5.0 Operations and System Planning

There are many significant aspects of the third grouping, Operations and Systems Planning. The City's stated project goals are:

- The capability to successfully tie into the existing light rail system
- Cost-effective stations and vehicles that are accessible and ADA compliant
- A route with limited crossing controls and no grade separations, and
- Preferred headways of five to seven minutes

Due to these are critical issues, the Team combined three major Tasks into this component of the Feasibility Study report.

5.1 Service Criteria and System Characteristics

The Service Criteria task develops a higher level of knowledge about the alignment, stations, the service design for the system, and the operational characteristics. There are several components of the Service Criteria task.

- The working assumptions are specified for alignments, station configuration, and operating characteristics
- The service design is specified
- A timetable is based on assumed station locations and expected running times
- Information is developed on system capacity and generalized operating and maintenance costs will be developed.

Understanding the streetcar system characteristics is important to developing service design criteria, scheduling, and operating and maintenance costs. System characteristics include:

- Alignment
- Stations
- Track Configuration
- Terminal Configuration\
- Vehicle type and performance
- Running Times
- Operating Speeds
- Operating Impacts

As Phase 1 progressed, service analysis was made for the initial alignment selected at the Charrette (Alignment A). Later, a second alternative (Alignment B) was analyzed. Finally, an Initial Preferred Alignment was chosen and final estimates were made.

5.1.1 Stations and Stops

Station Locations – Stop locations are on the alignment figures [Figures 2, 3, and 4] and in Table 7. Where the streetcar shares trackage with RT, the streetcars stop at the existing RT LRT stations, with specified boarding locations within the RT station areas.

Distances between stations - The standard for station spacing on the Downtown/ Riverfront Streetcar is between 1200 and 1400 feet between stations. One-quarter mile spacing allows reasonable walking access to stations along the line.

Station Design - Station design is simple, with right-side boarding platforms in most locations, sized for single-car trains. Most stations would have two platforms; one for westbound cars and one for eastbound cars. At Old Sacramento Station in the median of Capitol Mall, a shared center-island platform will be utilized for boarding cars going both directions from the same platform.

Disabled Boarding - Disabled boarding will be handled through the use of onboard lifts if replica cars are used or through carborne bridge ramps if new low floor streetcars are used, similar to Portland's streetcars. Both of these carborne solutions preclude the need to construct new wayside ramps or adapt RT's ramps and lifts for cars with different floor heights. Some modification would be required in K Street to accommodate low floor boarding, since existing pavement is at track elevation and the modern cars require a minimum 8" curb height.

5.1.2 Track Configuration

The optimal configuration for an urban streetcar system is to have all double-track within the right-of-way. This method eliminates the need to schedule meets for vehicles proceeding in opposite directions, and allows maximum flexibility in scheduling, operations, and recovery from delays.

The alignment for the Streetcar is assumed to be entirely double-track, except for the following locations (for Alignment A):

- K Street between 12th and 13th Street – Short segment of single track at the stub terminal for reversing
- Tower Bridge from west of Old Sacramento Station to west side of Tower Bridge – Single track assumed due to weight restrictions on the Tower Bridge and limitation of impacts on historic structure (approximately 1000' of single track)
- West Sacramento Transit Center – Short segment of single track at the stub terminal for reversing

Streetcar and light rail operations are very flexible, and can operate with trackage constructed in a variety of settings, from exclusive right-of-way through mixed traffic operation shared with general automobile traffic. Consult the Conceptual Track Engineering Technical Memorandum in the appendix for additional detail.

5.1.3 Terminal Configuration

The initial system incorporates single-track stub terminals for reversing and layover, with separate boarding and alighting platforms on the adjoining double track sections. This configuration allows multiple cars (up to three) to enter and layover at the terminal at the same time.

5.1.4 Running Times

Overall end-to end running time (for Alignment A), exclusive of layover time but inclusive of dwell times at stations, is estimated to be 23.6 minutes, for an estimated distance of 2.74 miles. Total cycle time is estimated to be 57.2 minutes, including layover times at the terminals. Layover times are assumed to be 5 minutes on each end of the line. This is slightly higher than the standard 10% of overall travel time often used to calculate layover times. This is prudent because of the schedule reliability uncertainties at the Tower Bridge.

Table 10. Cycle Time

	Time (min)
WB Travel Time	23.6
West Sacramento Layover	5.0
EB Travel Time	23.6
K Street Layover	5.0
Total Cycle Time	**57.2**

5.1.5 Operating Speeds

Average point-to-point operating speeds are assumed to be 6.5 miles per hour (mph) on the trackage shared with the Sacramento RT LRT service, and 10 mph on trackage not shared with RT. Speed is based on current RT scheduled service on K Street and 7th and 8th Streets. Operation on trackage not shared with LRT was assumed to be slightly faster, due to less interference with other services, more reserved right-of-way, and because operation on the K Street mall is restricted due to the presence of pedestrians.

5.1.6 Operating Impacts

A number of conditions could cause operating impacts or delays along the alignment.

Traffic Signal Delays - The operating speeds assume traffic delays. If signal priority measures are installed, operating speeds could be slightly higher on the segment, allowing the streetcars to make turns. Candidate locations include Tower Bridge Gateway/Third Street/ South River Road near Raley Field, which will be a complex intersection.

