff

Figure 6-21: Selected Option for North Terminal Platform



Source: Parsons Brinckerhoff

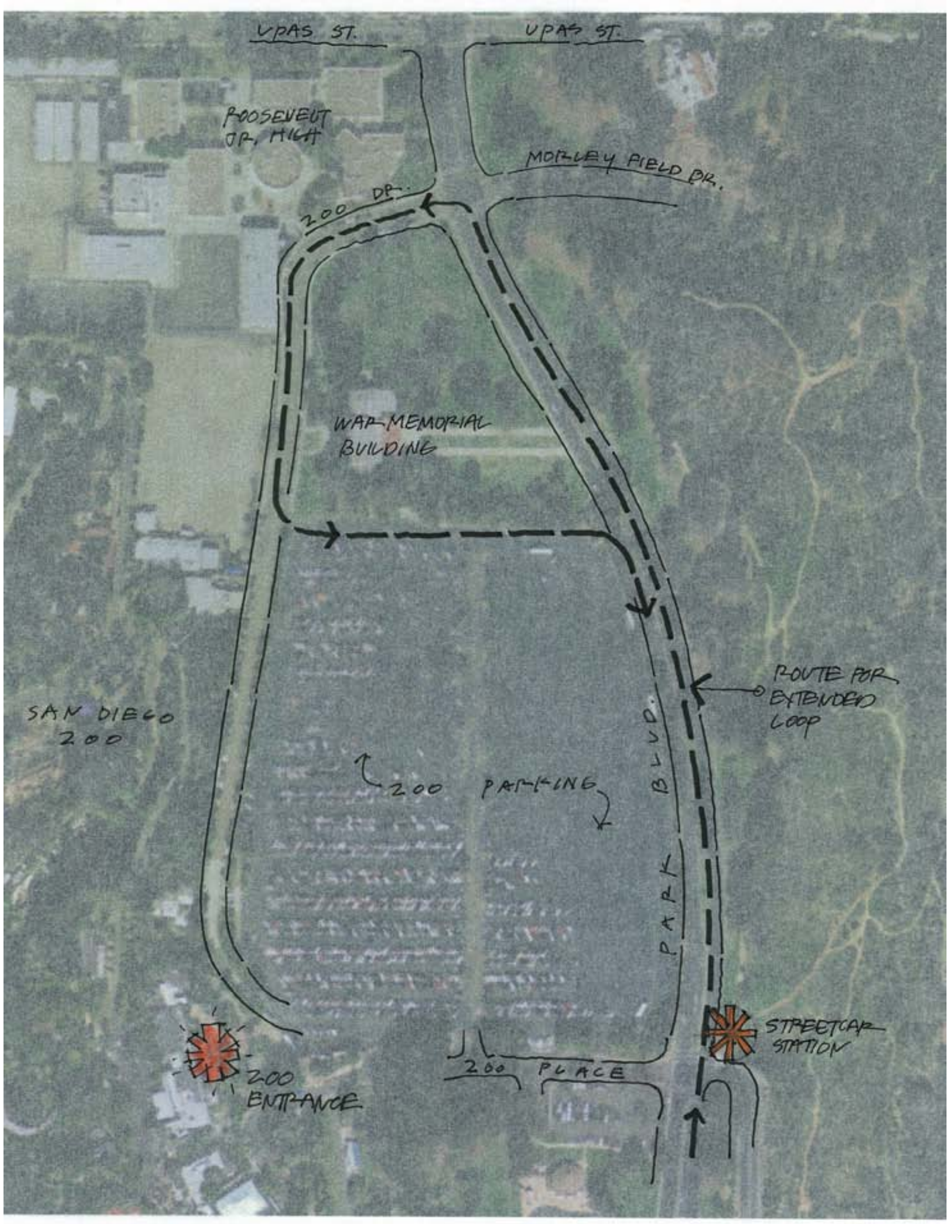
- **Single-Sided / Single-Ended Vehicles**

There are two alternatives that would work for single-sided, single-ended vehicles:

Loop System. This will lay a loop of additional track in order to allow the vehicle to turn around and proceed in the opposite direction. The loop system would require the streetcar to proceed north to Zoo Drive, turn left, continue southbound past the Veteran's Building and zoo entrance, and then proceed back to Park Boulevard to continue south to C Street.

Although this alternative is possible, it requires a significant amount of additional track (approximately 1,500 feet), extends the tracks outside the public right-of-way (thus requiring third-party negotiations), and requires additional signal priority treatment at Zoo Drive. Figure 6-22 illustrates the loop approach and demonstrates the potential alignment necessary for the streetcar to reverse direction.

Figure 6-22: North Terminal Loop System



Source: Parsons Brinckerhoff

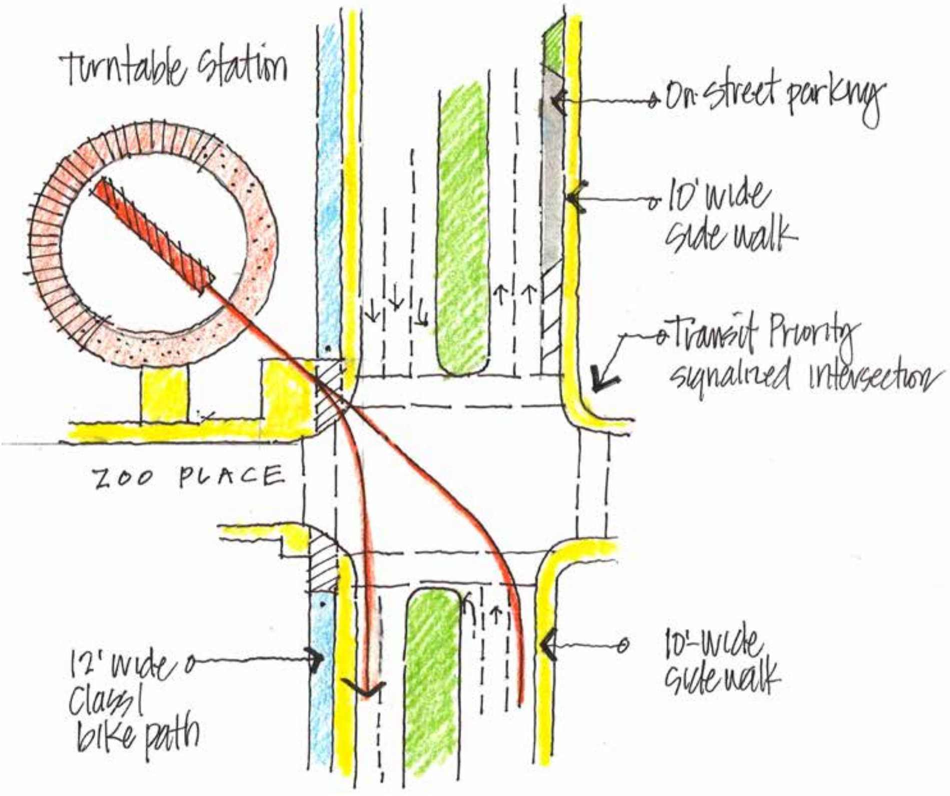
Turntable. The other alternative explored was the use of a "turntable" at Zoo Place. The location would be at the northwest corner of the intersection, within the San Diego Zoo's current parking lot. The turntable allows the streetcar to pull onto the dais platform, spin 180 degrees, and then proceed off the turntable in the reverse direction. Recently, a turntable system has been constructed for a streetcar service in Dallas and is in operation.

The turntable provides some vehicle flexibility as well, since it also can be used with the double-sided, double-ended vehicles. Once the vehicles are turned around, the cars wait for the signal priority treatment at the intersection of Zoo Place to continue in the southbound direction (Figure 6-23).

Several issues need to be addressed if the turntable solution is pursued, including the streetcar's northbound transition to the turntable as well as the need to negotiate with the San Diego Zoo to allow the facility in the zoo parking lot.

Additionally, there are potential operational issues pertaining to the staffing needs of the turntable that will need to be resolved. Typically, the controls are housed within close proximity to the turntable location, and it is reasonable to assume that the train operator could run the controls. Otherwise, the turntable can be remotely operated by a central control, or with a manual override on-site. Regardless, the turntable will require controlled queuing to protect passengers from the turntable gap. All of these items have the potential to contribute to higher operational costs.

Figure 6-23: North Terminal Turntable



Source: Parsons Brinckerhoff

6.6.2 South Terminal: C Street

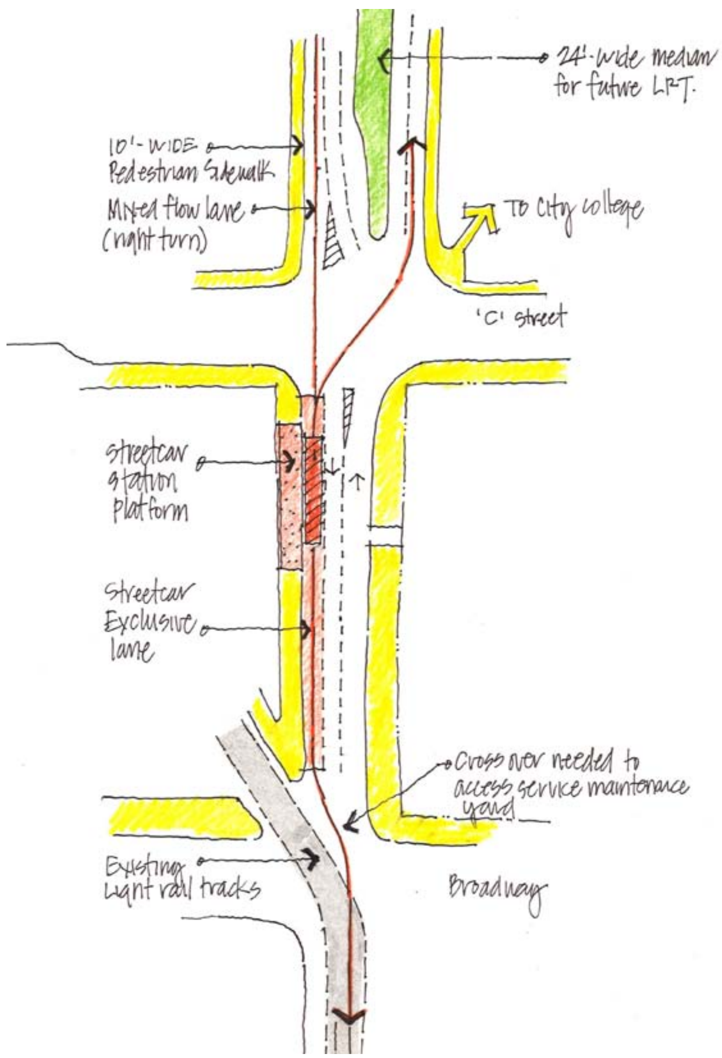
When determining the end-of the-line solution for the southern terminal, the “end-of-day” run to the storage yard must also be considered. An MTS storage and maintenance facility is located approximately one mile south of streetcar’s southern terminus at C Street, near 12th and Imperial Avenues. Because of this location, it is will be necessary for the streetcars to continue south to be stored in the yard overnight. The following assessment considers this requirement when determining the best options for the southern turnaround.

- **Double-Sided / Double-Ended Vehicles**

At the south end, the alternative with the best operational characteristics is a station and turn-around location using the southwest corner of the intersection of C Street and Park Boulevard. There are two southbound travel lanes, and the far right lane could be used as an exclusive streetcar lane as illustrated in Figure 6-24. This would be the location for the last station. In addition, the exclusive lane allows a layover for the streetcar, in order to reverse direction and continue northbound with signal priority measures at C Street.

To reach the storage and maintenance yard at 12th and Imperial Avenues, it is necessary to continue south on Park Boulevard. This requires a new crossover between C Street and Broadway. The streetcar would proceed south in “reverse running” mode until reaching the existing crossover between F and G Streets, and then continue in the southbound tracks to the storage yard. By using the existing crossover between F and G Streets, this avoids any modifications to the existing tracks at the intersection of Broadway and Park Boulevard.

Figure 6-24: South Terminal Platform



Source: Parsons Brinckerhoff

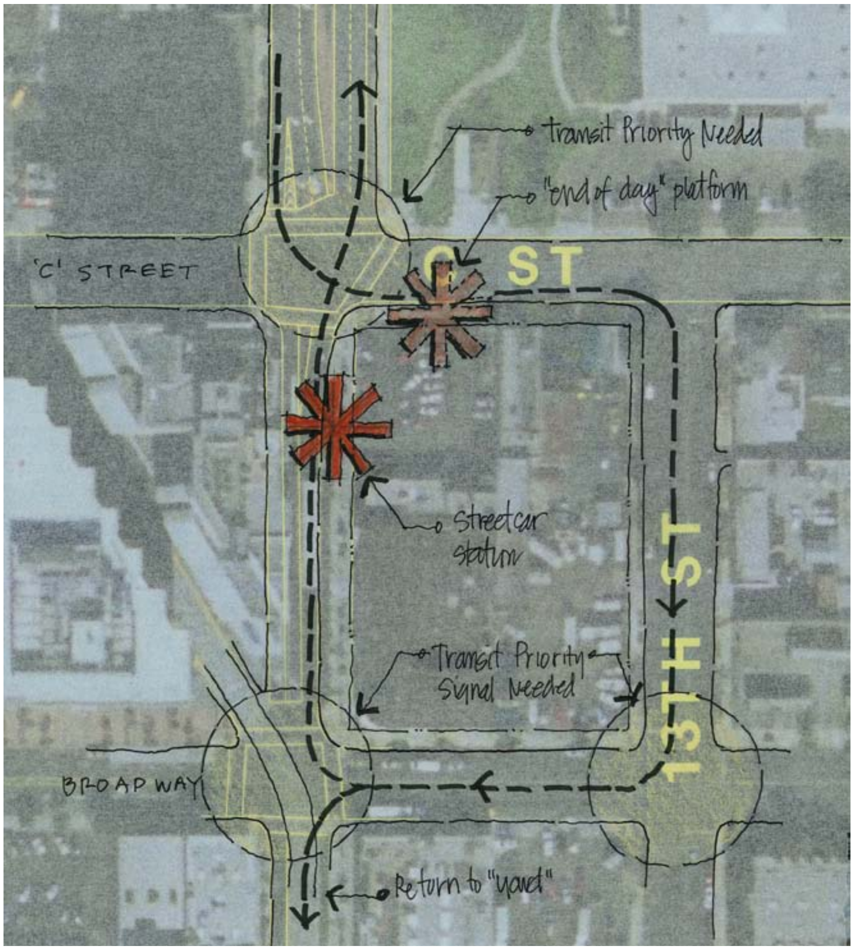
- **Single-Sided / Single-Ended Vehicles**

As with the north end of the alignment, there are two alternatives that would work at the south end for single-sided, single-ended vehicles: A "loop system" or a vehicle turntable.

Loop System. The single-sided, single-ended vehicle provides similar challenges for a turnaround at the south end as for the north end. The loop system that would allow the southbound streetcar to turn left on C Street in the right running lane, turn right on 13th Avenue in a median, then right again on Broadway in a median, until reaching Park Boulevard for the return trip (Figure 6-25). This alignment also creates additional track (approximately 700 feet) and potential conflicts with all the turn movements needed in public rights-of-way.

Additionally, two stations are needed. One station would be located on the east side of Park Boulevard for typical daily service. A second station would be needed on C Street for "end of the day" passengers to debark prior to the streetcar heading back to the service/maintenance yard at 12th and Imperial Avenues.

Figure 6-25: South Terminal Loop System



Source: Parsons Brinckerhoff

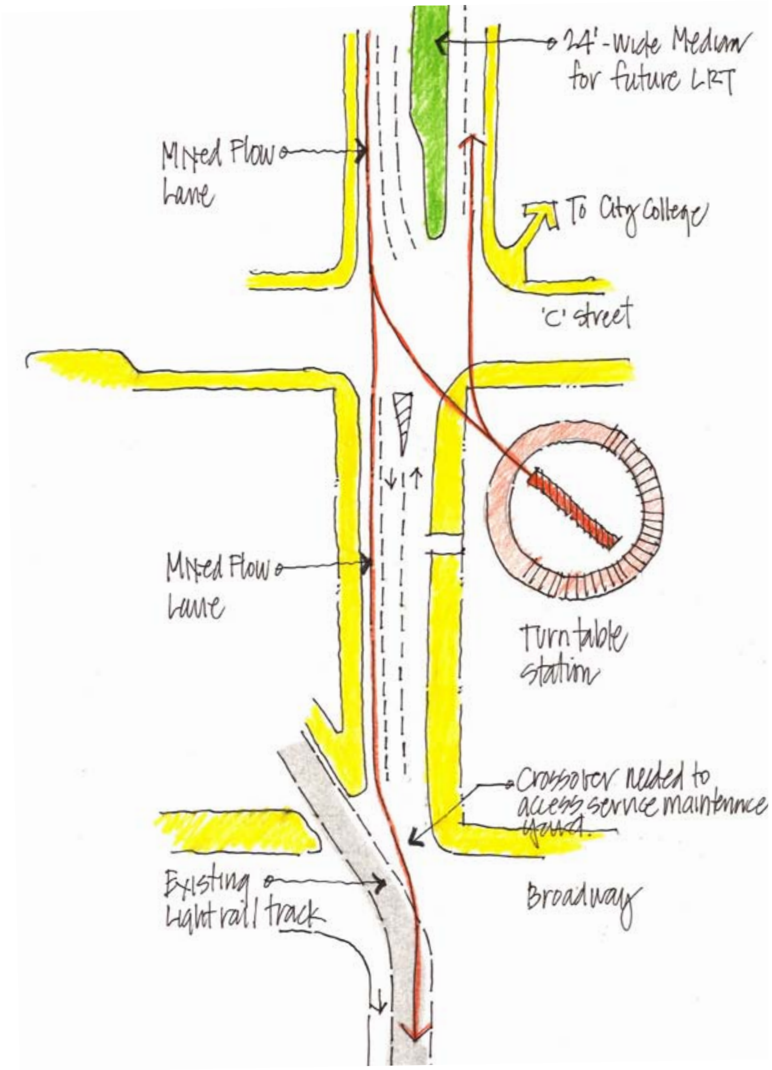
Turntable. The other alternative is to provide a turntable unit at the southeast intersection of Park Boulevard and C Street, as illustrated in Figure 6-26. This location will require signal priority measures for the southbound streetcar to reach the turntable and then return to the northbound lane.

The end-of-day run to the storage facility at 12th and Imperial Avenue would require the streetcar to:

- Reverse direction from the turntable to the southbound mixed-flow lanes;
- Proceed south to a new crossover between C Street and Broadway;
- Continue south in "reverse running" mode to the existing crossover between F and G Streets;
- Continue along the southbound tracks to the storage yard.

