

# **Technical Memorandum**

## **Downtown/Riverfront Streetcar Studies**

### **City of West Sacramento**

#### **Opportunities and Constraints**

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# OPPORTUNITIES AND CONSTRAINTS

## 1.0 Description of Task

This task item for the West Sacramento Streetcar Study shall identify and describe significant opportunities that the project may take advantage of and obstacles that the project should avoid or reasonably resolve. There are two components of this task. First, the opportunities presented by the alignment that could enhance the project's success, lower project costs or contribute to other goals will be described. Second, obstacles that could prevent or negatively impact implementation of the project will be specified.

Barriers are represented by geographical or structural issues that are not easily addressed or would require costs beyond what would typically fit within the budget of an initial streetcar system. To avoid implementation delays and added project costs, an initial segment should not impose major impacts and avoid barriers and constraints that require expensive solutions. Obstacles such as low overcrossings, surface railroad crossings and bridges can potentially result in delays in design approvals or add to project costs.

## 2.0 Description of Alignment Assumptions

### 2.1 Phase I Alignment Option A

The opportunities and constraints for two alignment options were evaluated for this task. The Phase I Alignment Option A for this project is assumed to be as follows (see also Figure 1A):

**Westbound** – The line's eastern terminus is a single-track stub terminal on K Street between 13th and 12th Streets in Sacramento, on a block that is now a pedestrian mall.

From this point, the westbound alignment crosses the eastbound Regional Transit (RT) light rail transit (LRT) tracks at K Street & 12th Street at grade and merges onto the LRT alignment on the K Street Mall, sharing track with light rail trains. The alignment follows K Street westerly to 7th Street (crossing LRT tracks at grade at 8th Street), and turns south on 7th Street, still sharing the alignment with the RT light rail service.

At Capitol Mall, the streetcar diverges from the light rail tracks and turns west onto Capital Mall. The route follows Capital Mall to the Interstate 5 overcrossing and then approaches the Sacramento Northern Railroad at-grade crossing followed by the Tower Bridge.

After crossing the bridge, the alignment shifts back to double track and shifts southward from Tower Bridge Gateway (former State Route 275) to South River Road. Now in the Triangle redevelopment area, the route would then either turn northward on the planned Garden Street (if the Union Pacific Railroad switching yard is no longer active) or on an existing street to approach a structure to cross over an active rail yard. In either scenario, the streetcar route would follow a new at-grade intersection of Garden and Tower Bridge Gateway and continue north to West Capitol and turn west; the route follows West Capitol to Merkley, where the

alignment turns left and terminates at a stub terminal adjacent to the future West Sacramento Transit Center.

**Eastbound** – The eastbound alignment is the same as the westbound, with the exception of the portion between Capitol & 7th Street in Sacramento and K Street. The route continues on Capitol Mall to 8th Street and turns left (north) on 8th and merges onto the RT light rail trackway. Continuing north on 8<sup>th</sup> to K Street, the route turns right (east) onto K Street, shares the existing light rail trackway with RT service and finally terminates on its own single-track terminus track just east of 12th Street.

## 2.2 Phase I Alignment Option B

The Phase I Alignment Option B for this project is assumed to be as follows (see also Figure 1B):

**Westbound** – The line’s eastern terminus is a single-track stub terminal just north of the Sacramento Valley Amtrak Depot immediately west of 5th Street. From this point, the westbound alignment turns south along 5th with double track and follows the street beneath the Westfield Downtown Plaza shopping center. The alignment then heads west along Capitol Mall and encounters its only single-track section as it traverses the Tower Bridge. The route then follows the Tower Bridge Gateway (the former State Route 275) that will be reconstructed with new at-grade intersections at 3rd, 5th and Garden Streets. At Garden Street, the alignment turns north toward West Capitol before heading west toward the Merkley Avenue single-track terminus. The western terminus location is the same as in Alignment Option A.

