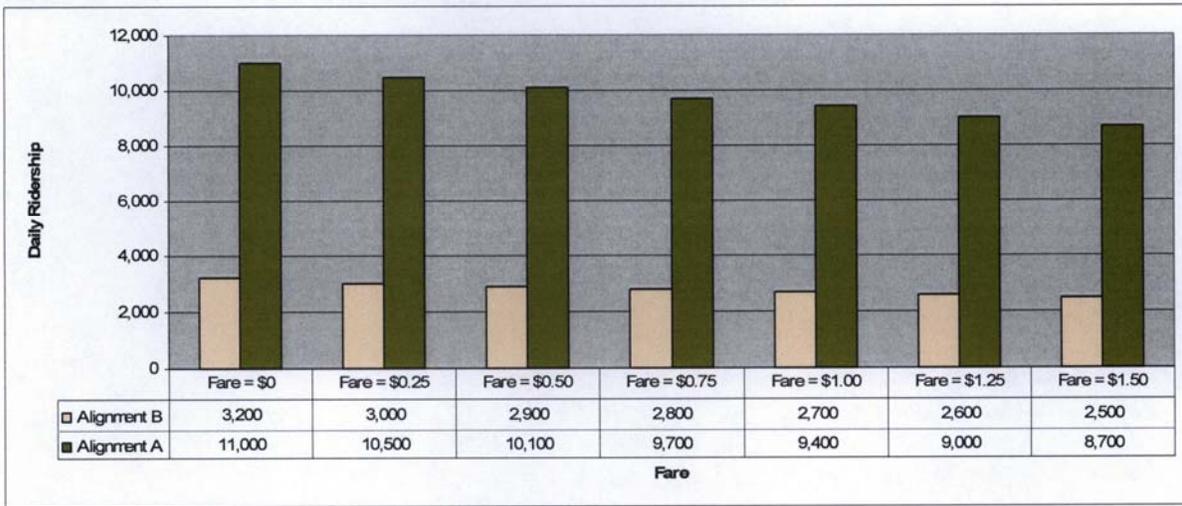


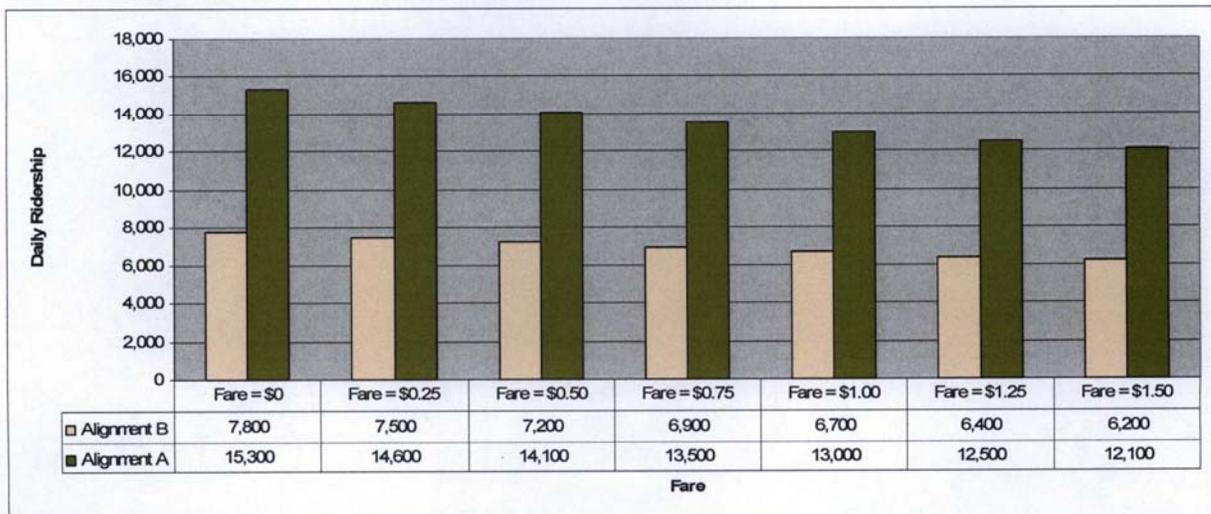


Figure 11. 2010 Ridership Comparison: Alignment A vs. Alignment B



Assumption: Complementary bus service, 10 minutes headway

Figure 12. 2030 Ridership Comparison: Alignment A vs. Alignment B



Assumption: Complementary bus service, 10 minutes headway

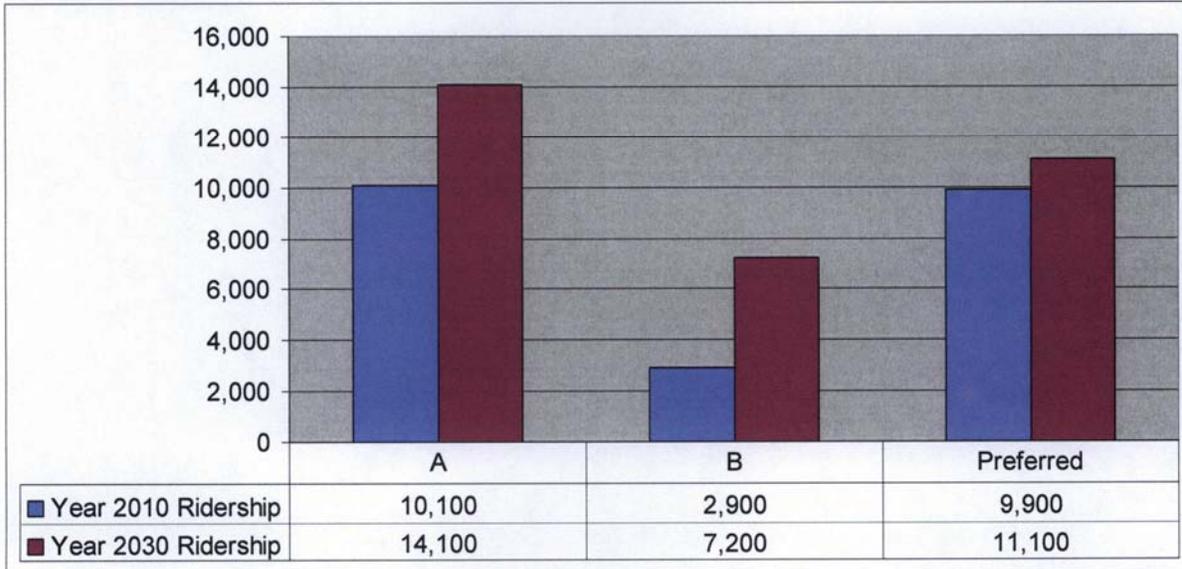
3.3.4 Ridership Estimate for the refined Preferred Initial Alignment

As noted in the Executive Summary and the Introduction to the Report, the team recalibrated ridership estimates for the Preferred Initial Alignment. To revise the estimate, the team used various combinations of Alignments A and B to approximate the Preferred Initial Alignment. For this purpose, the Preferred Initial Alignment consists of the Sacramento side of Alignment A and Alignment B on the West Sacramento side. In addition, the estimate is based on



complementary bus service, ten-minute headways, and a \$0.50 fare. As Figure 13 shows, the estimate is for 11,100 daily riders by 2030, a robust estimate.

