Chapter Ten – Feasibility of the Historic Streetcar

10.0 INTRODUCTION

The University Avenue "Traffic Calming Conceptual Study" prepared in November of 2002 proposed the reintroduction of streetcar service along University Avenue. The intent of implementing streetcar service is four-fold:

- Provide an enhanced form of transit that encourages people to ride transit and reduces traffic.
- Encourage economic revitalization along University Avenue.
- Provide a sense of historic preservation.
- Encourage and increase tourism in the North Park community.

The Community Workshop participants supporting the historic streetcar also suggested that streetcar service run along University Avenue and continue south on Park Boulevard connecting to downtown San Diego. The Park Boulevard terminus for the streetcar line is intended to be at or near the intersection of Park Boulevard (12th Avenue) and "C' Street.

This chapter provides a brief evaluation of the feasibility of providing an "historic" streetcar service in the defined study area of University Avenue from 32nd Street to Park Boulevard. This chapter addresses key issues pertaining to the relative feasibility and viability of streetcar service in North Park along the University Avenue corridor.

The streetcar analysis focused on the unique characteristics of the corridor, the streetcar, the design criteria set out in the Preferred Concept Plan from the University Avenue Traffic Calming Conceptual Study and the role the streetcar would play in providing transit options to this corridor of San Diego. The evaluation of the streetcar feasibility relies primarily on the physical requirements necessary to implement the streetcar system effectively within University Avenue. To support this effort the consultant team defined several study objectives:

- Define the route, or alignment, and confirm the station locations
- Define the streetcar or vehicle type (which would influence the design requirements)
- Establish the physical requirements and analysis
- Determine shared transit lanes feasibility
- Determine operations and maintenance responsibilities

10.1 ROUTE ALIGNMENTS, DESCRIPTION AND ASSUMPTIONS

This section describes the potential streetcar route's alignment, station locations, streetcar types, the study area and the necessary assumptions for operation of the historic type streetcar.

Alignment Descriptions

The streetcar alignment would begin at, or near, 32nd Street utilizing the dedicated curbside transit lanes or the mixed flow lanes as identified in the Conceptual Study and illustrated in Exhibit 10-1. The streetcar would continue along University Avenue to Park Boulevard. At Park Boulevard the alignment would leave the project study area by turning south on Park Boulevard. The streetcar would then be running in the proposed Bus Rapid Transit (BRT) lanes, which are currently in the planning stages as part of SANDAG's Transit First Showcase Project. The Showcase Project, which is currently planned to extend south of University Avenue on Park Boulevard, would provide either shared lanes (mixed-flow) or a side-running transitway.

Station Locations

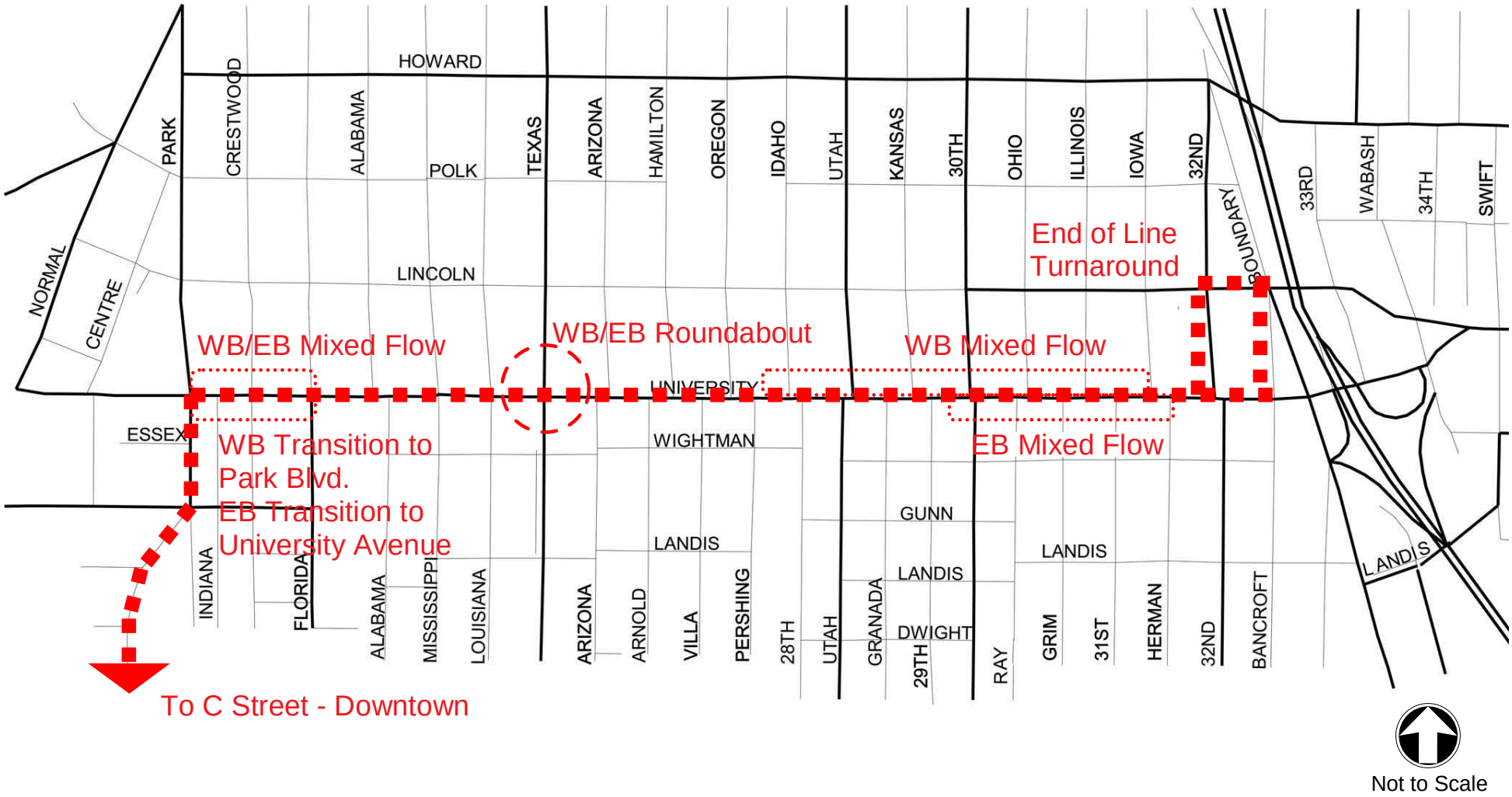
For this analysis the streetcar would utilize the same stations as the Metropolitan Transit System Route 7 and 908 on University Avenue as defined in the Preferred Concept Plan in the Traffic Calming Conceptual Study. These station locations, illustrated in Exhibit 10-2, include the following:

Westbound

- Iowa Street
- 30th Street
- Idaho Street
- Texas Street
- Alabama Street

Eastbound

- Alabama Street
- Texas Street
- Pershing Street
- 30th Street
- 32nd Street



HISTORIC STREETCAR ALIGNMENT

EXHIBIT 10-1

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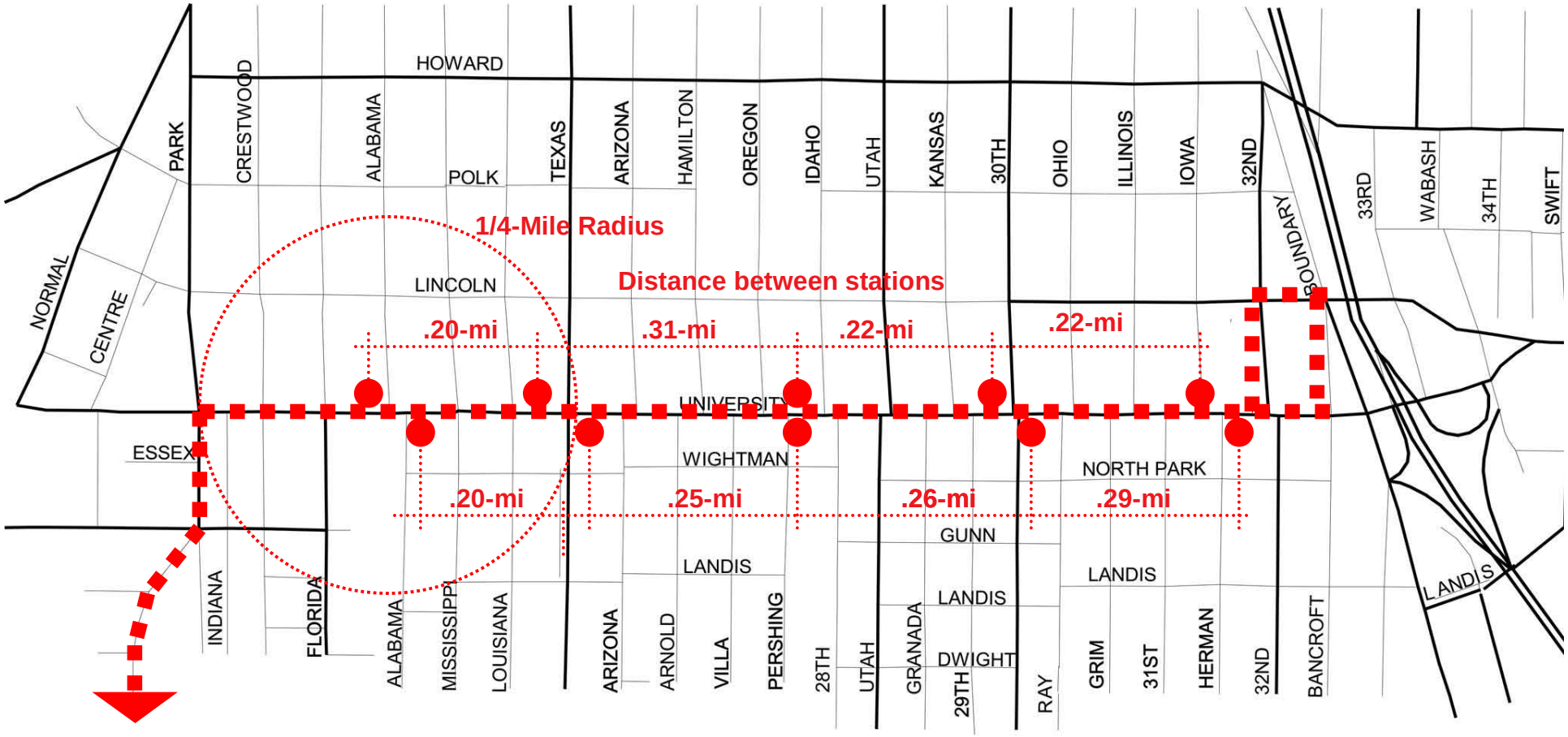

● **Proposed Streetcar Stops on University Avenue**

.25-mi Average distance between existing transit stops

Not to Scale

PROPOSED STREETCAR STOPS ON UNIVERSITY AVENUE

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-2

Streetcar Type

The requirements or demands for the implementation of the streetcar service would greatly depend on the specific type of car selected. At this point in time, the design of the alignment should be as flexible as possible to allow for multiple boarding sides, driver location, and minimum track installation. Based on these suggested requirements, there are three (3) possible vehicles proposed for the corridor:

- The three San Diego Class 1 Streetcars, which are privately owned, are located in San Diego, and are in need of restoration.
- The PCC streetcars that were operated in San Diego, but are not currently located in San Diego (as shown in photo below).
- Replica streetcars, which would need to be acquired, to supplement the historic streetcars in order to meet ridership demands necessary for the alignment.

For the purpose of this analysis, following are specifications necessary for the technical requirements of an historic type streetcar. These requirements would allow for "tighter" operational characteristics that are better suited for a highly urbanized area such as North Park. However, designing the streetcar alignment to these standards would not allow for current Light Rail Vehicles (LRV) to utilize the corridor. It should be noted that the track gauge and voltage requirements would be the same as those used by the current trolley line. This would allow the historic streetcars to operate on the lines in other locations within the San Diego Trolley system. The general streetcar assumptions include the following:

- Car end types:

  Double-ended cars: A double end car is one with controls at both ends of the vehicle (similar to the existing trolley cars operating in San Diego). These cars, similar to San Diego Class 1 cars, effectively have two fronts with no back. At the end of the line, the driver changes ends while lowering one pantograph arm and raising the other. This saves the space and expense of track looping at the end of a line, or at intermediate points where it might be necessary to reverse directions.

  Single ended cars: A single ended car is one with the controls on one end of the car similar to certain types of PCC cars. This type of car requires a loop system to change direction, and therefore requires a greater length of track at the end of the alignment.

- Door configuration:

- Double-sided cars: This vehicle type has doors on both sides allowing passengers to board from either side. This is typical for double-ended type cars that simply reverse direction.

- Single sided cars: A single sided car is one with the door on one side of the car. Again, this is similar to certain types of PCC cars. This type of car would always require passenger loading to occur on one side. Typically this is on the right side of the vehicle. Because of this type of door configuration, the single-sided car requires a loop system to allow for boarding to occur on just one side. This type of feature typically requires a greater length of track at the end of the line to reverse direction.

- Passenger capacity: Passenger capacity varies depending on the car type. The Class 1 type car has a seating capacity of 40 and a standing capacity of 50, while PCC type cars have a seating capacity of 46 and standing capacity of 60. Some approaches to accommodating ADA requirements can reduce the number of seats, but most retrofits to streetcars for ADA requirements do not reduce seating. Please see pages 10-35 and 10-36 for options and solutions that will not reduce numbers of seats.

- Method of power: The cars are electric with a 650-volt requirement.

- Track Gauge: 4-feet 8.5 inches – This is measured between the inner sides of the rail heads. These measurements are the same as the existing trolley lines operating in San Diego by MTS.

- Turn-around requirements: Within the study area, only one turn-around would be neededat the east end of the proposed alignment. This study will illustrate how the streetcar would change directions at this point for both single-ended and double-ended vehicles.

- Lane width requirements: 12-feet - The "dynamic envelope" of the vehicle establishes the required width of the travel lane. The dynamic envelope consists of the streetcar width plus 1.5-feet on each side, or 66-inches from the centerline of the track gauge. In this case, the lane should be a minimum of 11-feet wide with 12-feet as the preferred width.

