



APPENDIX C- Study Alignment and Vehicle Selection

Study Alignment

The study alignment was evaluated by the consultant team in consultation with the City's Acting Traffic and Engineer and Department of Transportation and Engineering staff to identify possible conflicts with the existing traffic operations that might result from the introduction of the streetcar.

The map, included in end of this appendix, identifies the lane configuration at each intersection along the study corridor. The lanes shaded in pink identify the lane in which the streetcar would run in the study alignment. This alignment was selected for study purposes only. The alignment that is ultimately chosen as the preferred alignment for construction may differ from this alignment. However, this alignment demonstrates the engineering feasibility, and minimal conflicts that the study alignment presents with existing traffic operations. The stop locations identified on the maps are for study purposes only. The number and location of stops were identified for feasibility and cost estimating purposes only. The number and locations of stops would be modified upon further study and rigorous public input.

Vehicle Type and Performance

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

- Basic size (length and width), capacity, turning radius and clearance requirements
- Performance (top speed, acceleration and braking rates, etc.)
- Ingress and egress (single-sided vs. double-sided)
- Direction of operation (single-ended vs. double-ended)
- Unit configuration (single unit vs. multiple units)
- Floor height (low floor vs. high floor) and the means of accessibility

Streetcar Vehicle Types - The following sections provide descriptions of the various streetcar vehicles available:

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. 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.



**Modern Streetcar (Inekon- Skoda)
Portland, Oregon**

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. 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.

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. 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.



Vintage Trolley – Dallas, Texas

There were many variations to these generalities. Rehabilitation of historic vehicles is an expensive undertaking. Several cities – Portland, Tampa, Little Rock and Charlotte have opted to replicate rather than rehabilitate a vintage trolley, 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. 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. One type of replica trolley currently used in other cities is the 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.



Replica Double Birney – Tampa, Florida

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.

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, 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.



Rebuilt PCC Car – Philadelphia, PA

The table 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.





Streetcar Types Summarized By City

City	Historic/Vintage Cars		PCC	Modern Cars	
	Restored	Replica		Streetcar	LRV
Boston	X		X		X
Charlotte	X	X		X	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				X
San Francisco	X		X		X
San Jose	X				X
Seattle	X			X	X
Tacoma				X	
Tampa	X	X			
Washington, DC				X	

Streetcar Feasibility Study Vehicle Selection –

The identified primary function of the proposed Cincinnati streetcar system is to provide a “pedestrian accelerator” that expands the “walkability” of Cincinnati’s urban core, encouraging people to live, work and shop in the downtown area without the need of a car. To achieve this goal, a streetcar vehicle must: maximize capacity; facilitate rapid ingress and egress to maintain a consistent schedule; and readily accommodate bicycles, wheelchairs, scooters, personal shopping carts and child strollers. In consideration of these criteria, the modern streetcar, similar to the model currently used in Portland, OR, was chosen by city staff and the consultant team to be used in the development of cost estimates and an operational analysis. The level floor boarding feature of the modern streetcar sets it apart from vintage and replica vehicles for accessibility. Final selection of vehicle type and manufacturer would be completed in further phase of study.



Inekon-Skoda Type T-10 Streetcar





The Feasibility Study assumes that six streetcars would be needed to serve the study alignment according to the Operating Plan prepared for this study, also allowing for two additional spare vehicles. Vehicle specifications for the Inekon-Skoda Type T-10 vehicle include:

- Configuration: Bi-directional, articulated three-section vehicle, two traction bogies, dual sided entry
- Floor height: 14 inches above top of rail
- Length: 66'-0" (39'-0" wheelbase)
- Width: 8'-1"
- Minimum turning radius: 60 ft.
- Grade parameters: 9% continuous grade (max.)
- Passenger Capacity: 30-40 seated, 130-140 maximum occupancy
- Vehicle weight: 63,500 lbs. (empty), 85,800 lbs. (fully occupied)
- Power requirements: 750 volts DC
- Pantograph height: 15'-0" to 20'-6" (operating), 13'-0" (storage)
- Maximum operating speed: 46 mph

Potential service expansion routes include connecting to the Clifton/Uptown area requiring the capacity to manage the 7%-9% continuous grade on Vine Street between McMicken Street and Calhoun Street. The selected vehicle can accommodate the steep grade. Other vehicles were not investigated for their grade limitations that could possibly preclude them from use.