Tower Bridge Lift Operation - The project includes a crossing of the Sacramento River on the Tower Bridge, a lift bridge operated by Caltrans. Regular operation of this bridge will affect streetcar operations several times daily, on a somewhat unpredictable cycle. It takes 10-12 minutes to raise and lower the bridge. From May 1 - November 30, the bridge is tended from 6 AM to 10 PM, opening approximately 10-12 times per day. From December 1- April 30, the bridge is tended from 9 AM to 5 PM, and it opens approximately 2-4 times per day.

The running time assumptions and the schedule developed for the service assumes additional recovery time at the line endpoints to allow for random bridge opening cycles, and to allow streetcars to get back on schedule if bridge openings occur.

Single track operation on Tower Bridge - The single-track operation on the Tower Bridge could cause an operating constraint that will restrict scheduling of the services and operations. The single-track segment will be about 1000 feet long and will require approximately 1.1 minutes for a streetcar to traverse. While a streetcar going in one direction is traversing this trackage, an approaching streetcar from the other direction must wait for the first car to clear the single track before proceeding. This will cause some minor delays but should be manageable under normal conditions.

The track segment needs to be signalized to control access from the two ends and to prevent occupancy by two cars at the same time heading in opposite directions. The single-track operation will force compromises in lane widths and roadway configurations on the Tower Bridge. The Bridge Evaluation Technical Memorandum addresses these issues.

Railroad Crossing Delays - Alignment A crosses mainline railroad track in four locations. Two of these locations (Sacramento Southern Railroad and the running track at the Union Pacific's Westgate Yard) are expected to remain permanently, but the two on South River Road are expected to be removed. None of these crossings except the Sacramento Southern experience frequent train activity; however the delay caused by a slow freight train crossing the alignment or switching cars in a lineside industry could be significant.

5.2 Service Design

The service is envisioned as an urban circulator, and as such would provide transportation for a multiple trip purposes - journey-to-work, shopping, entertainment, lunchtime trips, and others. The service needs to accommodate people making trips for all purposes. Service must offer convenient, basic transportation which is easy for the riders to use, is understandable from the point of view of how the service operates, and does not require the rider to plan ahead in order to use the service.

One of the goals for the project is for the streetcar to contribute to the placemaking efforts in redeveloping the riverfront and in developing areas. In order for this to occur, the service design must be legible to the rider, offer a high quality of service, and be convenient for the rider to use.

5.2.1 Days of operation

Streetcar service would operate 7 days per week.

5.2.2 Span of Service

The span of service for the service would be as shown in Table 11 below.

Table 11. Span of Service

Day	Span
Monday-Friday	5am-midnight
Saturday	6am-midnight
Sunday	6am-midnight

5.2.3 Headways

Headways are major factors in operating costs, determine the car requirements, and influence ridership numbers. Headways were analyzed for 7 ½ minutes for all hours of service. This was consistent with the policy direction established by the PSC and TAC to maintain headways between approximately 5 and 7 minutes. Establishing the headway at 7 ½ minutes allows clock headways to be established, resulting in eight trips per hour each direction, with departures possible at the same times each hour. Streetcar schedules may be effectively coordinated with connecting bus services operating at multiples of this headway, such as 15 minutes, 30 minutes or hourly. Also, with a short streetcar headway of every 7 ½ minutes, riders do not need a timetable – they can just walk to the stop and expect a streetcar within an acceptable waiting period. However, more frequent service requires a larger fleet and incurs higher operating costs. Due to budget constraints, a base headway of fifteen minutes and a peak (lunch period) headway of ten minutes have been used for cost estimating and are proposed for further study in Phase 2.

Capacity

Capacity is determined by several factors - vehicle size and configuration, operating characteristics, and the number of riders.

Vehicle Size –The seating and standing layout inside the car affects the number of riders that can be carried on each individual car.

Operating Characteristics - Operation of the line determines the ultimate number of riders that can be carried. Frequency of service (cars per hour) is the prime factor that determines overall line capacity.

Rider Turnover - The number of riders can turn over several times over the course of a transit vehicle's progress over the line, especially on long lines on crowded urban systems. In this situation, a line's capacity can be many times the capacity of the individual car, if riders are boarding and alighting for short trips and the car is filling up several times over. A way to summarize turnover is the capacity on hourly or daily capacity.

- Hourly - The hourly capacity is assumed to be 2240 riders per hour past any one point on the line if the modern streetcars are used, or 1408 riders per hour if Gomaco Birney replicas are used.
- Daily - The daily capacity is assumed to be 42,560 riders per day past any one point on the line if modern streetcars are used, or 26,753 riders per day if Gomaco Birney replicas are used.

5.2.4 Vehicle Demand and Spares

Requirements for vehicles on a system are determined by two factors – operating needs and spare cars. The requirement to operate service in the peak hour (known as peak vehicle demand) is determined by the cycle time and the service frequency at the busiest time of the day, when the maximum number of cars is scheduled to be in service.

Every system needs spare cars so repairs and cleaning can occur on cars that are not in service without affecting service delivery. Most systems use a 20% spare ratio requirement. For systems with a large fleet, this ratio is adequate, and in some cases may be reduced somewhat based on experience. For smaller systems, if the 20% spare ratio results in only one spare car, the decision is often made to have more than one spare. For the purposes of this project, a 20% spare ratio was assumed, with a minimum of two spares. Car requirements need to be evaluated carefully to ensure that the system is sized correctly in relation to the expected demand.