Figure 13. Estimated Ridership for the Preferred Initial Alignment



3.4 Opportunities and Constraints

This task identifies and describes significant opportunities that the project may present and constraints the project should avoid, overcome, or reasonably resolve. First, there are opportunities that could enhance the project’s success, lower project costs or contribute to other goals will be described. Such considerations might be available rights-of-way, traditional streetcar track locations, area of prime redevelopment with entitlements in place, areas with high concentrations of pedestrians, and access to alternative funding mechanisms

Secondly, there are constraints that could prevent or negatively impact implementation of the project. Constraints may be geographical or structural issues that can be costly; low overcrossings, surface railroad crossings, and bridges fall into this category. To avoid implementation delays and added project costs, an initial segment should not impose major impacts and avoid obstacles that require expensive solutions.

The opportunities and constraints analysis considers three basic clusters – alignment and operational opportunities and constraints, regulatory constraints, and institutional constraints.

3.4.1 Alignment and Operational Opportunities

There are a myriad of alignment and operational opportunities that accrue to both cities along the for the initial streetcar line. Among the most notable are:

Catalyze and focus redevelopment – One of the documented benefits of streetcars is their ability to stimulate and focus redevelopment. The same opportunities abound in West Sacramento and Sacramento. From west to east, the opportunities include:



- **Downtown West Sacramento** – The area around City Hall, both planned and potential, can support a wide range of added public, civic, and commercial activities that can be served by the streetcar. These activities, including a community college center and senior center, are producers and attractors of streetcar riders. A potential extension further to the west along West Capitol Avenue or Merkley Avenue offers access to significant future redevelopment opportunities.
- **Raley’s Landing and the Triangle** – The initial alignment, following Tower Bridge Gateway and West Capitol Avenue, provides access to these significant and ambitious development and redevelopment locations. The ability to move to and from these destinations via the streetcar will position them uniquely, especially with their attractive riverfront settings.
- **Capitol Mall** – The streetcar reinforces several major mixed use projects along the initial alignment as it moves into downtown. It provides a unique east/west mobility option for current and future residents, employees, and visitors, opening up new patronage potential for West Sacramento and the burgeoning Midtown area of Sacramento.
- **Shopping/Convention Center/K Street** – Sacramento’s premier downtown shopping venue, the Westfield Downtown Plaza, the Convention Center and hotels, and the K Street/Midtown entertainment district are all recipients of focused development. With increased pedestrian activity, existing and new infill retail, service, and food and beverage uses will see more traffic. While these areas are already in place, the attractiveness of these locations becomes more prominent.

3.5 Refine Objectives and Criteria

The purpose of the refinement of the objectives and development of evaluation criteria is to assure that the alternative alignments are properly correlated with and reflective of the project’s P&N and Goals and Objectives. The principal result is a rating or measurement scale for each criterion to be applied after other study elements are prepared. These elements are route studies, service criteria, equipment analysis, ridership and constraints analysis. Once the evaluation criteria were approved by the PSC and TAC, they were applied to overall alignment alternatives and/or individual segments, as were applicable.

3.5.1 Refined Objectives

The refined objectives and evaluation criteria resulted from a review of the Purpose and Need Statement and the initial objectives found there. The refined objectives are:

Mobility and Connectivity

- Enhance connectivity between existing and new downtown housing in both cities and the major employment, commercial, recreational, and cultural activity centers
- Offer a convenient and attractive means of transportation for residents, workers, customers, and visitors



- Improve access and opportunities for all existing and potential transit rider groups
- Enhance access to the riverfront

Sustainable Transit and Development Investments

- Implement a streetcar project that supports the existing and planned built environment
- Capitalize fully on the streetcar's demonstrated powerful placemaking attributes
- Link all possible key destinations in the study area
- Support adopted goals, objectives and plans
- Minimize negative impacts on historic, archaeological, traditional cultural places, parklands, public recreation areas, traffic, and businesses

Efficiency and Effectiveness

- Attract new riders to the local and regional transit system, including an increased ridership in the downtowns by offering fast and frequent service
- Inter-line with the light rail system to help meet the desired headways and to "extend" streetcar service with limited capital investment
- Enhance ridership by connecting the streetcar with all regional transit modes and intercity rail
- Locate streetcar stops close to areas of high existing and potential pedestrian activity
- Accommodate logical and efficient future expansion opportunities

Affordable and Expedited Delivery

- Minimize capital costs with simple stops, in-street running operations, no grade separations, and no park and ride lots
- Minimize net operating and maintenance costs by using existing light rail tracks and maintenance facilities where practical
- Fast track the planning, design, and construction period to total five years or less
- Maximize public-private partnership opportunities, including funding

3.5.2 Evaluation Criteria

The evaluation criteria were used for reviewing and assessing the potential of the candidate alignments. The initial 21 criteria are grouped into five sub-categories that demonstrate complementary relationships – Fundability, Cost Effectiveness, Minimize Construction and Cost Impacts, Maximize Development Opportunities, and Relationships to Local Goals. As a means of evaluation, quantifiable measures are presented as a means of evaluation whenever possible. The final list was reviewed and approved by the TAC. The five categories of criteria include:



Fundability

This criterion evaluates candidate alignments based on their ability to demonstrate funding feasibility, showing potential for private financial participation, and distributing costs among public partners.

Cost Effectiveness

This criterion evaluates candidate alignments based on their ability to demonstrate affordability and constructability, and the potential for future extensions.

Minimize Construction and Cost Impacts

This criterion evaluates candidate alignments based on their ability to minimize:

- Underground Utility Impacts
- Visual Impacts
- Environmental Impacts
- Historic and Cultural Resource Impacts
- Traffic Delays and Safety Concerns
- Minimizes Business Impacts

Maximize Development Opportunities

- This criterion evaluates candidate alignments based on their ability to serve key destinations, access development/redevelopment opportunity location, and enhance pedestrian activity.

Relationships to Local Goals

This criterion evaluates candidate alignments based on their ability to support adopted community goals and objectives, complements existing land use, redevelopment or Specific Plans, reflect neighborhood compatibility, and promote accessibility to the river.

3.6 Environmental Screening

The purpose of the environmental screening was to identify major environmental issues that could result from construction and operation of the proposed streetcar project. The environmental issues identified in this task were detailed in an Environmental Screening Technical Memorandum, developed in accordance with California Environmental Quality Act (CEQA) guidelines. The federal National Environmental Policy Act (NEPA) guidelines are not expected to apply since no federal transit funding is being used or anticipated for project development and construction. However, issues may arise during the project's Phase 2 Scoping process that may trigger NEPA.