It should be noted that this site, on the southeast corner of C Street and Park Boulevard, has an approved development plan with entitlements (See Appendix E) by the Centre City Development Corporation (CCDC). These development entitlements were recently extended in November of 2011. As such, acquiring this site as a "turnaround" location is questionable and further discussion will be necessary to establish its availability. Another consideration at this location is a fault line that travels through the site and is reflected in the development site plan

Figure 6-26: South Terminal Turntable



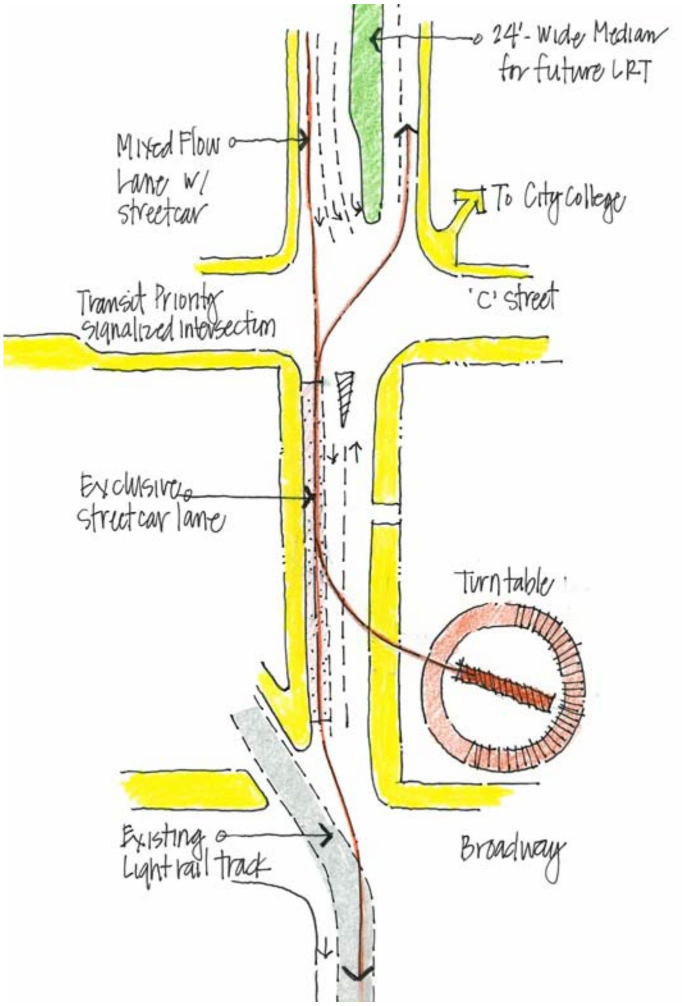
Source: Parsons Brinckerhoff

Another alternative, on the same block, is the property at the northeast intersection of Broadway and Park Boulevard as shown Figure 6-27. This location may be more feasible to incorporate a turntable at this time as no development plans have been but forth to CCDC. The site would require a "mid-block" crossing of the streetcar to access the turntable and an exclusive lane to allow for reverse running in public right-of-way. There may be a benefit of eliminating thru auto traffic in this block between C Street and Broadway due to the many movements required by the streetcar to access the turnaround platform, reverse direction for northbound travel and the end-of the day requirements. Additionally, there is a need for the both intersections to have transit priority signals to allow for the streetcar to travel north and southbound. The end-of the day run to the storage facility at 12th and Imperial Avenues requires the streetcar to:

- Reverse direction from the turntable to the southbound exclusive streetcar lane;
- Proceed south to a new crossover between C Street and Broadway;
- Continue south in "reverse running" mode to the existing crossover between F and G Streets;
- Continue along the southbound tracks to the storage yard.

Again, as discussed earlier, there is a fault line that will impact the final layout and design of the turntable and station area improvements.

Figure 6-27: South Terminal Turntable, Alternate Location



Source: Parsons Brinckerhoff

6.7 Station Locations

Each of the concepts features the same quantity and locations of proposed stations on Park Boulevard. There are seven station locations, all of which are associated with the activity centers in the corridor. If necessary, these stations could be shared by MTS Bus Route 7 and even the Mid-City Rapid Bus service. If this occurs, only three stations would be used by the Mid-City Rapid Bus due to its infrequent stops: Zoo Place, Naval Medical Center, and City College Trolley Station. However, these three stations would not be able to accommodate the Mid-City LRT service in the future since the LRT will be a median-running facility.

The proposed locations of the stations, named for the activity centers they serve, are:

- San Diego Zoo (Zoo Place);
- Balboa Park at El Prado;
- Naval Medical Center San Diego;
- Balboa Park at Presidents Way;
- San Diego High School;
- San Diego City College; and
- The "Smart Corner" mixed-use development, containing the City College Trolley Station.

Figure 6-28 illustrates the corridor study area and the proposed locations of the stations. A typical station's features and amenities are described in Section 3.3.

The following section provides a brief overview of each of the station locations, beginning in the north at Zoo Place and proceeding south to Downtown.

Figure 6-28: Proposed Station Locations

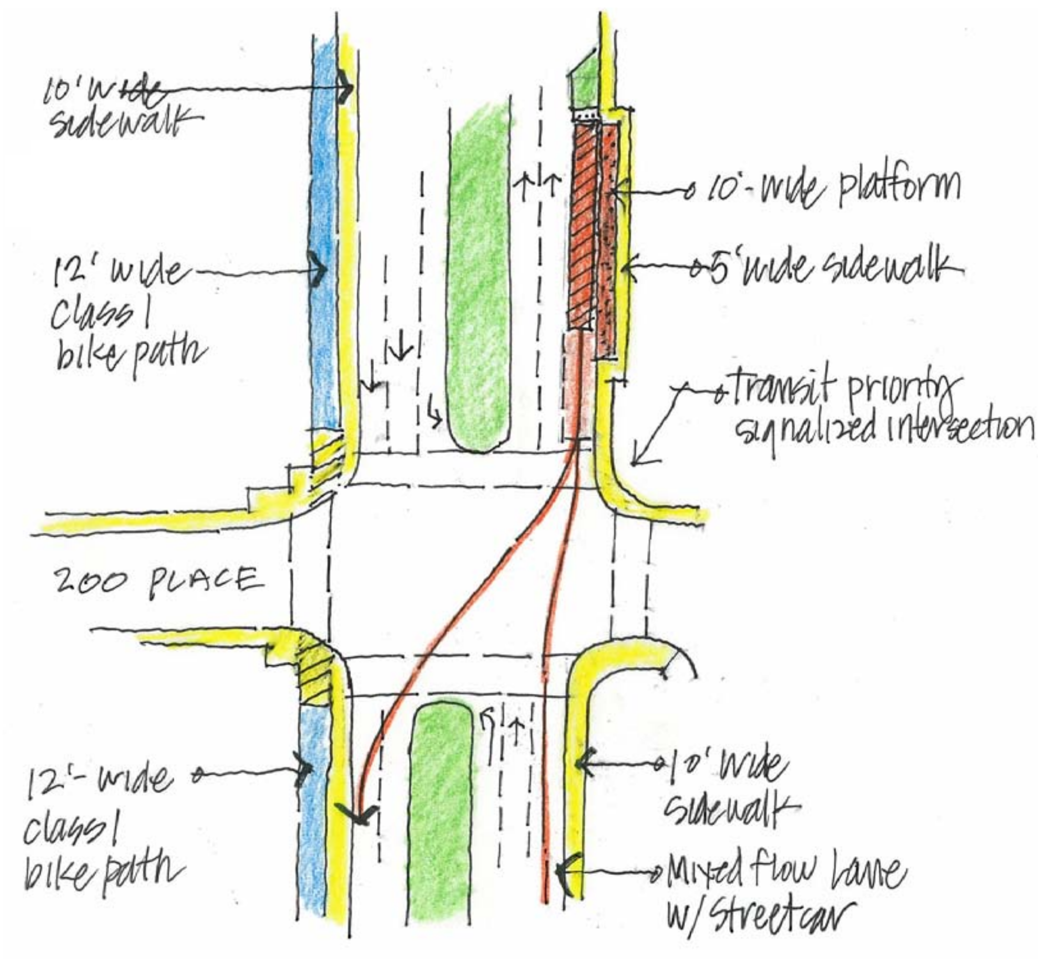
Source: Parsons Brinckerhoff

6.7.1 Zoo Place Station

There is only one station stop at this location and, as noted earlier, this location also will provide the turnaround opportunity. The station would be located on the northeast side of the intersection of Park Boulevard and Zoo Place. It would be outside of the two northbound travel lanes to allow for the streetcar to "lay-over." Figure 6-29 provides a concept of where the station would be located and how the streetcar would be able to reverse direction in order to return downtown. This movement would be aided by a transit priority signal at the intersection. This station could potentially be a shared facility that serves the Mid-City Rapid Bus service. The bicycle facility in this portion of the corridor would be the Class I Bike Path on the west side of Park Boulevard.

However, if a single-sided, single-ended vehicle is used, the station would be located on the northwest corner of the intersection. The location would be the same as the location illustrated in Figure 6-23 for the end-of-line turnaround facility.

Figure 6-29: Zoo Place Station



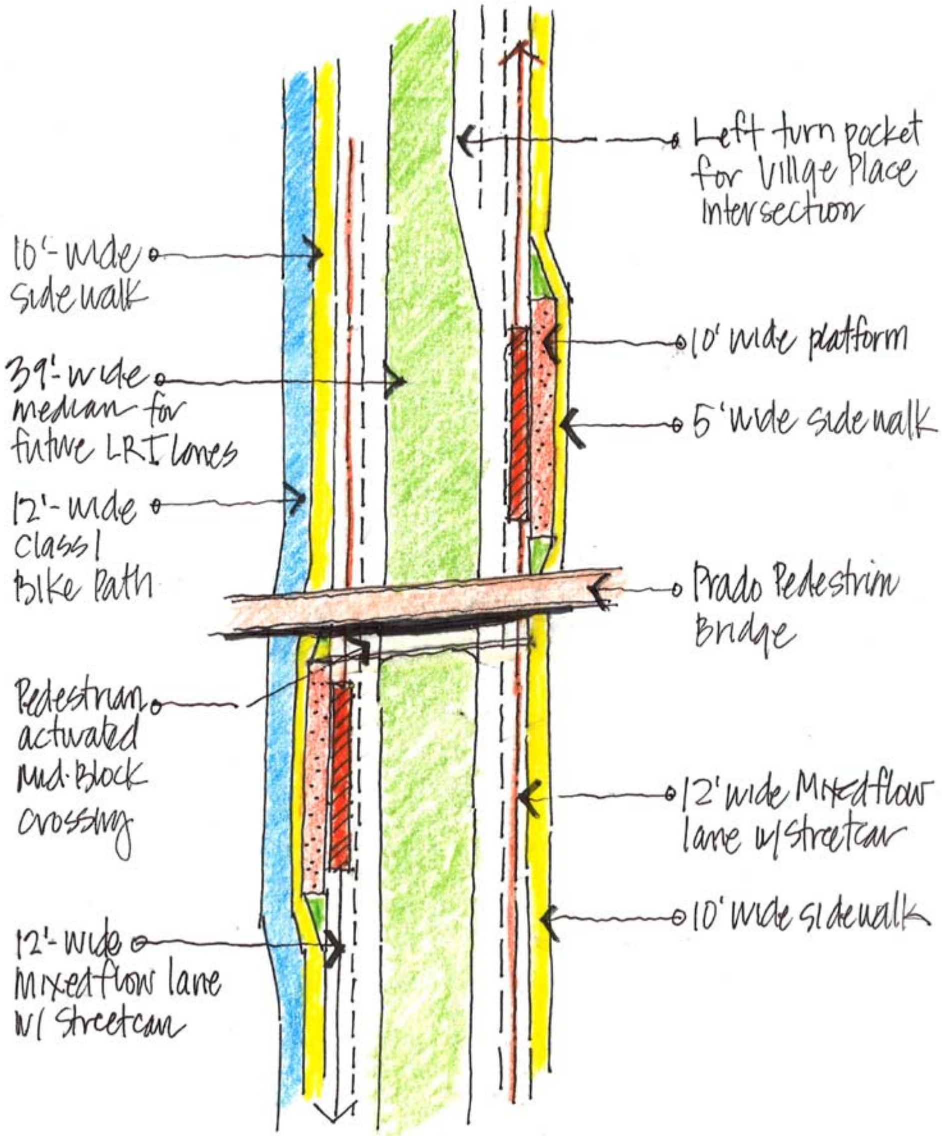
Source: Parsons Brinckerhoff

6.7.2 Balboa Park/Prado Station

The Balboa Park/Prado Station would be a mid-block station in the area of the Prado Pedestrian Bridge as illustrated in Figure 6-30. As noted earlier, the access to the bridge is not currently ADA compliant. Any future stations would need to provide an ADA-accessible path to reach the platforms if the existing bridge is used for crossing Park Boulevard.

However, a pedestrian-activated signal could be provided to allow passenger crossing of Park Boulevard. If this is provided, the platforms should be "offset" as shown below in order to ensure that the passengers can only cross behind the streetcars. The Class I bicycle facility continues on the west side of Park Boulevard and travels behind the pedestrian sidewalk and the station platform. Also, note that the sidewalk narrows to five feet behind the station platform to reduce the amount of right-of-way needed at the station locations.

Figure 6-30: Balboa Park/Prado Station

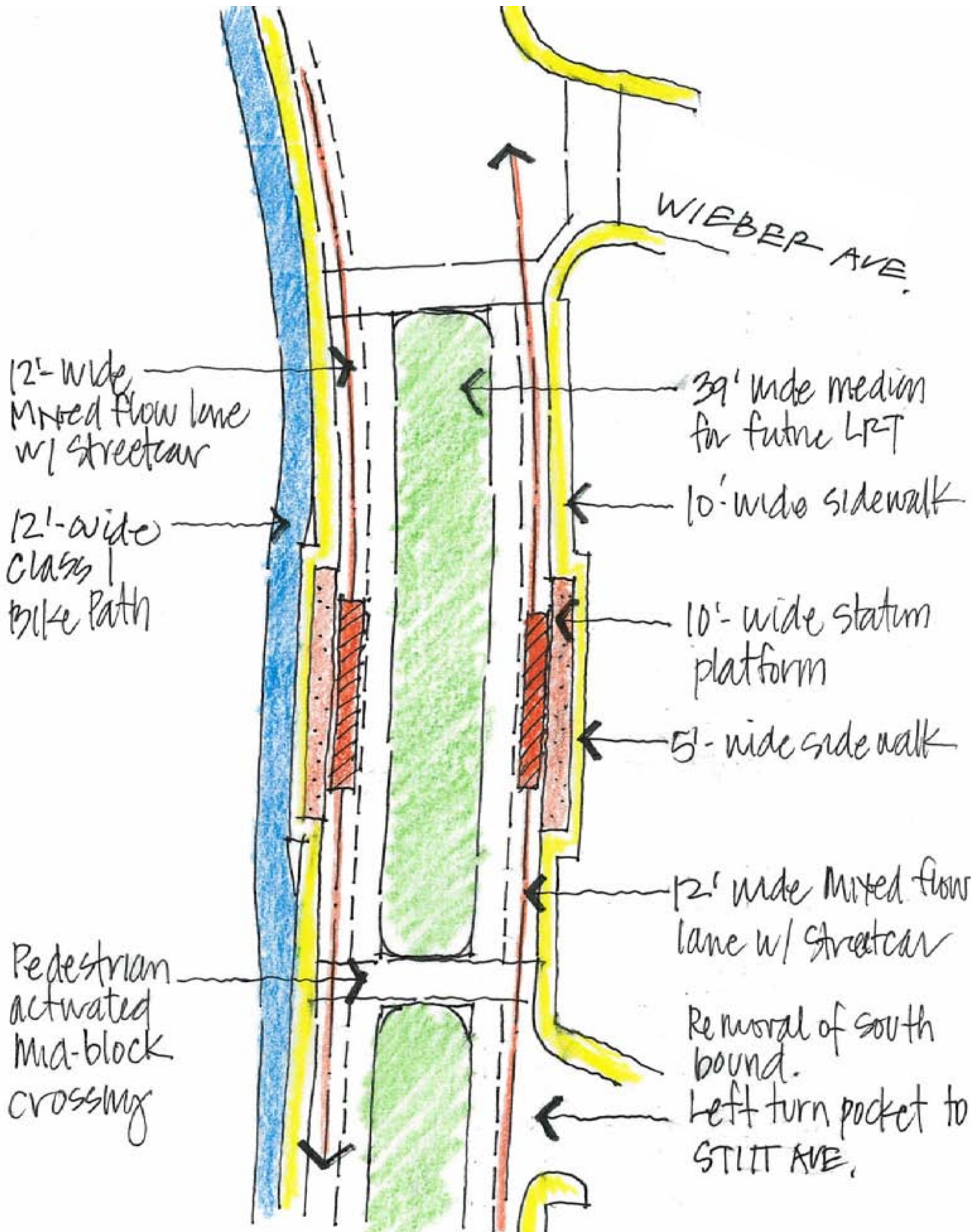


Source: Parsons Brinckerhoff

6.7.3 Naval Medical Center Station

The platforms for the Naval Medical Center Station would be located between Wieber Avenue and Stitt Avenue (or Inspiration Point Way) as illustrated in Figure 6-31. The alignment proposes to close the southbound left turn access to Stitt Avenue intersection to avoid turn conflicts with the streetcar. The passengers accessing the platforms would use the signalized intersections at either Wieber Avenue or Stitt Avenue. These station platforms could also be used by the Mid-City Rapid Bus service.

Figure 6-31: Naval Medical Center Station

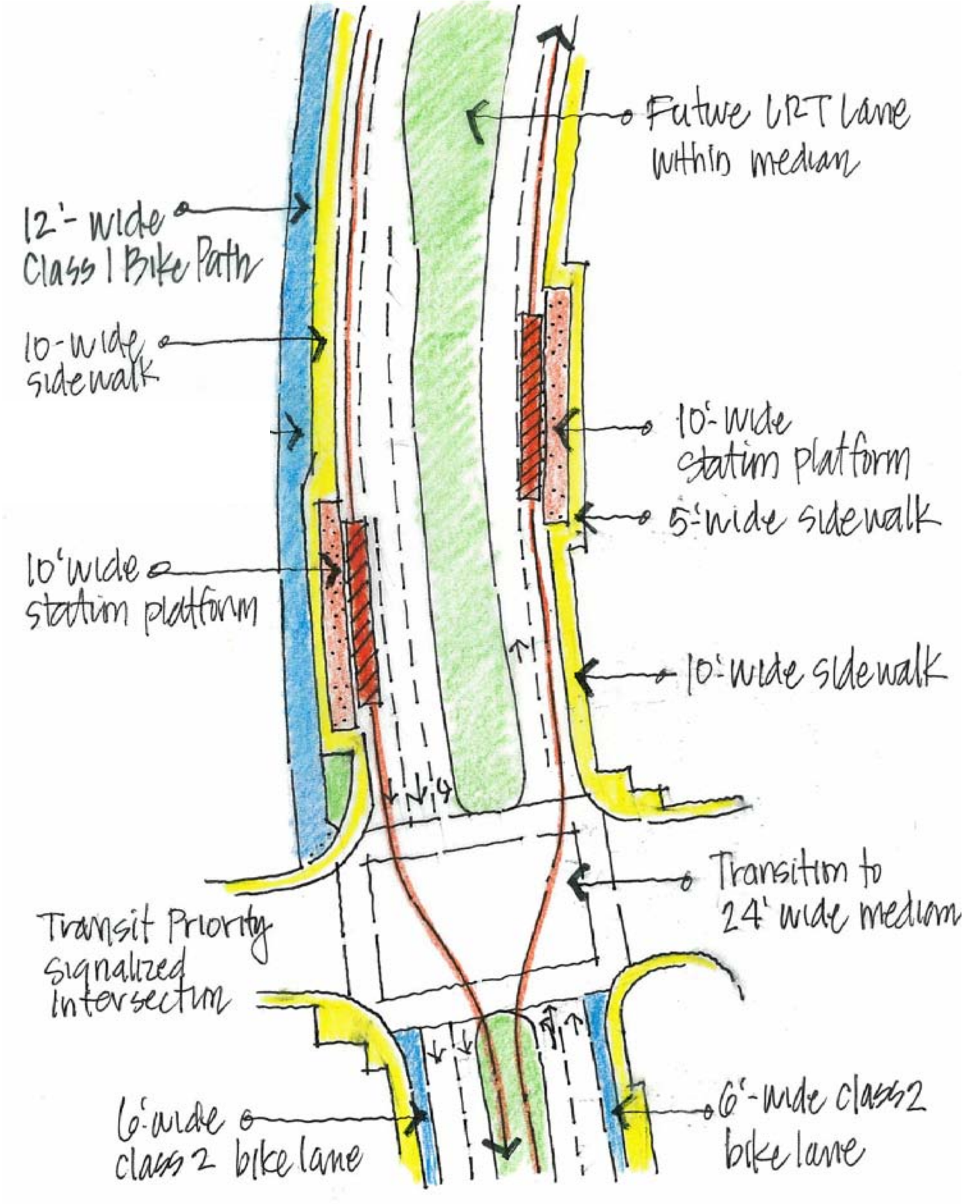


Source: Parsons Brinckerhoff

6.7.4 Balboa Park/Presidents Way Station

The stations at Presidents Way both would have a nearside platform for the southbound streetcars and a farside platform for the northbound streetcars as illustrated in Figure 6-32. This positioning of the station platforms allows for the streetcar to transition into and out of the center median on the south side of Presidents Way. The intersection would require transit priority signaling to allow for the transitional movements. Passengers would cross at the signalized intersection at Presidents Way.