- Minimum Radii: 50-foot radius would be the minimum used within the corridor. This radius is used in San Francisco on the F Line on Market Street. The 50-foot radius would allow for the streetcar to make for tight turns but at a slow rate of speed. This radius would preclude San Diego's standard trolley cars from being used on this route. Although a tighter radius can be used for the historic streetcars (typically entering or exiting a storage area) it is not typically used for operational purposes. A tighter radius creates excessive track wear and has a higher noise level related to the wheels "squeaking" on the tracks.

It should be noted that the PCC cars operating in San Francisco had the undercarriage rebuilt to handle the tight radius associated with the F Line. This would also be required here if the PCC cars are intended to operate in University Avenue corridor given the minimum radius standards that would be employed.

Quantity of Streetcars Based on Schedule and Ridership Assumptions

- Schedule: The preferred schedule for the streetcar, based on initial community input, is to provide regular daily service that would be consistent with the existing Route 7. This would mean providing vehicles at 6-minute intervals, at peak periods, and 10-minute intervals at other times. The average one-way time to cover the proposed alignment from I-805 to Park Boulevard and C Street is approximately 22-25 minutes, with a maximum layover of 5-minutes at each end. This requires approximately 56-minutes per round trip.

- Number of Street Cars Needed: Based on the headway, or intervals assumptions, serving the corridor during peak period would require approximately 10 vehicles. Also, at least four (4) additional vehicles should be available for on-going maintenance or service during the course of standard operations. The total number of vehicles required to serve the proposed alignment would then be 14. More vehicles may be needed if the seating

capacity of the selected vehicle cannot meet the ridership requirements for the alignment when service begins.

- The number of vehicles would also have an influence on the spatial requirements for the storage and maintenance facility for the vehicles, as discussed in section 3.4. It should be noted that the 908 line would continue to use this corridor and the streetcar would not supplement or replace this service. Both the existing routes 7, 908 and the streetcar would share the proposed curbside transit-only lanes.

- Ridership Assumptions: The streetcar is intended to operate on University Avenue from
- 32nd Street to Park Boulevard, and then south on Park Boulevard to C Street. It has been discussed through the course of the project that the streetcar could play a role similar to Route 7A. The Route 7A supplements Route 7 starting at 33rd Street and University Avenue during peak periods. However, Route 7A extends beyond the proposed streetcar route of C Street and Park Boulevard and ends at Broadway and Harbor Drive near San Diego Bay. So, if a transit passenger on the streetcar wanted to travel past C Street and Park Boulevard into downtown San Diego (during peak periods) they would have to transfer to either another bus or trolley at that location.

- Other discussions involved replacing Route 7 altogether from 32nd Street with the streetcar. Again, this is not recommended as two (2) transfer points by transit passengers traveling from La Mesa to downtown San Diego would be needed. The first one would be at 32nd Street where the Route 7 passenger would transfer to the streetcar and then the other transfer would be at C Street and Park Boulevard where the streetcar service would end and passengers would need to take another bus or trolley to continue downtown. Transfers are not desirable as they add to the complexity and time of transit trips, thereby discouraging transit patrons.
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- In both cases trying to emulate Route 7 or 7A with streetcar service requires the transfer of passengers. Assuming the transfer of passengers did occur, the streetcar capacity of 50-60 passengers would not be sufficient to accommodate the highest peak period ridership demand (97 passengers) for the corridor, which is illustrated in Table 10-1. Even without passenger transfers from the Route 7 eastbound of the proposed historic streetcar alignment, the morning peak period westbound passenger demand for the 7A (74 passengers) could not be accommodated by the streetcar due to its passenger capacity. In addition, SANDAG anticipates that by 2030, the ridership demands would increase by at least nine (9) percent. What this begins to identify is that the streetcar would not be able to replace Routes 7 or 7A during the peak periods.

- However, the high ridership counts and projections are only during the peak periods. Non-peak period passenger demand is not as strong. The streetcar could supplement Route 7 during non-peak times, but could not replace it, especially during the peak periods. Again the transfer of passengers would have to occur as stated above.

- As the implementation of historic streetcar service is explored, the issue of operational hours would need to be clearly defined with SANDAG and MTS. Determining if and how the streetcar can provide the level of service expected by the North Park community, while still handling the necessary volume of passengers, would require further dialog with SANDAG/MTS. Also, additional operational analysis is needed beyond the scope of this effort to determine how best to utilize the historic streetcar in the day to day operational needs of Route 7 and its passengers.

Table 10-2 outlines the requirements discussed in this section.

Table 10-1
Routes 7A and 7 - 2003 Passenger Count

Peak Period and Route Direction	**Number of Passengers On-Board**	
AM: Westbound	**Route 7A**	**Route 7**
Entering Study Area (Bancroft / University)	10	52
Leaving Study Area (Park Blvd. / University)	74	79
Mid-Route (Park Blvd./Zoo Drive)	24	97
End of Route (C Street)	4	21
AM: Eastbound		
Beginning of Route (C Street)	N/A	54
Mid-Route (Park Blvd./Zoo Pl.)	N/A	40
Entering Study Area (Park Blvd. / University)	N/A	10
Leaving Study Area (Boundary/University)	N/A	16
PM: Westbound		
Entering Study Area (Bancroft/ University)	N/A	62
Leaving Study Area (Park Blvd. / University)	N/A	49
Mid-Route (Park Blvd./Zoo Drive)	N/A	62
End of Route (C Street)	NA	24
Note: Highest passenger count at SDHS.		73
PM: Eastbound		
Beginning of Route (C Street)	N/A	65
Mid-Route (Park Blvd./Zoo Pl.)	NA	71
Entering Study Area (Park Blvd. / University)	N/A	57
Leaving Study Area (Boundary/University)	N/A	42

Note: Ridership indicates number of passengers between stops in the peak hour.

Table 10-2
Operational Requirements Summary

Car Type	San Diego Class 1	PCC	Replica Streetcar
End Type	Double Ended	Single Ended	Either Type
Door Type	Double Ended	Single Ended	Either Type
Passenger Capacity	40- seated + 10 standing	46-seated + 14 standing	TBD
Method of Mobility	Electric	Electric	Electric
Track Gauge	4'-8. 5"	4'-8. 5"	4'-8. 5"
Turn Around Location	32nd St and University Ave		
Lane Width	11'-12'		
Minimum Radius	50-feet	*50-feet	50-feet
Number of Vehicles	14 cars to meet headway and operational requirements		

10.2 PHYSICAL REQUIREMENTS AND ANALYSIS

Historic Street Car Alignment

As described earlier, the streetcar alignment would follow the transit only lanes and also use the mixed-flow lanes on University Avenue as defined in the Preferred Concept Plan. Analysis shows that the streetcar would run into operational problems trying to weave into and out of the transit-only lanes. Similar to the transit analysis provided for the project, the primary element affecting the streetcar would be the merge points with the mixed-flow lanes. In the concept plan, private vehicle traffic may utilize only one lane through most of the corridor. Providing only one mixed-flow lane creates significant queuing, making it difficult for the streetcar to transition into the mixed-flow lane. The Refined Concept Plan addresses this issue by removing on-street parallel parking and provides a continuous transit-only lane. The proposed short-term plan would allow parking in the transit only lane during the off-peak hours. This parking plan would pose operational problems for the streetcar. Therefore, on-street parallel parking would not be permitted if the streetcar were implemented.

Through the length of the corridor, this weave movement has its highest impact in the PM going eastbound. The travel time for the streetcar during this period in 2030, with the Conceptual Study implemented, could range from 16 to 18 minutes (similar to other transit vehicles) compared to 10 to 11

minutes today. Although this difference in time frame does not seem significant, it could require additional vehicles to meet the ridership demand for the corridor. This in turn increases the initial implementation cost.

Drop Suspension Support Poles

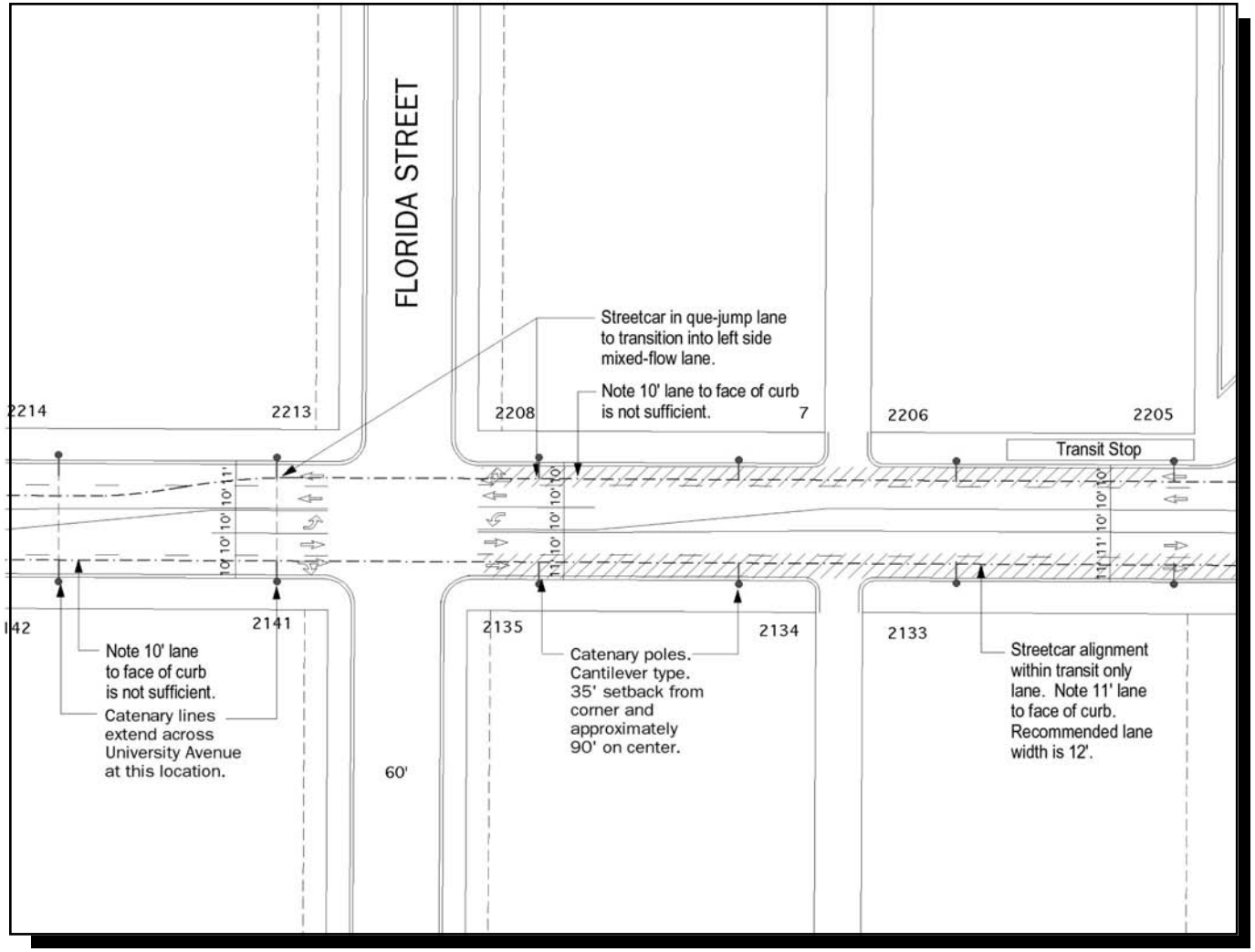
Drop suspension poles would provide the necessary power for the streetcar's electric service needs. Pole spacing and height is a critical project element when placing a new rail system into an existing urban environment. The existing infrastructure, underground utilities, overhead power lines, transformer boxes, street trees, and other public fixtures placed in the existing right-of-way all have an impact on where the poles can be located. Following are the minimum drop suspension pole requirements:

- Spacing: 4 – poles per block. The existing urban development blocks along University Avenue are typically 340-feet long, curb to curb. This includes a 300-feet building area, a 20-foot wide alley and another 20-feet for parkways. The recommended pole spacing is approximately 90-feet, or two per half-block as illustrated in Exhibit 10-3. In all cases it should be noted that drop suspension support poles could be outfitted with new street light fixtures. This would also alleviate a common concern identified during the community workshops regarding inadequate lighting in the corridor.

- The drop suspension lines do not have to reach across the entire width of University Avenue. Rather, cantilever poles could be used for the transit lane that runs curbside. Using the cantilevered poles allows the proposed median street trees to reach a greater height and canopy. Additionally, if the drop suspension lines span the entire width of University Avenue, the offsetting blocks could create a more complex spacing arrangement. In the areas where the streetcar would share the mixed-flow travel lanes, it would be necessary for the drop suspension lines to cross the entire width of the right-of-way.

- The typical minimum setback for drop suspension support poles from cross streets at street grade crossings is 35-feet. However, in highly urban areas, like downtown San Diego, the poles are setback 25-feet from the intersection cross street faces of curb.

- Due to the highly developed conditions along University Avenue, placement of the poles would have an impact on the existing above grade and below grade infrastructure. Most blocks contain utility boxes, street trees and other above grade structures. The impacts to below grade infrastructure include gas lines, sewer lines and waterlines. Future planning efforts would need to address specific locations for pole placement and the associated impacts to these utility features with the final placement.



Not to Scale

TYPICAL CATENARY POLE LOCATIONS

EXHIBIT 10-3

- Height: 19-feet. The messenger wire or drop suspension lines need to be a minimum of 19-feet above the street. This is intended for alignments that are only being used by Light Rail Vehicles and not rail freight lines, for which the streetcar would qualify. Once the drop suspension lines are installed along University Avenue it would become a restricted corridor. Certain types of vehicles (such as large vehicles moving a house) would not be able to cross or traverse along this portion of University Avenue. It is recommended that coordination with emergency services be initiated prior to the design stage. This would be to ensure that the lines would not inhibit emergency responses or vehicles.

