

APPENDIX C - INTERSECTION TREATMENTS

This is a brief discussion of the intersection treatments at critical locations along the recommended alignment. It is *excerpted* from an evaluation of alignment options that looked at additional locations along Phase 1. This material is included here for reference, and is accompanied by a short series of intersection close-ups (after the text).

CORDOVA AT RICHARDS/WATER

This intersection is the last on the alignment before the tracks enter the Phase I terminus at Waterfront Station. The western leg of the intersection has three eastbound and one westbound traffic lane, whereas to the east there are three eastbound traffic lanes. The westbound traffic comes from Water Street, which feeds both Cordova and Richards, a one-way southbound street. The issue here for the streetcar relates to the choice between the Cordova-only option and the Cordova-Water couplet, which have different impacts east of this intersection.

Impacts	Eastbound Tracks on Cordova, plus:	
	Cordova-only Option (Westbound tracks on Cordova)	Cordova-Water Couplet (Westbound tracks on Water Street, then Cordova)
Streetcar Operations	<ul style="list-style-type: none"> Eastbound and westbound streetcars pass through intersection on Cordova in the same phase as the eastbound traffic Active TSP to reduce signal delays 	<ul style="list-style-type: none"> Eastbound streetcars pass through intersection in the same phase as the eastbound traffic, westbound streetcars with the left turning traffic off Water Street (light for left turns is green most often) Active TSP to reduce signal delay for eastbound traffic
Street Configuration	<ul style="list-style-type: none"> Eastbound track in mixed-flow traffic except at Waterfront Station Westbound track in exclusive guideway except when passing through intersection, then mixed flow with westbound traffic lane until approach to station 	<ul style="list-style-type: none"> Eastbound track in mixed-flow traffic except at Waterfront Station Westbound track in mixed flow with westbound traffic on Water and Cordova until approach to station transition
Traffic on Cordova near Waterfront Station	<ul style="list-style-type: none"> Two eastbound lanes become two plus one mixed flow after station Westbound traffic leaves mixed flow lane and becomes revised curb lane 	<ul style="list-style-type: none"> Same
Traffic on Cordova east of Richards	<ul style="list-style-type: none"> Two eastbound lanes plus one mixed lane 	<ul style="list-style-type: none"> Same
Traffic on Water Street	<ul style="list-style-type: none"> Left turns need to be controlled to allow westbound streetcar on Cordova through intsn. 	<ul style="list-style-type: none"> Westbound streetcar mixed with traffic in left turn lane
Pedestrians	<ul style="list-style-type: none"> Cordova east of intersection becomes wider crossing as part of pedestrian space becomes westbound streetcar guideway 	<ul style="list-style-type: none"> Minimal impacts
RATING	DROPPED	RECOMMENDED

COLUMBIA AT CORDOVA + COLUMBIA AT POWELL

The issues at this intersection relate to the streetcar turning corners. For the Cordova-only option, both directions of the tracks turn at Cordova and the impacts are concentrated in one location. For the couplet, the impacts are split between Cordova and Powell Street.

Impacts	Eastbound Tracks on Cordova become Southbound on Columbia, plus:	
	Cordova-only Option (Northbound on Columbia turns west at Cordova)	Cordova-Water Couplet (Northbound on Columbia turns west at Powell)
Streetcar Operations	<ul style="list-style-type: none"> Northbound to westbound streetcar goes from mixed flow on Columbia to exclusive on Cordova Eastbound to southbound streetcar goes from mixed flow on Cordova to exclusive on Columbia 	<ul style="list-style-type: none"> Northbound to westbound streetcar goes from mixed flow on Columbia to Powell Eastbound to southbound streetcar goes from mixed flow on Cordova to exclusive on Columbia
Street Configuration	<ul style="list-style-type: none"> Cordova becomes two lanes + mixed lane + streetcar Columbia is streetcar (exclusive SB)+ parking + mixed flow lane + through/parking 	<ul style="list-style-type: none"> Cordova becomes three lanes + mixed Columbia is streetcar (exclusive SB) + parking + mixed flow lane + through/parking
Traffic on Cordova	<ul style="list-style-type: none"> Traffic is eastbound on three lanes instead of four, and every 8 minutes signal pre-emption would be needed to allow eastbound to southbound streetcars to cross other EB lanes V/C estimated to change from 0.35 to 0.44 	<ul style="list-style-type: none"> Similar to Cordova-only but four lanes are available eastbound (greater capacity) V/C estimated to change from 0.35 to 0.38 (less impact)
Traffic on Columbia at Cordova	<ul style="list-style-type: none"> One lane lost to provide SB streetcar – volumes relatively low. Parking lane next to SB exclusive streetcar – prevented from entering intersection by expanded ped bulb, to reduce risk NB traffic would cross streetcar during its turn 	<ul style="list-style-type: none"> Fewer impacts - one lane lost to provide SB streetcar.
Traffic on Columbia at Powell	<ul style="list-style-type: none"> No impact 	<ul style="list-style-type: none"> Left turn onto Powell Street would require modification of lanes on Columbia to: parking + left turns only + mixed flow left-thru + parking/thru lane Lanes left of streetcar would have to be set as left only to eliminate through traffic crossing a left-turning streetcar – most traffic here makes left turns
RATING	2	1

QUEBEC AT PACIFIC/EXPO

This intersection is a T-junction of Quebec Street (the “eastern” and southern legs) with Pacific Boulevard (the northern leg). The Phase I streetcar alignment turns the corner at this location and follows both parts of Quebec Street. Each alignment option on Quebec Street results in a different effect at this intersection, with one or both tracks crossing the intersection.