Figure 6-32: Balboa Park/Presidents Way Station

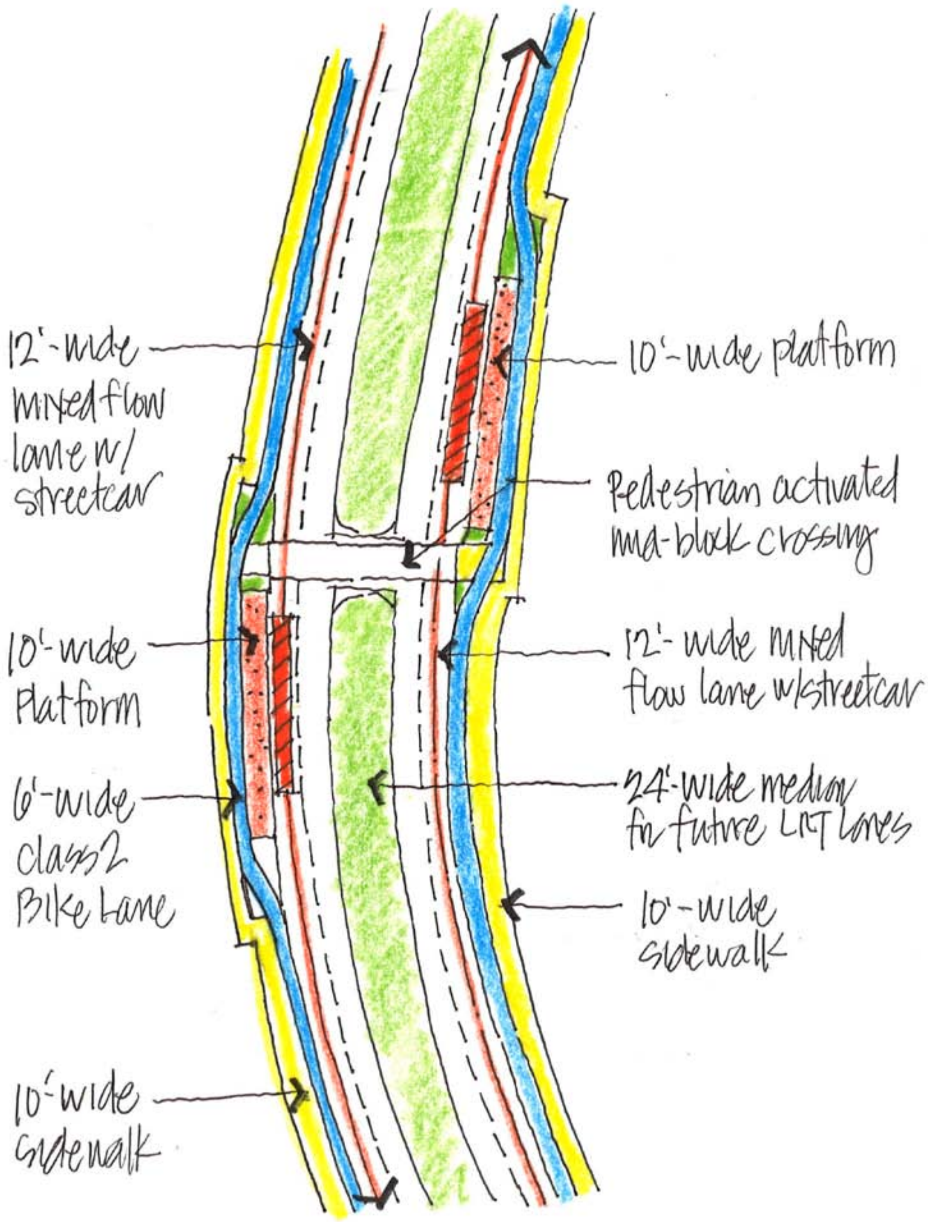


Source: Parsons Brinckerhoff

6.7.5 San Diego High School Station

The station platforms at San Diego High School would be located mid-block as illustrated in Figure 6-33. A pedestrian-activated signal would be required to allow for safe mid-block crossings. Additionally, the station platforms would be "offset" and located past the crossing to ensure that passengers cross only behind the streetcars.

Figure 6-33: San Diego High School Station

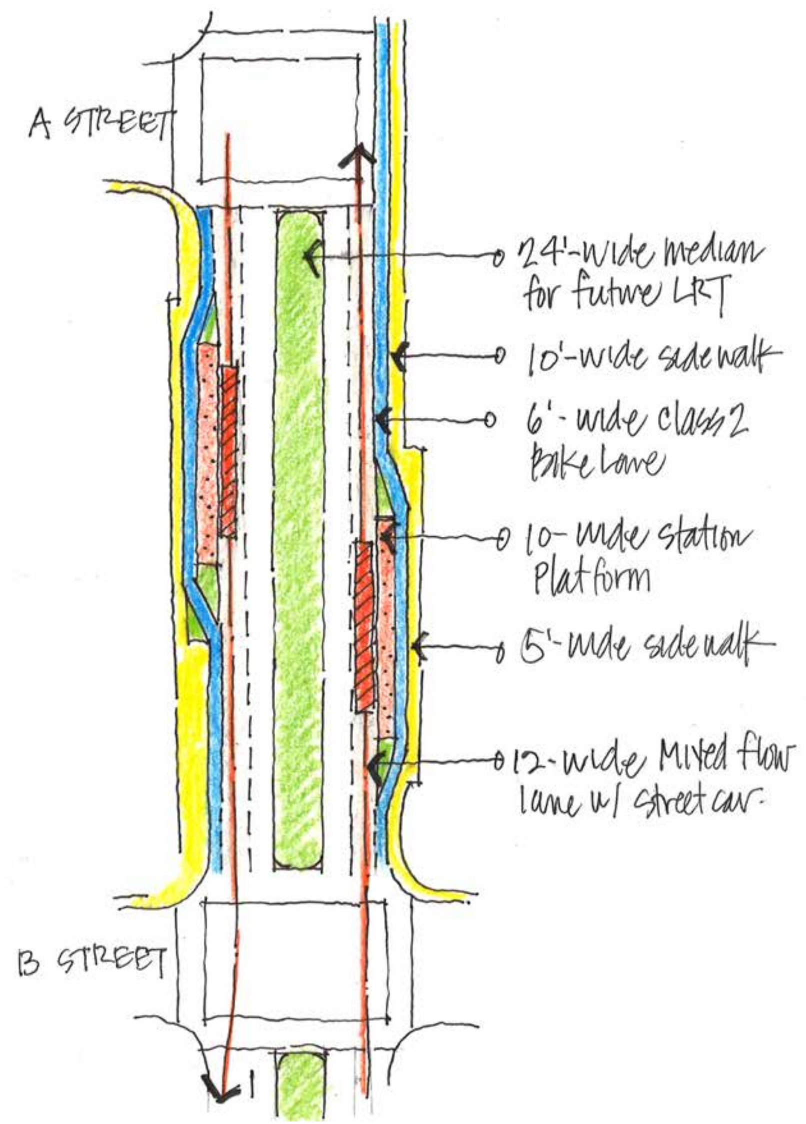


Source: Parsons Brinckerhoff

6.7.6 City College Station

The City College Station platforms would be located at the intersection of B Street and Park Boulevard as illustrated in Figure 6-34. The southbound station would be a near-side platform while the northbound station would be a far-side platform. Pedestrians would cross at the signalized intersection at B Street.

Figure 6-34: City College Station



Source: Parsons Brinckerhoff

6.7.7 Smart Corner Station

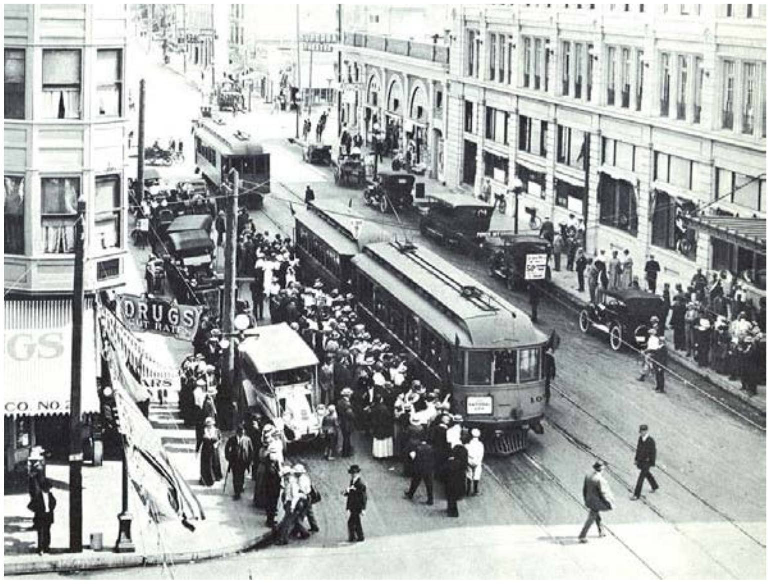
The Smart Corner Station would only have one platform location. Because this station would also be used as the turnaround location, two station options are proposed in Section 6.6.2 above—either a loop system or a turntable—that will depending upon the type of vehicle selected. The loop option features a platform on the southwest corner of Park Boulevard and C Street that could also be used by the Mid-City Rapid Bus.

Ridership Estimate

7

7.0 RIDERSHIP ESTIMATE

Figure 7-1: Riders Pack into Streetcars on Third Avenue, c. 1912



Source: Richard V. Dodge, "Rails of the Silver Gate"

Streetcars are just one of many transportation services that may be offered in an urban community. Compared to other transit modes, streetcars typically are intended for local, short-distance circulation, and are effective at providing a sense of permanence and identity within a corridor. While streetcars have historically enjoyed popular sentiment among local residents and visitors (Figure 7-1), this does not always translate to sustainable ridership levels, as ridership may vary depending upon a number of external factors. This section provides an estimate of potential ridership for the City/Park Streetcar, and was produced utilizing the operations plan outlined in Section 5 and preferred alignment selected in Section 6.

7.1 Existing Ridership

Figure 7-2: MTS Route 7 Articulated Bus

Source: San Diego MTS

There are currently seven bus stops on Park Boulevard along the potential streetcar alignment, all serving MTS Route 7 (Figure 7-2). Table 7-1 shows ridership data for these stops, using data gathered from onboard automatic counters in 2011.

The two northbound stops with the highest number of boardings, highlighted in blue below, are 11th Avenue at C Street (adjacent to the City College Trolley Station) and Park Boulevard at B Street. The two southbound stops with the highest boardings are Park Boulevard at Zoo Place and Park Boulevard at Village Place. All of these peaks occur at the ends of the proposed streetcar route.

A major contributor to the boarding totals at these seven stops is San Diego High School, which drives demand for peak afternoon bus service. Route 7 southbound has less ridership compared to the northbound route, due in part to the steep slope of Park Boulevard that encourages riders to walk south to the City College Trolley Station, rather than riding Route 7, to access the various routes available.

Table 7-1: Average Daily Boardings of MTS Route 7 at Proposed City/Park Streetcar Stops, 2011

Route 7 Northbound								
	WEEKDAY		***SATURDAY***		***SUNDAY***		***TOTAL***	
STOP	***ON***	***OFF***	***ON***	***OFF***	***ON***	***OFF***	***ON***	***OFF***
11th Avenue / C Street	1,498	141	941	76	1,310	16	3,749	233
Park Boulevard / B Street	323	47	85	10	62	4	470	61
Park Boulevard / San Diego High School	167	75	20	11	3	1	190	87
Park Boulevard / Presidents Way	24	69	9	44	23	71	56	184
Park Boulevard / Naval Hospital	49	160	26	43	28	27	103	230
Park Boulevard / Village Place	63	147	81	168	78	103	222	418
Park Boulevard / Zoo Place	32	161	34	169	22	111	88	441
Route 7 Southbound								
	WEEKDAY		***SATURDAY***		***SUNDAY***		***TOTAL***	
STOP	***ON***	***OFF***	***ON***	***OFF***	***ON***	***OFF***	***ON***	***OFF***
Park Boulevard / Zoo Place	131	35	165	39	76	31	372	105
Park Boulevard / Village Place	153	67	140	70	114	70	407	207
Park Boulevard / Inspiration Point	116	53	69	31	53	22	238	106
Park Boulevard / Presidents Way	72	13	29	8	38	7	139	28
Park Boulevard / Russ Boulevard	12	239	2	23	-	2	14	264
Park Boulevard / B Street	29	326	13	104	5	55	47	485
City College Transit Station	55	1168	28	870	34	1,082	117	3,120

7.2 Implications of Future Transit Service

As noted in Section 2, there are two additional transit modes currently planned for the Park Boulevard corridor: the Mid-City Rapid Bus, estimated for completion in 2013, and a new line in the San Diego Trolley LRT system, which is scheduled to replace the Rapid Bus around 2035.

As the Mid-City Rapid Bus is a limited-stop service, it is not necessarily intended to replace the local-stop Route 7 or the City/Park Streetcar, but instead to enhance transit options along the corridor. Cases in which riders may transition from Route 7 or the streetcar to the Mid-City Rapid Bus would be if riders can more efficiently arrive to their destinations on the Rapid Bus, if they prefer the stop amenities that a typical Rapid Bus service offers, or even if the Rapid Bus happens to arrive first while a passenger is waiting.

In contrast, the Mid-City Rapid Bus will not be appropriate for shorter-distance trips within a condensed geographic area (like the streetcar) nor will it provide primary access to numerous local communities (like Route 7). Once the Mid-City Rapid Bus is converted to LRT, it will continue to operate in a similar fashion, with larger distances between stops, higher speeds, and a focus on connecting regional centers rather than serving local circulation needs.

7.3 Current Transit Markets Served and Ridership Characteristics

Characteristics of the population that uses transit in the Park Boulevard corridor are identified through existing data sources, mainly the 2009 Onboard Transit Passenger Survey conducted by SANDAG. The agency performs the study every five years on all fixed-route transit services in the region.

In the 2009 survey, SANDAG personnel interviewed 424 persons traveling on Route 7 to determine their travel characteristics. The results are summarized in Table 7-2. In total, 26.9% of trips were from home to work, 17.2% of trips were from home to school, 14.4% of trips were for other purposes, and 14.2% of trips were from home to recreation. Passengers traveled from their first and last transit modes by walking an average of 2.14 blocks. In total, 41.1% of persons used a monthly pass and 25.9% used a regional day pass for the trip. On average, riders used public transportation 5.62 days per week. Overall, 61.6% of respondents rated the transit service in their area as “good,” 32.3% rated it as “average,” and the remaining 6.1% rated their area’s transit service as “poor.” Overall, 79.7% of persons had access to a car to make their trip.

Overall, the ridership trends on Route 7 reflect a population that uses transit for multiple trips and takes advantage of the varied land uses that surround the route. In addition, Route 7 travelers appear to desire transit that is able to transport them to destinations other than just work or school.

Table 7-2: Travel Characteristics of Riders on Route 7, MTS, and NCTD

Origin and Destination	Percentage of Route 7 Trips	Percentage of All MTS Bus Trips	Percentage of All MTS and NCTD Trips
Home to Work	26.9%	28.8%	31%
Home to School	17.2%	22.1%	21%
Home to Shopping	11.0%	9.6%	9%
Home to Recreation	14.2%	9.4%	10%
Home to Medical Services	2.9%	5.1%	4%
Home to Other	9.1%	8.5%	8%
Work to Other	4.3%	4.6%	5%
Other to Other	14.4%	12.0%	13%
Other than Work/School Trips	**55.4%**	49.2%	49%

7.4 Ridership Assumptions

Data from Route 7 and the City College Trolley Station are good sources for ridership estimates for this study, as they include riders using transit in both the city of San Diego as well as the San Diego region. With Balboa Park and the San Diego Zoo being regional attractions, it is necessary to examine trends in the entire region’s transit system. MTS and the North County Transit District (NCTD) have agreed to a regional fare policy under which each agency will accept the other’s fare media. Thus, all MTS pass holders have unlimited use of NCTD’s buses and the Sprinter LRT, while all NCTD regional pass holders have unlimited access to all MTS bus and LRT routes other than the Premium Express Bus and rural routes (which can be accessed by paying a supplemental fare). Therefore, the ridership estimates below assume that passengers using the appropriate fare media from either MTS or NCTD can transfer seamlessly to any of the region’s other transit services. In order to produce and validate ridership assumptions, this estimate relied upon Route 7 ridership data, studies on LRT performance, comparisons with peer cities, and MTS’s activity-center experience with its LRT system.

These ridership estimates are only for the first year of service. Levels potentially could increase in the future as the availability of streetcar service becomes more widely known, partnering strategies are implemented between local institutions and MTS, and the streetcar gets extended to the Mid-City communities as planned in the RTP. Ridership may also decrease in the future due to various factors such as economics, change in travel patterns, or land use, parking, and circulation practices that discourage transit ridership.

It should be emphasized that the ridership estimates developed at this stage should be considered preliminary planning-level estimates for comparative purposes. It should also be noted that the generation of ridership estimates in the preferred alternative are based on existing land uses, with some consideration given to the future development plans identified in Section 2.11.

7.5 Peer Analysis

To begin its ridership estimate, MTS performed a comparative analysis of streetcar systems in other United States cities. The review considered whether various factors were similar or dissimilar to San Diego, and how those factors are likely to influence ridership of the City/Park Streetcar. For consistency in ridership modeling, MTS selected streetcar systems that were geared to both tourism and local commuting. This provided a good baseline with which to certify its results and assumptions.

Table 7-3 depicts the fare policies of the selected streetcar systems, while Table 7-4 shows more details on their operations and ridership.

Table 7-3: Fare Policies of Selected Streetcar and LRT Systems in the United States

Fare Type	Portland	Seattle	Tacoma	Tampa	Little Rock	San Diego Trolley (LRT)
Youth	$1.50 (All Day)	$0.75 (All Day)	$1.25 (One Way) $2.50 (Round Trip)	$1.25 (One Way) $2.50 (Round Trip)	$0.50 - $1.00 (One Way) $1.00 - $2.00 (Round Trip)	$2.50 (One Way) $5.00 (All Day)
Adult	$2.10 (All Day)	$2.50 (All Day)	$2 - $2.75 (one Way) $4 - $5.50 (Round Trip)	$1.50 (One Way) $5.00 (Round Trip)	$1.00 (One Way) $2.00 (Round Trip)	$2.50 (One Way) $5.00 (All Day)
SDM	$1.00 (All Day)	$0.75 (All Day)	$0.75 (One Way) $1.50 (Round Trip)	$1.25 (One Way) $2.50 (Round Trip)	$0.50 (One Way) $1.00 (Round Trip)	$1.25 (One Way) $5.00 (All Day)
Monthly	TriMet Pass	Metro & Puget Pass	Orca Pass	N/A	N/A	MTS Pass Holders
Annual	$100	N/A	-	$200.00	-	-
Additional Notes	Transfer to regional transit valid for 2 hours after streetcar fare purchase on regional transit. Streetcar free in 'Fareless Square.'	PugetPass, Metro passes and all Metro transfers accepted. Sound Transit and Community Transit transfers are not accepted.	-	Regional transit passes not valid. $12.50 for all-day family pass. $11 for 3-day pass. $25 for 20-ride pass.	Regional transit passes not valid. $1 for 20-ride pass. $5 for 3-day pass.	Every Saturday & Sunday, two children 12 and under ride free with any paying passenger 18 and over. Friends Ride Free on some holidays.