5.2.5 Operating Scenario

Basic operation would be the streetcar in line-of-sight operation, controlled at intersections by traffic signals. Where signal priority is provided, where RT already has signaling, or where the streetcar must make a movement not normally allowed for automobiles, control would be provided by white "T" traffic signal indicators coordinated with the traffic signal system.

One segment of the line would be controlled by an interlocking signal system - the Tower Bridge segment, where signals would control the interface with the lift bridge, the single track section of track, the Sacramento Southern Railroad diamond and several street intersections

Diverging movements at junctions with Sacramento RT LRT trackage would be controlled by switch position indication lights. Signal aspects would be consistent with current RT operating rules.

5.2.6 Revision Estimates for the Initial Preferred Alignment

After the PSC/TAC decision to develop the Initial Preferred Alignment (a hybrid between A and B), the team made estimates of round trip times, headways, hours of operation, and annual operating and maintenance costs.

The round trip takes 55 minutes, approximately 28 minutes each way and the estimated operating speed is 6.5 miles per hour on RT tracks, and 10 miles per hour otherwise. The average dwell time at a stop is 25 to 50 seconds, depending on the particular stop. There is a five minute layover at each end of the route.

Headways (time between streetcars) are estimated at 10 minutes. The Planning Criterion for headways is 5 to 7 minutes and operation at that frequency is also feasible; it is assumed that for reasons of managing operating costs, initial headways will be 10 minutes during peak times and 15 minutes in off-peak times. In general, the streetcar operates from 5:00 AM to 12:00 AM, from Monday through Friday and 6:00 AM to 12:00AM on the weekend.

For the preferred route the estimated capital cost is $53,319,000 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.

As currently planned, the annual operating costs for an eight car fleet, with 7.5 minute peak-time headways, would be $3.55 million. If the headways are stretched to 10-minute peak-time service and 15 minutes in off-peak times, the annual operating costs fall to $2.61 million.

5.3 Equipment Analysis

No element of a rail transit system captures the hearts and minds of the public more than the vehicle itself. Both the riding and non-riding public usually interact with the transit vehicle more than with any other part of the transit system - from actually using it as a means of travel, to sometimes competing with it in traffic, or to recognizing it as a symbol of the transit service. In some cases, such as the cable cars in San Francisco, the vehicle can even become a defining symbol for the metropolitan area. Thus, selection of a vehicle – from the basic type of car to its various specific physical and performance characteristics, cost and aesthetics – is obviously a key decision, or series of decisions, to be taken in the course of a streetcar project.

5.3.1 Streetcar Characteristics

A wide range of alternative streetcars exists for consideration at the onset of a project. Electric streetcars have a long history, stretching back to the late nineteenth century when they supplanted vehicles whose motive force was provided by horses, or by cables propelled by steam engines. For the purpose of this report, streetcar vehicles are first divided into four broad, chronological categories: vintage and replica trolleys, Presidents Conference Committee (PCC) cars, and modern streetcars. Within each category, there are a number of variations and possibilities which will be summarized below. For modern streetcars, often it is a question of the extent of departure from service proven or "off the shelf" designs.

Some of the important configuration and operating considerations that factor into selection of a vehicle are:

- Basic size (length and width), clearance requirements, and capacity
- Performance (top speed, acceleration and braking rates, etc.)
- "Sided-ness" and "ended-ness", i.e., single-sided, single-ended vs. double-sided, double-ended
- Single unit operation (tow bar or mechanical coupling only) vs. multiple unit operation (mechanical and electrical coupling)
- Floor height (low floor vs. high floor) and the means of accessibility

These and other considerations are reviewed in the following sections.

Vintage Trolley and Replica Streetcars

Early streetcars typically were made with all-wood bodies or composite wood-and-steel bodies with deck roofs and clerestories. The earliest electric streetcars were small, 25 to 30 feet long with a single four-wheel truck, but the popularity of this new technology soon required that operating companies acquire larger cars in the range of 40 to 50 feet in length (Figure 19). These cars typically had two powered trucks, were not articulated, were high floor, were found in both single-sided, single-ended and double-sided, double-ended versions, and normally operated as single units. There were many variations to these generalities. Rehabilitation of historic vehicles is an expensive undertaking. In Sacramento, one historic PG&E car has been restored and operates on the light rail line on special occasions.

Figure 19. Vintage Trolley - Dallas, Texas

Figure 20. Replica Trolley - Portland

Several cities – Portland, Tampa, Little Rock and Charlotte have opted to replicate rather than rehabilitate a vintage trolley (Figure 20), and New Orleans has a large replica fleet in addition to its refurbished cars. Replicating a vintage trolley could involve, for example, the construction of a steel underframe and inclusion of more modern safety features while retaining an original or vintage looking appearance (Figure 21, below). This approach helps guarantee consistency of design and parts, and essentially results in a new product that has a vintage appearance, plus a long economic life ahead of it.

Of particular interest for this project, because they are so similar in appearance to cars operated in Sacramento from the 1920s until the streetcar system's demise in 1947, is the replica double-truck Birney car manufactured by the Gomaco Trolley Company in Iowa. First built for Tampa, additional units have been delivered to Little Rock, Memphis and Charlotte. These cars are 45 to 50 feet in length, 8.5 feet wide, and equipped with about 40 seats.