**Eastbound** – The eastbound alignment is exactly the same as the westbound.

## 3.0 Alignment/Operational Opportunities

### 3.1 Alignment Option A

#### 3.1.1 Catalyze and Focus Redevelopment

##### **Triangle Redevelopment Area**

The Triangle redevelopment area along the western bank of the Sacramento River in West Sacramento represents one of the more significant opportunities this streetcar project has to both catalyze and focus redevelopment activity. The City of West Sacramento has ambitious plans to transform this former industrial area into an active mixed-use residential and commercial area with a renewed focus on the riverfront; specific plan entitlements include up to 7 million square feet of office and 5,000 housing units. The area is already anchored by the Raley Field baseball park and residential construction has already begun along the northwestern-most edge of the Triangle.

##### **Other Redevelopment Opportunities**

Beyond the Triangle area, Alignment Option A will also serve several significant development sites. A prime site across West Capitol Avenue from the West Sacramento City Hall awaits redevelopment at Merkley Avenue along with a planned new transit center, a community college center, and a multi-generational community center. In the Raley's Landing area, 600,000 square feet of office is currently in construction, with entitlements in place for twice that plus a hotel and up to 1,000 housing units. This mixed use project would be complemented by restaurants and retail.

The alignment will also help reinforce the current pace of development in Sacramento's central district, particularly along Capitol Mall, and add activity to the streets where the streetcar would use existing light rail tracks.

### 3.1.2 Joint Use of Existing Light Rail Tracks

With Alignment Option A, this streetcar project would use 7 blocks of existing RT light rail tracks in downtown Sacramento. Although this arrangement requires coordination with the transit agency and some capital improvements to make it feasible, the opportunity to share this infrastructure represents a very significant opportunity. It allows the streetcar project to avoid the expense and disruption associated with constructing an all-new trackway in the segment and permits streetcars to access the existing RT light rail vehicle storage and maintenance facility at Academy Way.

### 3.1.3 Creation of Signature Streets

Construction of a streetcar line along Alignment Option A provides a major opportunity to create "signature" streets for both cities. In West Sacramento, streetcar line construction affords the chance to reconstruct three major streets that could significantly reshape the look of the city. Parallel to the river, streetcar tracks, a new streetcar station and new, higher-density development along South River Road would shape the look of a prominent street promenade.

Also in the Triangle area, the streetcar line, a streetcar station and new development have a similar chance to form the spine of the planned new Garden Street as part of the Triangle area's new street grid.

Coordination of the streetcar project with the recently approved West Capitol Avenue Streetscape Master Plan would help reinforce the status of the street as West Sacramento's Main Street.

### 3.1.4 Lower Construction Costs along Capitol Mall

As long as major utilities are not present below the center grass median along Capitol Mall (which remains an unknown at present date), streetcar construction costs could be reduced by constructing the tracks mostly within the median. This would permit less street reconfiguration, less overhead contact system (OCS) cost and improved streetcar

operations as left turn movements at existing traffic signals are already controlled. Please see the Civil and Track Engineering Technical Memorandum for additional details.

### 3.1.5 Lower Cost Construction Technique to Add Track on I-5 Structure

By constructing an exclusive use lane for the streetcar in the segment on the Interstate 5 overcrossing, the project has the opportunity to use a lower-cost construction technique that would lay the tracks on top of the existing structure. This would eliminate the need and considerable expense of having to cut into the existing concrete overpass to install the tracks so that they were flush with the pavement of other travel lanes for mixed traffic.

### 3.1.6 Return of Rail Service to Tower Bridge

Alignment Option A would restore rail service to the Tower Bridge in a manner that is generally consistent with the original configuration of rail traffic over the bridge. That is, streetcar service would occupy a single, exclusive-use lane in the middle of the bridge's cross section. See the Environmental Issues Technical Memorandum for more discussion of this item.

## 3.2 Alignment Option B

Since the two alignment options overlap along portions of their routes, only the opportunities that *differ* from those presented by Alignment Option A are discussed below.

### 3.2.1 Catalyze and Focus Redevelopment

Alignment Option B keeps the streetcar route north of the Raley Field ballpark and runs along a reconstructed and reconfigured Tower Bridge Gateway. Though two station pairs would still serve at least a part of the Triangle area (at the proposed “Raley Field” and “Gateway” stations), significantly fewer development sites within the Triangle would have “front door” access or the immediate perception of access (and direct visual connection) to the streetcar service.