Table 7-4: Operational and Ridership Characteristics of Selected Streetcar and LRT Systems in the United States

Characteristic	Portland	Seattle	Tacoma	Tampa	Little Rock	San Diego Trolley (LRT)
Description of Adjacent Land Uses	High density, civic, employment, & tourism	Downtown, mid-to-high density	Downtown, mid-to-high density	Downtown, mid-to-high density, tourism	Downtown, mid-to-high density, civic	Civic, employment, & tourism
Census 2010 Population	583,776	1,931,249	795,225	335,709	699,757	1,307,402
Estimated Annual # of Visitors to City FY11	8.9 Million	8.8 Million	3.1 Million	4.3 Million	5.2 Million	15 Million
Length	8.0 Miles	2.6 Miles	2.4 Miles	2.4 Miles	3.5 Miles	1.5 Miles
Year Opened	2001/2005	2007	2003	2003	2004/2007	Potential
Annual Total Ridership FY11	3,914,722	451,000	889,320	365,000	1,095,000	377,000
Annual Vehicle Revenue Hours	36,000	11,500	10,060	17,985	11,866	-
Annual Vehicle Revenue Miles	200,000	56,600	97,115	87,147	52,256	-
Miles Per Hour	5.5	4.9	9.6	4.8	4.4	-
Weekday Base Headway	15 min	15 min	10-20 min	20 min	25 min	15 min
Weekday Peak Headway	10 min	15 min	10 min	15 min	20 min	15 min
Saturday Base Headway	15 min	15 min	10 min	20 min	25 min	15 min
Sunday Base Headway	15 min	15 min	20 min	30 min	25 min	15 Min
Operating Hours	*Weekdays* 5:30AM to 11:30PM *Sat.* 7:15AM to 11:30PM *Sun.* 7:15AM to 10:30PM	*Mon. – Thurs.* 6AM to 9PM *Fri. – Sat.* 6AM to 11PM *Sun.* 10AM to 7PM	*Weekdays* 5:30AM to 9PM *Sat.* 8AM to 9PM *Sun.* 8AM to 9PM	*Mon. – Thurs.* 11AM to 10PM *Fri. – Sat.* 11AM to 2AM *Sun.* Noon to 8PM	*Mon. - Wed.* 8:30AM to 10PM *Thurs. – Sat.* 8:30AM to 12AM *Sun.* 11AM to 5PM	*Mon. to Sun.* 8AM to 6PM. Additional special event service.
Transit Service Notes	Corridor previously and currently has bus service. A minor ridership decrease occurred and rescheduling of adjacent bus routes, however no significant changes in level of service.	Existing transit in corridor. Connects to various bus routes.	Existing transit in corridor. Connects to various bus routes.	Existing transit in corridor. Connects to various bus routes.	Existing transit in corridor. Connects to various bus routes.	Existing transit in corridor. Connects to various bus routes and light rail lines.

7.6 Preliminary Transit Service and Ridership Forecast

Table 7-5 contains ridership estimates for the City/Park Streetcar. They were derived using the line productivity of peer cities, and adjusted for the operating conditions and land uses within San Diego adjacent to the proposed alignment. Estimates were validated and adjusted using current MTS understanding and experience of similar rail line productivity as well as SANDAG forecasting. Due to the limited scope of this feasibility study, it will be necessary to generate more-refined ridership estimates as the project moves forward.

Table 7-5: Ridership Estimates for City/Park Streetcar

Ridership Category	Ridership
Average Weekday Ridership	1,100
Average Weekend Ridership	1,800
Annual Weekday Ridership	279,000
Annual Weekend Ridership	98,000
Annual Total Ridership (Includes Special Events)	377,000

The northbound and southbound on-and-off data, shown in Table 7-1 above, was increased by 30% because rail-based transit typically is able to attract riders who would not usually take local buses. Weekend ridership was multiplied by 40% in order to reflect an increased level of transit usage for weekend events in Balboa Park, in addition to more appropriately reflecting current LRT ridership ratios between weekday and weekend travel. As shown in Table 7-6, ridership on weekends is expected to be significant, just as it is in other cities; on average, cities with streetcar systems get about 30% of their ridership from weekend trips.

Table 7-6: Weekday and Weekend Ridership for City/Park Streetcar (Projected) and Selected LRT Systems

Day Type	City/Park Streetcar (Projected)	San Diego Trolley (LRT)	Tacoma	Seattle	Portland
Weekday	279,000	1,887,607	836,288	535,543	1,624,981
Weekend	98,000	692,048	136,140	213,013	2,338,387
Total Passengers	377,000	2,579,655	972,429	748,556	3,963,368
Weekday	74%	73%	86%	72%	41%
Weekend	26%	27%	14%	59%	59%

To reflect transfers to the streetcar—which may occur if the streetcar arrives before another route, if passengers prefer to take the streetcar over other modes, or if individual travel patterns change over time—the ridership estimate was augmented by an amount equal to 5% of the northbound and southbound loads that occur on Route 7 just before reaching the proposed alignment area. Similarly, these changes in travel patterns are likely to affect bus ridership on Route 7, as some riders are expected to choose the streetcar in lieu of the bus. Therefore, once a streetcar is in operation, Route 7 may need to adjust its scheduling and stopping patterns to account for the overlapping service.

While the majority of visitors reach Balboa Park via private automobile, alternative forms of transportation are regularly used as well. Of those surveyed in a 2007 study by the Trust for Public Land, 38% of park visitors did not arrive via car, but only 5% used public transit.[1] This indicates the potential for transit services such as the City/Park Streetcar to capture a larger share of the market. Expanded survey results are shown in Table 7-7.

Table 7-7: Trust for Public Land Survey Results

Mode of Transportation	August Survey	September Survey	Telephone Survey	Weighted Average
Car	39%	55%	96%	**63%**
Tour Bus	24%	11%	2%	**12%**
Walk	19%	10%	2%	**10%**
Trolley/Transit From Outside Balboa Park	8%	5%	1%	**5%**
Bike	6%	11%	1%	**6%**
Motorcycle	4%	4%	0%	**3%**
Taxi	2%	3%	0%	**2%**

Note: Not all columns add to 100% due to rounding.

Data from SANDAG's Onboard Transit Passenger Survey reflect that 55.4% of riders on Route 7 use the route for trips not related to work or school. According to the agency's Regional Comprehensive Plan, Downtown San Diego and Park Boulevard are designated as "smart growth" areas, planned for higher-density, mixed-use development and a pedestrian-oriented focus. Streetcars can support this growth very well by acting as urban circulators, particularly if adjoining land uses encourage visitors who drive to park only once during, then use alternative forms of transportation for the remainder of their visit.

7.7 Summary

Figure 7-3: Opening Day Crowds on Seattle's South Lake Union Streetcar

Source: Seattle Bon Vivant

The projection of 377,000 total annual passengers on the City/Park Streetcar represents a conservative estimate. There is great potential for ridership to increase beyond this level in the future due to the rising cost of car ownership, the adjacent smart-growth initiatives, the general attraction of rail-based transit to the public, and the numerous activity centers in the Downtown and Balboa Park areas. Furthermore, if the system is expanded—thus connecting it to many more origins and destinations—and operating hours are increased, ridership will continue to grow with the expanding network. If the streetcar and other alternative forms of transportation are given priority in the corridor, they have a high potential to attract a whole new market of transit riders.

[1] "The Soul of San Diego: Keeping Balboa Park Magnificent in its Second Century," The Trust for Public Land, 2007.

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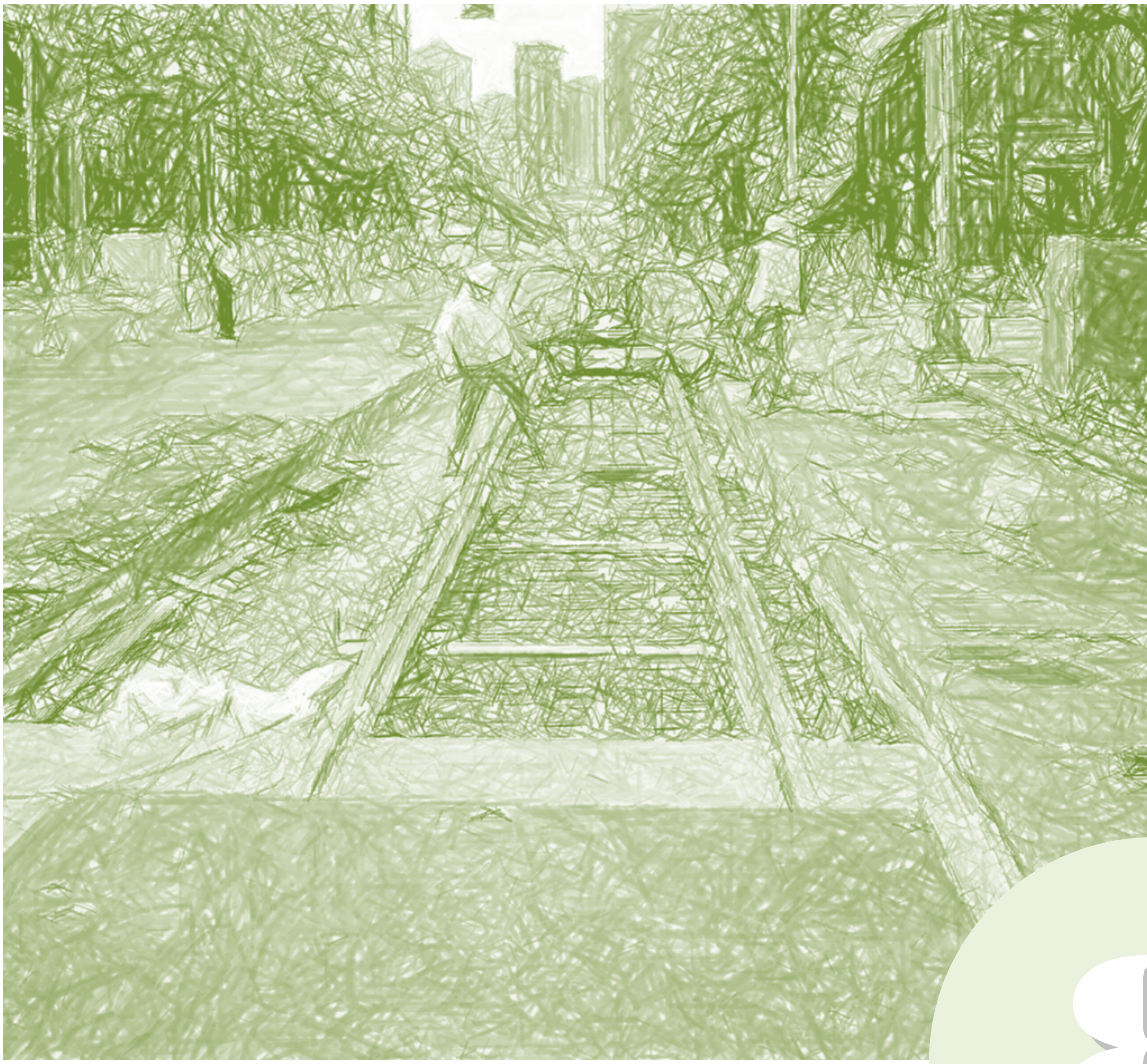


8 Capital Cost

8.0 CAPITAL COST

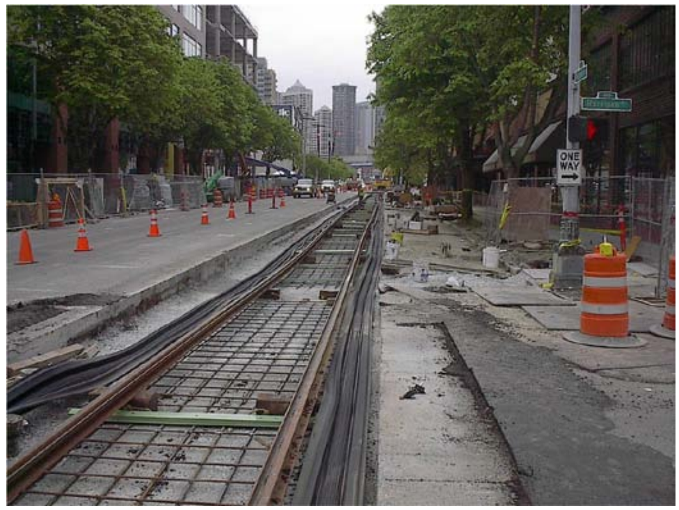
The capital cost of the City/Park Streetcar line consists of two primary drivers: construction cost and vehicle cost. Each of those elements is analyzed below to form an order-of-magnitude capital cost estimate for the entire system.

8.1 Cost Estimation Methodology

Conceptual costs for constructing the streetcar line have been prepared using the following methodology, with costs broken down into seven broad categories corresponding with the Federal Transit Administration's Standard Cost Category format. These include:

- Guideway and Track;
- Stations and Platforms
- Support Facilities;
- Site Work and Special Conditions;
- Systems;
- Right-of-way, Land, and Existing Improvements; and
- Professional Services.

Figure 8-1: Guideway and Track Construction in Portland



Source: Parsons Brinckerhoff

Each of these elements is described below, and followed by a capital cost estimate based on the selected concept provided in Section 6. Additionally, vehicle costs—which will vary significantly depending upon the type of vehicle chosen—are presented separately in Section 8.3, and in more detail in Section 4.

8.1.1 Guideway and Track

Guideway and track are the most fundamental elements of the streetcar system, providing the basic infrastructure around which everything else is built (Figure 8-1 and Figure 8-2). Generally, these two elements also comprise the most expensive parts of construction, as they often entail either major renovations to the existing roadway (for at-grade alignments) or the construction of entirely new facilities (for grade-separated alignments; such as the Interstate 5 Bridge). The City/Park Streetcar will be at-grade for the majority of its route, featuring ballasted track under a paved surface that will carry mixed-flow traffic.

At the Interstate 5 crossing, however, an aerial structure will be required that either modify or replaces the existing roadway bridge, since the current bridge cannot accommodate the streetcar's weight and electrical requirements. This estimate therefore accounts for the demolition and construction of a new bridge facility. However, with an LRT line planned for the same corridor in the next 25 years, an entirely new bridge probably will be necessary regardless of whether the City/Park Streetcar is ever built; therefore, any bridge replacement cost today should be viewed as a longer-term investment that will help defray the cost of the future LRT alignment.

If a single-sided, single-ended vehicle is used—the historic PCC model is the only such vehicle under consideration—it will also be necessary to build turnaround locations at each end of the line. As discussed in Section 6.6, this can consist either of looped turnaround track or a turntable facility similar to Figure 8-3. The estimate below therefore includes the cost of two turntables, which is roughly equivalent to the cost of one-quarter mile of additional guideway and track. In the event that a double-sided, double-ended vehicle is selected, this element can be removed from the cost estimate.

Cost estimates for guideway and track are generally very straightforward, using linear measurements based on alignment length. For that reason, these costs generally can be assigned aggregately with an acceptable level of accuracy. While each of the lane-design alternatives presented in this study may entail slightly different guideway and track costs, at the order-of-magnitude level their costs will be roughly similar. However, the cost estimate below is tailored specifically for Option 4, the recommended alternative described in Section 6.3.

8.1.2 Stations and Platforms

There are seven stops planned in each direction along the 1.5-mile route, which would mean a total of twelve station platforms: one shared platform for each of the end-of-line stations, and separated north-south platforms for the five mid-line stations. As discussed in Section 3.3, each station is at-grade and will feature a raised platform, shelter, seating areas, ticketing machines, and informational displays.

Figure 8-2: Paved Track Nearing Completion in Portland

Source: Parsons Brinckerhoff

Cost estimates are based on a notional station comprised mostly of standardized, "off the shelf" elements. Should specialized equipment or unique artistic features be desired at the stations, their cost can be expected to rise accordingly.

8.1.3 Support Facilities

The existing MTS support facility at 12th and Imperial Avenues provides an opportunity for cost savings as it already contains the storage, maintenance, and administrative facilities that the City/Park Streetcar would require. In fact, this site already houses two of the vehicles that are evaluated in this report: the modern Siemens SD8 vehicle, which is being phased into operation across the entire LRT system, and the historic PCC streetcar, which is currently used for the commemorative Silver Line weekend service. Moreover, LRT tracks leading to this facility are already in place on Park Boulevard south of Broadway, which would allow for an easy connection from the streetcar's southern terminus.

The MTS operations division has confirmed that the 12th and Imperial facility would be able to accommodate the City/Park Streetcar with very little modification from its current state, and therefore no cost is applied to this item. However, if the urban streetcar network is expanded in the future as planned the RTP, capacity issues eventually will arise that will necessitate expansion of the support facility.

8.1.4 Site Work and Special Conditions

The development of a functional streetcar system requires that a number of ancillary mitigation requirements, which may or may not be directly related to the transit service itself, be addressed. Site work and special conditions costs often include items that cannot be adequately represented by a typical cross-section because of design complexities, special site conditions, or other unique circumstances.

Major site work for the City/Park Streetcar will include landscaping, the installation of curbs, gutters, and sidewalks, and the construction of retaining walls.

For the alignment alternative selected, site work will also include roadway modifications like repaving and restriping. In addition, site work also includes utility relocation, demolition and clearing activities, and the disposal of any hazardous materials that may exist.

8.1.5 Systems

This category includes the electronic and mechanical systems that provide power, guidance, and communications capabilities to the streetcar. The most significant cost drivers are power-related: two substations to generate electrical power, and an overhead catenary wire system to deliver that power to the operating vehicles.

Figure 8-3: Streetcar Turntable in Dallas

Source: Dallas Observer

In addition, the systems category includes signaling devices that provide traffic direction and crossing protection to vehicles, as well as communications systems that allow vehicle operators, safety and maintenance workers, and central control personnel to remain in contact with each other.

8.1.6 Right-of-Way, Land, and Existing Improvements

This category covers all land acquisition and acquisition-related costs required to obtain the property needed for the streetcar system. This includes not only land for the streetcar's guideway and track, but also the space necessary to accommodate the station platforms, power substations, catenary poles, and other required facilities. As discussed in Section 6, the amount of land required for acquisition will depend in large part upon the specific lane-design alternative selected. Up to fifteen feet may be necessary to capture along each side of Park Boulevard (Figure 8-4).

Figure 8-4: Park Boulevard Right-of-Way Looking South

Source: Parsons Brinckerhoff

Land acquisition typically is a major cost driver for rail transit projects due to the high price of acquiring right-of-way. The City/Park Streetcar's alignment is situated almost entirely within public streets or public property. Bordering Park Boulevard along the vast majority of the proposed 1.5-mile route is Balboa Park, San Diego High School, and San Diego City College. The potential lack of private acquisition costs provides an opportunity for savings. However, in exchange for lower right-of-way costs, there may be other administrative and environmental issues pertaining to the elimination of public parkland. At this time, no cost for land acquisition is identified.

8.1.7 Professional Services

This cost category includes allowances for preliminary engineering, final design, project and construction management, project insurance, surveys and testing, and start-up costs. These allowances are calculated by applying a percentage to the total construction costs estimated for each cost category (excluding right-of-way and vehicle costs). The matrix below shows the various percentages used to calculate each item in the category.

8.2 Construction Cost Estimate

Using the above categories, Table 8-1 (spread across two pages) contains an order-of-magnitude cost estimate for the construction of the streetcar system. It excludes the cost of vehicles, which is discussed in Section 8.3.