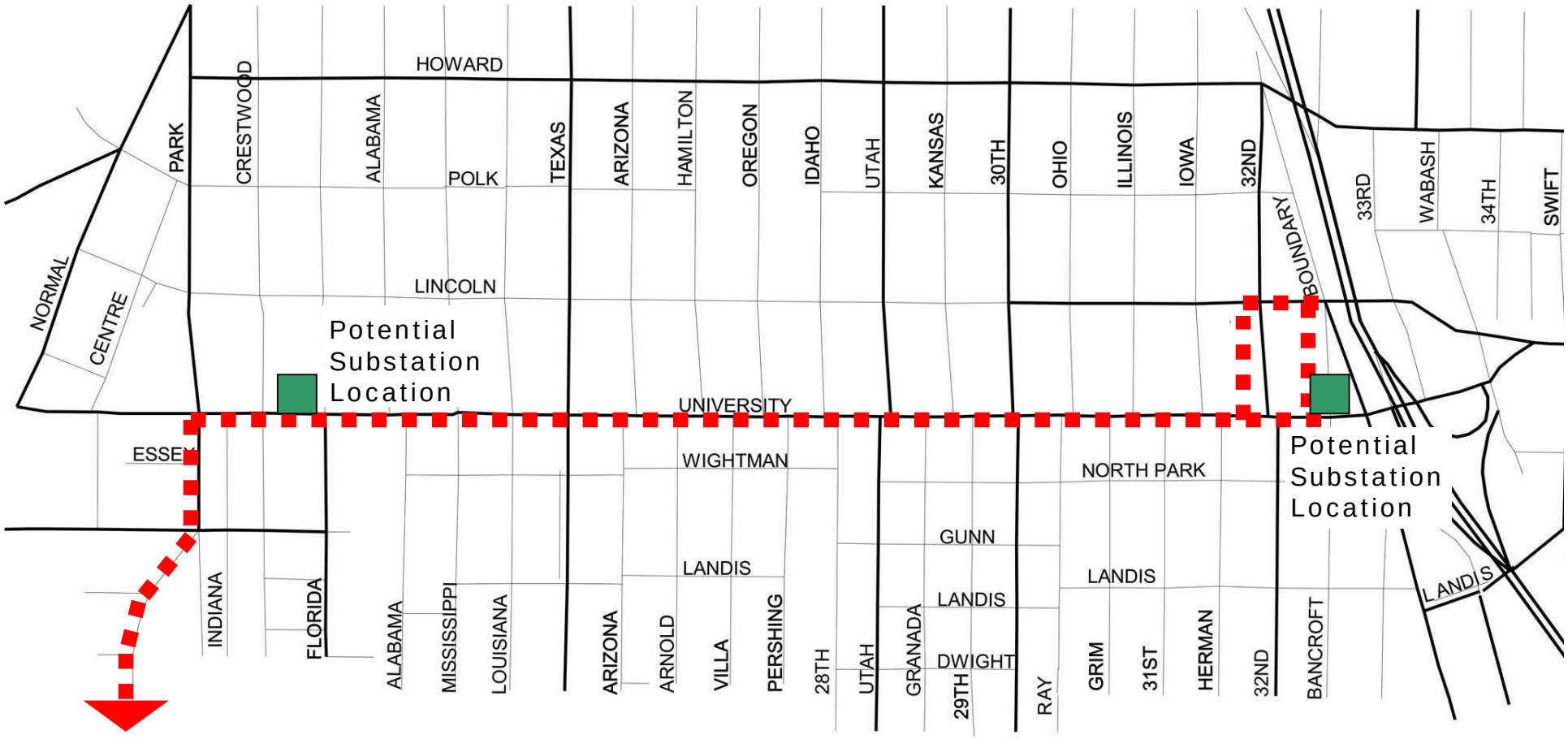
- Poles and Wires: It should also be noted that the drop suspension lines and support poles could create a negative impact on the corridor's visual quality. The webbing of lines and the number of poles needed to support the system could be perceived as a visual impact. The North Park community has spent considerable time and energy recently to remove overhead power lines in its neighborhood. Sensitive placing of the drop suspension poles would be necessary to minimize the visual impact.

  Although, if the streetcar implementation is in concert with other streetscape improvements, such as new sidewalks, lighting, street trees and more, the poles and overhead wires could be considered by the community as a minimal intrusion compared to the other improvements.

Substation Requirements

Substations would play an important role for the electrical streetcar by providing a constant flow of sustained power. Substations need to be located in close proximity to the corridor.

In normal trolley application, a substation is typically located approximately every 1.5-miles. The corridor along University Avenue being served by the streetcar is approximately 1.9-miles. This means that two (2) substations would be required to service the streetcar efficiently. Additional substations would be needed for the continuation of the streetcar line on Park Boulevard between University Avenue and C Street. Future study of this streetcar corridor is needed to determine the requirements for substations along this route and would need to be coordinated with those along the University streetcar line route. For University Avenue one, preliminary location should be near the beginning of the alignment at 32nd Street, and the other near Park Boulevard. These two locations are illustrated in Exhibit 10-4.



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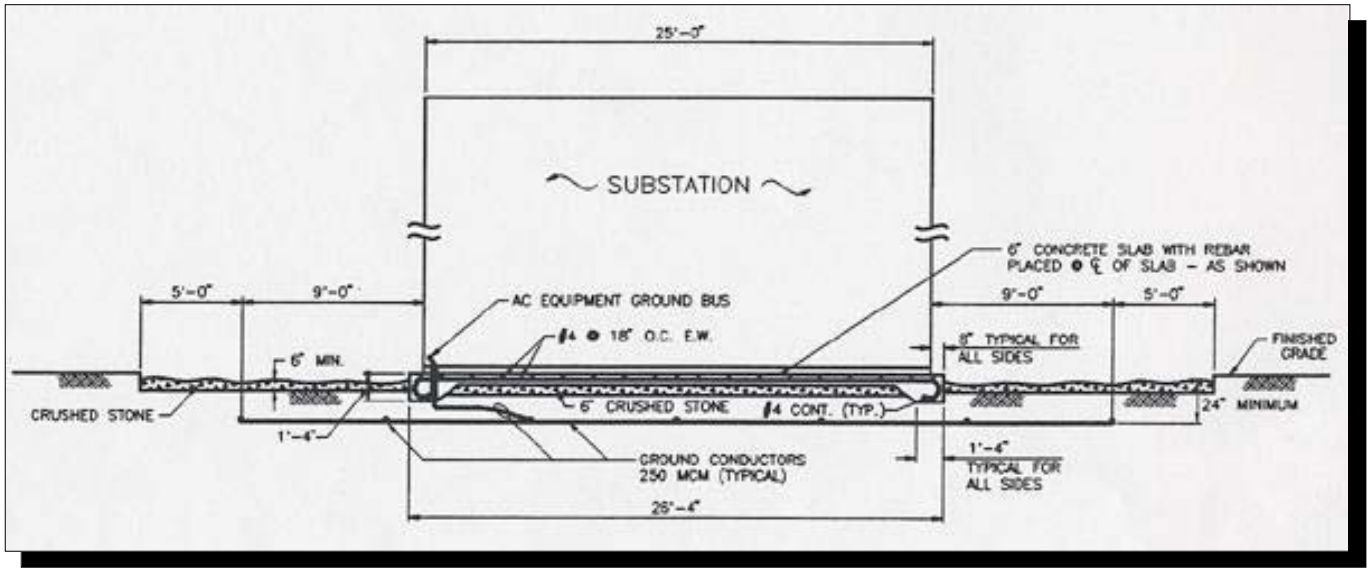
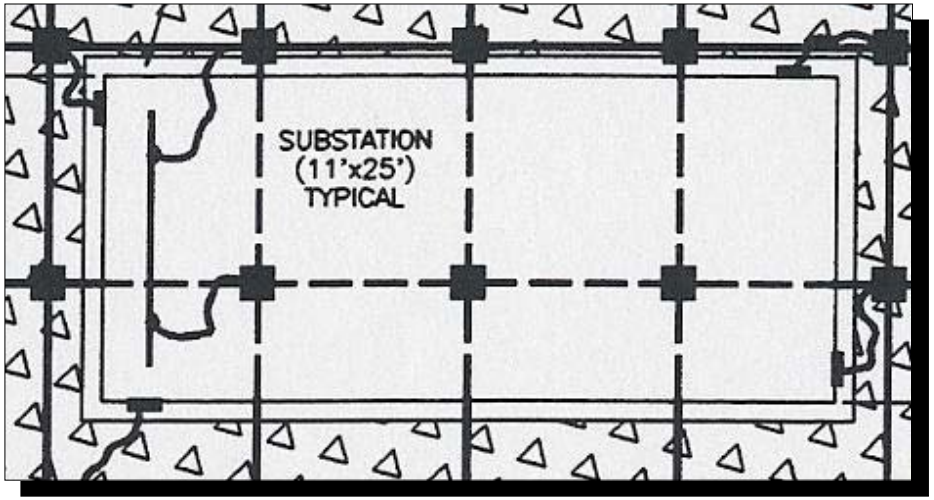
POTENTIAL SUBSTATION LOCATIONS

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-4



Section View



Plan View

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SUBSTATION SECTION AND PLAN VIEWS

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-5

The size of a typical substation unit is 25-feet by 11 feet, and is 11-feet high. This size substation would require a pad of 37-feet by 53-feet (for a single station) and a fully secured base. A section and plan view are shown in Exhibit 10-5. Because of the highly urbanized nature of North Park, especially on University Avenue, the placement of these units would require significant study and community involvement. Any potential substation locations in the general vicinity of the streetcar alignment would require some type of property acquisition.

There are other types of rail-oriented electric streetcars that do not require the drop suspension lines necessary for mobility. These cars are created with technology based on battery powered, inductively charged steel wheel trolley. This type of vehicle/service has been employed successfully in other areas including the Farmers Market in Los Angeles. This technology could provide a more "urban friendly" appeal by eliminating the overhead drop suspension lines and the necessary support poles from the surrounding streetscape. This is an area that future studies should explore as the visual and aesthetic concerns of the overhead lines are discussed. The biggest drawback for this type of system is limited operational speed. As the technology is advanced, the speed of the vehicle could improve making it a candidate to operate in the University Avenue corridor.

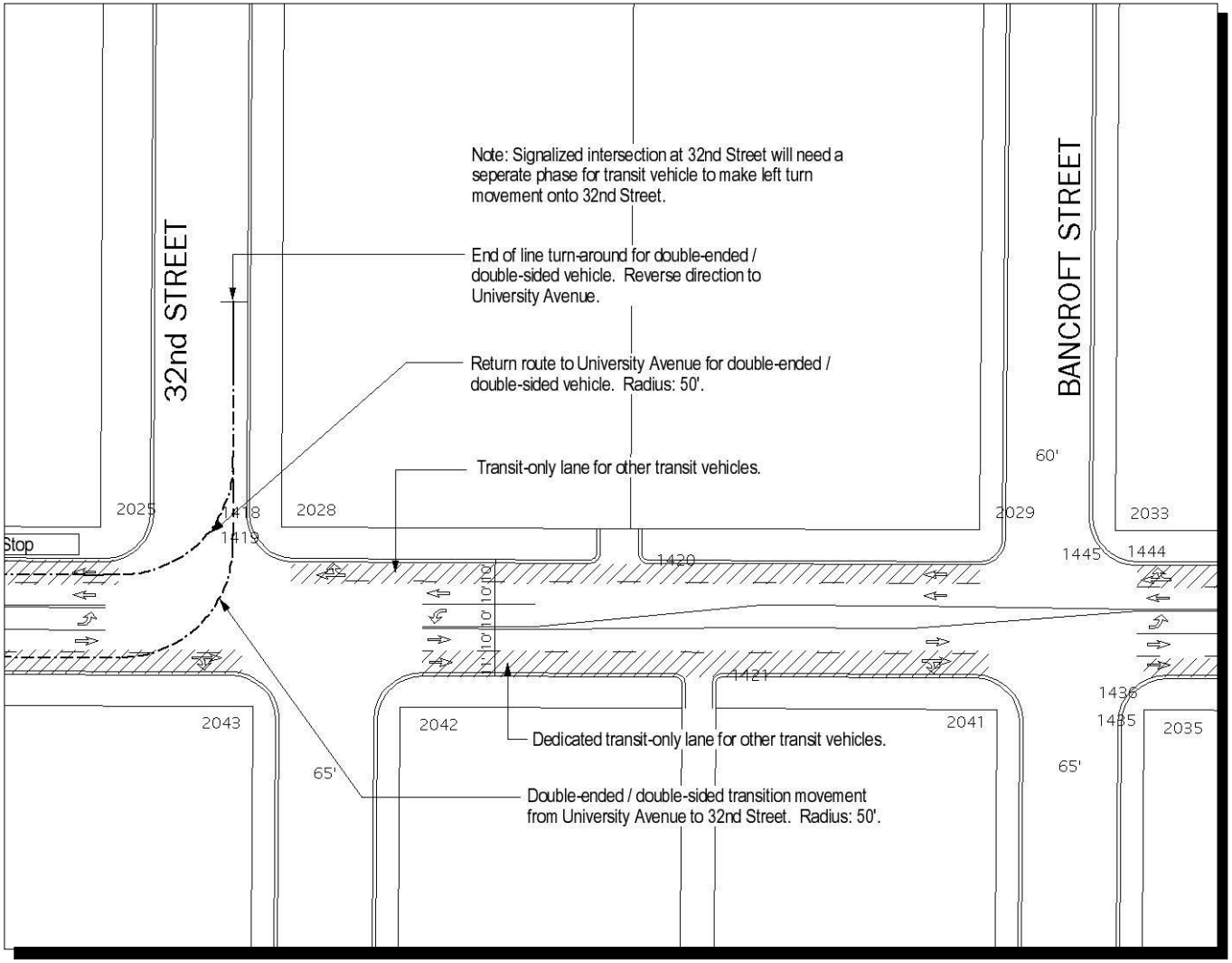
Turn-around Locations

The streetcar would need to turn around at the end of the alignment to make its return trip and proceed in the opposite direction. Within the study area there will only be one location needed for the turn-around – the intersection of the 32nd Street and University Avenue. The 32nd Street intersection is also the location of the last bus stop in the study area, and the intersection is signalized.

The 32nd Street intersection is also offset making it an extended or longer intersection than normal. This allows for an easier transition for the streetcar to enter 32nd Street to begin the turnaround process. There are two (2) ways of completing the end of line turnaround depending on the vehicle type selected for use. These include the following:

- Double-ended car: The eastbound vehicle would cross over the intersection into the far right lane on 32nd Street as illustrated in Exhibit 10-6. The vehicle would then proceed north of the intersection and stop. At this point the driver would proceed to the other end of the vehicle while lowering one pantograph arm and raising the other. The location for the streetcar would be a protected area on 32nd Street north of University Avenue, providing a better driver transfer.