However, Alignment Option B still presents opportunities to catalyze and focus development in the Raley's Landing area and at the northern edge of the Triangle area. The Raley's Landing area is entitled for approximately 2 million square feet of office (including the existing Ziggurat and the CalSTRS building under construction), a major hotel, up to 1,000 dwelling units, and 80,000 square feet of retail. Like Option A, the western terminus for Option B would be adjacent to the community college at Merkley Avenue and the planned future transit center.

On the Sacramento side, the streetcar alignment along the Capitol Mall will only reinforce the already strong and continuing-to-develop street. With Alignment Option B, streetcar construction and service present opportunities to improve street amenities and to

focus even more activity along 5th Street. The streetcar project could also give a significant boost to ambitious plans for redeveloping property adjacent to the Amtrak depot and the future Railyards redevelopment.

### 3.2.2 Connection with Existing Light Rail Tracks

With Alignment Option B, the streetcar project would connect with existing RT light rail tracks in downtown Sacramento just north of the Amtrak depot. Although this arrangement requires coordination with the transit agency, the opportunity to make this connection is significant. It allows streetcars to access the light rail system and therefore access the RT rail vehicle storage and maintenance facility at Academy Way. It also affords the chance to serve the intercity rail station with both modes of rail transit.

### 3.2.3 Creation of Signature Streets

Although Alignment Option B does not pass through the heart of the Triangle area, it still provides a couple of significant opportunities to create “signature” streets for both cities. Similar to Alignment Option A, the construction of the streetcar line affords the chance to reconstruct and enhance West Capitol Avenue near the City Hall as it approaches the major redevelopment site at Merkley Avenue.

On the Sacramento side, Alignment Option B retains the opportunity (as in Option A) to build upon the most attractive features of the Capitol Mall (e.g. the grass median). Additionally however, Alignment Option B adds new streetcar tracks and stations (and associated amenities) to 5th Street along one of the city’s principal shopping streets.

### 3.2.4 Lower Cost Construction Technique to Add Track on I-5 Structure

Since Alignment Option B is also routed along Capitol Mall as it crosses I-5 just as in Option A, Option B retains the possibility to use a lower-cost construction technique that would lay the tracks on top of the existing structure. There is no difference in construction techniques available for this route segment between the two alignment options.

### 3.2.5 Return of Rail Service to Tower Bridge

Similar to Option A, Alignment Option B would return rail service to the Tower Bridge that had previously occupied the bridge’s the middle lane. See the Environmental Issues Technical Memorandum for more discussion of this item.

## 4.0 Alignment/Operational Constraints

### 4.1 Alignment Option A

This alignment differs from Option B in that it traverses the Triangle area in West Sacramento and shares existing light rail tracks in downtown Sacramento. The western

terminus at Merkley Avenue, the middle segment across the Tower Bridge, and the segment along the Capitol Mall to 5th Street are the same as for Option B.

Traffic analysis will be detailed in a separate memorandum.

#### 4.1.1 Rail Yard and Costs Associated with Rail Yard Overcrossing

The most significant physical barrier presented along Alignment Option A is the Union Pacific Railroad's Westgate Yard in the Triangle area of West Sacramento. The UPRR uses the yard to switch rail cars and to wye (or redirect) trains and the longevity of the use the yard remains an outstanding question. The multiple tracks and continuing operations of train movements there make crossing the yard at grade a costly and questionable option. A grade-separated crossing of the yard would be most practical for streetcar operations; it would increase safety over an at-grade crossing, eliminate delays for streetcar operations and reduce delays associated with seeking railroad approval.

The streetcar route for Option A could cross over the rail yard on a temporary, single-track, streetcar-only structure similar to a railroad trestle. Such an overcrossing would also require right-of-way acquisition for its approaches. While this solution reduces the operational and coordination headaches associated with an at-grade crossing of the yard, it represents an investment in a structure that may be temporary until the railroad switching functions move elsewhere.

#### 4.1.2 Coordinating Improvements with Road Improvements

In order to reduce costs and disruption for the streetcar project and the planned reconstruction of West Capitol Avenue, the roadway improvements and streetcar trackway construction along West Capitol and across Tower Bridge Gateway (the former State Route 275) should be synchronized. The planned road improvements include new at-grade intersections at Garden Street, at 5<sup>th</sup> Street, and at 3rd Street. Garden Street is currently under construction. Improvement of the Tower Bridge Gateway/3<sup>rd</sup> Street/South River Road intersection is a prerequisite for either of the alignment options.