Table 8-1: Order-of-Magnitude Construction Cost Estimate

	Item Description	Unit of Measure*	Quantity	Unit Price (US $)	Total Price (US $)
GUIDEWAY & TRACK ELEMENTS					**$ 27,956,000.00**
1	Guideway: At-grade in mixed traffic	RM	1.43	3,125,000.00	4,468,750.00
2	Guideway: Aerial (I-5 bridge, including demo)	SF	35,000	350.00	12,250,000.00
3	Guideway: Aerial (contingency)	LS	12,250,000	30%	3,675,000.00
5	Track: Ballasted w/paving in mixed traffic	RM	1.43	3,375,000.00	4,826,250.00
4	Track: Direct fixation (I-5 bridge)	RM	0.07	4,800,000.00	336,000.00
6	Track: Special (switches, crossovers, and turnouts)	RM	1.50	600,000.00	900,000.00
7	Turntable (single-ended vehicles)	EA	2	750,000.00	1,500,000.00
8	Turntable (contingency)	LS	1,500,000	40%	600,000.00
STATION PLATFORMS					**$ 3,424,200.00**
9	At-grade station	EA	12	285,350.00	3,424,200.00
10	*1. Smart Corner - Park Blvd. and Broadway*		1		
11	*2. City College - Park Blvd. and B Street*		2		
12	*3. San Diego High School - Park Blvd. and Russ Blvd.*		2		
13	*4. Balboa Park - Park Blvd. and Presidents Way*		2		
14	*5. Navy Hospital - Park Blvd. and Wieber Avenue*		2		
15	*6. Prado - Park Blvd. and El Prado*		2		
16	*7. San Diego Zoo - Park Blvd. and Zoo Place*		1		
SUPPORT FACILITIES: YARDS, SHOPS, ADMIN BLDGS					**$ 0.00**
17	Administration building	EA	0.00	N/A	-
18	Light maintenance facility	EA	0.00	N/A	-
19	Heavy maintenance facility	EA	0.00	N/A	-
20	Storage or maintenance of way building	EA	0.00	N/A	-
21	Yard and yard track	EA	0.00	N/A	-
SITE WORK & SPECIAL CONDITIONS					**$ 3,957,000.00**
22	Demolition, clearing, earthwork	RM	1.50	200,000.00	300,000.00
23	Site utilities, utility relocation	RM	0.50	500,000.00	250,000.00
24	HAZMAT, contamination mitigation, water treatments	RM	1.50		-
25	Environmental mitigation	RM	1.50	20,000.00	30,000.00
26	Site structures, incl. retaining walls and sound walls	LS	1.00	200,000.00	200,000.00
27	Curbs and gutters	LF	48,000	24.00	1,152,000.00
28	Pedestrian facilities (sidewalks)	SF	80,000	6.00	480,000.00
29	Bicycle facilities - Class 2 (pavement and striping)	SF	30,000	7.50	225,000.00
30	Bicycle facilities - Class 1 (12' section / Balboa Park)	SF	52,000	10.00	520,000.00
31	Landscaping (planting and irrigation)	SF	160,000	5.00	800,000.00
32	Temporary facilities and other indirect costs	LS			-
SYSTEMS					**$ 8,875,000.00**
33	Traffic signals and crossing protection	RM	1.50	250,000.00	375,000.00
34	Traction power supply: Substations	EA	2.00	2,000,000.00	4,000,000.00
35	Traction power distribution: Overhead catenary	RM	1.50	2,500,000.00	3,750,000.00
36	Communications	RM	1.50	500,000.00	750,000.00
37	Fare collection equipment (included in station costs)	RM	0.00	-	-
38	Central control	RM	0.00	-	-
CONSTRUCTION SUBTOTAL					**$ 44,212,200.00**

	Item Description	Unit of Measure*	Quantity	Unit Price (US $)	Total Price (US $)
R.O.W, LAND, & EXISTING IMPROVEMENTS					$ 0.00
39	Purchase or lease of real estate (Space for turntables at Zoo Parking Lot & Park Blvd and C Street)	NA	-	-	-
40	Relocation of existing households and businesses	NA	-	-	-
PROFESSIONAL SERVICES (39%)					$ 17,242,758.00
41	Preliminary engineering (5.0%)	LS			2,210,610.00
41	Final design (10.0%)	LS			4,421,220.00
43	Project management for design & construction (7.0%)	LS			3,094,854.00
44	Construction administration & management (10.0%)	LS			4,421,220.00
45	Professional liability and other non-construction insurance (2.5%)	LS			1,105,305.00
46	Legal: Permits, review fees, etc. (1.0%)	LS			442,122.00
47	Surveys, testing, investigation, & inspection (2.0%)	LS			884,244.00
48	Start up (1.5%)	LS			663,183.00
CONSTRUCTION, R.O.W., & PROFESSIONAL SERVICES SUBTOTAL					$ 61,454,958.00
UNALLOCATED CONTINGENCY (10%)		LS			$ 6,145,495.80
TOTAL PROJECT COST (EXCLUDING VEHICLES)					$ 67,600,453.80

**Unit of Measure Legend: RM = Route Mile SF = Square Foot EA = Each LS = Lump Sum*

8.3 Vehicle Cost Estimate

Table 8-2 shows the estimated costs for all types of vehicles under consideration, with vehicle quantities based on the operations plan in Section 5. While actual costs may differ slightly from these estimates, the data clearly show two distinct cost ranges: the relatively low cost of historic and replica vehicles, and the comparatively high cost of modern vehicles. As noted in Section 4.7, both the historic and replica vehicles benefit from using reconditioned structural components, to include the vehicle trucks, bodies, and other parts where available.

However, up-front acquisition is only part of the overall cost of vehicles. As discussed in Section 4.7, modern vehicles bring several cost-saving advantages to the table: bi-directional cabs that eliminate the need for turnaround track, low-floor designs that improve boarding speed and ADA accessibility, and generally greater maintenance reliability that comes backed by contractual guarantees.[1] Without such an assurance of reliability for historic vehicles, all future repair costs for the SD1 or PCC cars—including the procurement of spare parts as the cars continue to age—would rest with MTS.

In addition, because the supply of historic vehicles is limited and their conditions vary, the actual restoration cost is likely to be different for each vehicle. For any supply of historic cars, it is reasonable to expect that the "easiest" restorations—that is, the cars in the best condition needing the fewest major repairs—will be completed first. This means that restoration costs are likely to increase with each successive vehicle, with the highest-cost restorations coming as the inventory of historic cars depletes. For this reason, the costs listed below for the historic SD1 and PCC vehicles should be viewed as conservative estimates that are likely to increase with each vehicle acquired.

[1] While the historic SD1 vehicle is double-sided and double-ended, in order to use it as a true bi-directional streetcar two ADA-compliant lifts must be installed: one for each side of the vehicle. If this option is selected, it can be expected to add significantly to the restoration cost.

Table 8-2: Vehicle Cost Estimate

#	Vehicle Type	Estimated Unit Price (Including Restoration)	Quantity Required	Estimated Total Price (Including Sales Tax)
1	Historic (SD1)	$900,000	4	$3,960,000
2	Historic (PCC)	$850,000	4	$3,740,000
3	Replica	$900,000	3	$2,970,000
4	Modern (Siemens)	$3,600,000	3	$11,880,000
5	Modern (United)	$3,500,000	3	$11,550,000
6	Modern (Inekon)	$3,100,000	3	$10,230,000
7	Modern (ameriTRAM)	Unknown	3	Unknown

8.4 Comparison to Peer Cities

To provide a rough cost comparison to other cities, Table 8-3 shows the capital costs of streetcar systems that have been constructed in the United States in the past decade.

It should be noted that capital costs can vary greatly from project to project depending upon site-specific issues such as land acquisition, engineering challenges, environmental clearance, and whether other supporting projects were constructed simultaneously (such as bridges, bicycle lanes, or pedestrian facilities). In addition, the general cost of construction often varies from region to region depending upon the local costs of labor, materials, and legal requirements. Finally, the effects of inflation and rising infrastructure costs over time must be considered when looking at past projects. For all these reasons, the cost data in Table 8-3 must be viewed only as a rough comparison.

Table 8-3: Capital Costs of Recent Streetcar Systems in Peer Cities

System		Start of Service	System Length		Capital Cost (Including Vehicles)	System Capital Cost	
			Corridor Miles	Track Miles		Per Corridor Mile	Per Track Mile
San Diego City/Park Streetcar *(Est.)*		N/A	1.5	3.0	$79.5 M*	$52.9 M*	$26.5 M*
Portland (OR) Streetcar							
	Initial Loop	2001	2.4	4.4	$56.9 M	$23.7 M	$12.9 M
	Riverplace Extension	2005	0.6	1.2	$16.0 M**	$26.7 M**	$13.3 M**
	SW Moody Extension	2006	0.6	1.2	$15.8 M	$26.3 M	$13.2 M
	Lowell Extension	2007	0.6	1.2	$14.5 M**	$24.2 M**	$12.1 M**
Tacoma (WA) Link		2003	1.6	3.2	$80.4 M	$50.3 M	$25.1 M
Seattle (WA) South Lake Union Line		2007	1.3	2.6	$50.5 M	$38.8 M	$19.4 M
Kenosha (WI) Electric Streetcar		2000	1.7	1.7	$6.6 M	$3.9 M	$3.9 M
Tampa (FL) TECO Line Streetcar		2002	2.4	2.4	$53.0 M	$22.1 M	$22.1 M
Little Rock (AR) River Rail Streetcar							
	Initial Phase	2004	2.5	2.5	$19.6 M	$7.8 M	$7.8 M
	Phase II	2007	0.9	0.9	$8.7 M	$9.7 M	$9.7 M

** For consistency with other cities, capital cost assumes the purchase of 3 modern Siemens vehicles. Capital cost would be lower if historic or replica vehicles were selected.*

***No vehicles were purchased during this extension.*

9 Next Steps!

9.0 NEXT STEPS: FUTURE ACTIVITIES AND FUNDING SOURCES

To move the City/Park Streetcar forward to realization, it is important to outline the next steps for implementation. Activities that would be undertaken include the planning, design, engineering and environmental review of the proposed the streetcar segment and the support facilities. The availability of public-right-of way for most, or all of the proposed improvements, enhances the ability for this project to move forward. The existing plans and polices support the implementation of the project and the other transit modes as defined in the selected alternative concept. Additionally, this chapter includes the identification of funding opportunities and requirements to prepare for the next steps of the project development.

9.1 Streetcar Implementation

The section below describes the next-step activities for the 1.5-mile streetcar segment on Park Boulevard.

9.1.1 Detailed Planning

The next step would build on the conceptual planning work that has been completed in this report and would lead into and support the conceptual engineering and environmental document preparation. Detailed planning will include a comprehensive alternatives analysis and project definition in accordance with the Federal Transit Administration (FTA). The project should be planned to ensure that it is fully integrated into the existing urban fabric and supports the multi-modal objectives of the corridor.

9.1.2 Conceptual Engineering

Conceptual engineering for the modern streetcar will support the environmental document preparation and an updated capital cost estimate for the project. Traffic studies will be conducted to support the alternatives analysis and project development. A conceptual design for the streetcar will define in more detail the routing, stations, site designs, and related infrastructure, including access to the existing MTS maintenance facility serving the streetcar operations.

9.1.3 Environmental Document Preparation

The environmental analyses conducted in the next steps will include both the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) document preparation and clearances. Initial analyses will determine whether a comprehensive Environmental Impact Statement/ Environmental Impact Report will be required to achieve environmental approvals. The environmental analysis will include all technical studies, including modeled ridership forecasts, to support the environmental document and preparation.

9.1.4 Funding Analysis and Financing Strategy

The City/Park Streetcar project will identify and analyze the market feasibility and revenue generating potential of prospective local funding sources to help support the future capital and operating costs for streetcar operations. The strategy and analysis will involve industry experts in the areas of public-private partnerships and joint development, real estate investment, economic and market feasibility, and assessment and fee-based funding strategies. It will reach out to businesses, Balboa Park tenants, property owners, and public institutions (such as CCDC and the city of San Diego) in the corridor area to participate in development of the strategy. The results of this work will allow MTS and SANDAG to develop a viable funding strategy for the streetcar project in the Detailed Planning effort.

9.1.5 Public Outreach

As part of the next efforts, a comprehensive public outreach program will be undertaken to obtain stakeholder and community input and concurrence during development of the modern streetcar. The input will be used to guide the project definition, address potential project impacts, and assess the feasibility of local funding strategies.

9.1.6 Schedule

Implementation of the City/Park Streetcar project will certainly have challenges along the way. Although the alignment is within an existing right-of-way, there still will be a need to widen the right-of-way in order to accommodate all of the proposed multi-modal facilities. This project would be relatively straightforward if the nature of construction remained in the existing right-of-way of Park Boulevard and required little or no right-of-way acquisition for implementation.

Other U.S cities that have implemented modern streetcar systems generally have been able to deliver the projects within five years. However, with the need to widen the right-of-way through Balboa Park and the possible reduction of parkland, a five-year implementation schedule for the City/Park Streetcar should be considered optimistic. The preliminary implementation schedule below should be updated continually as the project moves to the next steps.

1.5 years	Alternatives Analysis/Conceptual Engineering/Environmental Process
1.0 years	Preliminary Engineering/Vehicle Acquisition Solicitation/Funding Strategy
1.0 years	Final Design
1.5 years	Construction/Vehicle Delivery
5.0 years	**Total Delivery Time**

9.2 Funding Sources

One of the primary challenges for the implementation of any streetcar project is finding and securing funding, for both capital as well as ongoing operations and maintenance costs. This section provides a description of some of the possible funding opportunities available for the City/Park Streetcar. As with most projects of this type, a combination of creative leveraging from multiple funding sources is likely to be required. These include federal, state, local, and even private sources of revenue.

As noted in Section 2.11, the City/Park Streetcar would constitute the first portion of a streetcar network planned in the SANDAG 2050 RTP that will serve the Downtown, Bankers Hill, Hillcrest, North Park, South Park, and Golden Hill neighborhoods. In the 2050 RTP, SANDAG assumed only 10-percent regional capital funding for streetcars, with the rest to be paid by outside sources, including and public-private partnerships and local redevelopment efforts. As such, these outside sources should be fully explored for funding opportunities.

In contrast to light-rail projects, streetcar operational and maintenance funding is often subsidized using additional local sources other than just transit or regional transportation funds. For example, business improvement districts, parking meter revenues, and special district fees are secured (sometimes up to 20 years in advance) in conjunction with fares in order to maintain a level of service on the streetcar that encourages ridership.

Securing funds for both capital and ongoing operational and maintenance costs from a variety of sources could allow for the construction of a streetcar in a shorter time frame than typical light rail projects. For instance, securing funding for ongoing streetcar operational costs alleviates the potential conflict of re-directing already limited transit dollars from currently operating transit service to streetcar service. Many recent streetcar projects are unique in that they:

- Have not relied on traditional federal, state, and local funding sources;
- Used local funding sources such as redevelopment funds, improvement district funds, parking fees, special assessment districts for adjacent land owners, and/or local-option sales tax measures to cover the cost of selected short-term transit projects;
- Secured significant investment by private property owners adjacent to the streetcar line;
- Obtained sponsorships and volunteer labor; and
- Used, but did not exclusively rely on, local transit funds.

9.2.1 Federal Funding Opportunities

The vast majority of federal funds for transit come in the form of capital grants, with very little federal money available for operations and maintenance costs. Streetcar projects across the U.S. have enjoyed hundreds of millions of dollars in federal capital grants in the last several years through several temporary programs. Initially spurred by economic stimulus legislation in 2009, two phases of the Transportation Investment Generating Economic Recovery (TIGER) program provided streetcar funding for systems in Dallas, Tucson, Portland, and New Orleans. In addition, in 2010 the federal Urban Circulator grant program provided funds for streetcar planning in Cincinnati, Charlotte, and St. Louis, among other cities. However, the application deadlines for these specific programs have passed and all of the remaining funding has been allocated; it is uncertain whether additional rounds of these programs may appear in the future.

Beyond these temporary programs, funding historically has been difficult for streetcars under the Federal Transit Administration's (FTA) primary sources for capital assistance, the New Starts and Small Starts programs. This is often attributed to the evaluation criteria used by the FTA to assess projects, which does not weigh heavily the economic-development benefits of streetcars against other transit modes. A significant amount of transit funding and policy will depend on the way in which the recently approved federal transportation bill, Moving Ahead for Progress in the 21st century (MAP-21, July 2012), is implemented. The bill sets the government's priorities for surface transportation by appropriating two years' worth of federal transportation dollars. Preliminary research suggests that MAP-21 may weigh the economic-development benefits of streetcars higher against other transit modes than did the previous federal transportation bill, indicating a potential opportunity for federal support of the City/Park Streetcar.

No federal funding programs have been identified in this report because, at the time this report was published, the FTA had not yet released details on the implementation of MAP-21. However, it can be expected that any streetcar project would need to remain competitive on a national level in order to be awarded federal funding. In addition, the project also would need to be competitive among other local and regional projects identified in the 2050 RTP.

9.2.2 State Funding Opportunities

State funding will be dependent upon future legislation as perennial budget-deficit issues are addressed in Sacramento. For Fiscal Year 2011-12, the governor proposed a $12.8 billion budget for the Department of Transportation (Caltrans). While in the past the state has reduced funding for transit projects, this proposed budget increases the funding share allocated to the Public Transportation Account. It is unknown how many other California cities will apply for state funding for streetcar projects. With the legislature focused on major deficit issues, it is likely that capital assistance programs will award funding to projects that emphasize "state of good repair" measures and advance economic sustainability.

The state provides a considerable amount of funding for transit operations through the Transportation Development Act (TDA), which that provides two major financing sources for public transportation: the Local Transportation Fund and the State Transit Assistance fund. Funds available through TDA vary year-to-year because taxable sales fund the program. In recent years, due to the weak economy and the resulting reduction in sales-tax revenue, MTS has received significantly less funding through TDA, which has necessitated the reduction of many MTS services.

Potential state funding opportunities for a streetcar project include:

- Transportation Tax Fund;
- State Transportation Fund;
- Environmental Enhancement and Mitigation Program Fund;
- Historic Property Maintenance Fund;
- Mass Transportation Fund;
- Traffic Congestion Relief Fund;

- Transportation Investment Fund;
- Transportation Bond (Proposition 1B) – Highway Safety, Traffic Reduction, Air Quality, and Port Security Fund of 2006;
- Department of Transportation Capital Project Funds;
- State Lottery Funds;
- Federal Stimulus Funds;
- State Transportation Improvement Program;
- Local Assistance Program;
- State Highway Operation and Protection Plan;
- Traffic Congestion Relief Program;
- Legislation Action; and
- Transportation Development Act.

9.2.3 Local Funding Opportunities

Local funding opportunities include traditional transit sources such as advertising revenue, as well as options such as local improvement districts. In recent years, most fully funded or constructed streetcar systems utilized local funding sources that are not typically used for light-rail projects. Potential local funding sources for a streetcar project include:

- Local utility companies;
- Assessment districts (existing);
- Assessment district created specifically to fund a streetcar;
- Transit impact fees;
- Redevelopment funds;
- Local department of transportation funds (Caltrans);
- Stimulus funds;
- City funds;
- Sale of development or naming rights;
- Sale of property;
- Parking fees (metered & city-owned garages);
- Transit Occupancy Tax (TOT) – a share of the TOT could be appropriated to the streetcar capital or operation costs or the TOT could be increased to support the streetcar system.
- Sales tax measure (in addition to *TransNet*) for short-term projects such as streetcars; and
- Advertising.

9.2.4 Local Transit Funding and Fare Policy

Typically, SANDAG develops and builds capital projects that MTS then operates. Securing funding from SANDAG above the 10-percent assumed for streetcar projects in the 2050 RTP is uncertain. Furthermore, it is unlikely that a streetcar project could be completed solely with local transit funding sources. Potential local sources for funding the City/Park Streetcar include:

- Farebox revenue;
- MTS operating funds;
- MTS capital improvement funds;
- SANDAG regional funds; and
- *TransNet* sales-tax revenues.

Fare policy would be established as part of a detailed operations plan. One option is to establish a streetcar fare similar to the San Diego Trolley in order to minimize confusion among passengers. MTS and NCTD utilize a regional pass program that provides seamless transferring between the two operators. Therefore, those traveling from North County to Downtown San Diego and vice-versa can utilize a single pass. According to multiple outreach surveys conducted in 2011, 63.3% of respondents would be willing to use the current pass system or pay $1.50 or more in fare to ride the City/Park Streetcar.

Figure 9-1 depicts these survey results. (See Appendix A for more information on these surveys as well as other public outreach efforts conducted in support of this study.)

Figure 9-1: Combined Public Outreach Survey Results

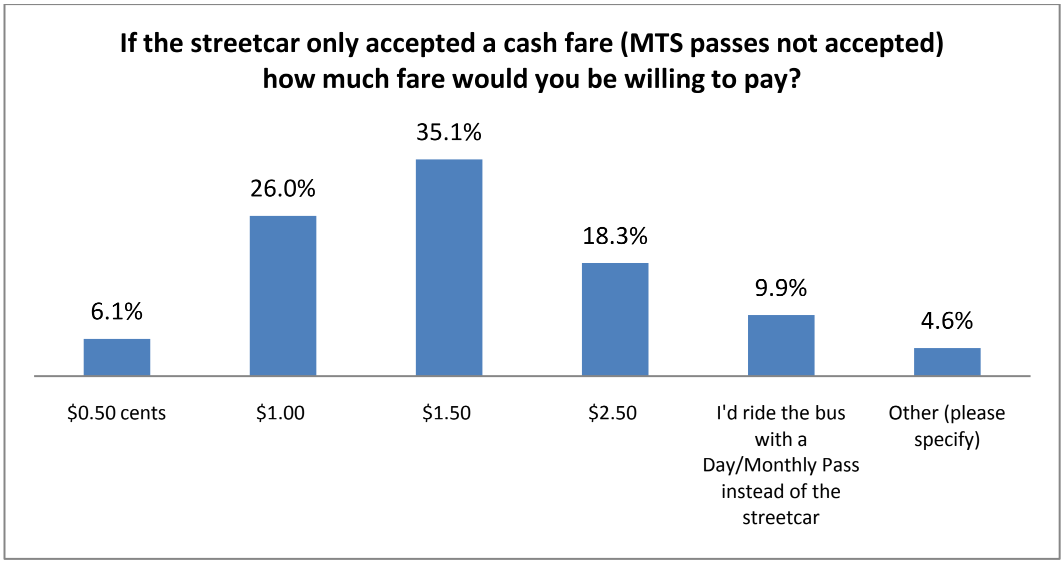


Table 9-1 below shows the fares of fully funded and/or recently constructed streetcar projects around the nation. The average fare for streetcar systems is approximately two dollars for a one-way trip and five dollars for a round trip. Some streetcar systems do not accept transit agency passes and/or do not sell all-day transit passes that would allow seamless transfer between streetcar and other transit services (commuter rail, light rail, and bus services). Implementation of the City/Park Streetcar project would require a more detailed analysis of streetcar fares, as fare policy can significantly affect the ridership and financial sustainability of a project.