- Also, the 32nd Street and University Avenue intersection would require a separate traffic signal phase to allow the streetcar the left turn movement off of University Avenue and the right- turn movement onto University Avenue. The streetcar phases would affect all intersection movements for the time it takes the streetcar to move through the intersection. This type of separate phasing for the streetcar would delay traffic and potentially cause longer vehicle queues on University Avenue.



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DOUBLE-ENDED CAR TURNAROUND

(OVERLAID ON THE PREFERRED CONCEPT PLAN)

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-6

Single-ended car: The eastbound vehicle would cross over the intersection into the middle lane on 32nd Street and continue to travel in the middle lane to Lincoln Avenue as illustrated in Exhibit 10-7. The vehicle would turn right on Lincoln into the far right travel lane, then continue to Bancroft and turn right into the middle lane. When the vehicle reaches University Avenue, it would turn right again and proceed in the westbound transit-only lane.

Also, each of the turning movements on the side streets (Lincoln and Bancroft Street) causes some impact to the adjacent property. This is the case even when using the minimum turning radius of 50-feet due to the curbside running track. Again, as with the double-sided cars, the 32nd Street and University Avenue intersection would require an additional separate traffic signal phase to allow for the historic streetcar's left turn movement off of University Avenue.

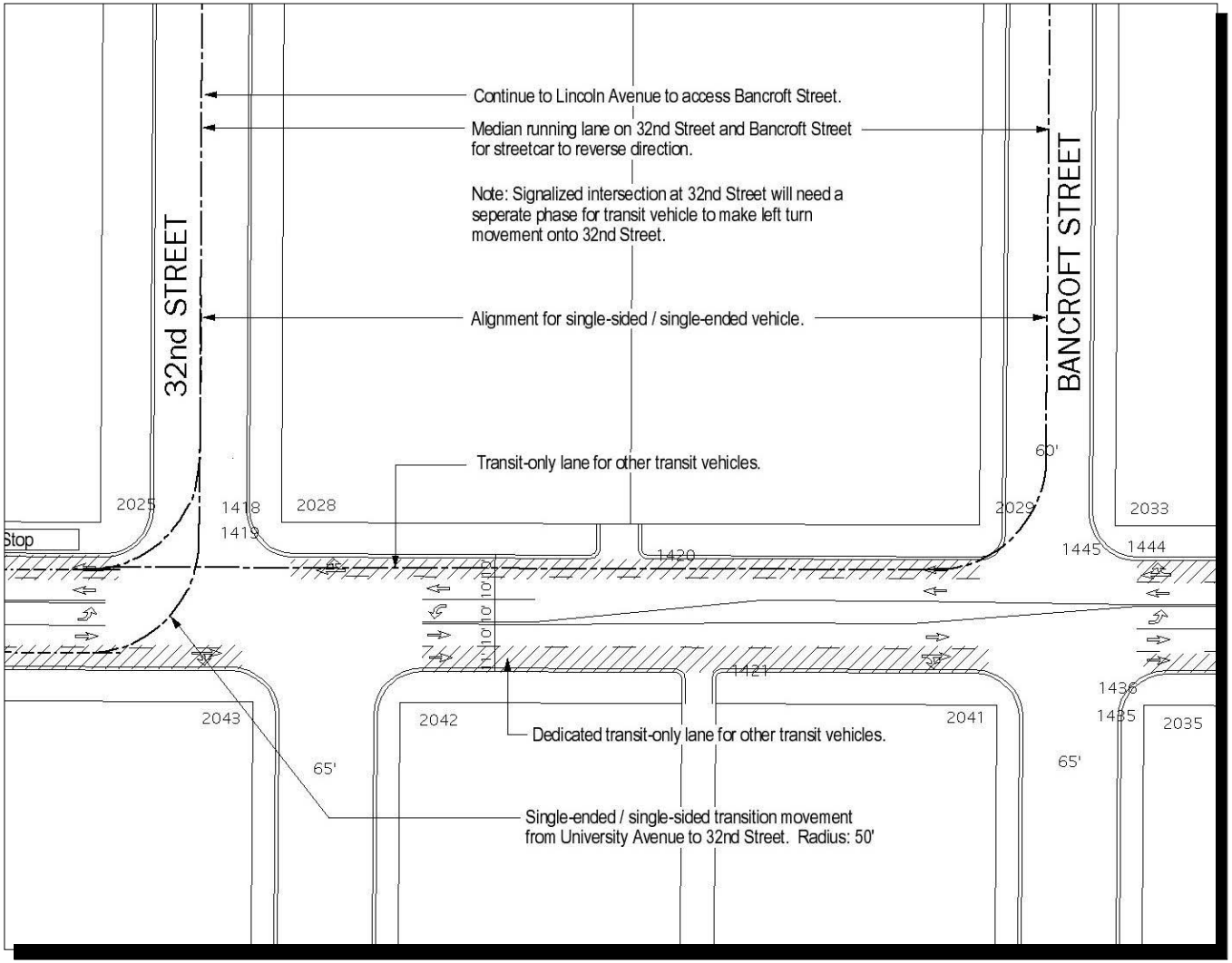
Streetcar Lane Width Requirements

The minimum lane width that provides sufficient safety is dependent upon the dynamic and static widths of the vehicle. The static width of the streetcar is approximately 8-feet 4-inches. The dynamic width of the streetcar (the area the streetcar moves from side to side while in motion) is 11 feet.

Based on the above information, the lane should be a minimum of 11-feet with 12-feet as the preferred width for a single curbside streetcar line. The Preferred Concept Plan shows three separate conditions for the operation of the streetcar. These conditions are:

- A 9-feet wide transit lane with a 2-foot painted or striped buffer as illustrated in Section A.
- A 12-foot wide transit lane as illustrated in Section B of the Conceptual Study.
- A mix-flow lane serving general traffic, transit, and streetcars of varying width from 10-feet to 11-feet.

The Refined Concept Plan minimizes the number of cross-sections along the corridor and provides for an 11-foot outside travel lane that would meet the minimum requirements for buses. The westbound transit only lane is proposed from Boundary Street to Florida Street to minimize the number of merge maneuvers required by transit vehicles. In the eastbound direction, the transit only lane is proposed from Utah Street to Boundary Street, with the potential for future extension of the eastbound transit only lane to Park Boulevard if traffic impacts could be mitigated.



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SINGLE-ENDED CAR TURNAROUND

(OVERLAID ON THE PREFERRED CONCEPT PLAN)

EXHIBIT 10-7

To meet the parking and loading needs of businesses along the north side of University Avenue, a parking concept plan was developed as part of the Refined Concept Plan that would allow vehicles to park in the transit only lane during the off-peak hours.

In order to provide the safest streetcar service, it is recommended that all streetcar lanes be a minimum of 12-feet. This requires that certain areas within the corridor provide additional width than what is currently proposed in the Refined Concept Plan. All parking should also be eliminated from the transit only lane.

This additional lane width would have to come from the adjacent travel lanes, median, or encroachment into the existing sidewalk or parkway. This could require the relocation of existing curb/gutters and sidewalks depending upon from where the additional travel lane width would be extracted. Also, additional width to the typical 12-feet lane would be needed to compensate for vehicle overhang during turn movements. During these turn movements, vehicles have either in-swings or out-swings at the radius points requiring greater clearance at these locations.

Maintenance Yard and Storage Facility

An integral component for the streetcar system would be the overnight storage facility and maintenance yard. In the past, these were known as "Car Barns" or Trolley Barns." These facilities stored the cars and also allowed for normal daily maintenance. It is anticipated that the restored cars (and even the replica cars) would require significant maintenance if they were to be used on a daily basis, while being expected to provide for normal peak period transit service.

The size of the facility would depend on the number of vehicles needed to serve the alignment's length and schedule, while providing for a certain number of cars under maintenance. Given the overall alignment length (approximately 3-miles to C Street and Park Boulevard) and the preferred schedule of 6-minute headways at peak periods, it was determined that 14 cars would be needed to meet the peak period demand loads.

In order to minimize the laying of additional track, the maintenance / storage yard facility should be in close proximity to University Avenue. Below are the base requirements that would be needed to store and service the streetcars.

- Spatial Requirements: In order to meet the needs of 14 cars, the associated maintenance area of approximately 22,000 sq. feet would be needed. This would allow for two (2) to four (4) cars to be under maintenance at one time, while 10 cars remain fully operational for service. This area would also provide the transitional area needed to return the cars back to the operational lines on University Avenue.

- Possible Facility Location: As discussed earlier, the maintenance / storage yard facility should be located as close as possible to University Avenue. At this time, no site-specific location is being proposed within the study corridor. However, it may be in the best interest for the overall system to locate the storage yard in an area between 32nd Street / Boundary Street and north of University Avenue, south of Lincoln Avenue. This is in the general area for the streetcar's "end of the line," at the edge of the community and bordered on one side by the freeway as illustrated in Exhibit 10-8. Future efforts should consider this area and continue to explore where appropriate maintenance facilities would be feasible.

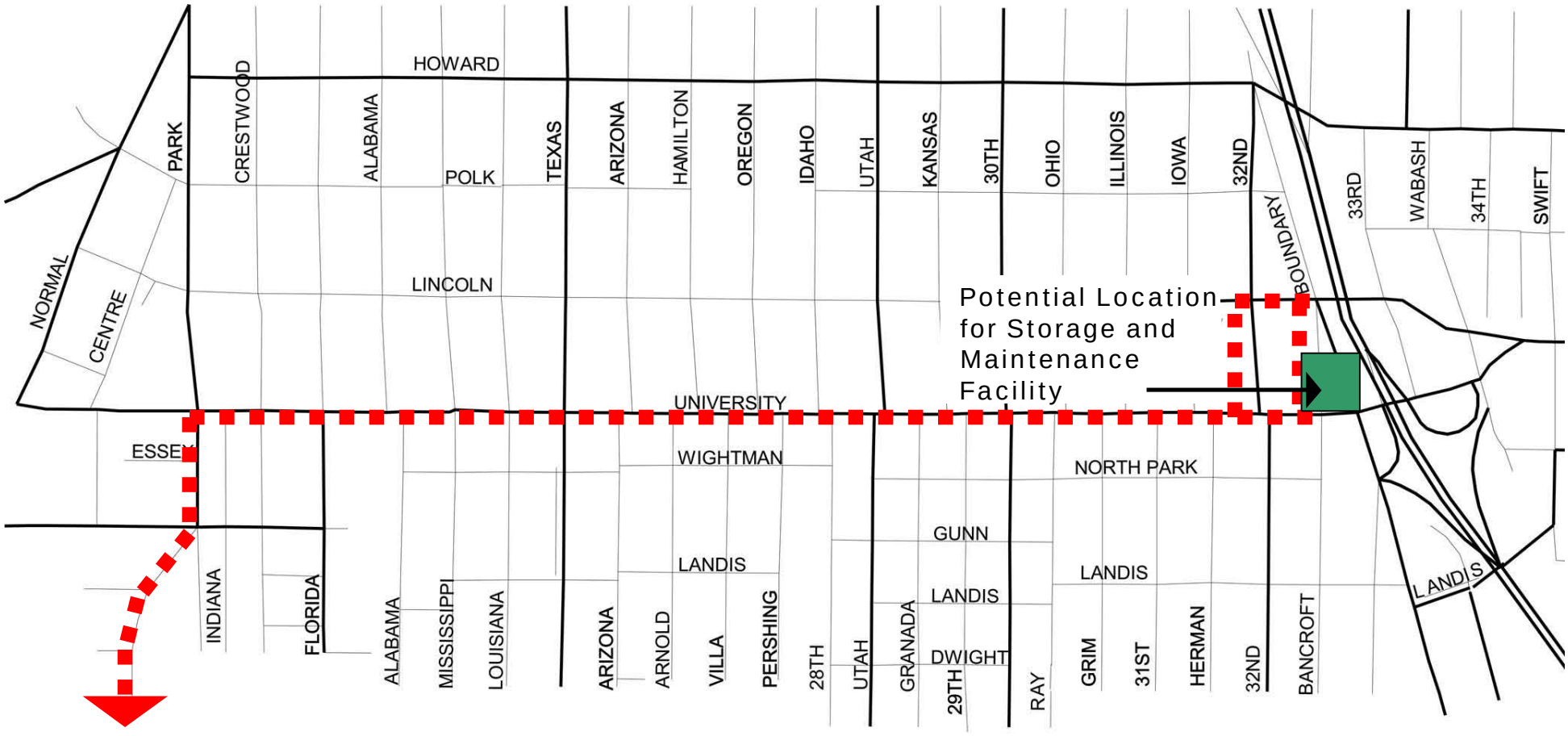
It has also been suggested that an alternative site might be the storage yard at Imperial Avenue and 12th Avenue. This existing storage yard currently houses the MTS trolley cars. If the streetcar alignment is extended to Park Boulevard and "C" Street, the streetcars could continue south on Park Boulevard (12th Avenue) to the Imperial Avenue storage yard. Coordination with SANDAG and MTS would be necessary to pursue this option to determine if sufficient room is available.

The storage yard is currently at capacity with the need requirements for SANDAG and MTS owned trolley cars. There is room to store perhaps 1 to 3 streetcars but no more. The use of this location today would not be possible. However, in the future as MTS operation and property assets change there may be storage capacity for the proposed streetcars. If the historic streetcar project moves forward, consideration for the Imperial Avenue site as a storage and maintenance facility site for the streetcars should be revisited.

Because of the historic nature of the vehicle, and the fine level of detail and materials used, historic streetcars are typically stored in buildings as opposed to outdoors. The storage/maintenance yard should be in a location that would allow building requirements necessary to house the streetcars.

Mid-Block Crossovers

Mid-block crossovers would be needed to provide a change of direction for streetcars that break down during the course of operations. The streetcars would need to return to the maintenance and operation yard without going in the opposite direction of the traffic flow. The typical recommendation for crossovers is one for each 1.25-miles of track. Along this length of the alignment on University Avenue of approximately 2-miles or 10,560-feet, a minimum of two (2) crossovers is recommended.



Not to Scale

POTENTIAL STORAGE/MAINTENANCE FACILITY

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-8

The best coverage for this corridor would be to have the crossovers at approximately .66 miles apart. This provides a crossover no further than 3,500-feet from a potential breakdown location. The locations of crossovers should be in areas that divide the corridor as evenly as possible. However, because of the proposed medians identified in the Refined Concept Plan, the potential locations for these crossovers are limited. For the study area two (2) locations (see Exhibits 10-9 and 10-10) were noted as feasible and having the least impact to the Conceptual Plan as designed. These locations are:

- Illinois Street - At Illinois Street, the intersection is of sufficient length to allow for the crossover to occur. Also, both of the streetcar lanes would be in mixed-flow lanes creating a narrow track center for transition.