This opportunity, however, also increases the amount of coordination effort required. It requires the design and construction timing of the streetcar project to roughly coincide with these other projects that could experience delays of their own.

#### 4.1.3 Geometrics

The geometric issues along this alignment are manageable. Alignment Option A will likely include an S-curve route that would allow the trackway to clear the UPRR rail yard in the Triangle area. The design will balance the need to gain enough height to clear the yard while minimizing the amount of property acquisition needed to allow the trackway to function appropriately. The structure includes curves of 200 and 300 feet radii and 7-percent-grade approaches of 500 and 600 feet in length. See the Civil and Track Engineering Technical Memorandum for details.

#### 4.1.4 Structural Clearances

As presently drawn, the Alignment Option A does not appear to have any vertical or horizontal structural clearance issues. The two vertical clearance locations of note occur while the route crosses over the UPRR rail yard, where 28 feet of vertical clearance is needed over the yard, and at the Tower Bridge where the streetcar trackway will run on a middle, exclusive-use lane. As long as the streetcar occupies this middle lane, where the vertical clearance is 23 feet at the bridge centerline, sufficient clearance should be maintained. See Bridge Structure Evaluation and Civil and Track Engineering technical memoranda.

#### 4.1.5 Street Grades

The noteworthy existing street grade to address along Alignment Option A is encountered at the at-grade crossing of the Sacramento Southern Railroad at the east end of the Tower Bridge. Though the grades here are manageable (approximately 3.9 percent), they will need to traverse, within a relatively short distance, three relatively fixed points: the intersection of Capitol Mall with Front Street, the rail line at-grade crossing and the Tower Bridge structure. See Bridge Structure Evaluation and Civil and Track Engineering technical memoranda.

#### 4.1.6 Safety

The at-grade crossing with Sacramento Southern Railroad presents the most significant safety issue that will need to be addressed. Already providing gated protection, some upgrades to the crossing may be needed in order to ensure safety with the reconfigured lane cross section and street reconfiguration.

Other traffic safety issues, including those on the Tower Bridge and at the eastern approach to the bridge from the Capitol Mall, appear manageable. See separate technical memorandum on traffic.

#### 4.1.7 Major Cost Issues

The most considerable cost issue along the Alignment Option A is likely to be the construction of the structure that crosses over the UPRR Gateway Yard. This expense is also significant due to the fact that the overcrossing may be used only temporarily until some time in the future when the rail yard activity is accommodated elsewhere. Cost pressure on this item will likely be tied to the ability to minimize property acquisition for the overcrossing approaches.

#### 4.1.8 Single-Track Segments Adds Operational Issues

The presence of two single track sections adds a manageable operational issue for streetcar service. See the Service Criteria Technical Memorandum for more discussion of this item.

#### 4.1.9 Utilities within Right-of-Way

No utilities that would preclude or exorbitantly increase cost pressure for streetcar trackway or station construction are known at this time but more analysis of existing utilities along the proposed alignment is needed. Particular attention should be given to the area below the center grass median on Capitol Mall.

#### 4.1.10 Right-of-Way Needs

By utilizing existing public rights-of-way along its length and using the planned public rights-of-way within the Triangle redevelopment area's proposed street grid, the need for property acquisition for Alignment Option A may focus upon the footprints needed for the approaches to the new rail yard overcrossing. These approach needs could involve railroad property which can sometimes involve protracted negotiations. Therefore, the project will attempt to minimize the need to acquire property in this area. In other portions of this alignment, the need for private property acquisitions has been avoided.

### 4.2 Alignment Option B

This alignment differs from Option A in that it borders, rather than traverses, the Triangle area in West Sacramento and it does not share any segments with existing light rail tracks in downtown Sacramento. Instead, Option B reaches its Amtrak Depot terminus via double track on 5th Street; the route would follow 5th Street as it descends below the Westfield Downtown Plaza mall.

Since Alignment Option B does not pass through the heart of the Triangle redevelopment area, it does not need to cross over the UPRR rail yard and therefore it also minimizes throw-away costs associated with that temporary structure.