Table 9-1: Fares of Recently Completed & Fully Funded Streetcar Projects in the United States

	Atlanta	Portland	Cincinnati	Tucson	Seattle
Project Status	Fully funded, in construction.	Constructed, extension in construction.	Fully funded, in construction.	Fully funded.	Constructed, extension in construction.
Current or Anticipated Streetcar Fare	$2.50 One Way $5.00 Round Trip $9.00 All-Day Transit System Pass	$2.10 Day Pass (Streetcar Only) $5 All-Day Transit System Pass	$1.75 - $4.25 One Way $2.25 - $4.75 for transfer within 90 minutes. No all-day pass available.	$3.50 Day Pass	$2.50 One Way

9.2.5 Private Investment

Private investors often perceive a streetcar project as a local government's commitment to improving public facilities, maintaining livability in order to attract a highly skilled workforce, and encouraging a business-friendly community. In addition, their workers or tenants may be more apt to commute on public transit services. Public and private stakeholders typically work together to create a funding plan in which the overall benefits of the project exceed the costs of the project for both parties. In some instances, property owners along a proposed streetcar line pay an assessment fee levied on their properties on the agreed presumption that eventual transit-related growth and property appreciation will exceed the incurred assessment fee. Most likely, any private investment along the City/Park Streetcar would take place along the southern end of the line Downtown, due to the absence of private investment potential along the line's northern segment. Most of the northern surrounding land is Balboa Park, consisting of public property dedicated to open space, museums, and other park facilities.

Private investments into streetcar projects vary in each city, depending on existing political and financial landscapes. In Tucson, for example, Gadsen Development Company pledged $3.2 million to the cost of construction of their streetcar to encourage the City of Tucson to continue pursuing the project, and to illustrate that private investors are interested in investing in a streetcar line.

In many cases, in lieu of any redevelopment efforts led by local governments, private developers opt to develop along streetcar lines. Adjacent parcels that are underutilized become significantly more attractive to these investors, and they also become major job generators. Some reasons for private investment along a streetcar line include: improved urban circulation translating into more customers, lowering of parking requirements making it more realistic to develop, improved public facilities along the route, sense of place (identifiable location), or ability to sell a less-desirable property to a developer (e.g. property needs environmental clean-up).

9.2.6 Funding Strategies

As this report seeks only to identify a set of potential financing options or scenarios, there are no specific recommendations for funding sources. Obtaining federal funding is a competitive process, with multiple cities likely to be pursing funding for streetcar systems. State and federal transit funds also go toward other modes of transit such as light rail, commuter rail, and bus. Therefore, a streetcar project must remain competitive among a varied landscape of transit projects in order to secure these valuable types of funding. In recent years, streetcar projects winning state and federal grants have had the following elements in common:

- **Promote Livability:** A streetcar project is placed in the city center and adjacent mid-density areas to act as an urban circulator to jobs and activity centers. In addition, neighborhoods are enhanced by improved public facilities including new or redone sidewalks, addition of bicycle lanes, and system maintenance (such as water & electrical upgrades in older neighborhoods).
- **Promote Economic Development:** The overall economic benefits of the streetcar project exceed the costs of the project. For example, adjacent development resulting from construction of the streetcar project optimizes parcel value and future commercial activity.
- **Emphasize State of Good Repair:** The streetcar project extends/enhances existing federally funded projects, addresses operational/maintenance needs, emphasizes movement of workers and goods, and increases economic activity, especially in economically depressed climates.
- **Enhance Transit:** Streetcar service connects to the existing transit network, benefits low-income and transit dependent households, and attracts new riders from various socioeconomic backgrounds.
- **Promote Sustainability:** The streetcar project aims to reduce carbon emissions, reduces single-occupancy automobile trips, protects or enhances the environment, consolidates parking, reduces fossil fuel dependence, and other related sustainability goals.
- **Leverage Public & Private Investments:** Since a streetcar project has the potential to benefit both public and private stakeholders, funding is shared between both parties.
- **Demonstrate Project Readiness:** According to funding application(s), the streetcar project has completed appropriate planning documents, legislative approvals, and financial and technical feasibility documentation.

The City/Park Streetcar has both strengths and challenges with regard to its competitiveness in obtaining funding. These are based on the proposed alignment, selected alternative, most feasible financing options, current funding opportunities, and previous MTS experience in implementing rail projects. The proposed project's funding strengths include:

- The selected preferred alternative outperforms the other evaluated alignments in terms of sustainability, enhancing transit, extending/enhancing existing federally funded projects, and promoting livability.
- The proposed streetcar line is located in areas with approved plans that contain smart-growth and "complete streets" principles. This demonstrates a commitment to supporting transit facilities and livable communities. Such plans include: The Downtown San Diego Comprehensive Parking Plan (consolidates parking and efficiently operates on-street parking spaces); the Downtown Comprehensive Plan (neighborhood center development); the Balboa Park Master Plan (consolidates parking, enhances natural landscape, and promotes active centers).
- The East Village neighborhood (at the southern end of the proposed streetcar line) is zoned for neighborhood mixed-use center or employment/residential mixed-use. Most of the land in this area is zoned for minimum floor-area ratio of 10.0 to maximum floor-area ratio of 20.0; this includes bonuses although other bulk and height restrictions may apply. The planned intensity and type of allowable development is characteristic of transit-oriented communities and other streetcar projects that have received federal funding.
- The potential exists to conserve future light-rail (Trolley) construction costs by implementing streetcar service along Park Boulevard through Balboa Park. For example, since the Interstate 5 bridge needs to be re-designed for light rail, it would be ideal to phase it such that improvements for both projects are done simultaneously.
- Major activity centers such as the San Diego Zoo and Naval Medical Center are looking for new ways to transport visitors and workers to their facilities due to parking constraints during peak times. In addition, these activity centers have long-term goals to improve and expand facilities to better serve the public needs, and as a result they are exploring options to accommodate the increase in the number of trips made by visitors and workers to their facilities.
- The City of San Diego is pursuing its own streetcar feasibility study as part of the Mid-City Community Plan update process.

The proposed project also faces several challenges. Unlike many other successful streetcar projects in recent years, the City/Park Streetcar provides little potential for private investment from adjacent landowners, as the vast majority of its alignment is surrounded by Balboa Park, San Diego City College, and San Diego High School.

In addition, with the San Diego Trolley LRT planned to operate on Park Boulevard by 2035, community support for running multiple rail modes in the same corridor may be lower than it would be if only one rail service were planned.

Depending upon the specific alignment selected, the corridor also risks losing some on-street parking capacity or expanding into existing park land (see Section 6), which may also meet with community opposition. Finally, the Interstate 5 bridge may present engineering complications as the alternatives are more fully evaluated in future design phases (further discussion in Section 2.1 and Section 6.5). This could affect the project's cost, delivery schedule, and ultimate feasibility in the Park Boulevard corridor.

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Appendices

A

APPENDIX A: STEERING COMMITTEE AND COMMUNITY OUTREACH

To guide the study process, MTS convened a Steering Committee of local stakeholders and conducted several community outreach efforts. The results of these events are summarized below.

A.1 Steering Committee

The Steering Committee, whose membership is listed in Table A-1 below, consisted of representatives from organizations in Balboa Park as well as Downtown. The committee met three times between April and October 2011.

A series of exercises were presented at the meetings in order to solicit input on stakeholder priorities, alignment options, and other project details. Figures A-1 and A-2 on the following pages show the Steering Committee's responses to two such exercises, held at committee meetings in April and June. Overall, the results show a clear desire to make Balboa Park more accessible via transit, bike, and pedestrian modes, as well as to ensure compatibility with plans for future transit expansions.

Table A-1: Steering Committee Members

Name	Organization Represented
Christopher Brown	San Diego Gas & Electric Company
Tom Clabby	MTS Accessible Services Advisory Committee
David Cohn	Balboa Park Plaza de Panama Committee
Bob Dillon	San Diego Zoological Society
Pete Ellsworth	Legler Benbough Foundation
Vicki Granowitz	Balboa Park Conservancy
Sachin Kalbag	Centre City Development Corporation (CCDC)
Mike Kelly	Balboa Park Committee of 100
James G. Kidrick	Balboa Park Cultural Partnership
Dr. Jeffrey Kirsch	Balboa Park Cultural Partnership
David Kinney	Balboa Park Central
Bob Martinez	City of San Diego Parks and Recreation Department
Robert Ripley	Naval Medical Center San Diego
Chris Schmidt	California Department of Transportation (Caltrans) District 11
Dave Schumacher	San Diego Association of Governments (SANDAG)
Leon Williams	Metropolitan Transit System (MTS)

Figure A-1: Steering Committee Evaluation of Relative Importance of Study Factors

MTS City/Park STREETCAR Feasibility Study

April 5, 2011 Steering Committee Exercise Results

	PRIORITY	DOTS PLACED BY STEERING COMMITTEE MEMBERS TO INDICATE IMPORTANCE
TRANSIT	Improve Balboa Park access to regional transit services	🟣🟣🟣🟣🟣🟣🟣🟣
TRANSIT	Shortest possible transit travel time between Balboa Park and Downtown	🟡🟣🟡
TRANSIT	Increase propensity of Balboa Park visitors/employees to use transit	🟣🟣🟡🟣
TRANSIT	Improve transit/pedestrian link between Balboa Park and Downtown	🟣🟣🟣🟡🟡🟣🟣🟣
TRANSIT	Alignment is conducive to future extension and expansions	🟣🟣🟡🟡🟡🟡🟡🟣🟣
BALBOA PARK	Proximity of streetcar to Balboa Park attractions	🟣🟣🟣🟣🟣🟣🟣
BALBOA PARK	Retain Balboa Park core parking spaces	🟣🟣🟣
BALBOA PARK	Retain Park Blvd. on-street parking adjacent to Balboa Park	🟣🟣
BALBOA PARK	Reduction of traffic into and around Balboa Park	🟣🟡🟡🟡🟡
BALBOA PARK	Maintain current Balboa Park street capacity (i.e., 4 lanes on Park Bl., etc.)	🟣🟡
BALBOA PARK	Maintain historical character of Balboa Park	🟣🟣🟣🟡🟡
BALBOA PARK	Keep streetcars out of center of Balboa Park	
BALBOA PARK	Bring streetcars into center of Balboa Park	🟣🟣🟡
BALBOA PARK	Retain as much greenspace, trees, and landscaping as possible	🟣🟣🟡🟡
DOWNTOWN	Good City College Trolley Station area transit and pedestrian circulation	🟡
DOWNTOWN	Preservation of Downtown on-street parking spaces	🟣
DOWNTOWN	Preservation of Downtown green space	🟣
DOWNTOWN	Maintain existing Downtown street capacity (i.e., four lanes on Park Blvd., etc.)	🟡
DOWNTOWN	Reduction of traffic into and around Downtown	🟣
DOWNTOWN	Connections of streetcar to Downtown attractions	🟣🟣🟡
DOWNTOWN	Extension of 'Park-to-Bay' street section (sidewalk width, bike lanes, etc.)	🟡
FUNDING	Minimize streetcar capital/construction cost	🟡🟡
FUNDING	Minimize streetcar operating cost	🟡
FUNDING	Maximize opportunities for future private investment	🟡🟡🟣

🟣 = Dot placed by Balboa Park institution 🟡 = Dot placed by Downtown institution

Figure A-2: Steering Committee Evaluation of Priorities

City/Park Streetcar Feasibility Study

June 14, 2011 Steering Committee Exercise | Results

		Agree ← Place a 'X' in the box to select your response				→ Disagree	
		5	**4**	**3**	**2**	**1**	**COMMENTS**
1.	It is desirable to design the streetcar infrastructure to accommodate light rail (Trolley) service in the future, as included in the 2050 RTP.	50%	20%	30%	0%	0%	• Very different types of services. • Why rail instead of bus? Far more flexible, less bicycle issues.
2.	It is desirable to design the streetcar infrastructure to tie-in to future extensions desired by adjacent communities.	45%	36%	9%	9%	0%	• Yes- tie into downtown system as a possible loop. • Where the destination value? Continue to Adams Avenue.
3.	Longer waits at traffic signals to accommodate exclusive streetcar phases are acceptable. Cycle times could increase by 30-45 seconds at some intersections.	36%	27%	27%	9%	0%	• Focus on moving people rather than vehicles. • The goal should be to improve traffic flow overall.
4.	The pedestrian bridge over Park Blvd. at El Prado is a historical feature that should be retained.	0%	27%	9%	18%	45%	• May be historic but something better could be a replacement. • Very problematic with HRB (Historic Resource Board). • It need to go not really historic. • That bridge is not historic. A bridge is important.
5.	Using historic cars would be a value to the City/Park streetcar line and to Balboa Park, even if there are some design trade-offs and/or higher costs.	0%	30%	10%	30%	30%	• No opinion. • I suggest the modern features and high capacity but perhaps a vintage look.
6.	Left turns across Park Blvd. could be eliminated at lower volume intersections to reduce conflicts with streetcars (possibly Space Theater Way, Inspiration Pt. Way, etc.).	27%	36%	9%	18%	9%	• Again moving people vs. vehicles. • Proper the modern vehicle for ADA operational issues. • Problematic for patrons visiting DRP headquarters and activity center.
7.	A streetcar spur along Presidents Way to Pan American Plaza would be worth the loss of parking on Presidents Way and some potential loss of parking in Pan American Plaza.	27%	36%	9%	9%	18%	• Yes, street move vehicles not to store them. • Depends on where it extends downtown (ridership demographics) and park tram. • Spurs are $ intensive. • It doesn't appear to be a long enough spur to be worth the cost -
8.	It is preferable to have streetcars running in the left lanes with stations located in the median on Park Blvd.	20%	10%	30%	20%	20%	• Seems like a very challenging pedestrian circulation pattern. • Best solution. • As long as red cross traffic interrupting flow is limited.
9.	It is preferable to have streetcars running in the right lanes with curbside stations.	30%	20%	20%	10%	20%	• Most accommodate bike lane even if parking is lost. See # 7. • Need to avoid bicycle conflicts.

Figure A-2 (cont'd.): Steering Committee Evaluation of Priorities

City/Park Streetcar Feasibility Study
June 14, 2011 Steering Committee Exercise

			Agree ⟵ Place a 'X' in the box to select your response ⟶ Disagree					
			5	4	3	2	1	COMMENTS
↑	10a.	Some reduction in the width of the median to accommodate a streetcar could be acceptable **NORTH OF I-5** (Balboa Park).	64%	27%	9%	0%	0%	• Ambivalent.
↑	10b.	Some reduction in the width of the median to accommodate a streetcar could be acceptable **SOUTH OF I-5** (Downtown).	73%	9%	18%	0%	0%	
↑	11a.	Widening of Park Blvd. to accommodate streetcar, station platform, bike lane, and bay-to park-pedestrian link could be acceptable **NORTH OF I-5** (Balboa Park).	55%	18%	18%	9%	0%	• Depends on level of impact and serviced benefit.
↑	11b.	Widening of Park Blvd. to accommodate streetcar, station platform, bike lane, and bay-to park-pedestrian link could be acceptable **SOUTH OF I-5** (Downtown).	50%	20%	30%	0%	0%	• Depends on level of impact and derived benefit. Parking on-street should not be sacred.
↑	12a.	Minor loss of parking (15% or less) on Park Blvd. to accommodate the streetcar alignment or stations could be acceptable **NORTH OF I-5** (Balboa Park).	64%	27%	0%	9%	0%	• On-street parking not sacred.
↑	12b.	Minor loss of parking (15% or less) on Park Blvd. to accommodate the streetcar alignment or stations could be acceptable **SOUTH OF I-5** (Downtown).	73%	0%	18%	9%	0%	• On-street parking not sacred.
↑	13.	Eliminating the left turn from northbound Park Blvd. onto northbound 163 would be acceptable to make the streetcar work across I-5.	27%	27%	27%	18%	0%	• Depends on traffic study, should be okay. • Don't believe the mass transit volume will counter the need.
→	14.	Extending the tracks to Morley Field Dr. for a historical car is worth the loss of some landscaping/trees/grass near the Veterans Mem. Bldg. and a small amount of Zoo parking.	27%	9%	27%	27%	9%	• Depends on impacts.

A.2 Community Outreach

A community outreach meeting was held in June 2011 to solicit input from other community members, and was attended by approximately fifty people. In order to accommodate those who could not attend the meeting, MTS conducted an online survey in July 2011 that asked respondents the same questions from the meeting. MTS gathered approximately 35 responses from meeting attendees and 95 responses from the online survey. The combined results of the surveys are listed below in Table A-2.

To promote these efforts, materials from the Steering Committee and community outreach meetings were placed on a City/Park Streetcar Feasibility Study webpage on the MTS website. In addition, MTS used flyers along bus stops on Park Boulevard, online multimedia tools, and press opportunities to advertise the June 2011 public outreach meeting and online survey.

Finally, MTS prepared a plan for outreach to Limited English Proficiency (LEP) persons who could be affected by the project. Project materials such as the community outreach flyer, the MTS webpage for the project, and the public survey were produced in both English and Spanish in order to fulfill the LEP Plan for this study.

Table A-2: Community Survey Response Summary

#	Percent	Response
1	**46.2**	**Median isn't necessary, can be used for streetcar or other need**
	27.3	Okay to reduce width of median a bit (5-8 feet)
	9.8	Leave median as-is (reduces streetcar options) or No Opinion
2	**53.2**	**Okay to expand the street into park areas to allow bike lanes and streetcar**
	36.0	Streetcar project should be modified (at a higher cost) for future bike lanes
	7.2	Project does not need to account for future bike lanes
3	**24.6**	**Okay to remove most of the on-street parking along Park Boulevard**
	24.6	**Okay to remove all on-street parking from one side of Park Boulevard**
	21.0	On-street parking is not important along Park Boulevard
	20.3	Okay to remove up to 30% of the on-street parking along Park Boulevard
4	**47.7**	**Okay to remove a minimum number of left turns as necessary**
	35.6	Prioritize the streetcar design over left turns
	13.6	Keep all left turns open, even if it impacts the design or cost of a streetcar
5	**51.2**	**Prioritize streetcar design over auto travel time**
	44.0	Short auto delays are okay to accommodate a streetcar
	4.8	A streetcar is not worth longer auto delays
6	**75.4**	**It is very important to design this project to be able to expand into a larger network serving other communities. This could impact vehicle type, station locations, and space needed.**
	19.7	It is somewhat important to design this project to be able to expand
	4.9	It is not at all important to design this project to be able to expand

Table A-3 (cont'd.): Community Survey Response Summary

#	Percent	Response
7	**45.2**	**It is very important to design this project for later conversion to full LRT/trolley line. This could require more park space and/or remove a traffic lane or parking.**
	33.9	It is somewhat important to design this project for later conversion to full LRT/trolley line
	20.9	It is not at all important to design this project for later conversion to full LRT/trolley line
8	**44.5**	**I like the vintage streetcar vehicles because of historical charm**
	26.8	I like the vintage streetcar vehicles because of their local availability
	17.7	I like the vintage streetcar vehicles because of their more compact size
9	**31.9**	**I like the modern streetcar vehicles because of their easy integration with the current LRT/trolley system**
	25.1	I like the modern streetcar vehicles because of their low-floor access
	19.9	I like the modern streetcar vehicles because of the availability of additional cars
10	**31.4**	**Cost and fares should be a minor consideration**
	31.4	**Cost and fares should be a major consideration, though not the only one**
	17.8	Vehicle type chosen should offer the lowest costs and fares
	13.6	Vehicle choice should not be affected by costs and fares
11	**47.2**	**Accessibility should be a major consideration, though not the only one**
	24.0	Accessibility should be a minor consideration, but not drive a decision
	12.8	As long as the vehicle is minimally accessible it should not be affected by costs and fares
	12.8	The vehicle type with the best accessibility should be chosen
12	**37.5**	**System expandability should be a major consideration, though not the only one, when choosing a vehicle type**
	23.4	The vehicle type best suited for system expansion should be chosen
	30.3	System expandability should be a minor consideration, but not drive a decision on vehicle type

Note: Not all items add to 100% due to non-responses to some survey questions.