- Mississippi Street - At Mississippi Street, the crossover would need to transition from the westbound curbside lane to the eastbound curbside lane. This is a distance of approximately 37-feet to reach the opposite track center. The Mississippi Street intersection is offset significantly allowing for this wider crossover to occur.

The crossovers occurring at two (2) locations should span the proposed intersections to allow the crossover plates to be outside the intersection. This would allow for the crossover plates to avoid cross traffic impact. The crossover plates are extremely sensitive and subject to breaking if significant traffic crosses over the plates.

Transitions to Mixed-flow lanes

There are six (6) locations that require the streetcar to transition from one lane to another in the Preferred Concept Plan. The majority of the transitions occur when the streetcar leaves or returns to the transit only lanes from the mixed-flow lanes. Since the lanes vary in width, each of these locations would require slightly different design requirements to meet the streetcar needs. In each case the transitions could physically occur and are illustrated in Exhibits 10-11 through 10-14. The following are locations where the transitions are located.

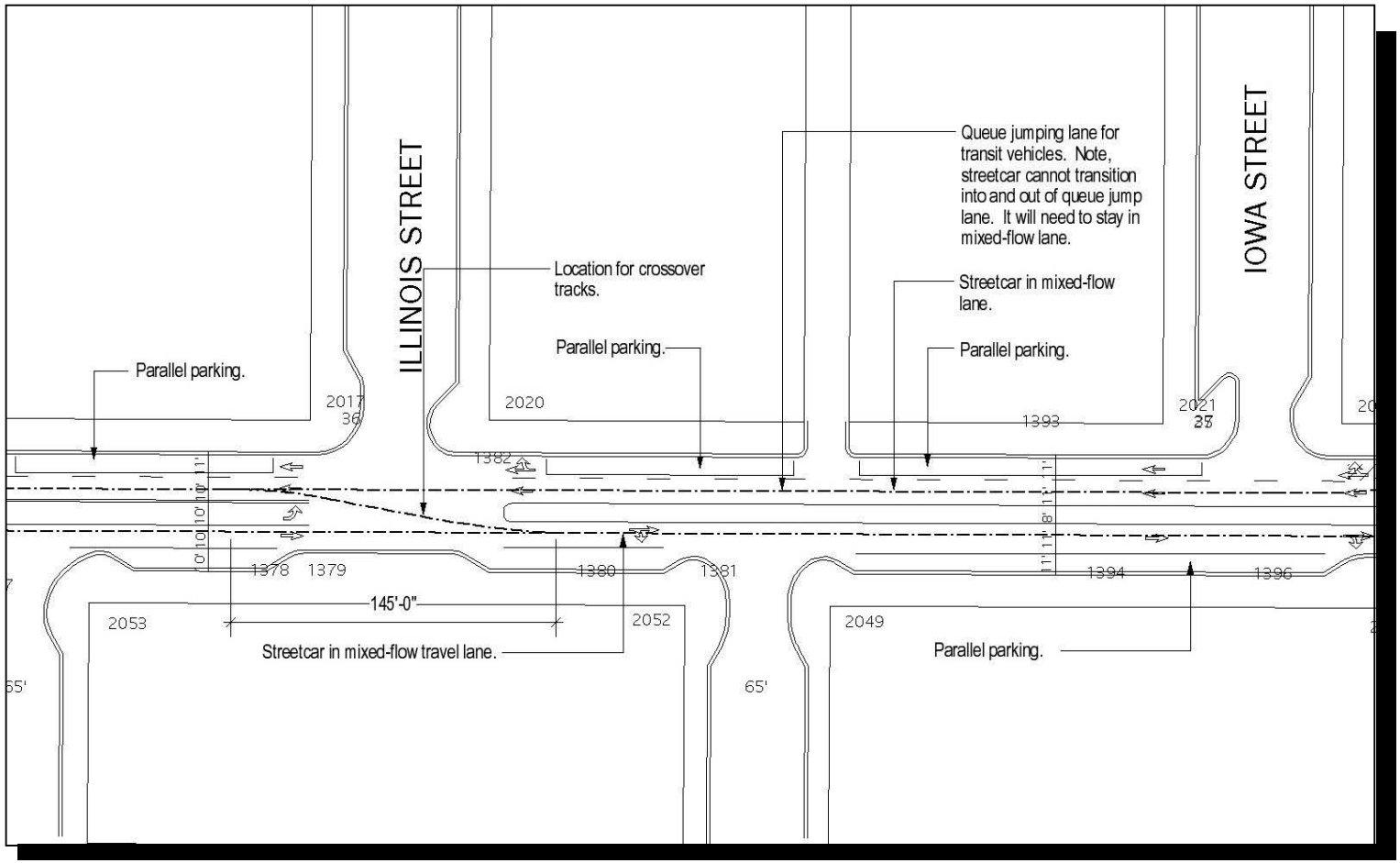
Westbound Lanes

- *Iowa Street – Exhibit 10-11*
- *Idaho Street – Exhibit 10-12*
- *Florida Street– Exhibit 10-13*

Eastbound Lanes.

- *Florida Street: – Exhibit 10-13*
- *30th Street: –Exhibit 10-12*
- *Herman Street: – Exhibit 10-11*

However, the number of transitions could have an effect on the streetcar's operational characteristics. Because there would be only one mixed-flow lane, heavy queuing would be expected during peak periods for major portions of the corridor. These long lines of traffic would have a negative impact on how smoothly the streetcar can transition from the transit only lane to the mixed flow lane and would also negatively impact traffic flow.



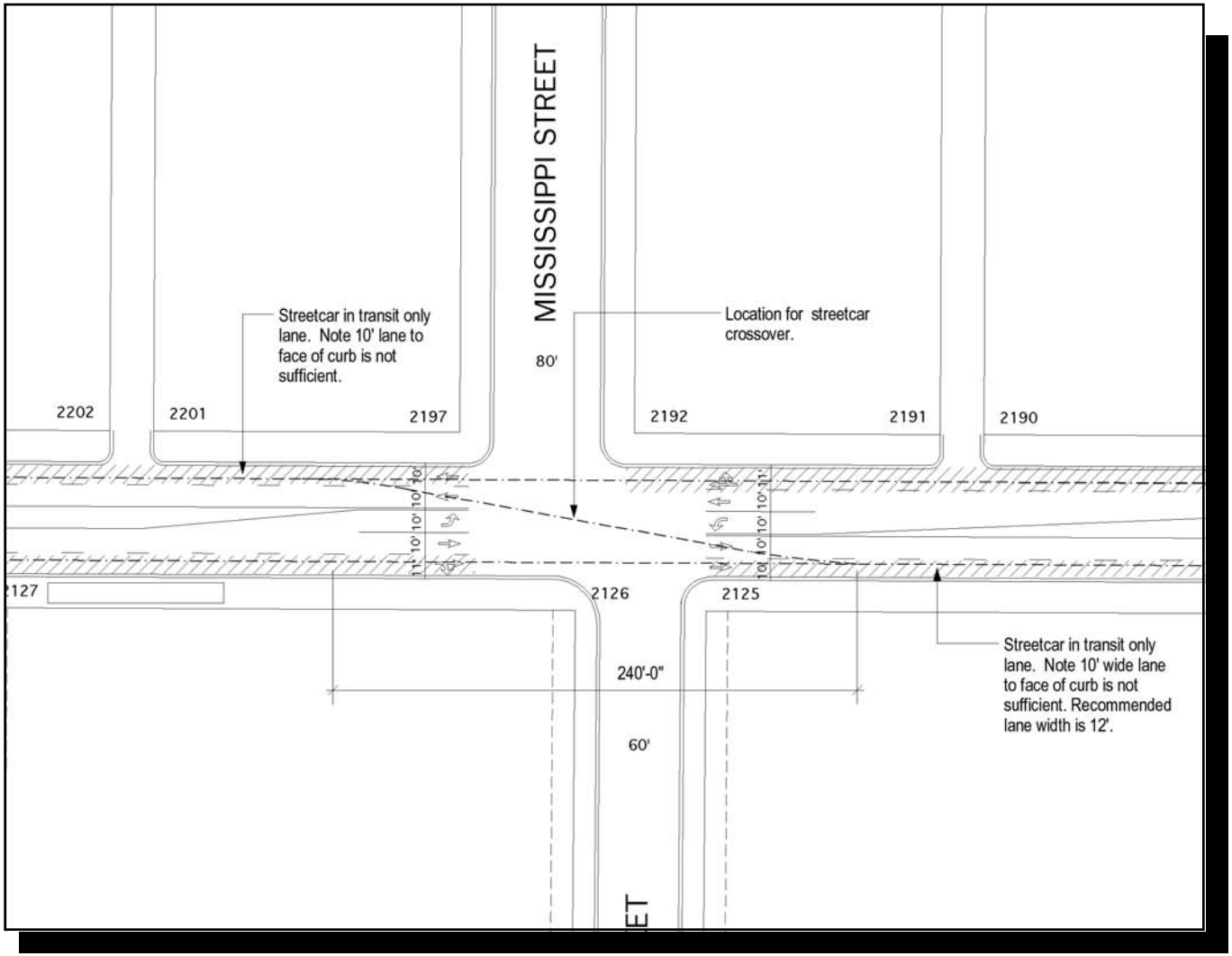
Not to Scale

ILLINOIS STREET - MID-BLOCK CROSSOVER

(OVERLAID ON THE PREFERRED CONCEPT PLAN)

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-9



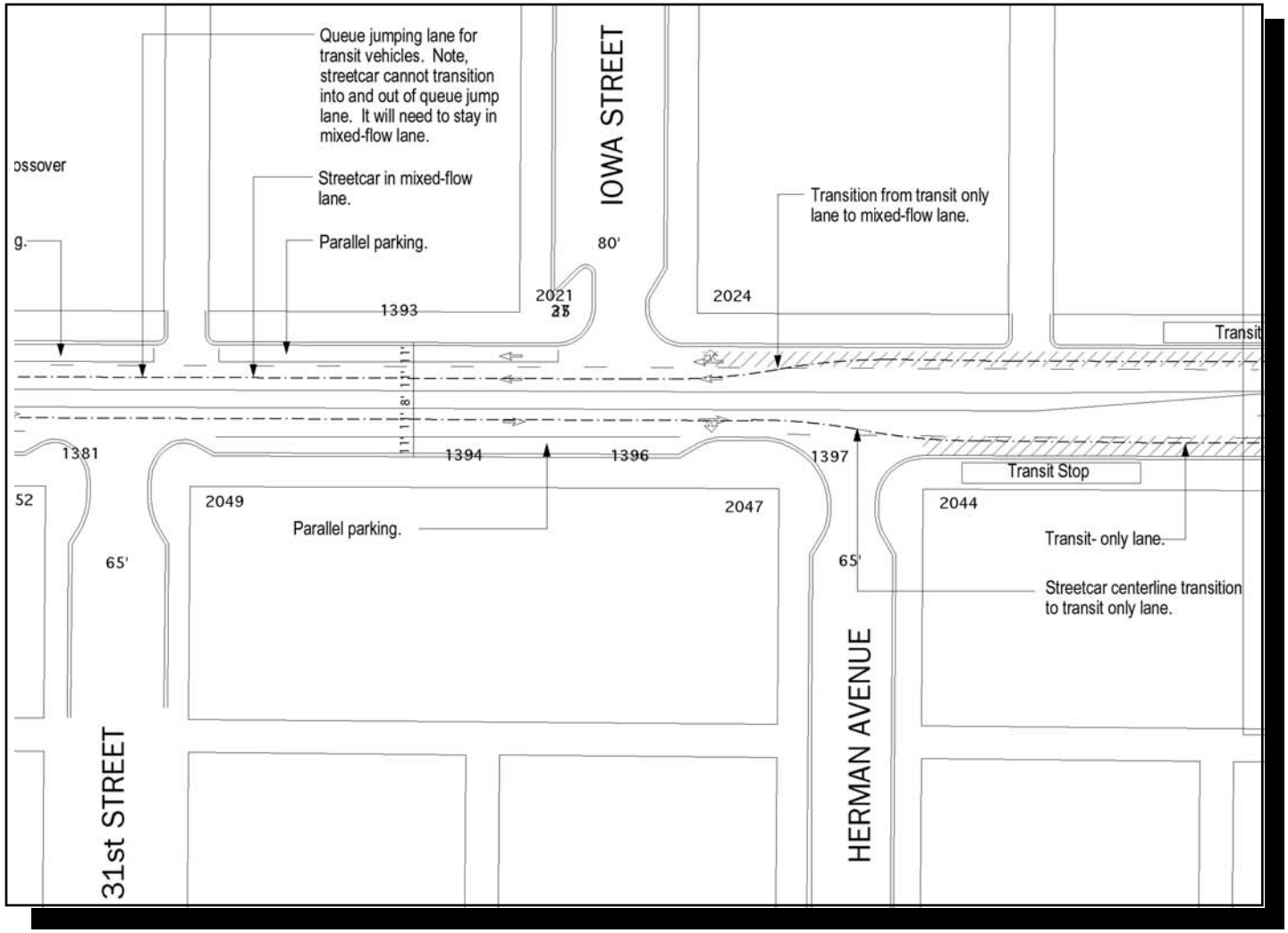
Not to Scale

MISSISSIPPI STREET - MID-BLOCK CROSSOVER

(OVERLAID ON THE PREFERRED CONCEPT PLAN)