Traffic analysis will be detailed in a separate memorandum.

#### 4.2.1 Coordinating Improvements with Road Improvements

Similar to Alignment Option A, Option B should coordinate design and construction with the road improvements planned for West Capitol Avenue and Tower Bridge Gateway. While Option B would also be affected by the two new at-grade intersections to be constructed at 3rd and at Garden streets, and by a third new at-grade intersection to be built at 5th Street.

#### 4.2.2 Geometrics

This alignment option eliminates the need for the rail yard overcrossing and faces fairly standard geometric hurdles. Along the rest of this alignment, the design will need to facilitate trackway curves that are similar to those found in Option A.

#### 4.2.3 Structural Clearances

Alignment Option B shares the need to clear the Tower Bridge overhead structure but eliminates the need to clear the UPRR rail yard. It also adds the need to clear the structure at the Westfield Downtown Plaza as 5th Street descends below the shopping center. The existing approximate 20-foot clearance on 5th appears to be adequate for the streetcar. Option B would also need to clear the structure where Tower Bridge Gateway passes under the UPRR railroad line.

#### 4.2.4 Street Grades

Option B shares the somewhat challenging street grade with the fixed points of the Capitol Mall intersection with Front Street, the Sacramento Southern railroad at-grade crossing and the eastern approach to the Tower Bridge structure. Aside from this area, the route should not experience other challenging street grades. This is predicated on the planned reconstruction of West Capitol and Tower Bridge Gateway (the former State Route 275) with new at-grade intersections. See Bridge Structure Evaluation and Civil and Track Engineering technical memoranda.

#### 4.2.5 Safety

This option shares the same existing, gated at-grade crossing with the Sacramento Southern Railroad as Option A. Some upgrades to the crossing may be needed in order to ensure safety with the reconfigured lane cross section. Option B would also change the operations of 5th Street from its existing one-way configuration to a two-way configuration. See separate technical memorandum on traffic.

#### 4.2.6 Major Cost Issues

As noted, Option B eliminates the most significant cost issue of Alignment Option A by removing the need to cross over the UPRR Westgate Yard. Even though Option B does not take advantage of the existing light rail trackway in downtown Sacramento, it requires a similar amount of new track miles to be constructed; Option B would construct 3.2 miles of new track versus 3.8 miles of new track for Option A (these figures represent track miles and not route miles).

#### 4.2.7 Single-Track Segment Adds Operational Issues

The presence of one single-track section on the Tower Bridge adds a manageable operational issue for streetcar service; Option B presents one fewer single-track section than Option A by eliminating the structure over the rail switching yard. See the Service Criteria Technical Memorandum for more discussion of this item.

#### 4.2.8 Utilities within Right-of-Way

Similar to Option A, this option has no known utilities that would preclude or exorbitantly increase cost pressure for streetcar trackway or station construction but more

analysis of existing utilities along the proposed alignment is needed. Particular attention should be given to the area below the center grass median on Capitol Mall.

#### 4.2.9 Right-of-Way Needs

Aside from the possibility of property encroachment around the terminus just north of the Amtrak station, Option B utilizes existing public rights-of-way along its entire length. Right-of-way should also not be an issue along 5th as the public street descends below the Westfield Downtown Plaza.

## 5.0 Regulatory Constraints

### 5.1 Alignment Option A versus Option B

There are no significant differences in regulatory constraints between the two options.

### 5.2 Buy America

Projects using Federal funds are required to meet Buy America regulations. See Equipment Analysis Technical Memo for discussion of Buy America regulations as they would apply to this project if federal funds were used.

### 5.3 Federal Railroad Administration

The Federal Railroad Administration (FRA) has jurisdiction over all rail tracks that is part of or connected to the national mainline railroad network. This project contains four possible locations for grade crossings with FRA-regulated tracks. Three of these may be removed or avoided by routing options, but the Sacramento Southern crossing near Old Sacramento, at a minimum, will remain as an active crossing. The FRA (and CPUC General Order 33-B) requires that mainline rail/light rail crossings be fully interlocked with appropriate signaling and other safety devices. The railroads that own the existing tracks that this project will need to cross will need to agree to the installation of the crossing before it can be installed, and it is normal practice for the entity requesting the crossing to be responsible for all costs related to the construction, ownership and ongoing maintenance of the crossing.