Figure 21. Replica Double Birney - Tampa

PCC Cars

From the mid-1930s through the early 1950s, the Presidents Conference Committee (PCC) car rose to fame throughout North America, and its design was exported to Europe and elsewhere. Again, while

there were many variations, the PCC car was basically an all-steel, non-articulated car, approximately 50 feet in length, with two powered trucks and high floors.

Figure 22. Rebuilt PCC Car

PCCs were built in both single-sided and double- sided configurations, and they were operated as single cars and in multiple unit consists. The rounded, more contoured look and several performance and passenger comfort improvements generally distinguished the PCC car from older vintage trolleys. Some transit agencies in the U. S. cities, e. g. Boston and San Francisco, have retained and rehabilitated some of their PCC cars, and still operate them in limited or special service. Philadelphia has completed a PCC rehabilitation program (Figure 22), which included substantial changes to the original cars. In New Jersey, NJ Transit has purchased modern vehicles to replace its PCC fleet for the Newark Subway. Many of these cars were purchased to be used on the San Francisco F Line. These cars were never used in the Sacramento area so are not consistent with local history.

Modern Streetcars

The term "modern streetcar" is meant to encompass new streetcars currently available in the marketplace and generally based on designs, technologies, and product improvements developed within the last ten or so years. However, there is no precise technical definition for a "streetcar", and, while there is considerable experience in the U. S. with modern light rail vehicles (LRVs), the actual experience with modern streetcars (as generally understood) in this country to date is limited to the Inekon/Skoda vehicle produced for Portland and duplicated with minor exceptions for Tacoma (Figure 23). A similar car is being developed by Inekon for Seattle's South Lake Union Streetcar project and for the Anacostia Streetcar project in Washington, DC. Most of what is considered modern streetcar experience resides in Europe, and streetcar vehicles there are typically defined more by the characteristics of their rights-of-way (ROW) than necessarily by the characteristics of the vehicle itself. Thus, distinctions between modern streetcars and modern light rail vehicles (LRVs), particularly in the European context, can often be more blurred than instructive.

Figure 23. Modern US Streetcar by Inekon/Skoda - Portland

Figure 24 Replica Vintage Trolley - New Orleans

In Portland, a conscious effort was made to distinguish the city streetcar service and the streetcar vehicle from the regional light rail service and the LRV. Compared to the LRV, the streetcar vehicle is shorter (66 feet vs. 92 feet) and narrower (8 feet vs. 8 feet 8 inches), thus making it less intrusive and more in scale with crowded urban streets and residential neighborhoods (Figure 24).

Portland chose to avoid multiple unit operation, so all streetcar service is with single cars, further enhancing the feel of a smaller scale, urban rather than regional system. Performance parameters are accordingly reduced compared to those of the LRVs which operate at higher speed and on considerable grade-separated ROW throughout the metropolitan area.

Table 12, below, provides a summary of U.S. cities that have some form of vintage trolleys, PCC cars, replica cars, or modern streetcars either in service or in the process of being procured. Also noted are modern light rail vehicles (LRVs) in those cities that have such vehicles as well as streetcar in service. Overall counts of the numbers of cities with various classes of streetcars are: restored vintage trolleys – 10, replica trolleys – 7, restored PCC cars – 5, and new modern streetcars – 3 in service with orders placed by 2 more projects.

Table 12. Survey of US Streetcars in Service or Procurement

City	Historic/Vintage Cars		PCC	Modern Cars	
	Restored	Replica		Streetcar	LRV
Boston	X [a]		X		X
Charlotte	X	X		X[b]	X
Dallas	X		X		X
Kenosha			X		
Little Rock		X			
Lowell		X			
Memphis	X	X			
New Orleans	X	X			
Philadelphia			X		X
Portland		X		X	X
Sacramento	X [a]				X
San Francisco	X		X		X
San Jose	X				X
Seattle	X			X	X
Tacoma				X	
Tampa	X [a]	X			
Washington, DC				X	

Notes: [a] restored vehicles

5.3.2 Criteria for Vehicle Selection

There are obviously different approaches to purchasing rail vehicles. The approach recommended in this report is that resources initially be devoted to deciding the basic type and configuration of streetcar vehicle and to not focus on a specific vehicle or vehicle details until more general considerations are resolved, and the parameters of the overall streetcar project more sharply in focus. Once the basic type of streetcar vehicle is decided and a procurement process started, the procurement documents would list in detail all the specific criteria for evaluation and selection. Typically these criteria include the following major categories:

- Qualifications and experience of the manufacturer and sub-suppliers
- Manufacturing plant (location and capacity of facilities, Quality Assurance program, testing capabilities)
- Conformance of proposed vehicle to technical specifications

- Price (in various aspects)

Characteristics and issues related to the several vehicle alternatives are summarized in Table 13.

Table 13. Summary Comparison of Vehicle Alternatives

Item	Modern	PCC	Replica	Vintage
Initial $ Each	$3.0 M	~$1.5 M	≤$1.0 M	~$1.5 M
Cost: 5 or 8 cars	$15 M/$24M	$7.5 M/$12M	$5 M/$8 M	$7.5 M/$12 M
Meet project schedule?	Yes	Doubtful [a]	Yes	Doubtful [a]
Accessibility	Low Floor w/Level Boarding	Lift (Rear Door)	HiBlock or Lift (Front Door)	HiBlock or Lift Major Modification to Car
LRT Compatibility?	[b,c]	[b]	[b,c]	[b]
Double Ended, Double Sided	Yes	No	Yes	Some
Electrification (voltage)	750 vdc	600 vdc [f]	600/750 vdc	600 vdc[f]
Fit Sacramento History	No	No	Possible [d]	Possible [e]

a- Must undergo painstaking and time consuming restoration of PCCs or historic carbodies.
b- May need to adjust streetcar anticlimber to match LRV anticlimbers if thee is shared track.
c-Need upgrade carbody compression to 2g per GO 143B, or obtain waiver (does not affect cars built prior to 1956).
d- Gomaco Birney cars close in appearance to 1920s PG&E American cars used in Sacramento.
e- Car 35 (operational) and FLRT carbodies - all old Sacramento trolleys, but limited in number.
f- Propulsion system usually can be modified to work with 750 vdc TES.