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-10



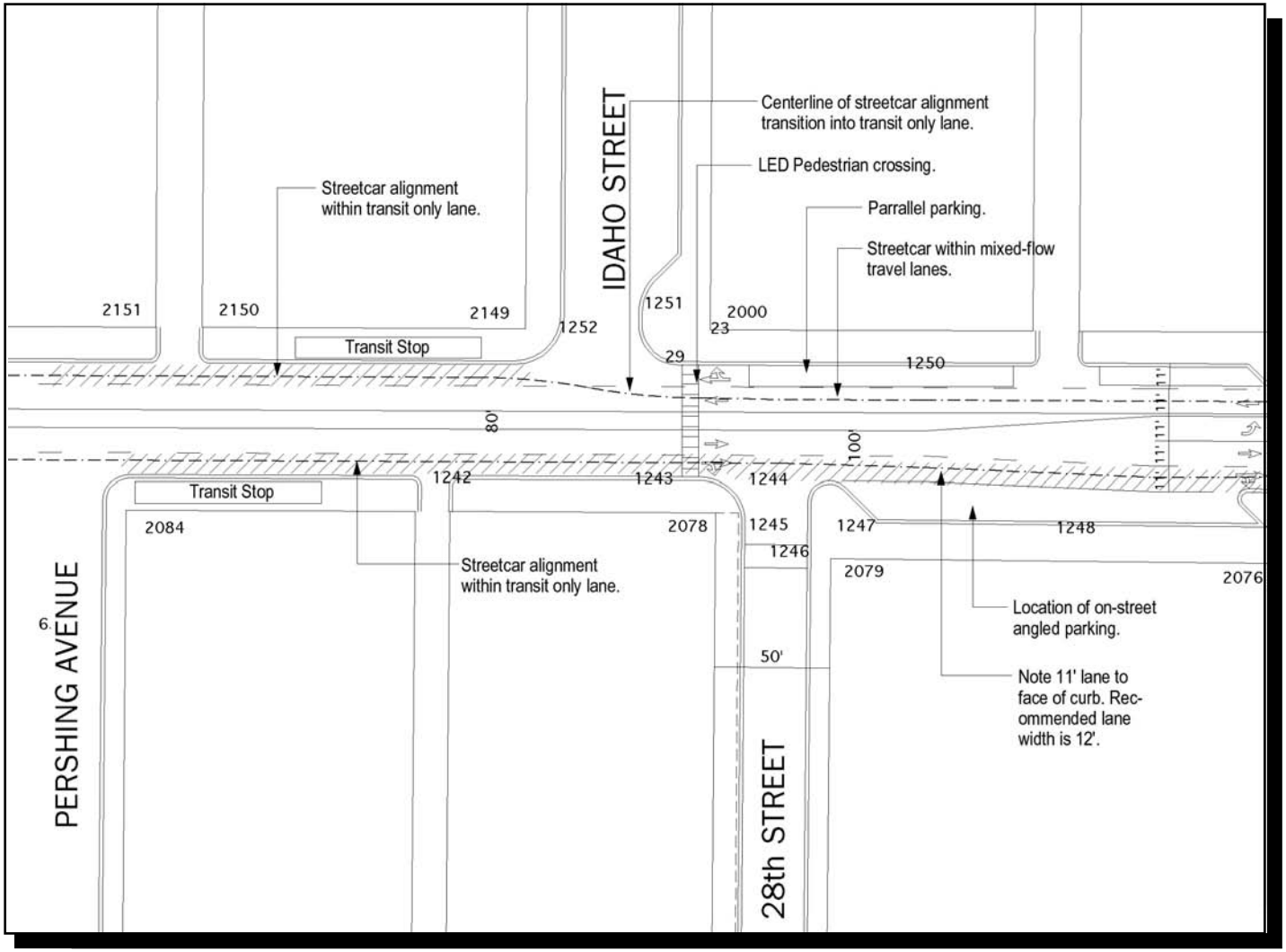
Not to Scale

IOWA STREET / HERMAN AVENUE - TRANSITION TO MIXED-FLOW

(OVERLAID ON THE PREFERRED CONCEPT PLAN)

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-11



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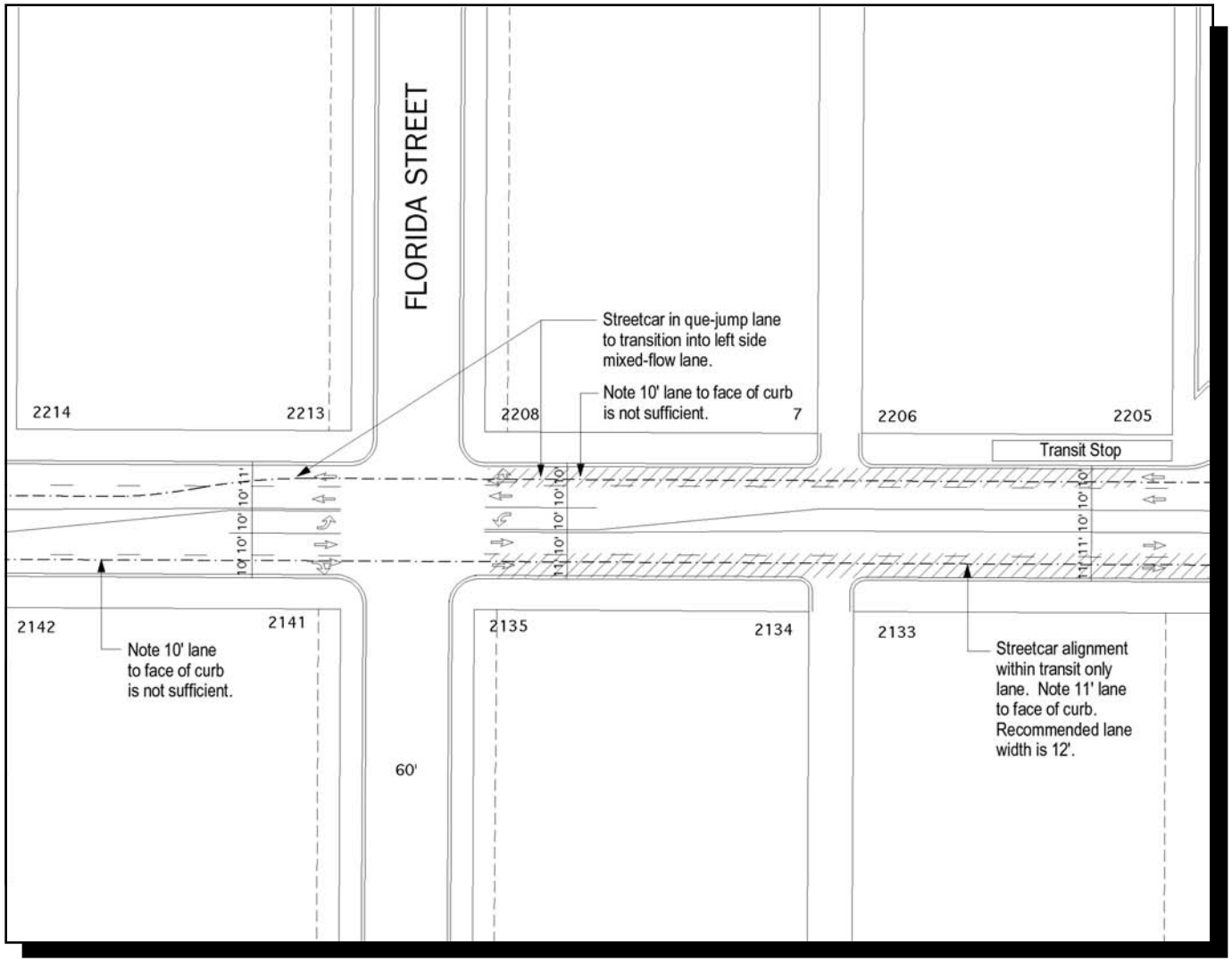
IDAHO STREET TRANSITION TO TRANSIT-ONLY LANE

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-12



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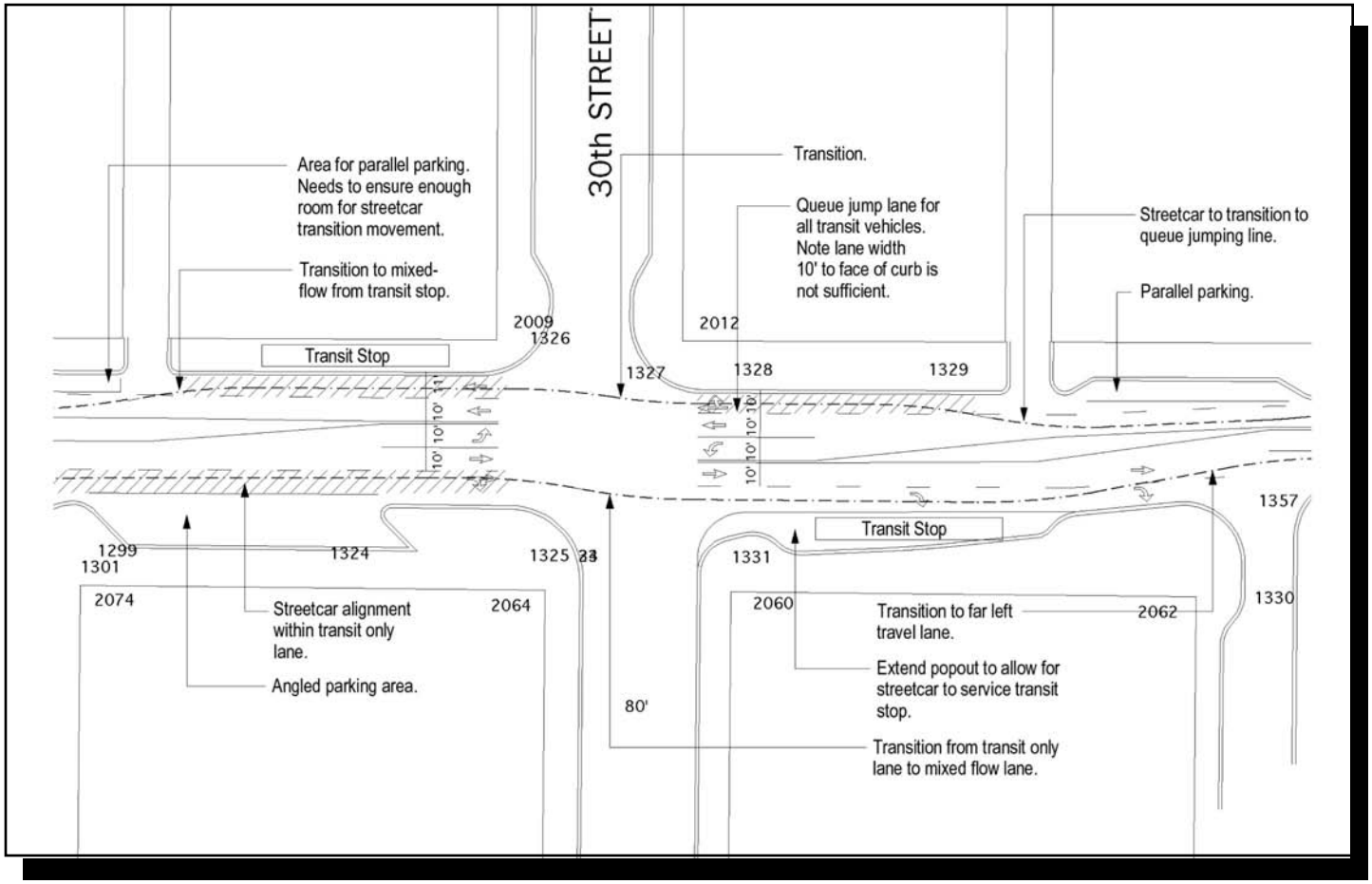
FLORIDA STREET - TRANSITION TO MIXED-FLOW

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-13



Not to Scale

30TH STREET - TRANSITION TO MIXED-FLOW

(OVERLAID ON THE PREFERRED CONCEPT PLAN)

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-14

The Refined Concept Plan recommends the relocation of parking to the side streets to provide for a continuous transit only lane. This would eliminate the need for the streetcar to merge into the mixed flow travel lanes.

Transition to Park Boulevard

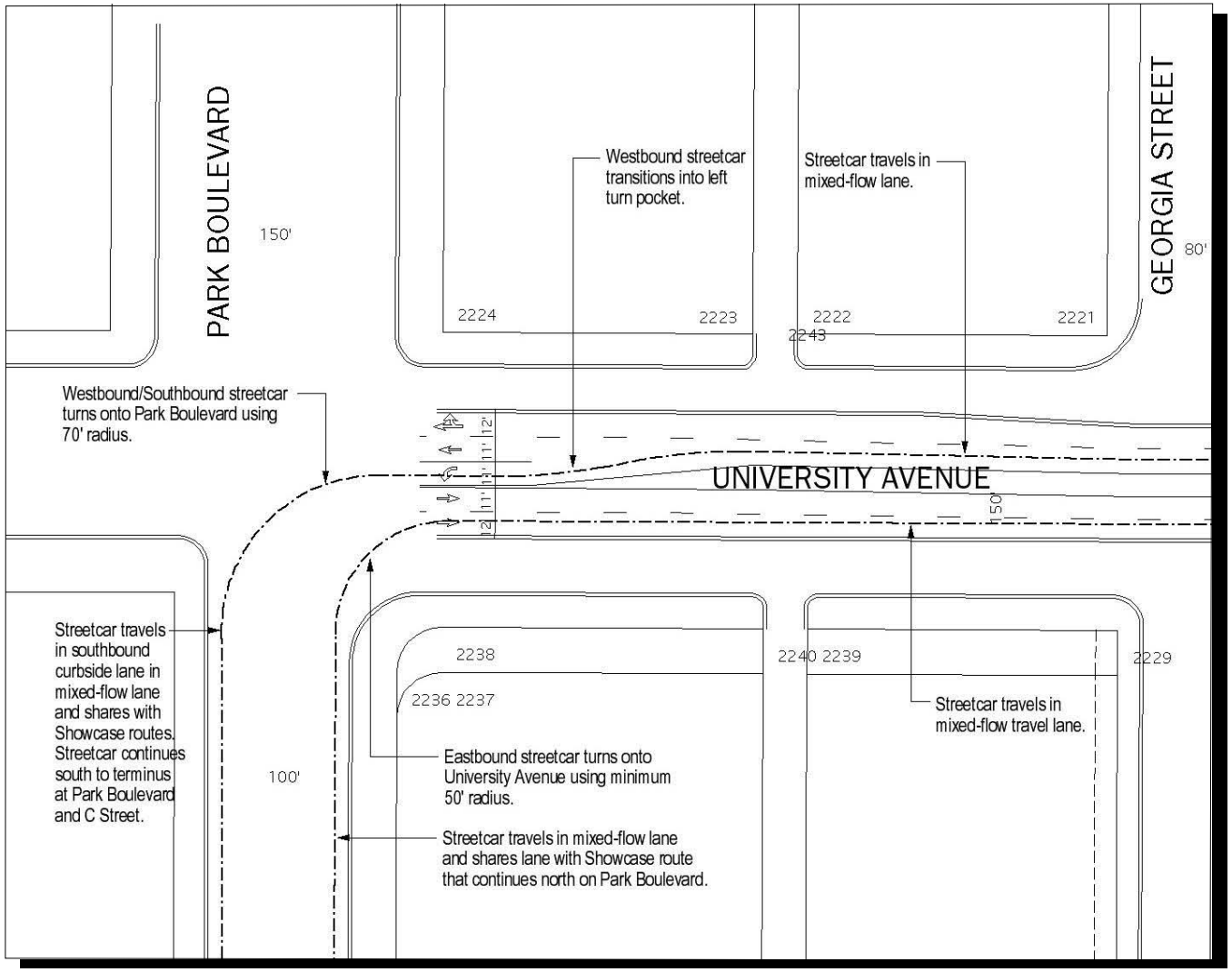
The streetcar would enter and exit the study area at Park Boulevard. Based on the direction the streetcar would be traveling, following is a description of how the streetcar would transition into and out of the corridor at Park Boulevard.