Results of the Phase 1 effort combined with those of the Phase 2 Scoping process will determine the level of environmental analysis and appropriate documentation required for CEQA compliance. If the issues raised are limited and can be mitigated to a less than significant level,



then a Mitigated Negative Declaration (MND) may be sufficient for gaining environmental clearance for the project. If this information indicates that that the project would cause potentially significant impacts that may not be easily mitigated, are controversial, or are likely to be unavoidable, an Environmental Impact Report (EIR) would be required. The EIR compares the environmental effects of No Project with those from Project implementation. An EIR embodies a more comprehensive environmental analysis than the MND, and is accompanied by extensive public involvement.

3.6.1 Potential Environmental Issues

The Phase 1 environmental screening analysis was preliminary and is not intended to substitute for complete environmental analysis and documentation. The purpose of the screening was to assess whether preliminary data revealed environmental fatal flaws that would trigger modifying the project description.

The project, although less than three miles in length, traverses many different communities, presenting a variety of conditions that could affect the streetcar. For the purposes of environmental screening, the alignment was divided into nine segments or components, starting with the project's western planned terminus at the West Sacramento Transit Center and ending at its eastern terminus adjacent to the Sacramento Convention Center. Specific alignment details and potential environmental issues and/or the status of environmental analysis (shown in *italic* text) for each of the nine segments or components include:

1. West Sacramento Transit Center to the Triangle Area - The segment between the West Sacramento Transit Center and the Triangle Specific Plan area may be completed as part of the Phase 1 construction or later after the active freight rail line and Union Pacific switching yard are removed from the Triangle area. *At this time, no fatal flaws or unavoidable impacts are anticipated in this segment.*

2. West Capitol Avenue to South River Road – This section of the streetcar alignment would veer south from West Capitol Avenue (following the alignment of a new street created within the Triangle Specific Plan area) through to South River Road.

Assuming land acquisition, infrastructure improvements and soil remediation are completed for the Triangle area prior to project construction, no fatal flaws or unavoidable impacts are anticipated in this segment. However, a traffic analysis, including the study of freight rail operations and potential grade crossing conflicts, may be required to ensure that proper mitigation strategies are applied to expedite streetcar operation without impeding traffic circulation and freight rail operation in the Triangle Specific Plan area.

3. South River Road to Tower Bridge — The alignment in this segment would use the street right of way along South River Road to the Tower Bridge. There is sufficient width within the right away for streetcar operation without diminishing roadway capacity. No parking currently exists along this road although future plans call for redeveloping this area into a mixed use community.



Assuming land acquisition, infrastructure improvements and soil remediation are completed for the Triangle Specific Plan area prior to Project construction, no fatal flaws or unavoidable impacts are anticipated in this segment. However, a traffic analysis, including the study of freight rail operations and potential grade crossing conflicts, may be required to ensure that proper mitigation strategies are applied to expedite streetcar operation without impeding traffic circulation and freight rail operation in the redevelopment area. Additionally, the Raley's Landing Draft EIR (City of West Sacramento, October 2005) identified unavoidable future traffic impacts at Tower Bridge Gateway/3rd Street, at the streetcar entry onto Tower Bridge. One of the goals of implementing streetcar service in this area is to encourage transit use instead of auto travel to access Raley Field and other destinations in the Triangle and Raley's Landing project area. Use of transit may reduce traffic congestion at the Tower Bridge Gateway/3rd Street intersection. This assumption would need to be verified by studying the cumulative effect of the streetcar project on traffic circulation in this area.

4. Tower Bridge - Tower Bridge, a drawbridge crossing the Sacramento River, is an historic structure built in 1934. Historically, the Sacramento Northern Railroad operated across Tower Bridge. The bridge had a single track and overhead before all rail facilities were removed in 2004. New streetcar track and catenary would restore this historic function to the bridge. However, the restoration of rail service may add new elements to the bridge that could alter its design or appearance. Similarly, the cumulative weight of previous bridge improvements in combination with weight of project elements may adversely affect the bridge's current lift mechanism. Alteration of the bridge's design, appearance, or historic mechanical system could be a significant impact, and would require a determination of effect made in consultation with the State Historic Preservation Office (SHPO).

A more rigorous structural analysis of Tower Bridge and consultation with Caltrans and SHPO must occur to determine the potential effect of the project on the historic bridge and also to determine whether (NEPA) Section 106 and Section 4(f) evaluation is required. Any adverse effect would be mitigated by implementing terms identified in a memorandum of agreement with SHPO. The proposed traffic lane and on-bridge streetcar track configuration would reflect the outcome of traffic analysis, including traffic mitigations (if required) that are approved by Caltrans. The analysis would include a cumulative assessment of future traffic conditions at the eastern approach to Tower Bridge. At this time, it is anticipated that any cultural resource or traffic impacts along this segment could be mitigated.

5. East of Tower Bridge and the I-5 Overcrossing - The alignment continues east on Capitol Mall and crosses an active railroad at grade and the I-5 freeway at an overcrossing. Unlike Tower Bridge, the I-5 overcrossing at Capitol Mall Avenue was never designed to accommodate rail. However, preliminary structural analysis indicated that the additional dead weight of project facilities on the overcrossing would not require bridge modification or strengthening. A more detailed structural analysis, in consultation with Caltrans, would need to be performed to confirm this preliminary finding.

The alignment will cross the Sacramento Southern Rail Line at Front Street. This action will require consultation with SHPO since the Sacramento Southern's Walnut Grove Branch Line



(located on the Sacramento levee) is on the National Register of Historic Places (South Sacramento Corridor AA/DEIS, September 1994).

No fatal flaws or unavoidable impacts are anticipated on the I-5 overcrossing at this time. It is anticipated that construction impacts on the overcrossing would be temporary and could be mitigated. However, the crossing of the Sacramento Southern rail line at Front Street will require consultation with SHPO. A traffic flow analysis would be required at the eastern approach to Tower Bridge.

6. Capitol Mall for the I-5 Overcrossing to the 7th/8th Streets - The streetcar could visually alter Capitol Mall, which was created within the M Street right of way as a formal entrance to the State Capitol Building from the Tower Bridge. As the Tower Bridge was previously used to support rail operations, and the Sacramento Northern had been located here, overhead wire and rail were part of the historic landscape in this area. The visual modifications resulting from project implementation would restore these visual elements and would be designed to conform to the existing RT facilities that cross Capitol Mall on 7th and 8th Streets. Light rail facilities are typically considered part of the urban landscape and not regarded as significant visual impacts.

The project is not expected to produce unavoidable visual and aesthetic impacts to the State Capitol Building or the building viewshed. Streetcar operation may help reduce cumulative traffic impacts in this segment. A more detailed traffic analysis would be needed to verify this assumption.