5.3.3 Summary

Either replica vintage trolleys or modern streetcars could work successfully in the context of initiating a streetcar circulator between West Sacramento, Sacramento, and the riverfront. Vintage trolleys or PCCs, while potentially available, will likely to require a restoration and rebuilding effort that will exceed the project timeline. Primary issues to consider are image, cost, availability and accessibility.

- **Cost:** Replica cars are likely to have an initial cost about one-third as much as modern streetcars
- **Regulatory Issues:** Conforming to California Public Utility Commission regulation, or seeking relief from them
- **Availability:** Both replica and modern streetcars can be purchased from existing suppliers, using existing designs
  - **Replica** – Gomaco (double truck Birney)
  - **Modern** – Any of several global suppliers, if willing to build a small order or able to combine with another city's order

- **Accessibility:** Both replica and modern cars can be equipped to meet ADA
  - **Replicas** – Lift in right front door at each end of car (e.g., Gomaco Birney)
  - **Modern** – Level boarding from raised platform at mid-car door; however, raised platforms pose a design issue, especially on any trackage shared with RT Light Rail, which has some downtown station platforms at rail height (street) level.

Whichever approach is chosen, the basic vehicle configuration should be double-sided, double-ended and, for planning purposes, the basic vehicle width should be no wider than RT's existing LRVs since shared track is contemplated. While the capital cost of modern streetcars would be higher compared to replica trolleys, modern streetcars provide improved performance and passenger comfort, quieter operations, higher capacity, a better long-term accessibility solution, and greater ease in expanding the system beyond a short starter line.

6.0 Financing and Organization

How the project will be funded and operated organizationally is fundamental to its success. This cluster of tasks, **Financing and Organization,** includes the Financing Plan, but it is expanded to address operating and governing considerations.

Goals and principles guiding this section included:

- A total initial project of $50 million or less
- A planning and delivery period of five years or less
- A local funding strategy, including significant private participation in funding

Toward these ends, the Team developed the Financing and Organization cluster to focus on the financial and organizational elements necessary to deliver a locally funded project.

6.1 Funding Tools

This section identifies a "short list" of potential streetcar funding mechanisms. Each was evaluated for preliminary feasibility and appropriateness for the Downtown/Riverfront Streetcar project. The list of funding tools does not include those that were considered inappropriate (whether for legal, political, technical, or other reasons) for the project. The fund sources are grouped by the potential source – Development Related, City, County/Region, and State and Federal.

The analysis of potential funding revealed there are several suitable and available fund sources to move the project to the next stage of project development. Following the brief description and a possible range of funding, Table 14 demonstrates the potential low-to-high range by candidate source. The next step in the process is to perfect a package of acceptable funding mechanisms for the streetcar's implementation.

6.1.1 Development Related

Four principal sources fall under this category. The sources are the Community Facilities District (CFD), Special Assessment District, Tax Increment Financing (TIF), and Development Impact Fees. A brief description is presented with an estimate of a potential range of funding for each.

Community Facilities District

A community facilities district (CFD or Mello-Roos CFD) assesses property owners to pay for specific infrastructure that benefits the district. Revenues can be collected up front or paid over a fixed period of time in annual assessments. The formula for assessing property can be very flexible. For a streetcar, it could be variable based on a property's distance from the streetcar, with those closest to the alignment paying more. Other factors in the assessment formula could include the size of the parcel, the number or size of residential units, the amount of commercial space, fronting footage along the streetcar, and other factors.

CFDs must be approved by a 2/3 majority of property owners. However, this only applies when the planned area is essentially vacant or only made up of commercial properties. If there are more than 12 registered voters in the proposed district, then the CFD must go to a public vote of all registered voters in the district. This could present a much higher hurdle to achieving the 2/3 support.

The potential funding range is from $5 million to $50 million. This was calculated by estimating total property value within the area served by the proposed streetcar line, using data provided by SACOG for each of the TAZs, and projected to 2015. Assessment rates of 2% and 3% of total value were applied to low and high estimates of value to derive the potential funding range.

Special Assessment District

Special Assessment Districts are very similar to Mello-Roos CFDs in intent, logistical implementation, and result. Like a CFD, special assessment districts are geographical areas in which property owners receive a special benefit from new publicly-financed infrastructure, and assessments are made on property in order to build and sometimes operate that infrastructure. Special assessment districts are widely used in California.

Assessment Districts are authorized by three pieces of legislation—dating from 1911, 1913, and 1915—that allow for the collection of assessments (1911 and 1913) and for bonds to be issued, paying for the improvements or operations related to assessments (1915). Thus, the districts have a very long history of legal precedence and infrastructure funding in the state. Since 1913, assessment districts can fund public transportation projects, so this will not be an issue in the case of the streetcar.