- Westbound Lane: The transition for the streetcar to Park Boulevard actually begins at Florida Street. At Florida Street the streetcar would receive a queue jump, allowing the streetcar to begin the transition to reach the left turn pocket at Park Boulevard. Once the streetcar is in the left turn pocket, it would turn onto curbside running tracks. The streetcar would share the curbside running lane with the proposed Showcase BRT vehicles. Although the Showcase BRT treatment in this area is in mixed- flow (can use either of the two southbound lanes), the streetcar would stay curbside at this location as illustrated in Exhibit 10-15. The radius used for this turn movement is 70-feet to allow for a smooth and easy transition.

- Eastbound Lane: The transition for the streetcar to University Avenue from the northbound lane of Park Boulevard would utilize a 50-foot radius. There should be no impact to the adjacent properties when making this turn movement. The streetcar would share the curbside running lane on the south side of University Avenue with other transit vehicles.

Texas Street Roundabout

The Preferred Concept Plan includes a single lane roundabout at Texas Street. The streetcar would not be able to negotiate the roundabout at Texas Street. The roundabout radius of 50-feet would too tight for the streetcar to maneuver properly. The width of the track would extend beyond the radius of the roundabout and would require two reverse curves with no tangent for transitioning as shown in Exhibit 10-16. This causes the streetcar to travel through the roundabout extremely slowly and would cause excessive track wear at this location. Additionally, the streetcar would be transitioning into the mixed flow lanes just prior to the roundabout. So at this location the streetcar would be required to negotiate multiple movements within a very limited distance.



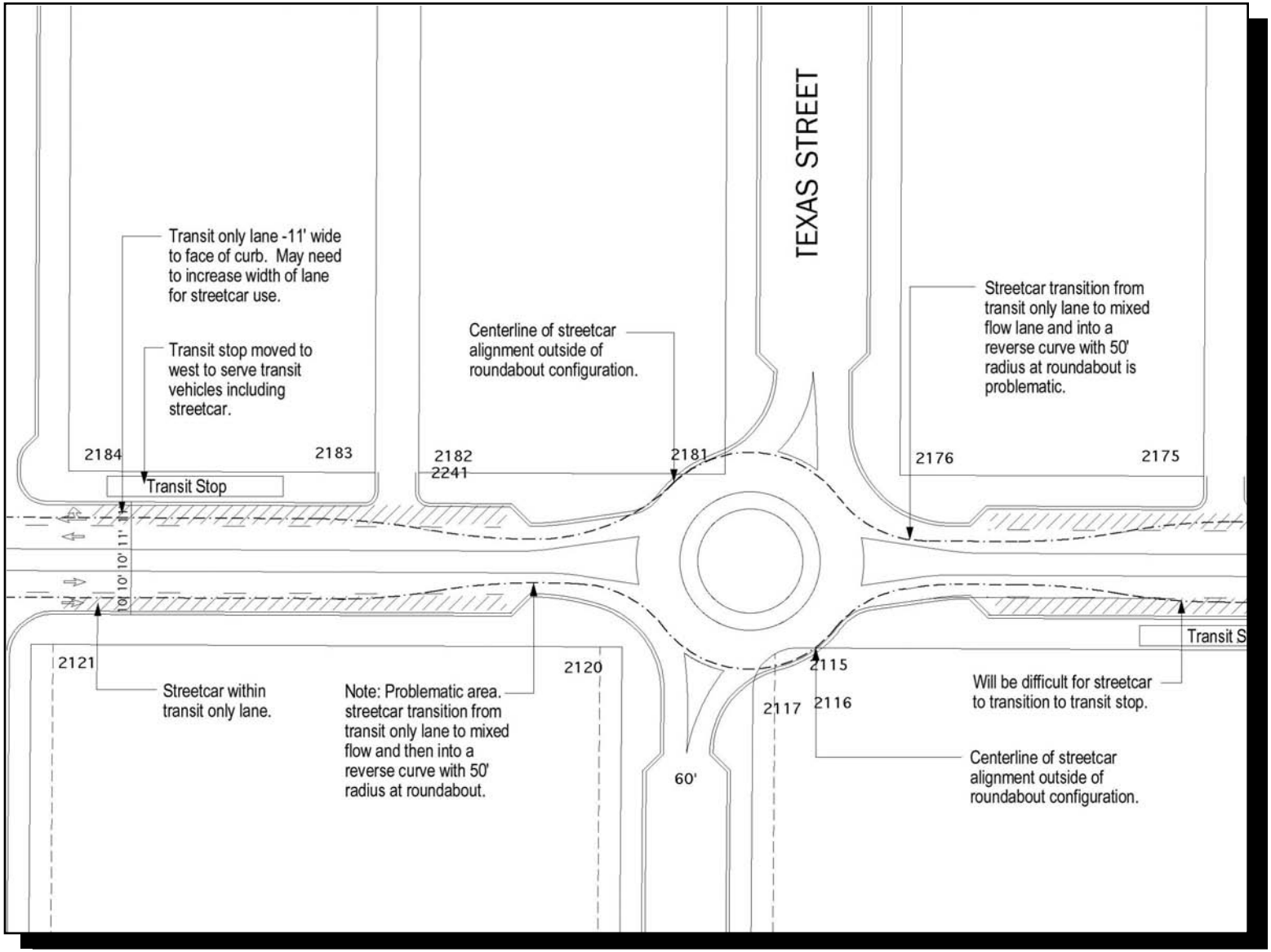
Not to Scale

UNIVERSITY AVENUE TRANSITION TO/FROM PARK BOULEVARD

(OVERLAID ON THE PREFERRED CONCEPT PLAN)

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-15



Not to Scale

TEXAS STREET ROUNDABOUT

(OVERLAID ON THE PREFERRED CONCEPT PLAN)

55-100140.001 - March 2004 (2004-0331)

EXHIBIT 10-16

There has been some discussion that the streetcars simply travel straight through the roundabout thereby avoiding all of the turn movements. However, this is not considered a safe operation. The traffic would be moving freely around the roundabout and the streetcar would be in conflict with the general flow of traffic creating an unsafe condition. A possible solution considered for this area was to increase the size of the roundabout by using a larger radius or even a two-lane roundabout.

Given all of these issues, the roundabout is very problematic for the streetcar. A different design is needed at this location for the streetcar to be able to traverse the corridor effectively and smoothly.

A single lane roundabout was determined to result in significant delays along the corridor to both passenger and transit vehicles. Therefore, the single lane roundabout was removed at Texas Street. The Refined Concept Plan recommends that Texas Street remain a signalized intersection.

Station Accommodations

Any of the proposed stations identified in the Preferred Concept Plan would accommodate the length of the streetcar. The Refined Concept Plan made no modifications to the recommended transit station configurations. Therefore, in the Refined Concept Plan, the typical transit station or stop would be 110-feet in length and the streetcars measure out at 46-feet. This allows for a significant amount of linear space for the streetcar to operate within. However, in some cases the station would have to be moved slightly from the location proposed in the Refined Concept Plan to accommodate the streetcar. This realignment is due to the streetcar transitioning from a mixed-flow lane to a transit only lane. In these locations, the stations would need to be moved over to allow for the streetcar to position itself parallel to the curb to allow for proper boarding.

Each station would have to accommodate those with disabilities, per the Americans with Disabilities Act (ADA). The ADA identifies numerous requirements that transit systems must meet to assure that transit is readily available to those individuals who have a disability. Many of the provisions associated with ADA requirements are related to signage and tactile surfaces, most of which can be provided relatively easily. However, the most difficult provision for a historic streetcar system to meet is easy access into cars for the mobility impaired. The design of historic streetcars requires climbing multiple steps when entering the car, and then frequently climbing another step from the vestibule to the main passenger compartment of the car. These types of cars are not accessible for people in wheelchairs, or individuals who have difficulty climbing stairs.

Choosing an accessibility solution would need to be considered during planning so that all new replica car systems, including those using unmodified or historic cars, meet ADA accessibility requirements. To meet these requirements historic streetcar systems have typically used one of the following three methods, each of which has its advantages and disadvantages. All options require space to accommodate

passengers in wheelchairs. Depending on the number of seats in a streetcar, 3 to 4 fold-up seats are needed to make room for passengers using a wheelchair. These seats can be used by the able bodied when not in use by passengers in a wheelchair.

- **On-car lifts.** Historic streetcars can be retrofitted with up to two wheelchair lifts per car, with one on each side. Some lift configurations can be intrusive, losing between three and four seats to accommodate the lift. But retrofitting a streetcar with a standard bus lift that retracts into the stairway will not eliminate any seating. Advantages of this approach are that no special equipment is needed on the station platforms and the same technicians and tools that maintain a city bus can be used to maintain the streetcar lift. Also, if a lift on one car malfunctions, the following car can pick up the disabled passenger. The disadvantage is that the cycle times for the wheelchair lift is one to fifteen minutes, which can be relatively long. Their use can disrupt operating schedules, particularly on a line with frequent service. This cycle time can be lengthened if the streetcar operator needs to enable the tie down to secure the wheelchair to the lift instead of the passenger in the wheelchair taking this action.

- **Platform elevators.** Another means of providing accessibility is to install elevators on station platforms to lift the passengers to the level of the car floor, and then to bridge the gap to the car by means of a folding plate mounted on either the lift or carried on the car. The advantage of this approach is that it does not require giving up interior space or changing the interior appearance other than equipping some seats to fold out of the way. The disadvantage is that the lifts require platforms large enough to accommodate them.

- **High blocks and ramps** The third accessibility approach is to place ramps leading to short raised platforms (often called "high blocks") at car stops. The overall size for this configuration is eight feet wide by eight feet deep by two feet high for the "high block" or top landing plus the ADA ramp itself. Passengers waiting to board cars can go up the ramp before the car arrives, at which time a bridge plate can be used to reach the car, as with platform elevators. The advantages of this solution are that the car's interior would not have to be changed, there is no mechanical system to malfunction, and the time required for a passenger to board or alight is the shortest of the three approaches.

- The primary disadvantage of this approach is that the space required on station platforms is relatively large, and the ramps and high blocks are visually intrusive. However, this approach is currently in use in San Francisco and is being constructed in Tampa.

In the case of either the platform lift or the high blocks and ramps, access is provided to the car's front platform or vestibule. If another step is required to enter the passenger compartment, then a conforming means must be identified to allow the passenger to pass this barrier as well.

Utilities Relocation

Currently the majority of utilities serving North Park have been under grounded within the curb-to-curb section of University Avenue. The dry utilities (electrical, telephone, cable) tend to be on the north side or under the westbound lanes, Of the wet utilities the sewer line runs down the centerline of the street, while the water line is on the south side or under the east bound lanes.

Utilities that are buried directly under the proposed historic streetcar alignment would have to be relocated when constructing the tracks/roadbed for the streetcar. This can be an extremely expensive component when implementing any type of rail service within an existing community. The dry utilities would be not be part of the cost equation as these facilities are required to be moved by the utility companies at no cost to the project. However, moving the wet utilities can carry a significant cost that would have an impact on the City of San Diego's fiscal budget and the ratepayers. This would be an important consideration if the project moves forward towards implementation.

Implementation and Construction Issues

One of the main considerations for the implementation of the streetcar improvements would be the impact to the corridor during construction. How the improvements would impact traffic and local businesses during the course of construction must be clearly outlined to the community. The implementation for such a project could certainly take 18-24 months. Another consideration is the location of staging areas necessary to support the construction effort.

One possible way to minimize the construction impacts to the surrounding business community is to schedule construction activities during the nighttime, although this may have some impact to residents due to noise. This method was used for the sewer and water pipeline construction project on El Cajon Boulevard. Although not all business would be impacted at the same time, constant construction in the corridor would have a definite impact on access to their local businesses. Disruption to businesses due to construction is a common occurrence when providing improvements in a developed business district. The level of disruption and impacts would need to be addressed as part of any mitigation measures. As with any large project, these construction issues should be taken into consideration early in the process and with extensive community involvement.

10.3 FEASIBILITY OF SHARED TRANSIT LANES

Operational Headway

One of the main issues with the shared transit lanes is operational headway. Would the streetcar impede other transit vehicles from meeting scheduled stops and time frames? The operating speeds of buses in the corridor are typically 15 to 25 miles an hour. The operation, or running speed, is based on transit station locations and the buses' acceleration rate prior to the next transit stop, as well as dwell time. This speed of 15 to 25 miles per hour is well within the operating capability for the streetcar. Also, since the transit only lanes are not physically divided, other buses could transition back into mixed flow lanes to by-pass any slower transit vehicles including the streetcar.

Another issue related to operational headway is the proposed Showcase BRT route along Park Boulevard. Although the Park Boulevard section is outside this study area, it should be noted that the proposed streetcar operation in this corridor is an issue requiring further exploration. The Showcase stations would be located further apart than typical local services, providing a higher level of speed for the transit vehicles. It is intended that the streetcar alignment would share the same curbside lanes as the BRT route on Park Boulevard. With the buses higher speed, the streetcar might become a hindrance. The Showcase route would be fully implemented prior to the proposed streetcar, so its operational requirements should be well known. If the streetcar moves forward towards implementation, the Park Boulevard corridor issues would need to be studied.