Further, the entity maintaining the crossing must maintain the crossing and all related equipment, cabinets, drawings and plans to FRA standards, and have maintenance staff trained in FRA requirements with regular refresher courses. The FRA performs regular inspections of all crossings. Discussions should begin early with the railroads involved, the State of California Railroad Museum (as owner of the Sacramento Southern), and the FRA as to the requirements and procedures necessary to authorize the grade crossings on this project.

### 5.4 California Public Utilities Commission (CPUC)

The California Public Utilities Commission (CPUC) General Order 143-B and other regulations governs all aspects of light rail and streetcar operations, track and traction power

construction, vehicle design, vehicle onboard equipment and specifications, and signaling. Of special interest to this project are the regulations governing streetcar vehicle construction standards and crash-worthiness, and standards that would apply to the operation of this project if it were to share tracks with Sacramento RT's existing light rail operation. See Equipment Analysis Technical Memo for discussion of these regulations.

The CPUC also must issue a Safety Certifications on all new light rail and streetcar systems. For standards that may be more applicable to light rail systems than streetcar systems, CPUC can issue waivers for certain requirements, however discussions need to begin early in project design with CPUC staff. CPUC General Order 33-B governs required configuration of crossings between mainline rail systems and light rail systems.

## 5.5 California SHPO

Modifications to Tower Bridge could affect the historic appearance and design of the bridge, which is on the National Register of Historic Place. Any modifications, other than restoration of historic rail facilities that once were located on the bridge, would require SHPO consultation and agreement of appropriate mitigation measures. In addition, the project would not violate State Office of Historic Preservation Guidelines promulgated to ensure the visual presence of the Capitol building along the Mall (see Environmental Issues Technical Memorandum).

## 5.6 Caltrans

Caltrans, as FHWA's representative for the I-5 overcrossing and the owner of Tower Bridge, would need to be consulted and give approval to the design and structural modifications to the overcrossing and bridge. Of specific concern is the increased weight created by constructing two tracks (and supports) on the bridge and the effect of the added weight on the bridge's lift mechanism, an effect that would not occur with a single track (see Bridge Structure Evaluation Technical Memorandum).

Caltrans would also determine whether SHPO would need to be consulted for any modifications to the historic elements of the bridge (see Environmental Issues Technical Memorandum). Preliminary structural calculations have indicated that the I-5 overcrossing can be modified to accommodate two streetcar tracks without affecting the overcrossing's structural integrity (see Bridge Structure Evaluation Technical Memorandum).

## 5.7 US Coast Guard

The Sacramento River is a navigable waterway. The project must not interfere with boat passage under Tower Bridge. Construction activities may temporarily disable the bridge's lift mechanism. As with the Pedestrian Improvement Project to be implemented on Tower Bridge, the bridge may need to be raised for the duration of project construction to ensure continued passage of boats under the bridge. Traffic diversions would be identified and

publicized to avoid the temporary closure of the bridge (see Environmental Issues Technical Memorandum).

## 5.8 California Department of Fish & Game

For the Pedestrian Improvement Project on Tower Bridge, Caltrans received a permit from the state Department of Fish and Game to allow construction activities to occur on the bridge and proper mitigation measures applied so that the plant and animal species would not be adversely affected. The same permit approval process would be required for the project (see Environmental Issues Technical Memorandum).

## 5.9 Local Permit Approvals

The streetcar Alignment Option A would basically follow public street rights-of-way that would require approval from the Cities of West Sacramento and Sacramento. The streetcar Alignment Option B would also follow public street rights-of-way that would require approval from the Cities of West Sacramento and Sacramento.

For both alignment options, permits for temporary traffic diversions during construction and permanent use of the street/pedestrian rights-of-way would also be required from both cities (see Environmental Issues Technical Memorandum).

## 5.10 Other Utility Approvals

Water, sewer, gas, electricity, and telecommunications companies having facilities along the streetcar alignment would need to be consulted and agreed-upon mitigation measures implemented to ensure that utility services were not interrupted during construction. It is not expected that any major utility line would need to be permanently relocated by the project (see Environmental Issues Technical Memorandum).