APPENDIX B: UTILITY AND TOPOGRAPHIC MAPS

The following utility and topographic maps are provided for detailed segments of the proposed alignment.

Figure B-1: Existing Utilities (North Segment)

Figure B-2: Existing Utilities (Central Segment)

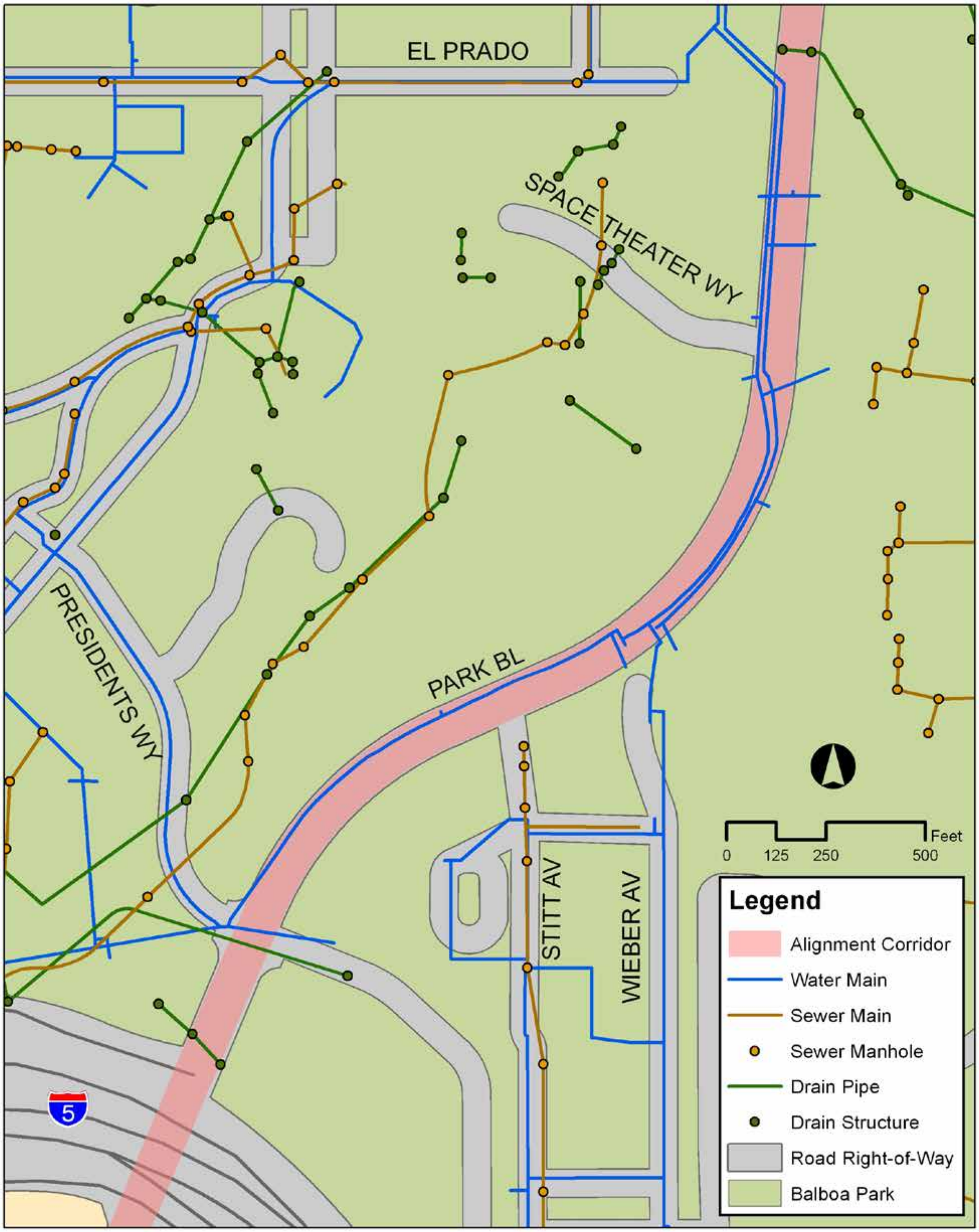


Figure B-3: Existing Utilities (South Segment)

Figure B-4: Existing Topography (North Segment)

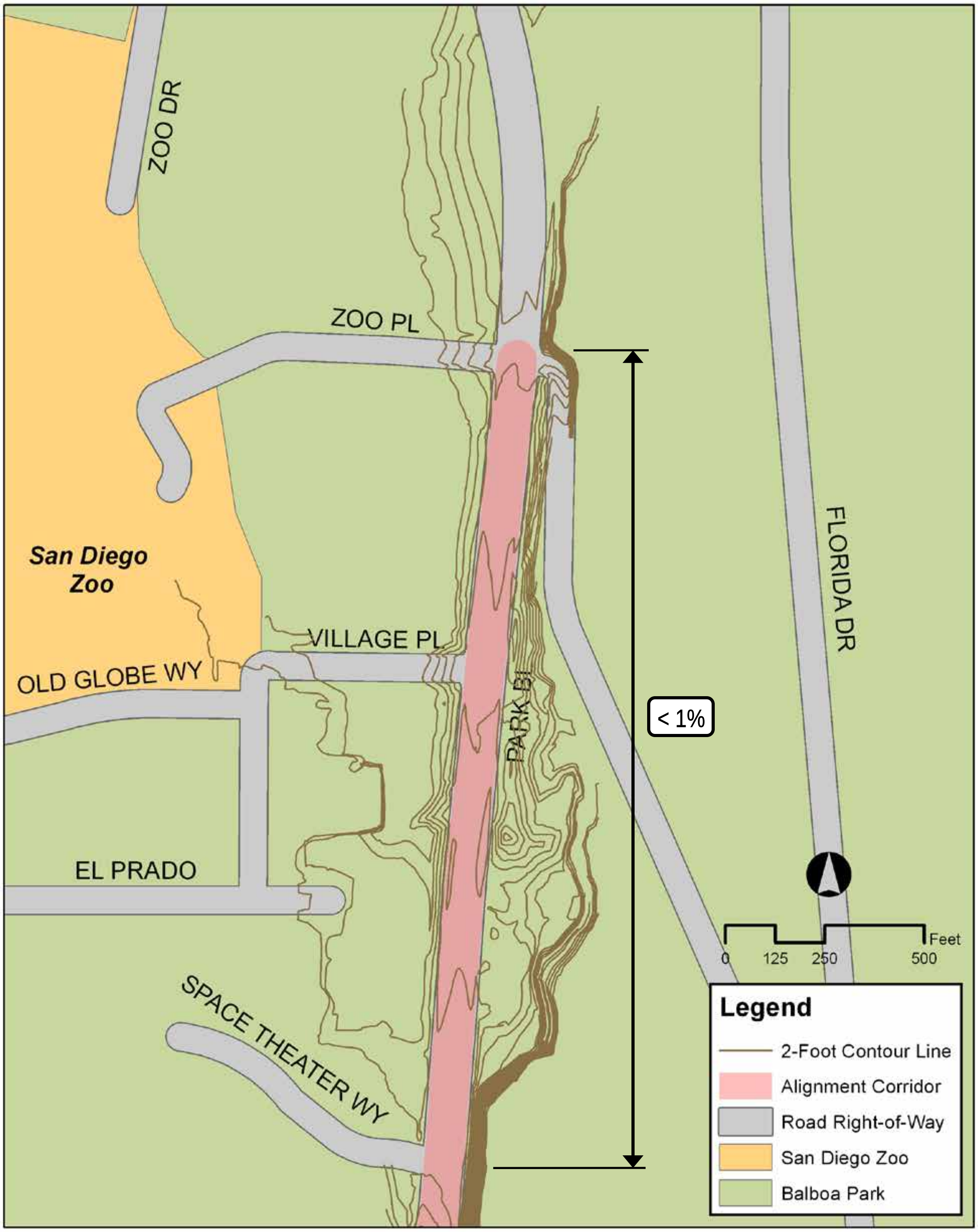


Figure B-5: Existing Topography (Central Segment)

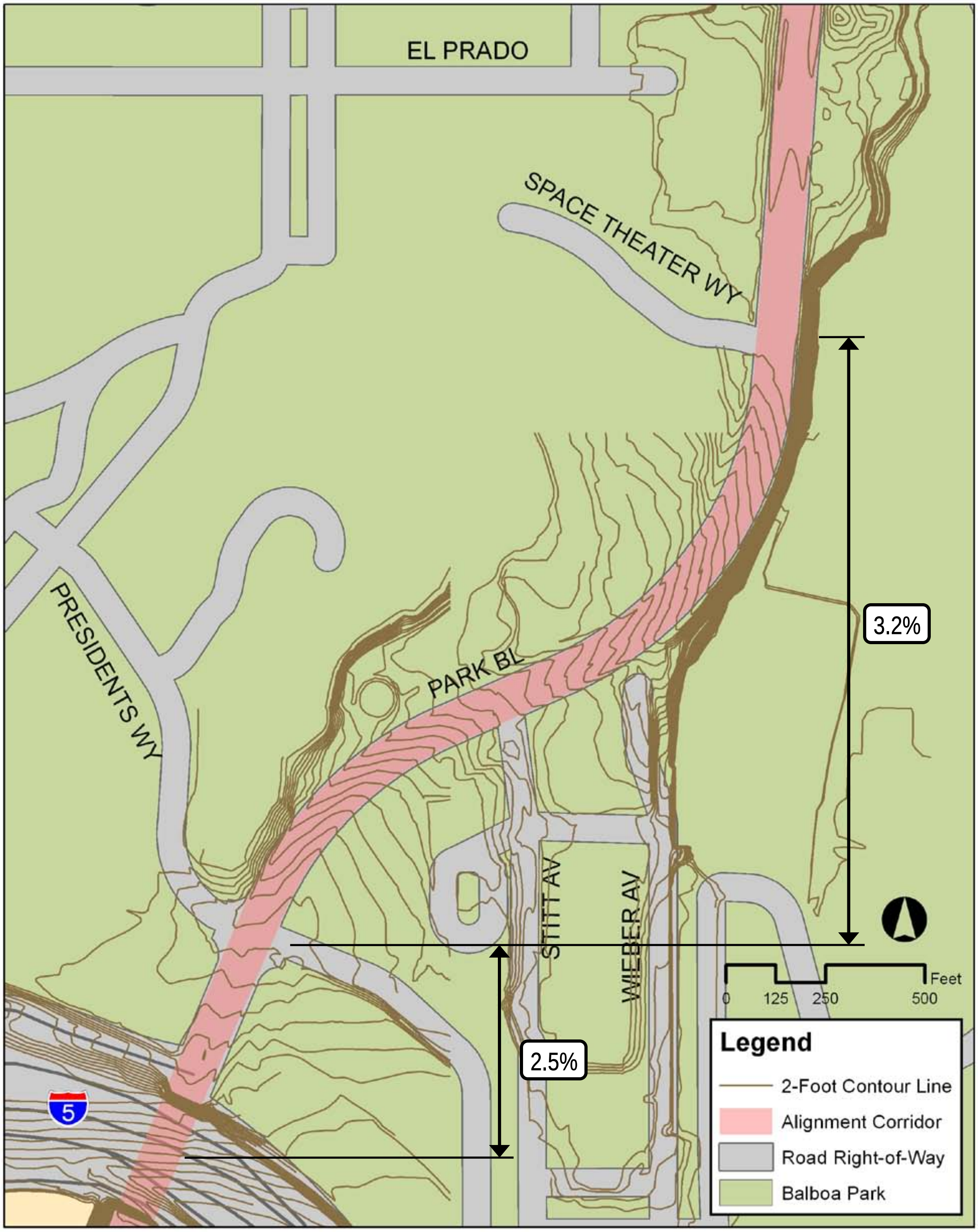
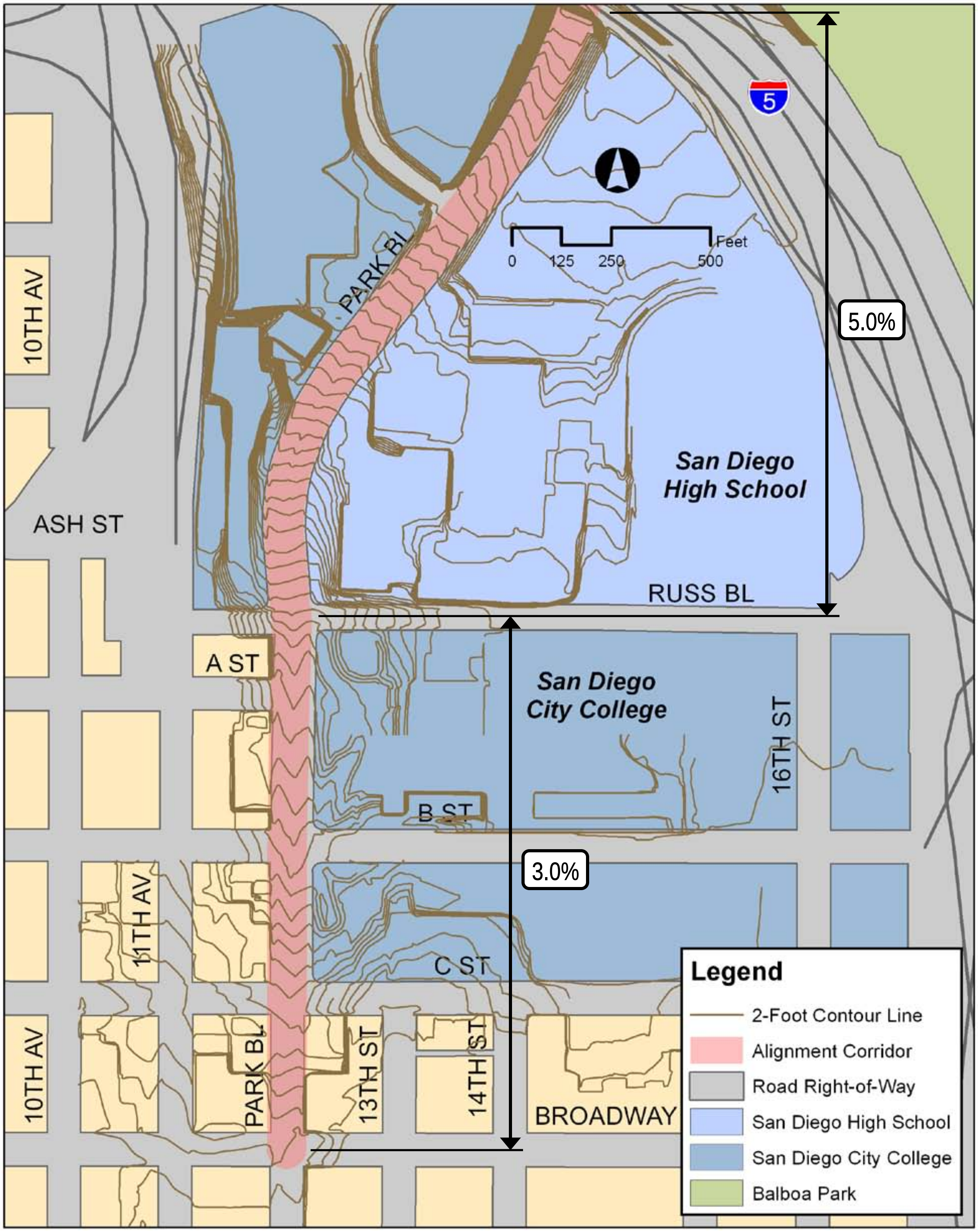


Figure B-6: Existing Topography (South Segment)



APPENDIX C: PLANNED BICYCLE FACILITIES

Figure C-1, taken from the City of San Diego Bicycle Master Plan, shows the Class II bicycle facility recommended for Park Boulevard. It is ranked seventh on the plan's "high-priority" project list.

Figure C-1: Bicycle Master Plan High-Priority Project 7: Park Boulevard from Upas Street to Broadway

Project Description

This project serves bicycle demands between the communities of North Park, Balboa Park, and Centre City by providing Class II bicycle facilities along Park Boulevard from Upas St. to B St. and Class III facilities from B St. to Broadway. This high priority project is nearly two miles long and connects the relatively dense residential neighborhoods of Hillcrest and North Park to key downtown land uses and recreational and cultural land uses in Balboa Park. This bike facility provides connections to local bus Routes 7 and 923 and the Blue Line and Orange Line City College trolley station.

In order to provide the necessary space for Class II bike facilities, it would be necessary to narrow the width of existing raised median by 2 feet on each side along Park Blvd between Upas and B Streets, including removing the entire median portion between Upas St. and Zoo Pl. There are no anticipated parking impacts associated with this project.

Bicycling issues along this project corridor include travel speeds of approximately 40 mph, a difficult freeway crossing at I-5, and difficult topography on the north side of I-5. This segment had 13 reported bike crashes from 2002-2007.

This high priority project ranked 7th with an average weighted prioritization score of 32.5 points.

Proposed Improvements

▪ Remove traffic striping along Park Boulevard to accommodate Class II bike facility	$56,460
▪ Roadside signage on post	$7,250
▪ Class II traffic striping	$36,699
▪ Class II & III pavement markings	$12,000
▪ Install concrete curb	$575,440
▪ Bicycle detector loops	$9,600
▪ Street lighting	$294,000
▪ Other construction related costs	$1,702,484

Cost

$2,693,933

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APPENDIX D: ALIGNMENT CONCEPT EVALUATION MATRIX

The evaluation matrix below provides a detailed overview of the implementation feasibility and corridor issues for each alignment concept described in Section 6.