Mixed Traffic or Shared Travel Lanes with Rail Cars

It is fairly common to find rubber tire vehicles, whether private passenger cars or transit vehicles, sharing a travel lane with rail type cars in other cities, although not a preferred practice as it: adds more vehicles to the transit lane often slowing transit, creates traffic pattern confusion between fixed transit line use and non-fixed rubber tired vehicular use, and the streetcar tracks cause rubber wheeled vehicles to slide when it rains. It has been done for years in numerous other cities such as San Francisco and Portland. However, it should be noted that this configuration is most suitable when automobile traffic is not heavy. This is not the case with University Avenue, which carries and would continue to carry a high volume of automobile traffic.

Currently, SANDAG does not allow private vehicles or buses to share the existing trolley lanes where trolleys run on street rights-of-way. Maintaining this separation between vehicles is based primarily on safety issues. At this time SANDAG does not have an official position on the possibility of shared lanes for a streetcar type service and any proposal for joint use would have to address all safety and traffic engineering concerns identified by SANDAG, MTS, and the City of San Diego.

Based on the Refined Concept Plan, a significant portion of the streetcar alignment is in mixed flow traffic. The streetcar would be required to use mixed-flow travel lanes as it transitions from curbside running at Florida Street to the westbound left turn lane at Park Boulevard. As recommended in this report, the streetcar would be required to share the travel lanes with mixed-flow traffic eastbound from Park Boulevard to Utah Street.

Additionally, there are multiple locations where the streetcar merges from the transit only lanes to the mixed-flow lanes due primarily to on-street parallel parking. The number of transitions would have an effect on the streetcar's operational characteristics. Because there is only one mixed-flow travel lane, heavy queuing is expected for major portions of the corridor during peak periods. These long lines of traffic would have an impact on how smoothly the streetcar can transition from the transit only lane to the mixed flow lane. Minimizing the number of transitions occurring in the corridor would help to ensure that the streetcars (and other transit vehicles) move more freely along University Avenue. SANDAG would have to reconsider their current position on shared lanes if the streetcar is to be implemented.

Another consideration is that the curbside running streetcars would have to contend with illegally parked cars on the tracks or commercial trucks unloading merchandise at curbside. Because the streetcar is restricted to a fixed rail, the streetcar would not be able to avoid these types of impediments potentially causing delays. Enforcement and quick removal of these types of vehicles would be necessary and this would need to be part of the overall service and operational plan.

Since the Refined Concept Plan proposes non-peak period parking in transit lanes the streetcar could not work under this plan. Again, the parked vehicles would impede the progress of the streetcar basically rendering the streetcar fixed rail type service infeasible. Therefore, all parking would be removed from University Avenue with the operation of the streetcar.

Vehicle Breakdown Response

If MTS were the chosen operator, they would be responsible for responding to streetcars that are "down" in the system. Currently MTS operates the San Diego Trolley and has in place response vehicles that tend to the service needs when trolley vehicles experience operational problems. However, because the streetcars are unique vehicles, a separate team may be needed to respond to their service needs. Individuals could be trained to work on both types of vehicles. The main considerations would be a timely response and being able to get to the vehicle operational or provide another vehicle quickly.

10.4 OPERATIONS AND MAINTENANCE

Operations and Maintenance Responsibility

It has been suggested that the general planning of the streetcar system would be the responsibility of SANDAG, and the operation and maintenance of the streetcar system would be the responsibility of MTS. From a system planning and operations standpoint SANDAG and MTS do not have the financial resources to implement a duplicate service along the University Avenue corridor. Route 7 is able to serve the passenger needs with the current services of buses within its budgetary constraints. Diverting monies to provide a different mode type (streetcar) in a corridor that is already served takes away valuable financial resources from the overall transit system. Although community revitalization efforts could be enhanced by the streetcar, SANDAG could have a difficult time justifying the funding or the expense for the historic streetcar implementation when other areas in the region are not currently served or are underserved by transit. SANDAG would have to conduct a "Measures of Effectiveness" analysis and make a determination that the streetcar warrants implementation if it is to move forward in the future. These would include establishing the:

- Route Category
- Passengers per Revenue Hour
- Average for Route Category
- Operating Cost per Passenger
- Average for Route Category

The Route 7 and Route 908 have a performance for all of these measures, which is well above the average performance of like services within the current system. Replacing or duplicate this level of effectiveness with the streetcar may not be feasible.

Additionally, SANDAG/MTS does not currently employ staff with the training to plan, operate and maintain historic or "historic-type" streetcars. SANDAG/MTS would have to invest in hiring or training personnel to plan, maintain and operate these types of vehicles.

However, a key factor for most successful historic streetcar lines has been the collaboration of government, business, and nonprofit organizations in creating and operating the historic line. This wide level of involvement has helped convince funding sources to support and fund the streetcar line not only for implementation but also for continued ongoing maintenance and operations. So, if other funding sources became available and did not impact SANDAG's funds or budget there might be a greater willingness by SANDAG to review the merits of implementing the Historic Streetcar service along University Avenue.

Volunteers typically play an active role in regular operation and maintenance, or handle this function in its entirety. They perform all operation and maintenance functions in many historic streetcar service programs. In other cities, these groups share or supplement the staff of public agencies. A historic streetcar also typically requires a wide variety of skills from a diverse group of supporters to help accomplish the many tasks necessary to maintain the character and historic nature of the vehicles. Although it may not be possible to have an "all volunteer" group run this historic streetcar line due to the level of service expected, the presence of nonprofit groups with willing and skilled volunteers could help accomplish many tasks at greatly reduced cost. Almost every existing historic streetcar line benefits from the collaboration of these different groups.

10.5 CAPITAL COST

At this point in the analysis, a general "estimated order-of-magnitude capital cost" for the streetcar service cannot be provided. The streetcar layout and design is far from being done and numerous items and issues still need exploration before a more specific cost can be prepared. Additional research for the segment of University Avenue within the study area from Park Boulevard to 32nd Street would be needed. The capitals cost estimates given here are those costs that are typically incurred to design and construct similar facilities. This includes the placement of the rails, catenaries poles, and other improvements. Table 10-3 identifies the general estimates for those capital costs that are known.

Implementation of the historic streetcar within the University Avenue corridor from Park Boulevard to 32nd Street is estimated to have a capital cost of approximately **$25 million**, not including the maintenance and storage facility (both land and building cost), the utility relocations, the land acquisition for the substations, or the extension of the streetcar from Park Boulevard to downtown. It should be noted that the transit vehicles represent 45-percent of the known estimated capital costs. All of these vehicles would be needed for the entire length of the alignment (from Park Boulevard to C Street) and not just for the University Avenue corridor.

Table 10-3
Order of Magnitude Capital Cost Estimate (per Mile)

	Item Description	Unit	Unit Cost	Qty	Costs
1	At grade Transit Lane 12'-wide	LF	240	21,000	5,250,000
2	Misc. Roadway /Street Improvement (note 1)	LF	25	21,000	525,000
3	Construction Area Traffic Control Plans	EA	240,000	1	240,000
4	Boarding Platforms - ADA ramps/railings	EA	10	65,000	650,000
5	Sub Station Cost	EA	506,000	2	1,012,000
6	Utility Relocation	NA	NA	NA	NA
7	Drop Suspension Support Poles	EA	9,000	144	1,300,000
8	Crossovers	EA	120,000	2	240,000
	A: Subtotal Items Above				**9,217,000**
	Mobilization (4% of Sub total)				369,000
	Contingency (15% of Sub total)				1,383,000
	Admin/Eng/Const (30% of Sub total)				2,765,000
	B: Subtotal Items Above				**4,517,000**
	Preliminary Total Construction Cost				
	Associated Facilities Costs				
	Vehicle Cost (note 5)	EA	800,000	14	11,200,000
	Maintenance Facility & Equipment	NA	NA	NA	NA
	C: Subtotal Items Above				**11,200,000**
	Total Project Capital Cost for Items A, B and C				**24,934,000**
	Total Project Capital Cost per Mile				13,123,000

Assumptions:

1: At grade expanding existing curb-to-curb misc. roadway/street improvements. Item includes minor demolition of existing improvements and construction of base and asphalt pavement for street improvements.

2: Traffic control system (TCS) is in place

3: Transit operation system (TOS) is in place

4: Site Furnishings at transit stations in place

5: Price based on teleconference with Giomaco Trolley Company for newly constructed replica streetcars.

6. Does not include land or building cost for Storage and Maintenance Facility

7. Covers cost of constructing streetcar alignment from 32nd Street to Park Boulevard only. Does not include cost of constructing streetcar alignment on Park Boulevard from University Avenue to C Street in downtown.

10.6 CONCLUSIONS

In general, it is possible to physically implement and operate an historic streetcar system within University Avenue corridor as designed by the Refined Concept Plan. The feasibility of implementing and operating an historic streetcar system within the corridor is contingent upon addressing the following changes. Lane widths would need to be increased from 11 feet to 12 feet along the curb and all parking along University Avenue would need to be prohibited to accommodate the streetcar. The widening of the lane would result in a reduction in the width of the raised median and left turn lanes from 10 feet to 9 feet, or sidewalks would need to be reduced by one foot on either side of University Avenue to accommodate the minimum 12-foot width. Outside of the design of the Refined Concept Plan, there are several other challenges and issues that would need to be addressed if the planning and design of the facility moves forward.

Experience of other successful operating historic streetcar lines shows that a few critical factors must be in place for plans to be realized. In planning a new streetcar/rail system within University Avenue, considerable time should be devoted to ensuring that these factors, as summarized below, are addressed.

Define the car type: This would go a long way in determining the final design requirements of the alignment, the end-of-the-line turn-around, and of the stations, and determining impacts to intersections and surrounding properties.

Lane width: The lane width for the streetcar is important. For this type of alignment and the three potential vehicle types, a 12-foot lane width is preferred. The existing narrow right-of-way of University Avenue does not consistently accommodate this width throughout the corridor. The additional needed width could require the relocation of existing curb/gutters, sidewalks or the proposed medians. This relocation is dependent upon from where the needed travel lane width is extracted. Also, clearance beyond the typical 12-feet lane would be needed to compensate for vehicle overhang during turn movements. In general, a wider travel lane than what is currently designed in the Refined Concept Plan is needed for the streetcar implementation.

Maintenance facility: Define the location for the maintenance and storage facility. This study has determined that at least 14-vehicles would be needed to operate in the proposed alignment along University Avenue from 32nd Street to Park Boulevard and Park Boulevard from University to C Street if the streetcars are used during peak periods. The number of streetcars could be more or less depending on the final operational characteristics for the system. The maintenance facility should be within close proximity to the alignment to minimize the laying of additional track.

Transition to mixed-flow lanes: The Preferred Concept Plan had several locations where the streetcar would merge from the transit only lanes to the mixed-flow lanes. The number of transitions could have an effect on the streetcar's operational characteristics. Because there is only one mixed-flow lane, heavy queuing is expected for major portions of the corridor during peak periods. These long lines of traffic would have an impact on how smoothly the streetcar can transition from the transit only lane to the mixed flow lane. Minimizing the number of transitions occurring in the corridor would help to ensure that the streetcar (and other transit vehicles) move more freely along University Avenue. In the short-term, the Refined Concept Plan allows off-peak parallel parking in the transit only lane. All on-street parallel parking in the Transit Only Lane would need to be prohibited along University Avenue if the streetcar is operational.

Shared Travel Lane: It is fairly common to find rubber tire vehicles sharing the lane with rail type cars. A significant portion of the streetcar alignment is in mixed flow traffic. It is feasible to assume that the streetcar can operate in the mixed-flow travel lane and also share the transit only lanes with buses. At this time SANDAG does not have an official position on the possibility of shared lanes for a streetcar type service and any proposal for joint use would have to address all safety and traffic engineering concerns identified by SANDAG, MTS and the City of San Diego.

Operational Considerations: As the historic streetcar implementation continues to be explored, the issue of operational hours would need to be clearly defined with SANDAG/MTS with the understanding of the day-to-day operational needs of Route 7 and its passengers. If and how the streetcar could provide the level of service expected by the North Park Community, while still handling the necessary volume of passengers, requires further dialog with SANDAG /MTS. From an operations stand point SANDAG may not be able to prioritize or justify a duplicate service that utilizes both the streetcar and bus service along the University Avenue corridor over the service needs of other areas that are currently underserved.

Texas Street Roundabout: The roundabout as designed in the original Preferred Concept Plan is problematic for the historic streetcar. The roundabout would not allow for the streetcar to operate correctly due to the tight radii used for the roundabout design. However, the roundabout is no longer proposed in the Refined Concept Plan due to other operational considerations.

Operational Entity: Partnering with SANDAG and MTS as the planning and operational entities for the streetcar needs to be initiated. A partnership with SANDAG is necessary to work towards an implementation strategy that enables the streetcar to be a success. This includes defining the funding sources necessary for the initial implementation and operation of the streetcar service on University Avenue and ultimately on Park Boulevard.

Sources of Capital and Operating Funding: Creativity and persistence in finding funding for a historic streetcar project is crucial. At this time there is no dedicated source of funding to implement such a project. Historic streetcars do not generate sufficient direct revenues to cover their capital and operating costs. As there is great competition for governmental sources of funding. Successful projects have typically obtained funds from a variety of public and private sources, and have often been very innovative in finding or developing new sources of funding.

Partnerships between Government, Business, Community, and Non-Profit Groups: A key factor for most successful historic streetcar lines has been the collaboration of government, business, and nonprofit organizations in creating and operating the line. The wide level of support such collaboration demonstrates has helped convince funding sources to support the lines. In addition, the wide variety of skills from diverse groups of supporters has helped accomplish the many tasks necessary to maintain and operate this type of service. The presence of nonprofit groups with willing and skilled volunteers has helped accomplish many tasks at greatly reduced cost. Virtually all-historic streetcar lines have benefited from collaboration of different groups to make them successful.

Champion in Local Government: Perhaps the single most important factor contributing to successful implementation of previous historic streetcar lines is for a person well placed and well connected in the local government to function as a champion for the project. This person can fill the critical role of winning support from government, business, and community organizations. He or she can also continue to provide momentum to a project when the inevitable roadblocks, setbacks, or other obstacles arise. Without someone filling this role, it is unlikely the resources necessary to implement a project can be obtained, or that the labyrinth of governmental issues can be negotiated.

Perseverance: Experience shows that moving a historic streetcar idea from conception to operation can take as long as 10 (or even as long as 15) years, given the need to build support, win approvals, secure funding, and complete construction. Therefore, when launching an historic streetcar project, it is critical to have a realistic, long-term view and to have project supporters who would stay with the project for the duration.