The potential funding range is from $5 million to $50 million, derived in the same manner described for CFDs. Assessments could be paid upfront, in a lump sum, or spread over time and repaid with annual installments.

Tax Increment Financing

Tax increment financing (TIF) is one of the most powerful urban financing tools available. All of the streetcar alignment is within redevelopment districts in Sacramento and West Sacramento. However, budgets in both districts are overcommitted with projects, and other project funding priorities would need to be delayed in order to add the streetcar to the project list. Nevertheless, doing this should be strongly considered by both cities since the streetcar is exactly the kind of infrastructure project that TIF is designed for: to lay the groundwork for more intensive private investment that will generate higher property taxes in the future.

The potential funding range is estimated from $2 million to $10 million per City (up to $20 million combined).

Development Impact Fees

Development impact fees can be collected on new development that occurs within the project area. The fees cover the capital cost of the infrastructure needed to serve new development and the people who occupy or use the new development. The potential funding range is from $1 million to $5 million.

6.1.2 City Sources

Two principal sources fall under this category, and one source is applicable to both cities. The sources are the extension of the West Sacramento ¼ cent sales tax, and the second is General City Funds. A brief description is presented with an estimate of a potential range of funding for each.

West Sacramento ¼ cent Sales Tax

West Sacramento's Measure K provides for a ½-cent citywide sales tax to fund a variety of projects. This is actually a combination of two separate ¼-cent sales taxes, one of which is set to expire in 2013. By renewing the expiring portion of the sales tax, significant revenues would continue to be generated, a portion of which could be dedicated to the streetcar. Such an extension would require a citywide vote and the revenues would likely need to be dedicated to a range of citywide projects in addition to the streetcar in order to gain widespread support. The renewal would only require a 50 percent voter approval. This vote could take place before the expiration of the tax, allowing for future revenues to be bonded for construction in the next few years.

The potential funding range is $750,000 per year or $9.4 million bonded for capital construction.

City General Funds

General funds are always in tight supply, but such funds have been used to partially pay for a number of streetcar systems, including Portland and Charlotte. Since all parties have agreed that the streetcar should have minimal impacts on existing budgets, a relatively small range of general fund revenues is included here.

The potential funding range is $1 million to $3 million per City.

6.1.3 County/Regional Sources

The Sacramento Area Council of Governments (SACOG) is the only source of regional resources. Once planning and engineering is complete, West Sacramento (or whichever agency will be responsible for construction) could pursue a grant from the Community Design program. Regarding County Sources, there is discussion of a future Sacramento County sales tax proposal to fund a variety of transportation improvements.

6.1.4 State/Federal Sources

- **Proposition 1B (Transportation Bond Package)** - California's Transportation Bond Package (Proposition 1B) was approved by voters in November 2006 and later enacted by Senate Bill 1266, allocating $19.9 billion to a wide variety of transportation-related projects around the state, of which $4.0 billion is specifically directed towards public transportation fleet expansion and capital improvement. The majority of the $4.0 billion public transportation fund will be allocated according to formulas;

- **Proposition 1C** - Passed in November 2006, Proposition 1C will provide funding for housing, with specific applications to transit-oriented development (TOD). Pending further legislative definition of applicable projects, this funding source could potentially be used for infrastructure (such as streetcars) that supports TOD and housing;
- **State Grants and Federal Earmarks** - Such earmarks have been used in other transit systems and the streetcar would seemingly be a good candidate due to its potential to serve as a model for other California cities. Earmarks or any other federal funding sought for this project are assumed no to include Federal Transit Administration grants, since other projects in the region will be seeking such funding.

Table 14. Summary of Potential Capital Funding Sources

Funding Type	Range (millions)		Location	
(Listed from Local to Federal)	Low	High	Sac	W. Sac.
Development-Related				
CFD or AD	$5.0	$50.0	✓	✓
TIF (Sac)	2.0	10.0	✓	
TIF (West Sac)	2.0	10.0		✓
Development Impact Fees	1.0	5.0	✓	✓
City				
W. Sac ¼-cent Sales Tax Extension	0	9.4		✓
W. Sac General Fund	0	3.0		✓
Sac General Fund	0	3.0	✓	
County / Region				
SACOG Community Design Grant	0.5	2.0	✓	✓
SUBTOTAL	*10.5*	*92.4*		
State/Federal				
Prop 1B	0.0	10.0	✓	✓
Prop 1C	0.0	20.0	✓	✓
Legislative Earmark	0.0	20.0	✓	✓
TOTAL	***16.5***	***142.4***		

6.1.5 Summary of Potential Capital Funding Sources

Table 14 summarizes the range of potential funding from the sources identified above. If only the lowest amount were secured from each source, there would clearly be a funding shortfall. Therefore, it will be critical that at least some of these funding sources are secured at the high end of the range indicated here, if not even higher, in order to reach the projected budget of $55 million. The potential funding from the new Propositions 1B and 1C introduces a significant

unknown opportunity. The high range potential from all of these sources totals more than twice the projected capital cost of the streetcar. Therefore, there should be room to adjust the mix of funding tools as more information becomes available about each one and as they are tested more thoroughly with property owners, businesses, and public agencies.

6.1.6 Sample Assessment Calculation

Since one of the project criteria was to incorporate substantial private sector participation in financing, and a special assessment district appears to have good potential for funding some of the streetcar costs, a sample assessment calculation is included here.