7. 7th/8th Streets and K Street to the Sacramento Convention Center - The proposed streetcar alignment would share existing RT light rail facilities along 7th, 8th and K Streets through 12th Street. Operational issues, including scheduling, supervision, and operating capacity would need to be examined to determine whether streetcar operation would affect RT's existing light rail service. After 12th Street, the streetcar alignment would divert from the existing light rail line, continuing on K Street into an exclusive pedestrian walkway leading to the Convention Center between 12th and 13th Streets, and then returning to the street grid in order to circumnavigate the Convention Center on 13th, J, 15th, and L Streets on the Preferred Initial Alignment. Pedestrian circulation, safety issues, and visual impact issues associated with alteration of the design and visual context of the proposed walkway would need to be further examined.

Based on preliminary analysis, no fatal flaws or unavoidable impacts are anticipated in this segment.

8. Streetcar Storage and Maintenance - The proposed streetcar would share RT's existing light rail storage and maintenance facilities the RT Academy Way light rail facility. The maintenance facility would not need to be altered to maintain the streetcar fleet. However, an additional storage track may need to be constructed. RT maintenance and dispatching activities should be examined to determine whether concurrent operations would adversely affect RT activities.

No fatal flaws or unavoidable impacts related to vehicle storage and maintenance are anticipated at this time.

9. Traction Power Facilities - Traction power facilities (e.g., support poles and catenary, and substations, which have the largest footprint of the traction power facilities) take up space within



the public right of way. Substations that convert electrical current to the proper voltage for streetcar, use approximately 375 square feet of space and would be placed approximately every one-half mile along the alignment.

If the traction power facilities were located within the public right of way and the substation facilities were designed to be unobtrusive to the urban landscape, these facilities would not produce visual, land use or displacement impacts. As a result, no fatal flaws or unavoidable impacts related to project traction power facilities are anticipated at this time.

3.6.2 Environmental Screening Conclusion

The primary identified preliminary environmental issues focused on potential traffic and transportation impacts along the alignment (particularly on and in the vicinity of Tower Bridge) and potential cultural resource impacts resulting from project construction and operation on Tower Bridge.

At this time, no environmental fatal flaws or unavoidable impacts have been identified that would make the project implementation infeasible or imprudent. It is anticipated that an EIR will be prepared during Phase 2.



4.0 Concept Development

For this project, Concept Development analysis included:

- Bridge Structure Evaluation
- Conceptual Engineering
- Station/Stop Design Criteria
- Cost Estimating

One of the most critical elements that can set the stage for the successful implementation of a streetcar system occurs through **Concept Development**. In general, **Concept Development** focuses on:

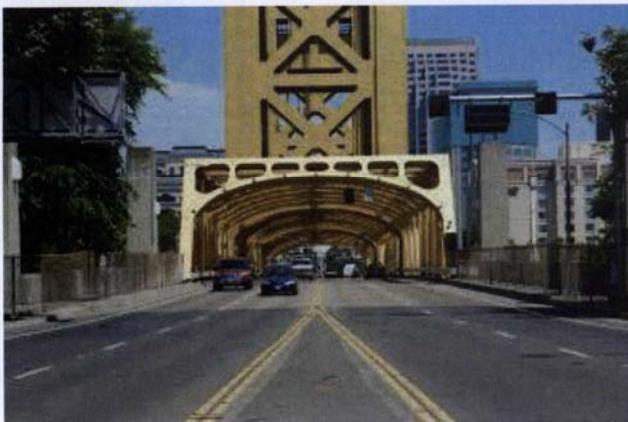
- Avoiding underground utilities where possible
- Minimizing potential modifications to traffic operations at critical intersections
- Minimizing impacts to on-street parking
- Configuring termini with consideration for future expansion
- Optimizing streetcar operations

For this project, such issues as the structural integrity of the Tower Bridge and I-5 overpasses can affect project costs. Where the tracks and stations are physically placed can have a direct effect on capital costs, traffic operations, surrounding built environment and the amount of disruption to the community during construction.

4.1 Bridge Structure Evaluation

The Downtown/Riverfront Streetcar Study project area includes two existing bridges - the Tower Bridge over the Sacramento River and the Capitol Mall Separation, which carries Capitol Mall over Interstate 5. The analysis includes a preliminary investigation of both structures' ability to carry streetcar traffic with current motor vehicle, bicycle and pedestrian traffic. Lane configurations, clearances and structural capacities of each bridge were also analyzed. The evaluation also included preliminary recommendations for addressing issues related to bridge structures. Historic issues were explored as part of the environmental screening process.

Figure 14. West Sacramento Approach to Tower Bridge



ability to carry streetcar traffic with current motor vehicle, bicycle and pedestrian traffic. Lane configurations, clearances and structural capacities of each bridge were also analyzed. The evaluation also included preliminary recommendations for addressing issues related to bridge structures. Historic issues were explored as part of the environmental screening process.

A Bridge Structure Evaluation Technical Memorandum detailed findings of the analysis. Summaries of specific findings



are described below:

4.1.1 The Tower Bridge

The Tower Bridge (Figure 14, above), owned by Caltrans, is listed on the National Register of Historic Places. It is a seven-span steel truss and plate girder bridge with lightweight concrete deck. The bridge spans 737 feet 7 inches over the Sacramento River. The main river span is a vertical lift span measuring 209 feet 6 inches. The lift span is flanked by truss spans of 192 feet 6 inches and 167 feet 5 inches on the west and east, respectively. The overall bridge width is just over 68 feet with a 52-foot-wide roadway and 4-foot wide sidewalks cantilevered outside of the trusses.

The bridge originally carried a single track electric interurban passenger and freight railway line along the center of the bridge flanked two lanes of traffic on each side. After the interurban passenger trains stopped operating, freight trains continued to use the bridge for a number of years before the tracks were paved over and ultimately removed.

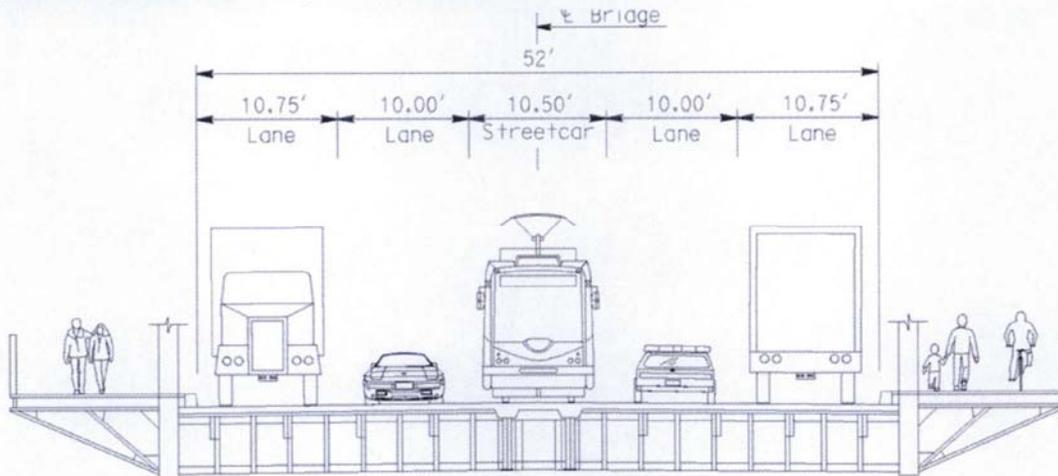
Alternatives Evaluated

Three rail transit alternatives were evaluated to determine the most efficient traffic and streetcar operation scenario and to assess whether structural reinforcements would be needed:

- ***Two Traffic Lanes with One Dedicated Streetcar Track*** - In this alternative, a single streetcar track would run in a centered, dedicated right of way. Here, the number of traffic lanes would be reduced from four to two - one eastbound and one westbound traffic lane. This alternative would include 12-foot-wide traffic lanes, a 14-foot dedicated streetcar guideway, and seven-foot-wide shoulders. Initial discussions with Caltrans indicate that this alternative may be feasible. Both of the cities, however, object to the reduction in capacity given traffic projections for the area. In Phase 2, traffic studies will be conducted to further evaluate the viability of this option.
- ***Two Traffic Lanes and Two Mixed Flow (Traffic and Streetcar) Lanes*** - This lane configuration is comprised of four 11-foot-wide traffic lanes with two 4-foot-wide shoulders. However, two of the four lanes (one in each direction) would serve as mixed-flow of highway and streetcar traffic lanes. For this alternative, the mixed-flow lanes could either be the two interior lanes or the two exterior lanes. This configuration would require structural alteration to the bridge deck or roadway stringers to accommodate double tracking.
- ***Four Traffic Lanes with One Dedicated Streetcar Track*** - In this alternative, shown in Figure 15, a single streetcar track would run along the centerline of the bridge in a dedicated right of way between two eastbound and two westbound traffic lanes. This is the historic rail configuration. Implementing this alternative would require reducing lane widths to below 11 feet and eliminating the existing 4-foot shoulders. This would require a design exception from Caltrans, which Caltrans has indicated would not be approved.



Figure 15. Possible Tower Bridge Configuration



A final lane configuration for the Tower Bridge will be selected in next phase of project implementation.

Original Tower Bridge Design Loads

The original rail line was designed to accommodate rail use of the bridge. Two heavy steel stringers, designed were constructed directly under each rail of the original bridge rail track. Generally speaking, all of the rail vehicles being considered for the proposed streetcar system can be accommodated.

Current Design Loads — Streetcar Loading

Two different electric traction vehicles are being considered for the proposed streetcar system: a replica Birney Trolley (Birney, manufactured by Gomaco Trolley Company), and a modern streetcar such as the Inekon TRIO (modern streetcar).

Streetcar Dead Loads

Dead loads associated with track, train control equipment and an Overhead Catenary System (OCS) must be considered for analysis of project implementation on the Tower Bridge structure. Strengthening of the floor system for double tracking would further add to the dead load.

The bridge’s lift span is extremely sensitive to the addition of dead load. The lift span weighs approximately 1,000 tons and the counterweights have a combined weight of over 988 tons. Caltrans’ goal is to avoid adding additional lifting weight to the span.

- **Existing and Required Capacity** - The capacity of the main structural components, the lift span trusses, floor beams and stringers to carry the proposed streetcar loads was evaluated by comparing the proposed loads to the original design loads and to the current rated capacity of the bridge. This analysis indicated that the trusses are adequate for all lane configuration alternatives when using either the modern streetcar or the Birney trolley. The floor beams are adequate for any of the proposed streetcar vehicles, including the LRV.



For the third lane configuration, use of either the modern streetcar or the LRV would require strengthening roadway stringers. Consequently, only three first two lane configurations are viable without strengthening of either the deck, four of the roadway stringers, or both.

- **Structural Modifications** - Addition of streetcars to the existing Tower Bridge would require significant strengthening the roadway stringers when using the third lane configuration.

Finally, any re-introduction of electric transit to the bridge will require consideration of electrical stray current. Stray current provisions will need to be added to the bridge to prevent stray current corrosion.

4.1.2 Capitol Mall Separation (Capitol Mall over Interstate Route-5)

The Capitol Mall Separation (Br. No. 24 0236), shown in Figure 16, was constructed in 1966 and is a three-span prestressed concrete box girder structure that carries Capitol Mall over Interstate Route 5 (I-5). This structure actually consists of two independent structures carrying the eastbound and westbound lanes of Capitol Mall and separated by a 1-inch joint centered on the raised median. The structure is approximately 225 feet long with spans, from west to east, respectively, of 48 feet, 87 feet, and 90 feet. The total width of the deck is approximately 108 feet, including barriers, sidewalks, raised median, and a 90-foot roadway.

In contrast to the Tower Bridge, the Capitol Mall Separation was not designed for interurban trains or any other rail vehicles. However, being designed in the 1960s, it was designed for HS 20 loading and overload vehicles.

Alternatives Evaluated - Currently, the structure accommodates one eastbound auxiliary lane between 1st Street and an off ramp to 3rd Street, two eastbound through traffic lanes, a 10-foot raised median, two westbound through traffic lanes, one westbound auxiliary lane extending from the on ramp from 3rd Street to a right turn only lane at 1st Street, and four 2-foot shoulders. There is also a westbound left turn lane to 1st Street that starts just before the west end of the separation structure. The separation structure has sufficient width within its 90-foot roadway to accommodate streetcars either in existing traffic lanes or in the median, except at the westbound left turn lane.

Figure 16. Capitol Mall Separation, Looking East Near Front Street



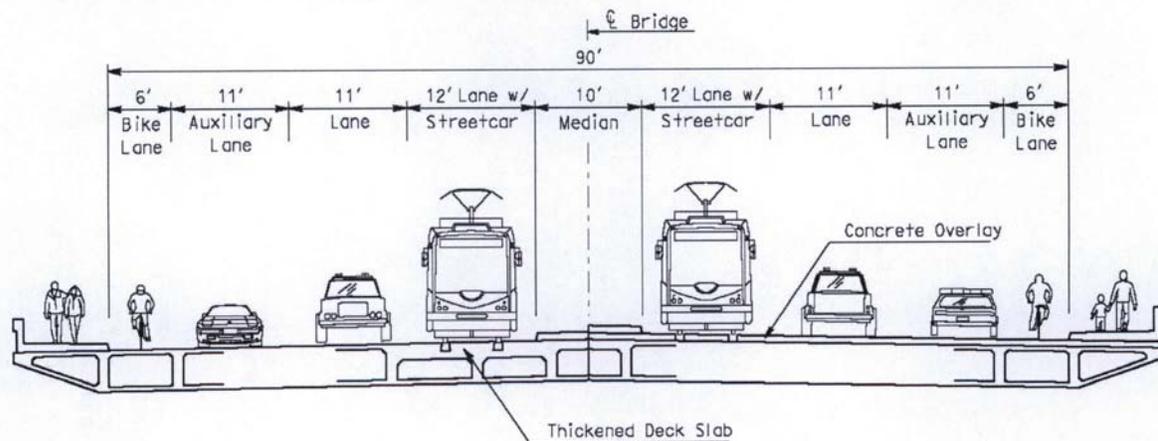
According to Caltrans, there is a plan to remove the two ramps to and from 3rd Street. If this is done, then the two outer (auxiliary) lanes on the structure may no longer be needed, especially if the Tower Bridge is reduced to two lanes. For purposes of this discussion, the two auxiliary



lanes will hereafter be referred to as the outer traffic lanes. Following are three potential lane configuration alternatives that were investigated:

- **Six Traffic Lanes and One Dedicated Streetcar Track** - This alternative would consist of placing a single dedicated streetcar track in the existing 10 foot median while maintaining the existing six lanes on the bridge. This lane configuration could be accommodated with either flush-mounted rail or rail on the raised median. This configuration is incompatible with the westbound left turn lane unless the turn lane is shortened so it is not on the structure and the track splits between the separation structure and 1st Street.
- **Four Traffic Lanes and Two Dedicated Streetcar Tracks** - This alternative would consist of adding double track in dedicated ROW replacing either the two inner or two outer lanes.
- **Four Traffic Lanes and Two Mixed Flow Lanes** - This alternative would consist of adding double track to either the two inner or two outer lanes to create two mixed flow lanes as shown in Figure 17. This configuration would not require change to the existing raised median and lane configuration, except that the one eastbound and one westbound lane would be converted into a mixed flow lane where automobiles, trucks, and streetcars would all share the same lane. This alternative would require either flush-mounting the track in the existing bridge deck or overlaying the bridge deck with up to 7 inches of concrete or asphalt to raise the entire deck surface to the track elevation.

Figure 17. Possible Capitol Mall Configuration



Existing and Required Capacity

- **Structural Modifications** - The analyses for all of the proposed lane configurations and all three streetcar vehicles indicate that the overall capacity of the existing structure is adequate for these alternatives. Local thickening and strengthening of the deck slab would be required for flush-mounted embedded rail.



- Consideration will also have to be given for the Capitol Mall Separation, as for the Tower Bridge, for electrical stray current. Stray current provisions will be added to the bridge to mitigate stray current corrosion.

4.1.3 Conclusions

Following is a summary of conclusions reached based on our data collection and analyses of the two structures:

- The addition of streetcars to both the Tower Bridge and the Capitol Mall Separation is feasible using either Birney replica trolleys or modern streetcars such as the Inekon TRIO.
- The Capitol Mall Separation also has adequate capacity for Sacramento Regional Transit LRVs.
- The Tower Bridge appears to have adequate capacity for LRVs on a single, central track, but more detailed analysis would be required to confirm this.
- Both single and double track alternatives are structurally viable for the Capitol Mall Separation.
- Double tracking on the Tower Bridge may be structurally feasible, but would require strengthening or replacement of at least four stringers and a portion of the deck, as well as the addition of support beams for the rails if the existing stringers are to remain and be strengthened.
- Stray current provisions would be required for both structures.
- Tracks on the Capitol Mall Separation could be recessed into a thickened and strengthened deck slab, placed in a full-width overlay, or set on a raised concrete pad.
- Vertical clearances through the trusses on the Tower Bridge are adequate for any lane configuration.

4.1.4 Cost Estimate

Preliminary cost estimates have been prepared for modifications to the two bridges to accommodate streetcars. These do not include track, power distribution and train control systems, mobilization or a contingency.

Tower Bridge

- Single Track Modifications- \$720,000
- Double Track Modifications - \$4,320,000

Capitol Mall Separation

- Double Track Modifications (thickened slab)- \$936,000
- Double Track Modifications (overlay) - \$720,000



4.2 Conceptual Engineering

The Conceptual Engineering Technical Memorandum presents the track design requirements for Alignments A and B. The level of design enables an initial analysis and discussion of how the alignment and streetcar interact with existing traffic, parking, adjacent properties, and pedestrian and bicycle traffic. Cost-saving design elements are discussed. A set of 11"x17" Conceptual Engineering drawings accompany the detailed Technical Memorandum in the appendix.

4.2.1 Alternative A – West Sacramento Civic Center to the Sacramento Convention Center

Following is a general description of the general alignment, and details are shown in Table 6. Beginning at the West Sacramento Civic Center/Community College/Transit Center on Merkley Avenue, the alignment proceeds northward onto West Capitol Avenue. It continues on West Capitol Avenue and turns south onto the proposed Garden Street into the planned Triangle street network. The alignment would traverse over the existing Union Pacific rail yard on a temporary trestle, then continue along Riske Lane to South River Road. Here it would turn north to Raley Field and onto the approach to Tower Bridge. The single track proceeds across the bridge toward Capitol Mall.

On the east side, it passes Old Sacramento and crosses over I-5 to 3rd Street, where the tracks enter the grass median on Capitol Mall. The eastbound streetcar operations would then leave Capitol Mall and join the existing Sacramento RT light rail tracks on Eighth Street. The streetcar operations would operate jointly on the existing RT tracks on 7th/8th Streets and along K Street to 12th Street. East of 12th Street, streetcars would enter a short stretch of single track and terminate at 13th Street.



Table 6. Conceptual Alignment Summary Alignment "A"

Street	Segment	Tracks in:	Remarks
Merkley Avenue	Terminus to West Capitol Avenue	West curb lane	Two-way single track at Civic Center Stop/Terminus
West Capitol Avenue	Merkley Avenue to Garden Street	Left (inside) lane	Streetcar runs in traffic adjacent to existing median
Planned Garden Street	W. Capitol Avenue to Tower Bridge Gateway	Travel lane	Future at-grade intersection, no stops
Future Garden Street	Tower Bridge Gateway to Riske Lane	On new trestle	Two-way single track on temporary trestle over switch yard
Riske Lane	Future Garden Street to South River Road	West edge of ROW	Two-way single track, temporary alignment
South River Road	Riske Lane to Tower Bridge Gateway	Travel lane	Two lane, two-way traffic
Tower Bridge Gateway	South River Road to Tower Bridge	Left lane	Transitioning to exclusive single track
Tower Bridge	Tower Bridge Gateway to Capitol Mall	Median	Two way, exclusive, single track
Capitol Mall	Tower Bridge to I-5 Crossing	Median	Exclusive, embedded double track
Capitol Mall	I-5 Overcrossing	Median	Exclusive double track on top of deck
Capitol Mall	I-5 to Third Street	Median	Exclusive, embedded double track
Capitol Mall	Third Street to Eighth Street	Median	Exclusive, landscaped track
7 th , 8 th , K Streets	Capitol Mall to Twelfth Street	Existing LRT track	Shared with light rail vehicles
12 th /K Pedestrian Mall	Eastern terminus	Exclusive ped area	Two-way single track

4.2.2 Alternative B – West Sacramento City Hall to Amtrak Station via Capitol and 5th St.

Following is a general description of the general alignment, and details are shown in Table 7. The eastbound alignment begins at the West Sacramento Civic Center/Community College/Transit Center and turns right onto West Capitol Avenue. It continues down West Capitol Avenue, turning right on planned Garden Street. The trackway would then turn left onto Tower Bridge Gateway through a new at-grade intersection.