# 6.0 Institutional Constraints

## 6.1 Alignment Option A versus Option B

There are at least five significant differences in Option A versus Option B relative to institutional constraints. They are:

- Unlike Option B, Alignment Option A would present the need to coordinate construction and operations with the existing light rail operations along the existing segment where both light rail and new streetcar service would occur.
- Unlike Option B, Option A presents the need to coordinate design and construction of the rail yard overcrossing with the UPRR.
- Unlike Option B, Alignment Option A would present the need to coordinate design and construction of the streetcar trackway with the proposed street grid of the Triangle redevelopment area. Both options require coordination with the Tower Bridge

Gateway/Third Street/South River Road intersection and the removal of the spur track across South River Road.

- Unlike Option A, Alignment Option B presents the need to coordinate design and construction of the new streetcar alignment along 5th Street with Federal Courthouse officials. See further discussion of this item below.
- Unlike Option A, Option B would require coordination of design and construction of the new streetcar alignment along 5th Street with the owners of the Westfield Shopping Center.

## 6.2 Property Owners

The project assumes that the streetcar alignment and substations would be confined to the public rights-of-way, either existing or planned, such as in the Triangle Redevelopment area. Use of existing RT storage and maintenance facilities would preclude the need to purchase property to store and maintain the streetcar fleet (see Environmental Issues Technical Memorandum).

## 6.3 Multiple Railroads

The project will have several locations where the streetcar tracks will cross mainline or spur rail tracks, owned and/or operated by the Union Pacific Railroad, the Yolo Shortline Railroad or the Sacramento Southern Railroad (owned by the State of California/California State Railroad Museum). Arrangements for crossing the railroads will need to be carefully considered and negotiated with the railroads, and have cost implications for the capital and operating aspects of the project.

Crossing the railroads can be done in one of two ways – either at-grade or through a grade-separation. If an at-grade crossing is pursued, then full interlocking, per California Public Utilities Commission (CPUC) General Order 33-B would likely be required. This type of crossing would require the permission of the railroad to cross, and is likely to require the streetcar system to pay for the installation, maintenance and ongoing operation of the interlocking. Streetcar system staff would need to be trained in FRA-compliant maintenance procedures for the upkeep of the interlocking and all associated track and equipment. Streetcar operations would be subject to disruption by train movements or switching activities. The crossing of the Sacramento Southern near Old Sacramento will undoubtedly be this type of crossing, as there is no practical alternative to an at-grade crossing at this location.

The other three crossings on the system could either be avoided by alignment changes to the project, eliminated through abandonment of the track, or grade-separated. Due to changing land uses, the two rail crossings on South River Road will be removed as the businesses there close or move, as expected within two years. The Union Pacific Westgate Yard is potentially the most problematic crossing on the system, and would likely require grade-separation.

## 6.4 Governance and Management Arrangements

Many institutional arrangements are possible for the governance and management of the project, whether during the design and construction or during ongoing operations. See the Technical Memo on Operations and Management Scenarios for a full discussion of these alternatives.

## 6.5 Operations

Parallel with the governance and management structures, there are options for how the system could be operated, either through existing agencies or through the creation of new arrangements or entities. Service could be directly operated, or contracted. See the Technical Memo on Operations and Management Scenarios for a full discussion of these alternatives.

## 6.6 Capital Funding

There are a wide variety of funding models that have been used for the design and construction of projects such as this. For a full discussion of these, see the Technical Memo on Funding Tools.

## 6.7 Operations Funding

Funding for ongoing operations will be a key decision point in moving forward with this project. For an initial discussion of operating funding mechanisms, see the Technical Memo on Funding Tools.

## 6.8 Labor Policy

One of the operating scenarios is for Sacramento RT to operate the system, either as the owner/operator of the system, or as a contract operator if a joint powers agency or some other institutional arrangement owns the system, with RT operating the system under contract. This will mean that RT's labor agreements with the Amalgamated Transit Union (ATU) will apply for operating personnel, and RT's labor agreements with the International Brotherhood of Electrical Workers (IBEW) will apply for maintenance personnel. Work rules with these unions will affect how the service can be scheduled and operated, which ultimately will have an effect on costs for the operation. For a full discussion of these issues, see the Technical Memo on Operations and Management Scenarios.