In order to generate $25 million in funds and limit the assessment to two percent of value ($2 per $1,000 in value), the special assessment district would need to be spread over a collection of properties valued at $11.7 billion. Total property value within the streetcar service area was projected to be approximately that amount by 2015. To annualize the $25 million assessment, a 20 year bond financed at 6% interest was assumed; annual payments on the bond would be $2.2 million. Spread over the $11.7 billion in properties, that equates to a payment of about 19 cents per $1000 in property value per year. So for a property valued at $1,000,000, the annual assessment payment would be $190. If any exemptions were made for certain property types (e.g., residential, institutions, churches, etc.) the assessment rate would need to be higher for remaining properties to make up for the loss.

Another way to look at this sample assessment would be on a per employee basis. Property value estimates for office and retail properties were based on the projected number of employees. A property value of $1,000,000 was derived from assuming $300 per square foot in value for a small retail building of about 3,300 square feet. Such a building was assumed to host 9 employees. The same $190 annual assessment works out to about $21 per employee, or $1.75 per employee per month.

For a residential property worth $325,000, an assessment equal to 0.2 percent of value would be $650. Annualized, using the same 20 year bond financed at 6%, the payment would be $57 annually or $4.75 per month.

This sample assessment could be reduced by varying the total property value over which it is spread, or by adjusting the percentage of value that's used, or by changing the total amount of funds to be financed. The primary benefit to properties paying the assessment is the locational advantage of being close to the streetcar, and the value added by the streetcar.

6.1.7 Potential Operations and Maintenance Funding Sources

The package of funding tools for ongoing operations and maintenance will need to be different than that for capital construction, as the former requires a steady, predictable flow of money over the long term, rather than a lump-sum contribution up front. For this reason, bonded money is not as important as sources that will generate cash flow each year.

Farebox Revenues

In most other cities, farebox revenues cover only a portion (between 2 and 40 percent) of operating costs of streetcar systems. This is partially due to the fact that some cities, like Portland, have lowered or eliminated fares in order to improve downtown transit circulation. The magnitude of farebox revenues will depend on many factors, including whether the streetcar integrates with fare structures for Yolobus and RT, whether transfers are allowed (and if so, for how long), monthly pass usage, fare evasion rates, and other factors.

Parking

Revenues from city-owned parking meters and garages have played a critical role in the funding of the Portland Streetcar. The potential funding range from this source was not evaluated because parking funds are dedicated to other purposes in the City of Sacramento and because no public parking revenue is currently generated in West Sacramento.

Property Based Improvement District (PBID)

A PBID assesses businesses and property owners to support district marketing, safety, and maintenance and could potentially be used to support operation of the streetcar. A PBID currently exists in downtown Sacramento that surrounds much of the proposed streetcar alignment.

Special Assessment District

An assessment district, as described above, can also fund operating costs. The proposed regional riverfront entity may be one vehicle.

Transit Agency Operating Funds

Many streetcar systems have been subsidized through general operating funds from the regional transit agency. The source of these funds would be each agency's share of regional transit operating funds from state sources and sales taxes (TDA). This could require redirecting funds used to provide current services. Operating funds that currently go toward lines that could be discontinued can be redirected to streetcar operations.

Extension of the West Sacramento ¼-cent Sales Tax

A portion of an extension of the West Sacramento sales tax could be dedicated to operations and maintenance instead of being bonded for capital construction. Since the full amount of existing sales tax revenue is dedicated through 2012 (its scheduled expiration) the timing would be right for using an extension to fund operating costs.

Advertising and Sponsorships

Advertising and sponsorships have been an important component of most other streetcar systems, either through annual advertising renewals or long-term prepaid sponsorships, advertising can supplement the operations budget.

Endowment Fund

An endowment could be a source of long-term stability for ongoing operating costs for the streetcar. Creating an endowment would require a significant up-front source of money, but would relieve budget uncertainty in future years.

6.1.8 Summary of Operations Funding Sources

Table 15, below, summarizes the potential revenues that could be generated for operations and maintenance. Funding operations and maintenance will undoubtedly be one of the most challenging aspects of the project and will require more detail in Phase 2. With incomplete knowledge about potential revenue sources, the funding package could still cover the $3.5M in annual operating costs if revenues were secured at the high range for each source.

Table 15. Operations and Maintenance Funding Tools

Funding Type	Range (millions)	
	Low	High
Farebox	$0.00	$0.70
Funds from Discontinued Bus Service	0.00	0.16
PBID	0.50	1.00
W. Sac. ¼-cent Sales Tax Extension	0.00	0.80
Advertising / Sponsorships	0.30	2.00
Parking	0	TBD
Future Sacramento County Transportation sales tax	0	TBD
Total	**$0.80**	**$4.66**

6.2 Management Scenarios

While the proposed West Sacramento-Sacramento streetcar system is not difficult to understand conceptually, there is a wide range of functions which would have to be exercised in order to design, permit, fund, construct, operate and maintain the system. This section suggests several alternative managerial structures that could undertake the functions required to make the project a reality, and operate it on a continuing basis.