Running east, the tracks would be located exclusively in the median or in the left-lane adjacent to the median. The alignment would pass under the existing Union Pacific Railroad overcrossing and then arrive at the Gateway stop adjacent to a new, signalized, at-grade intersection with Fifth Street. The type of trackway used in the Capitol City Freeway median could be one of several types depending on cost constraints and aesthetics, and could include embedded concrete track slab, landscaped or grass track, or tie and ballast. Continuing in the median the alignment would cross a new at-grade intersection at Third Street to serve Raley Field and Raley’s landing. The



alignment would enter a single-track segment across the Tower Bridge, and then back to a double-track alignment.

Similar to Alternative A, the exclusive-running tracks would serve Old Sacramento and cross I-5 and Third Street into the Capitol Mall median, where landscaped double track would extend as far as Fifth Street.

The alignment would turn north at Fifth Street in the right lane. Fifth Street's lane configuration and traffic signaling is configured for two-way traffic operation north of Capitol Mall, the length of the streetcar alignment. The tracks would follow the existing roadway under the Westfield ShoppingTown Downtown Plaza and transition to the west curb line of 5th Street north of I Street, adjacent to the Amtrak station. Immediately north of the Amtrak station the single-track alignment would turn left and join with existing LRT tracks to serve a shared terminus stop platform.

Table 7. Conceptual Alignment Summary Alternative "B"

Street	Segment	Tracks in:	Remarks
Merkley Avenue	Terminus to West Capitol Ave.	West curb lane	Two-way single track at Civic Center Stop/Terminus
West Capitol Avenue	Merkley to Garden Street	Left (inside) lane	Shared lane adjacent to existing median
Planned Garden Street	West Capitol Ave. to Tower Bridge Gateway	Travel lane	Future at-grade intersection, no stops
Tower Bridge Gateway	Garden Street to Tower Bridge	Median	Shared, right lane
Tower Bridge	Tower Bridge Gateway to Capitol Mall	Median	Two-way, exclusive, single track
Capitol Mall	Tower Bridge to I-5 Crossing	Median	Exclusive, embedded double track
Capitol Mall	I-5 Overcrossing	Median	Exclusive, above deck, double track
Capitol Mall	I-5 to Third Street	Median	Exclusive, embedded double track
Capitol Mall	Third Street to Fifth Street	Median	Exclusive, landscaped, double track
Fifth Street	Capitol Mall to I Street	Right lane	Two way, double track, adjacent to parking
Fifth Street	I Street to H Street	Left lane	Single, exclusive, embedded, adjacent to curb
H Street Terminus	Adjacent to Amtrak Platform	Right lane	Single, shared with existing LRT

4.3 Station/Stop Design Criteria

For streetcar stop design criteria, the intent is to have the most cost-effective, community accessible stops at the proper locations. The criteria are coordinated with the general alignment developed in the Route Study, Service Planning, Equipment Analysis, and Conceptual



Engineering Tasks. The primary design principles for this Task, in keeping with the overall project goals, are to:

- Keep the design simple and inexpensive
- Use “off-the-shelf” equipment whenever possible
- Design for ease of construction
- Provide safe locations for streetcar patrons
- Offer patrons information on arrival of the next streetcar

4.3.1 Basic Parameters

While the preferred vehicle type can affect the design of the stop, the following basic parameters are applicable:

- Most stations will have two platforms - one for westbound cars and one for eastbound cars
- The streetcar berthing area will be approximately 60-65 feet long, sized for a single car
- The boarding area will be 40-45 feet long
- A shelter, schedule and patron information rack, a sign with the stop name, a bench, a lean rail, a trash receptacle, and an appropriate ADA pedestrian warning strip at the curb edge, along the entire length of the boarding area, would be provided at each station
- “Next vehicle arriving” technology would be included in the shelter to inform riders when the next streetcar will arrive
- A ticketing kiosk, unless there is no fare or there is on-board ticketing, would be provided
- A bicycle rack
- A curb extension (bulb out) to board the car to minimize the loss of on-street parking
- If a replica streetcar is used, an on-board lift or a high block platform will be required for ADA access
- If a modern car is used, curb modifications will be required along K Street and in the median stations

4.3.2 Enhanced Parameters/Amenities

For higher visibility stop locations, in addition to the basic parameters, enhanced amenities may include:

- Enhanced architectural treatment for shelters to reflect the character of the specific location
- Specialty lighting with banners or other decorative features
- Enhanced paving
- Information kiosks

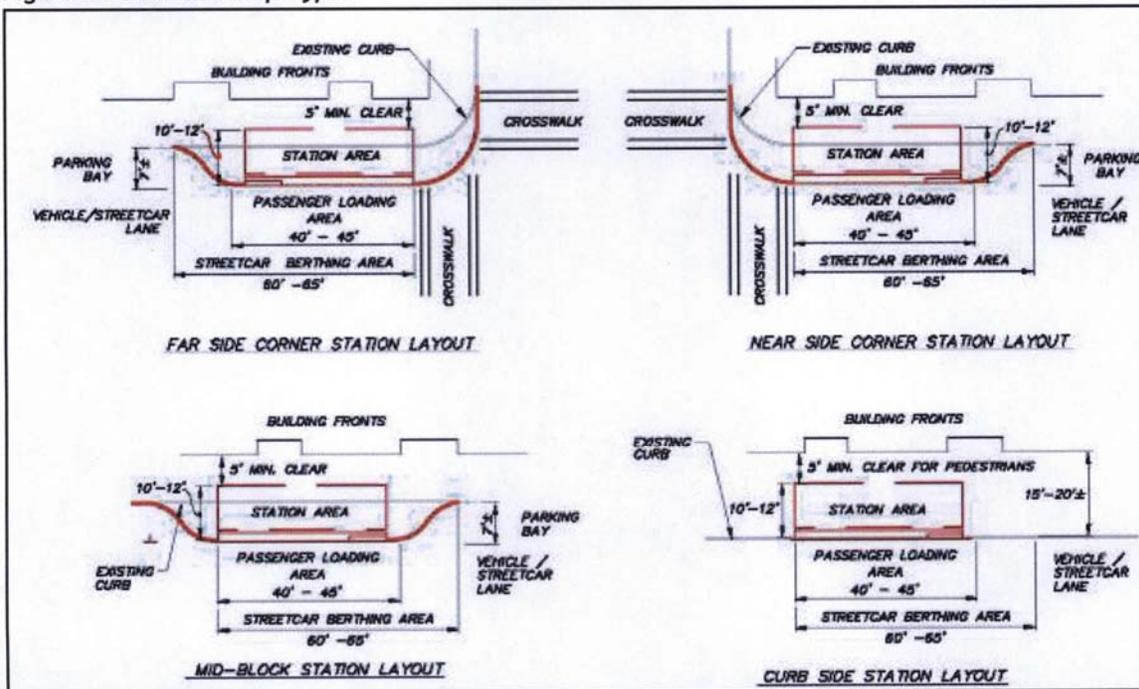


- Public art
- Additional seating beyond the shelter

4.3.3 Streetcar Stop Types

Based on the proposed stop locations and the basic parameters, several stop types may be found – Corner, Mid-block, Curbside and Median/Center Stops. A general description and diagram (Figure 18) of these types follow.