## 6.9 Interoperability with Sacramento RT LRT Service

In addition to the CPUC regulatory issues outlined above for mixing streetcar operations with Sacramento RT's light rail operations, there will also be issues of integrating the two operations on the shared sections of track on 7th and 8th Streets and the K Street Mall. Among the issues that are likely to need to be addressed are:

- Vehicle performance characteristics (speed, acceleration, braking distance) may be different between streetcars and LRVs, and this may affect scheduling of the services;
- RT's Academy Way maintenance facility may be the most likely location for streetcar storage and maintenance. If this facility is used, streetcars will need to pull in and pull out over RT's system for a distance of approximately 4½ miles. Given that the top speed of the streetcars is likely to be lower than the operating speed for LRVs on this line segment, pulling streetcars in and out may be an operational issue, and could delay LRV service if done during LRT service hours. One solution would be to pull all streetcars out before LRT service starts, and wait to pull them back in until after LRT service shuts down. This has operating cost implications, however.
- Different vehicles may require different platform configurations and different platform heights at stations;
- Accessible boarding may be handled differently on the two types of vehicles, and this may affect station configurations;
- Streetcars and LRVs can have different optimal wheel and/or rail profiles based on different operating performance characteristics, which could affect maintenance requirements for both the vehicles and for the rail infrastructure;
- Communication equipment will need to be compatible;
- Fare policies will need to be coordinated;
- Adding streetcars to RT's routes may require boosting electrical substation capacity; and
- Compatibility of overhead wire systems needs to be analyzed technically.

### 6.10 Option B Terminus and the Federal Courthouse

Phase I Alignment Option B would use 5th Street to access the Amtrak Station as the Sacramento terminus instead of operating on RT's K Street Mall tracks. This alternative would still need to use RT's tracks for pull-in and pull-out access to the Academy Way maintenance facility, and a track connection would need to be built at the Amtrak Station between the streetcar tracks and the RT tracks in the rear of the station. A limiting factor in this alternative is that the RT extension to the Amtrak Station was constructed as a single track line, in deference to the objections of the Federal Court on the block bounded by H Street, 6th Street, Eye Street and 5th Street. The court was concerned that the light rail system could be used as a terrorism weapon, and would only agree to allow a "temporary" single track connection to be built. The single track, however, presents an operational constraint.

The RT line between 7th Street and the Amtrak Depot is one signal circuit, designed to permit a single train to operate to the depot, take layover time and return to 7th Street. The circuit is essentially occupied all day by normal operation of the Amtrak Depot-Folsom line, so that the addition of streetcar traffic for pull-ins and pull-outs would be difficult if not impossible to accommodate during hours when RT LRT trains are operating at 15-minute headways. This could limit the hours for pull-in and pull-out to before LRT service starts in the AM, and after service goes to 30-minute headways in the PM.

In addition, the Federal Courts may object to the construction of a new streetcar line along the west side of their building using the same objections voiced over the RT line.

### **Pull-In and Pull-Out Access**

In addition to the Courthouse issue, Alignment Option B also would require the construction of new track connections to allow streetcars to pull-in and pull-out via the Amtrak Depot. Finally, there is no curve between the southbound 7th Street track between H and K, and the K Street Mall tracks, and there is no eastbound track on the K Street Mall between 7th and 8th. Either a connecting track from 7th to 8th on K would be needed (which would require moving a disabled loading ramp), or an additional crossover would have to be built somewhere. As another alternative, streetcars pulling into the maintenance facility would have to run all the way down to the 13th Street crossover in order to pull in, or use a new curve at 8th Street & O Street.

These are some of the likely issues that would emerge as planning and design proceeds on the project. More issues are likely to become known as the project develops. Full technical review is needed on each of these items.

## **7.0 Conclusion**

As with any project of this scope, there are significant physical and institutional obstacles to address or overcome. However, none of the issues described above represents a fatal flaw or a hindrance that cannot be avoided, mitigated or resolved.

Furthermore, both alignment options present note-worthy opportunities to provide a useful transportation connection between West Sacramento and downtown Sacramento, to focus and catalyze continued redevelopment on both sides of the Sacramento River and to create signature streetscapes for both cities.

## **8.0 Credits**

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