The present feasibility study was undertaken by an ad hoc consortium of the Cities of West Sacramento and Sacramento, and the principal transit agencies – the Yolo County Transportation District and the Sacramento Regional Transit District. As the work moves forward into the implementation stage, a more formal organization, with legal authority to reach decisions and act, likely will be required. In addition to meeting the requirements of public expectation as to political responsiveness and administrative transparency, the organization will need to be able to receive funds from various sources, carry out standard accounting functions, enter into contracts, and arrange for the extension of liability and property insurance over the operations and assets of the streetcar system. The relationship of a permanent implementation and operating structure that recognizes the participation of the various entities, while addressing ongoing performance of operations and maintenance functions for the streetcar system, is a key issue to be addressed by the feasibility study partners.

During the final design, procurement and construction period, the entity will have to be able to oversee the completion of environmental documents, implementation of the physical aspects of the system, and negotiate and enter into any necessary agreements with local and state agencies. In addition, the agency must have an ability to objectively monitor the actual operation and maintenance of the service.

6.2.1 General Requirements

An optimal permanent administrative and management structure for the West Sacramento, Sacramento and riverfront streetcar system is required to discharge the following general requirements within the three phases – Project Development, Construction and Procurement, and On-going Operations and Maintenance.

Project Development Phase

In the Project Development Phase, the existing partnership is the entity that oversees preliminary engineering and environmental analysis. In this capacity, the following actions will occur:

- Finalize the west and east ends of the alignments, service and operations plan, ridership estimate, and overall project cost
- Fund and oversee the successful completion of all preliminary engineering tasks
- Develop and negotiate an agreement for a funding and cost-sharing strategy among the four partners, including a continuing cost-sharing agreement
- Finalize a specific funding package for capital and annual operating expenses
- Conduct public outreach as required
- Develop a financing and cost-reimbursement structure for operations

Construction/Procurement Phase

As the project development moves into implementation, the complexities begin to build, and the pressure for centralized management becomes more evident. During this Phase, the project goes through final design and construction. Requirements for the Phase are to:

- Complete the final design of all civil and systems elements
- Develop and adopt a construction management plan
- Construct, install, test, and accept the track, traction power system, OCS
- Procure the vehicles
- Construct/test/accept modifications to RT maintenance facility as required
- Conduct operations and maintenance training
- Procure, test, and install fare collection equipment
- Complete the safety certification of entire system
- Put property and liability insurance in place

- Develop an O&M contract for the use of RT track and facilities
- Complete and implement the complementary bus/transit service plan (YoloBus and RT)
- Conduct public information campaign

Ongoing Operations and Maintenance Phase

- Implement O&M contract
- Monitor compliance with operations and cost objectives
- Implement marketing and promotion programs
- Modify as necessary
- Continuously monitor ridership and public/stakeholder satisfaction
- Prepare plans for extension

6.2.2 Management Alternatives

The means of owning and operating the streetcar in a multi-jurisdictional setting is a critical decision for the communities. The management orientation is to offer a range of possible approaches to be refined and recommended in then next phase of the project. Three models are offered for further evaluation and discussion.

The RT Option

Three possibilities for RT operation of the streetcar are described below. Several variations and alternatives may come up in Phase 2 of the study, as well.

- **First** YCTD, or West Sacramento, and Sacramento could contract for the provision of streetcar service with RT. Streetcar service parameters, including financial contributions and sources could be addressed in that agreement. The Policy Steering Committee created for this streetcar study could continue meeting on an as-needed basis.
- A **second** alternative (a variation of above) would be if West Sacramento contracted directly with RT for streetcar service, regardless of the funding source. West Sacramento would be entitled to appoint at least one person to the RT board. As the current legislation allows, votes are weighted based on the level of financial support from participating jurisdictions. This alternative offers the immediate advantage of not financially jeopardizing the continuation of YCTD bus service, which is largely dependent on West Sacramento TDA funds.
- A **third** alternative would be for the City of West Sacramento to activate full membership with RT. West Sacramento, YCTD, and RT would need to resolve operational, managerial, and financial issues associated with this option.

At this early stage, there is no reason to debate whether TDA funds should be shifted from YCTD to RT; rather, the intention of the streetcar project was never to establish one service mode by decimating the other. New funding sources will be needed to address the streetcar

funding needs. Bus and streetcar service are complementary to one another. Both YOLOBUS and RT may choose to reconfigure some of their local fixed route services to enhance transfer opportunities to/from streetcars.

The Portland Model

The City of Portland together with private sector supporters of the streetcar concept arranged for the incorporation of a not-for-profit corporation to provide focused leadership for the project. This entity is Portland Streetcar, Incorporated (PSI). PSI was established to provide the greatest possible flexibility in addressing implementation of the streetcar system. The PSI Board represents both the city and private partners, while contractual relationships with the City itself and with TriMet provide for the necessary flow of funding, the power of eminent domain, and for operations and maintenance. The Board membership is supportive and stable.

As the primary sponsoring public agency, the City of Portland assigned a Project Manager to oversee the entire sequence of streetcar planning, design, construction, and operating activities. PSI's staff works closely with the City Project Manager, in addition to reporting to the PSI board. In the West Sacramento-Sacramento context, this approach could be used by forming a similar not-for-profit corporation designed to meet the requirements of the local context. Board membership could be on the basis of appointments made by each of the current study partners, and might or might not also include representatives of the private sector.

Joint Exercise of Powers Authority (JPA)

JPAs are commonly used in California and elsewhere where mutually desired projects are dependent upon the coordinated effort of more than one public entity, across jurisdictional boundaries. The Capitol Corridor is a good example of a successful JPA, and some of the parties involved in the streetcar feasibility study are parties to that JPA.