Figure 18. Streetcar Stop Types



- Corner Stop (near or far side) – This stop occurs at the corner to allow direct access from the sidewalk (direct boarding with a low floor vehicle, from an on-board lift or from a raised, ADA-compliant high block platform). The stop is a “bulb-out” or an extended sidewalk. The vehicle stays in the travel lane, minimizing on-street parking loss.
- Mid-block Stop – This type occurs less frequently but may be required due to specific site or block considerations, and it, too, is a “bulb- out” design. The vehicle stays in the travel lane, minimizing on-street parking loss.
- Curbside Stop (Likely Mid-block) – This stop is on a street with no on-street parking, and it allows berthing directly from the existing curb.
- Median/Center Stop – This type occurs if the streetcar is running on the inside lanes. It may take up more available lane width, since it cannot be located in a moving lane. The Median/Center Stop is also applicable for the tracks that run through the grassed median in the Capitol Mall. This application requires enhanced pedestrian safety and amenity features. The primary implication of this type is the need for left side doors on all cars in the fleet, and



- Left-side disabled boarding capability.

The following table summarizes planned stations, locations, and platform types for the Preferred Alignment.

Table 8. Streetcar Stations

Station Name	Location	Type	Improvement Level
Civic Center	West side of Merkley Avenue, in planned Transit Center	Curbside	Minor modification to existing Transit Center
West Capitol at Garden	West Capitol at Garden	Median/Center	High
Raley Field	Tower Bridge Gateway and Third Street	Median/Center	High
Old Sacramento	Capitol Mall and Front Street	Median/Center	High
Fourth and Capitol	Capitol Mall and Fourth Street	Median/Center	High
Eighth and Capitol (eastbound)	Eighth Street, north of Capitol	Curbside	Medium
Seventh and Capitol (westbound)	Seventh Street, north of Capitol	Existing – curbside	Low
St. Rose of Lima	7 th -8 th and K Street	Existing – Midblock	Low
Cathedral Square	11 th and K Street	Existing – Midblock	Low
Convention Center	13 th and K Street	Curbside	Low
Fifteenth and J	15 th south of J Street	Curbside	Medium
Fifteenth and L	L Street west of 15 th	Curbside?	Medium

4.4 Cost Estimate

The capital costs include the track and systems work, civil and roadway engineering, stop shelters and amenities, vehicles, and soft costs associated with the design and construction of the preferred project. For the Initial Preferred Alignment, the estimated capital cost is \$53,132,000 or approximately \$14,966,000 per track mile. The Planning Criterion was a project cost to not exceed \$50,000,000; however the decision to include the loop to Midtown was made with the understanding that the Planning Criterion on cost would be “flexed” to allow a slightly more expensive, but significantly more viable project.



Table 9. Conceptual Cost Estimate

Item	Cost Category	Unit Price	Units	Quantity	Total Price
1.1	Trackwork – Track Slab (single)	\$425	tf	10,250	\$4,356,250
1.2	Trackwork – Grass Track (single)	\$468	tf	2,800	\$1,310,400
1.3	Trackwork – Tee Rail on Tower Bridge (single)	\$450	tf	660	\$297,000
1.5	Trackwork – Tee Rail on Tie & Ballast (single)	\$270	tf	5,100	\$1,377,000
Total Length of Single Track				18,810	
2.0	Trackwork – Turn/Track Crossing Installation	\$150,000	ea	10	\$1,500,000
3.0	Catenary Poles and Overhead Wire	\$200	tf	18,810	\$3,762,000
4.0	Traffic Signals – New (or Full Replacement)	\$200,000	ea	8	\$1,600,000
5.0	Traffic Signals – Modified	\$120,000	ea	9	\$1,080,000
6.0	Civil/Roadway – general pavement overlay	\$15	f	10,250	\$153,750
7.0	Civil/Roadway – High end treatments & landscaping	\$200	f	3,850	\$770,000
8.1	Utilities – High Allowance	\$600	f	450	\$270,000
8.2	Utilities – Medium Allowance	\$300	f	5,500	\$1,650,000
8.3	Utilities – Low Allowance	\$150	f	4,300	\$645,000
9.0	Drainage Allowance	\$100	f	12,475	\$1,247,500
10.1	Stop Platforms – Low (side)	\$20,000	ea	5	\$100,000
10.2	Stop Platforms – Low (center)	\$30,000	ea	-	\$0
10.3	Stop Platforms – Medium (side)	\$45,000	ea	-	\$0
10.4	Stop Platforms – Medium (center)	\$70,000	ea	2	\$140,000
10.5	Stop Platforms – High (side)	\$100,000	ea	5	\$500,000
10.6	Stop Platforms – High (center)	\$150,000	ea	3	\$450,000
11.0	Temp. Trestle over Triangle Rail yard (1250' long)	\$0	sf	-	\$0
12.0	Tower Bridge Improvements (single track)	\$900,000	ea	1	\$900,000
13.0	I-5 Overcrossing (double track)	\$900,000	ea	1	\$780,000
14.0	Substations	\$500,000	ea	4	\$2,000,000
15.0	Train Signaling Systems	\$550,000	ea	5	\$2,750,000
16.0	BASELINE SEGMENT COST				\$27,758,900
MOS Alternative					
17.0	Construction Subtotal				\$27,758,900
18.0	Construction Soft Cost (mob. Traffic control, QC)	18%		4,996,602	\$4,996,602
19.0	SUB-TOTAL CONSTRUCTION COST				\$32,755,502
20.0	Construction Contingency Cost	15%		4,913,325	\$4,913,325
21.0	TOTAL ANTICIPATED CONSTRUCTION COST				\$37,668,827
22.0	Engineering and Administration Cost	15%		5,650,324	5,650,324
23.0	Vehicles (including testing, spare parts, etc.)	\$1,000,000		8	\$8,000,000
24.0	Right-of-way				\$0
25.0	Maintenance Facility Allowance				\$2,000,000
26.0	TOTAL PROJECT COST (2007 DOLLARS)				\$53,131,885