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Legend:
0 Does Not Apply
1 Low
2 Medium

Table D-1: Alignment Concept Evaluation Matrix

ENGINEERING FEASIBILITY	Option 1	Option 1	Option 3	Option 4	General Comments
Interstate 5 Bridge					
Minimize impacts to the existing bridge crossing over Interstate 5	Transition to median leading to bridge will require greater horizontal distance to reach the median. Priority treatment at two intersections are required at Presidents way and Interstate 5 on-off ramp south of the bridge.			Transition to median running alignment in bridge section will require less horizontal distance. Will require priority treatment at two intersections	
SCORE	0	0	0	0	
Utilities					
Minimize impacts to existing above and below grade utilities	No significant impacts on below grade utilities. Intial review of existing GIS utilites plans show no utilities in Park Blvd. from Russ Street north to Zoo Place. There are above grade utilites consisiting primarily of street lights and should present no issues for implemtation. Further study will be needed south of Russ Street to locate sewer and storm drain lines which may need to be relocated. All options have the same issues relating to existing utilities.				
SCORE	0	0	0	0	
R.O.W. Requirements					
Minimizes the need for additional right-of-way	Additional right-of way would be required at least 9-feet total to allow for the Class 2 bike lane. Maybe less would be neeeded if reduction of median is permitted to accomadate the bike lane.			Additional right-of way would be required at least 10.0' to include Class 2 bike lane. Maybe less if reduction of median is permitted	Only option 4 eliminates the need to expand the right-of-way. However, if a "Sharrow" approach to the bike lane is permitted then option 4 could accommodate bikes with a reduction of the median
SCORE	3			2	
Vehicles					
Most flexible in vehicle types serving the alignment	The right side running lane would allow for both single sided and double side type vehicles			Only double sided - double ended vehicles can be used in this option	Vintage vehicles would be restricted to right running lanes and would not be able to operate in a left lane (median lane) option.
SCORE	3			2	
Track Miles					
Minimizes the length of track needed for operations include turn-around requirements for single ended/single sided vehicles	The length of track is primarily the same in all options and will only be modified based on the turn around option used at the south end for a single sided / single ended vehicle. There are no advantages for track length by any of the alternatives, rather it is based more on the vehicle choosen to serve the corridor.				
SCORE	0	0	0	0	
Platform Requirements					
Minimizes implementation and maintenance cost for proposed station platforms	The station platform will be adjacent to the parkway and			Platform is in the median and can be shared by both north and south bound vehicles. Reduces implementation and maintenacnce cost by only needing one set of platform improvements and site features. Does not eliminate on-street parking. Platform length will depend more on the vehicle type than location	Option 1 is the most suitable when dealing with platform requirements
SCORE				3	
ENGINEERING SUBTOTAL	**6**	**0**	**0**	**7**	

OPERATIONAL FEASIBILITY	Option 1	Option 2	Option 3	Option 4	General Comments
On-Street Parking Conflicts					
Minimizes the number of on-street parking spaces eliminated	Minimal parking lost due to station platform location. Several stations are located in existing "red curb" areas where parking is not allowed.			With the median side running option there are no on-street parking eliminated	
SCORE				3	
Bicycle Conflicts					
Minimizes conflicts with existing and proposed bicycle improvemets. Increases saftey and enhances connectivity	Proposed Class 2 bike lane would be adjacent to the streetcar track. While not ideal, this relationship occurs in other cities . A greater seperation between bikes and tracks are univerally preferred such as center-running or left running streetcar tracks. Behind the station platform detours will be required which works well for uphill or flat terranin but not for downhill stations.			The location of the tracks adjacent to the median minimized potential bicycle conflicts	
SCORE				3	
Pedestrian Conflicts					
Minimizes conflicts with existing and proposed pedestrain improvemets. Increases saftey and enhances connectivity	Right side running tracks allow for stations to be adjacent to the pedestrain sidewalks in parkway. Crossing would typically be at signalized intersection. Mid-block crossing should have pedestrian activated signals.			The median platforms requires passengers to cross travel lanes to reach sidewalks,activity centers, or the stations. Opportunity to enhance sidewalks for "Bay to Park" link is possible	
SCORE	3			1	
Existing Street Compatibility					
Minimizes vehiclluar conflicts at intersection and turn movement	Most stations will be located on far-side of intersection and in the right lane. The left side travel lane would allow for thru traffic. At least three (3) intersection would require			Reduces left turn acess at several intersections No impact on right-turn movements	
SCORE				3	
Station Location					
Stations are located at key activity centers. Serves other regional transit connections	Station locations for all four (4) alternative are the same and are situated to take advantage of the existing activity centers.				
SCORE	0	0	0	0	
Sub-station Requirements					
Minimizes the number of sub-stations required Location of sub-stations has minimal impact	Three (3) sub-station are required for all four (4) options. The location for the substations would also be the same for any of the options.				
SCORE	0	0	0	0	
Ridership Potential					
Maximizes the ridership opportunities	All four alternative would have the same ridership potential and in each one of the alternataive the location of the stations are similar and would play a simiar role in attracting ridership.				
SCORE	0	0	0	0	
Headway Requirements					

OPERATIONAL FEASIBILITY	Option 1	Option 2	Option 3	Option 4	General Comments
Provides the most flexible headway frequencies/options	The effect on headway requirements has more to do with the vehicle types and the turn-around requirements than the placement of the track or the location of the stations. If a single ended/sided vehicle is used the turn-around requirement could require a greater distance and as such influence the headway requirements				
SCORE	0	0	0	0	
Traffic Conflicts					
Minimizes the number of intersection conflicts and other traffic movements. *Potential to relieve congestion*	Same as Street Compatabilty?			Same as Street Compatabilty?	
SCORE	0	0	0	0	
OPERATIONAL SUBTOTAL	**3**	**0**	**0**	**10**	
COST FEASIBILITY	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**General Comments**
Capital Cost					
Low initial capital cost *Hghest potential for private investment*					
SCORE	0	0	0	0	
Operational Cost					
Low operational cost; funding sources; partnering sources					
SCORE	0	0	0	0	
Cost Effectiveness					
Total cost per new rider is low. *Total cost per passenger mile*					
SCORE	0	0	0	0	
COST SUBTOTAL	**0**	**0**	**0**	**0**	
OTHER FEASIBILITY	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**General Comments**
Systems Intergration					
Integration w/ bus and trolley				All the options could intergrate into the trolley system... overlap of bus service siphon off ridership	
SCORE	0	0	0	0	
Expansion to Future Systems					
Alignment can expand into larger streetcar network				All the options appear to be able to expand into a larger system	
SCORE	0	0	0	0	
Integration into Balboa Park					
				Not sure this is needed	
SCORE	0	0	0	0	
Visual Impact					
Minimizes visual impacts or issues					
SCORE	0	0	0	0	
Environmental Issues					
Minimizes environmental issues					
SCORE	0	0	0	0	
Consistency with Planning Documents					
Option is consistant with CiSD and SANDAG				Consistent with all planning documents	
SCORE				3	
Economic Development Opportunities					
Maximizes economic development along the corridor					
SCORE	0	0	0	0	
Stakeholder items					
Option address many of the Stakeholder issues					
SCORE	0	0	0	0	
Known Issues/Advantages					
SCORE	0	0	0	0	
OTHER SUBTOTAL	**0**	**0**	**0**	**3**	
TOTAL SCORE	**9**	**0**	**0**	**20**	
	Option 1	**Option 2**	**Option 3**	**Option 4**	

Alt. 1: Right side running lane with on-street parking and bike lane

Requires: 112' -right of way (existing right-of-way 103'). Requires an additonal 9-feet (4.5' of each side) of right of way to accomadate new bike lane.

Description:
In both direction this option provides:
Two travel lanes in each direction. The right side travel lane is a 12'-wide mixed flow lane allowing for the streetcar and other general purpose vehicles.
The left side 11' travel lane could transition to exclusive LRT lane of 12' (capturing 1' from the median);
7' wide class 2 bike lane;
7-' wide on-street parking lane and; a
10'- parkway . Note parkway may increase to allow for wider "Bay to Park" link.

Alt. 2: Right side running w/ on-street parking

Requires: 134' -right of way (existing right-of-way 103'). An additonal 31' of right-of-way required.

Description:
In both directions this option provides:
Two (2) general purpose travel lanes of 11'. The left side 11' travel lane could transition to exclusive LRT lane of 12' (capturing 1' from the median);
One (1) exclusive streetcar / transit lane (right side running) of 12' ;
7' wide Class 2 bike lane;
7' wide on-street parking lane; and a
10'- wide parkway. Note parkway may increase to allow for wider "Bay to Park" link.

Alt. 3: Right side running w/ no on-street parking

Requires: 116' -right of way (existing right-of-way 103'). An additonal 13' of right-of-way required. May not be feasible south of C Street

Description:
In both directions this option provides:
Two (2) general purpose travel lanes of 11'. The left side 11' travel lane could transition to exclusive LRT lane of 12' (capturing 1' from the median);
One (1) exclusive streetcar / transit lane (right side running) of 12' ;
5' wide Class 2 bike lane; and a
10'- wide parkway. Note parkway may increase to allow for wider "Bay to Park" link.

Alt. 4: Left side running w/ bike lane

Requires: 112' -right of way (existing right-of-way 103'). An additonal 9' of right-of-way required.

Description:
In both directions this option provides:
Two (2) travel lanes - The left lane is 12' wide and is a mixed flow lane with the streetcar. The other lane is a general purpose lane of 11';
7' wide Class 2 bike lane;
7' wide on-street parking lane; and a
10'- parkway. Note parkway may increase to allow for wider "Bay to Park" link.

APPENDIX E: PLANNED DEVELOPMENT AT PARK BOULEVARD AND C STREET

Figure E-1 shows the approved development plan for a mixed-use residential project at Park Boulevard and C Street. Known as "13 & C," this project's development permit was extended by the city in November 2011. However, the project has not moved beyond the permitting stage in several years and its ultimate completion remains in question.

Figure E-1: Planned Development at Park Boulevard & C Street

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APPENDIX F: BALBOA PARK FACILITY OPERATING HOURS

Balboa Park's various institutions and attractions were surveyed to determine the daily hours when the public or other primary users are allowed access. These operating hours are shown below in Table F-1. It should be noted that these are the public hours of operation; many employees are likely to arrive before the opening time and leave after the closing time.

Table F-1: Balboa Park Facility Operating Hours

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
BALBOA PARK INSTITUTIONS							
Centro Cultural de la Raza	Closed	12 p.m. – 4 p.m.	12 p.m. – 4 p.m.	12 p.m. – 4 p.m.	12 p.m. – 4 p.m.	12 p.m. – 4 p.m.	12 p.m. – 4 p.m.
Marston House	Closed	Closed	Closed	Closed	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.
Mingei International Museum	Closed	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.
Museum of Photographic Arts	Closed	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m.– 5 p.m.	10 a.m. – 5 p.m.	10 a.m.– 5 p.m.
Reuben H Fleet Science Center	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 8 p.m.	10 a.m. – 7 p.m.	10 a.m. – 6 p.m.
San Diego Air & Space Museum	10 a.m. – 5:30 p.m.	10 a.m. – 5:30 p.m.	10 a.m. – 5:30 p.m.	10 a.m. – 5:30 p.m.	10 a.m. – 5:30 p.m.	10 a.m. – 5:30 p.m.	10 a.m. – 5:30 p.m.
San Diego Art Institute	Closed	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	12 p.m. – 4 p.m.
San Diego Automotive Museum	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.
San Diego Hall of Champions	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.
San Diego History Center	Closed	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.
San Diego Model Railroad Museum	Closed	11 a.m. – 4 p.m.	11 a.m. – 4 p.m.	11 a.m. – 4 p.m.	11 a.m. – 4 p.m.	11 a.m. – 5 p.m.	11 a.m. – 5 p.m.

BALBOA PARK FACILITY OPERATING HOURS

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
San Diego Museum of Art	Closed	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	12 p.m. – 5 p.m.
San Diego Museum of Man	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.
San Diego Natural History Museum	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.	10 a.m. – 5 p.m.
San Diego Zoo	9 a.m. – 5 p.m. (6 p.m./9 p.m. in summer)	9 a.m. – 5 p.m. (6 p.m./9 p.m. in summer)	9 a.m. – 5 p.m. (6 p.m./9 p.m. in summer)	9 a.m. – 5 p.m. (6 p.m./9 p.m. in summer)	9 a.m. – 5 p.m. (6 p.m./9 p.m. in summer)	9 a.m. – 5 p.m. (6 p.m./9 p.m. in summer)	9 a.m. – 5 p.m. (6 p.m./9 p.m. in summer)
Timken Museum of Art	Closed	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	10 a.m. – 4:30 p.m.	130 p.m. – 4:30 p.m.
Veterans Museum & Memorial Center	Closed	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.	10 a.m. – 4 p.m.
WorldBeat Center	Varies	Varies	Varies	Varies	Varies	Varies	Varies
OTHER INSTITUTIONS							
Naval Medical Center San Diego	24 hours	24 hours	24 hours	24 hours	24 hours	24 hours	24 hours
San Diego City College (subject to change)	6:10 a.m. – 10 p.m.	6:10 a.m. – 10 p.m.	6:10 a.m. – 10 p.m.	6:10 a.m. – 10 p.m.	6:10 a.m. – 10 p.m.	7 a.m. – 5 p.m.	Closed
San Diego High School	7:30 a.m. – 2:28 p.m.	7:30 a.m. – 2:28 p.m.	7:30 a.m. – 2:28 p.m.	7:30 a.m. – 2:28 p.m.	7:30 a.m. – 2:28 p.m.	Closed	Closed

APPENDIX G: SAMPLE SCHEDULING AND OPERATING COSTS

Table G-1 is a sample run-time matrix based on the operations plan in Section 6. It provides for a fifteen-minute service frequency between 8:00 a.m. and 6:00 p.m. and requires two vehicles in operation.

Table G-1: Sample Scheduling Matrix

OPTION 1 PARK & C - BALBOA PARK: Double Cab **NORTHBOUND / SOUTHBOUND**

MONDAY-FRIDAY SCHEDULE

	SCHED NO.	Park Blvd. & C Street DEPART	Park Blvd. & Presidents Way	Park Blvd. & Zoo Place ARRIVE	Park Blvd. & Zoo Place DEPART	Park Blvd. & Presidents Way	Park Blvd. & C Street ARRIVE	Lay-over Time	Run Time	Depart Time
	RunTime	8a-10a	5	4	3	4	4		20	
		10a-3p	5	6	1	5	4		21	
		3p-6p	5	5	2	6	5		23	
								Layover	Run	Dep
HDWY	SC01	8:00	8:05	8:09	8:12	8:16	8:20	0:10	0:20	8:30
0:15	SC02	8:15	8:20	8:24	8:27	8:31	8:35	0:10	0:20	8:45
0:15	SC01	8:30	8:35	8:39	8:42	8:46	8:50	0:10	0:20	9:00
0:15	SC02	8:45	8:50	8:54	8:57	9:01	9:05	0:10	0:20	9:15
0:15	SC01	9:00	9:05	9:09	9:12	9:16	9:20	0:10	0:20	9:30
0:15	SC02	9:15	9:20	9:24	9:27	9:31	9:35	0:10	0:20	9:45
0:15	SC01	9:30	9:35	9:39	9:42	9:46	9:50	0:10	0:20	10:00
0:15	SC02	9:45	9:50	9:54	9:57	10:01	10:05	0:10	0:20	10:15
0:15	SC01	10:00	10:05	10:11	10:12	10:17	10:21	0:09	0:21	10:30
0:15	SC02	10:15	10:20	10:26	10:27	10:32	10:36	0:09	0:21	10:45
0:15	SC01	10:30	10:35	10:41	10:42	10:47	10:51	0:09	0:21	11:00
0:15	SC02	10:45	10:50	10:56	10:57	11:02	11:06	0:09	0:21	11:15
0:15	SC01	11:00	11:05	11:11	11:12	11:17	11:21	0:09	0:21	11:30
0:15	SC02	11:15	11:20	11:26	11:27	11:32	11:36	0:09	0:21	11:45
0:15	SC01	11:30	11:35	11:41	11:42	11:47	11:51	0:09	0:21	12:00
0:15	SC02	11:45	11:50	11:56	11:57	12:02	12:06	0:09	0:21	12:15
0:15	SC01	12:00	12:05	12:11	12:12	12:17	12:21	0:09	0:21	12:30
0:15	SC02	12:15	12:20	12:26	12:27	12:32	12:36	0:09	0:21	12:45
0:15	SC01	12:30	12:35	12:41	12:42	12:47	12:51	0:09	0:21	13:00
0:15	SC02	12:45	12:50	12:56	12:57	13:02	13:06	0:09	0:21	13:15
0:15	SC01	1:00	1:05	1:11	1:12	1:17	1:21	0:09	0:21	1:30
0:15	SC02	1:15	1:20	1:26	1:27	1:32	1:36	0:09	0:21	1:45
0:15	SC01	1:30	1:35	1:41	1:42	1:47	1:51	0:09	0:21	2:00
0:15	SC02	1:45	1:50	1:56	1:57	2:02	2:06	0:09	0:21	2:15
0:15	SC01	2:00	2:05	2:11	2:12	2:17	2:21	0:09	0:21	2:30
0:15	SC02	2:15	2:20	2:26	2:27	2:32	2:36	0:09	0:21	2:45
0:15	SC01	2:30	2:35	2:41	2:42	2:47	2:51	0:09	0:21	3:00
0:15	SC02	2:45	2:50	2:56	2:57	3:02	3:06	0:09	0:21	3:15
0:15	SC01	3:00	3:05	3:10	3:12	3:18	3:23	0:07	0:23	3:30
0:15	SC02	3:15	3:20	3:25	3:27	3:33	3:38	0:07	0:23	3:45
0:15	SC01	3:30	3:35	3:40	3:42	3:48	3:53	0:07	0:23	4:00
0:15	SC02	3:45	3:50	3:55	3:57	4:03	4:08	0:07	0:23	4:15
0:15	SC01	4:00	4:05	4:10	4:12	4:18	4:23	0:07	0:23	4:30
0:15	SC02	4:15	4:20	4:25	4:27	4:33	4:38	0:07	0:23	4:45
0:15	SC01	4:30	4:35	4:40	4:42	4:48	4:53	0:07	0:23	5:00
0:15	SC02	4:45	4:50	4:55	4:57	5:03	5:08	0:07	0:23	5:15
0:15	SC01	5:00	5:05	5:10	5:12	5:18	5:23	0:07	0:23	5:30
0:15	SC02	5:15	5:20	5:25	5:27	5:33	5:38	0:07	0:23	5:45
0:15	SC01	5:30	5:35	5:40	5:42	5:48	5:53	na	0:23	OOS >
0:15	SC02	5:45	5:50	5:55	5:57	6:03	6:08	na	0:23	OOS >
								5:30	14:16	19:46 HH:MM
								5.50	14.27	19.77 Hours
		Mileage:	*0.70*	*0.80*	*0.00*	*0.80*	*0.70*	3.00	Miles/Round Trip	
	8a-10a	MPH:	8.42	11.97	0.00	11.97	10.52	8.41	MPH (excluding layover)	
	10a-3p	MPH:	8.42	7.98	0.00	9.58	10.52	6.07	Total MPH (including layover)	
	3p-6p	MPH:	8.42	9.58	0.00	7.98	8.42	40.0	Total Trips	
		Trips:	40	40	40	40	40	119.94	Total Daily Miles	
		Total Miles:	28.05	31.92	0.00	31.92	28.05			
	SC01	PARK&C	8:00	17:53	PARK&C	**9:53**				
	SC02	PARK&C	8:15	18:08	PARK&C	**9:53**				
						19:46	**HH:MM**			

Table G-2 shows the operating statistical assumptions used for the operations cost estimates below. Table G-3 and Table G-4 show annual train and car operating data for the San Diego Trolley (FY 2011) alongside projections for the City/Park Streetcar. Finally, Table G-5 contains the San Diego MTS operating rates for FY 2012.

Table G-2: Operating Statistical Assumptions

DAY	Revenue Miles/Day	Annual Days	Annual Revenue Miles			Pull Miles/Day	Annual Pull Miles	Annual Total Miles
Weekday	120.0	255	30,600			4.1	1,046	31,646
Saturday	120.0	53	6,360			4.1	217	6,577
Sunday	120.0	57	6,840			4.1	234	7,074
		365	**43,800**				**1497**	**45,297**

DAY	Revenue Hours/ Day	Annual Days	Annual Revenue Hours	Cost/ Revenue Hour	Annual Cost	Pull Hours/Day*	Annual Pull Hours	Annual Total Hours
Weekday	19.8	255	5,041	$148.74	$749,724	2.0	510	5,551
Saturday	19.8	53	1,048	$148.74	$155,825	2.0	106	1,154
Sunday	19.8	57	1,127	$148.74	$167,585	2.0	114	1,241
		365	**7,215**		**$1,073,134**		**730**	**7,945**

**Pull hours = 30 minutes per block at block start & end*

Table G-3: Annual Train Data, San Diego Trolley (FY 2011) and City/Park Streetcar (Projected)

Annual Train Data	San Diego Trolley (FY2011)	City/Park Streetcar (Projected)
Revenue Miles	3,131,806	43,800
Total Miles	3,156,499	45,297
% Miles Revenue	99.2%	96.7%
Revenue Hours	171,987	7,215
Total Hours	173,701	7,945
% Hours Revenue	99.0%	90.8%

Table G-4: Annual Car Data, San Diego Trolley (FY 2011) and City/Park Streetcar (Projected)

Annual Car Data	San Diego Trolley (FY2011)	City/Park Streetcar (Projected)
Revenue Car Miles	7,397,791	43,800
Total Car Miles	7,435,144	45,297
% Miles Revenue	99.5%	96.7%
Revenue Car Hours	411,822	7,215
Total Car Hours	416,319	7,945
% Hours Revenue	98.9%	90.8%
Train Revenue Miles/Revenue Hour	18.2	6.1
Car Revenue Miles/Revenue Hour	18.0	6.1
Train Total Miles/Total Hour	18.2	5.7
Car Total Miles/Total Hour	17.9	5.7

Table G-5: San Diego MTS Operating Rates, FY 2012

BUS RATES			
	San Diego Transit	**MTS Contract Services Fixed-Route**	
		(Veolia)	**(First Transit)**
Unit of Measure:	*Revenue Hour*	*Revenue Mile*	*Revenue Hour*
Fully Allocated Rate	$119.50	$5.30	$47.75
Variable Rate (Including Overhead)	$97.43		
Variable Rate (Excluding Overhead)	$89.86		
Fixed Route Rate (Contract Rate and Fuel)		$5.10	$46.24
Fixed-Route Rate (Contract only)		$4.72	$34.81
LIGHT RAIL RATES			
	San Diego Trolley		
Unit of Measure:	*Total Mile*	*Revenue Hour*	
Variable Rate (Including Overhead) - Car 1	$7.34	$148.74	
Variable Rate (Including Overhead) - Car 2	$3.14	$0.00	
Variable Rate (Including Overhead) - Car 3	$3.14	$0.00	
Variable Rate (Including Overhead) - Car 4	$3.14	$0.00	