Impacts	Quebec Layout Option		
	West Side (Tracks Off Street)	Centre (Tracks in Median)	Split (SB Track Off Street + NB Track Next to Curb Lane)
Road Configuration	<ul style="list-style-type: none"> Pacific Boulevard realigned in this area and reduced to two through lanes + 1 left turn onto Quebec North of intersection, 2 of 4 current lanes (2 NB + 2 SB) become mixed flow 	<ul style="list-style-type: none"> No change to lanes except south of intersection, Quebec tapers to 2 southbound lanes EB/WB portion of Quebec and Expo NB both crossed by streetcar tracks 	<ul style="list-style-type: none"> Northbound “right turn” (through lane to Quebec) becomes mixed flow (NB track) Southbound Pacific crossed by SB track
Pacific North of Intersection	<ul style="list-style-type: none"> Minimal impact, crossing streetcars use same phase as current traffic 	<ul style="list-style-type: none"> Left turns onto Quebec have increased delay from streetcars crossing intersection 	<ul style="list-style-type: none"> Minimal impact, crossing streetcars use same phase as current traffic
Quebec North of Intersection	<ul style="list-style-type: none"> Minimal impact, streetcars add to overall volume of traffic 	<ul style="list-style-type: none"> Left turns onto Quebec from WB portion delayed by SB and NB streetcars 	<ul style="list-style-type: none"> Least impact, NB streetcars add to overall volume of traffic
Quebec South of Intersection	<ul style="list-style-type: none"> Minimal impact, streetcars are part of EB/WB traffic movements 	<ul style="list-style-type: none"> Northbound through traffic onto Expo delayed by streetcars crossing intersection 	<ul style="list-style-type: none"> Least impact, WB to SB streetcars are part of WB traffic movements
Streetcar Operations	<ul style="list-style-type: none"> 16 streetcars per hour (8 each direction) cross Expo and Pacific Boulevard – SB and NB streetcars move with WBL turns from Quebec to Quebec NB streetcar gets its own signal, Quebec turning traffic (at Pacific) becomes permitted phase and must yield to streetcar 	<ul style="list-style-type: none"> 16 streetcars per hour (8 each direction) cross two legs of intersection and briefly interrupt most traffic movements 	<ul style="list-style-type: none"> 8 streetcars per hour (SB) cross Expo and Pacific Boulevard –move with WBL turns from Quebec to Quebec NB streetcars share free movement (mixed flow lane) from Quebec to Quebec
RATING	SELECTED	3	1

QUEBEC AT TERMINAL

This is one of the busier intersections along the streetcar alignment and an assessment of the traffic impacts helps to differentiate the layout options on the Quebec Street section.

Impacts	Quebec		
	West Side (Tracks Off Street)	Centre (Tracks in Median)	Split (SB Track Off Street + NB Track Next to Curb Lane)
Road Configuration	<ul style="list-style-type: none"> Per future plans, three lanes each way: 1 SBT + 1 SBT/R + 1 SBR; 2 NBT + 1 NBR Northbound streetcar track would be where one existing SB lane is currently 	<ul style="list-style-type: none"> Per future plans, three lanes each way: 1 SBT + 1 SBT/R + 1 SBR; 2 NBT + 1 NBR Northbound lanes moved eastward to accommodate tracks in median 	<ul style="list-style-type: none"> Per future plans, three lanes each way: 1 SBT + 1 SBT/R + 1 SBR; 2 NBT + 1 NBR 1 NBT lane shared with NB streetcar
Traffic on Quebec	<ul style="list-style-type: none"> Minimal impact to future traffic condition (reduction in lane versus existing part of planned development) 	<ul style="list-style-type: none"> Most impact – streetcar movements block southbound left turns. 	<ul style="list-style-type: none"> Minimal impact – marginal delay due to streetcars adding to northbound through traffic
Cross Traffic	<ul style="list-style-type: none"> No impact 	<ul style="list-style-type: none"> Impact depends on whether TSP is used. V/C exceeds 1.0 if green time is truncated to provide active TSP. 	<ul style="list-style-type: none"> Minimal impact to cross traffic.
Streetcar Operations	<ul style="list-style-type: none"> Off-street 	<ul style="list-style-type: none"> SB and NB in exclusive median Active TSP considered – but negatively impacts westbound traffic to shorten its green time 	<ul style="list-style-type: none"> SB off-street NB in mixed flow lane
RATING	SELECTED	3	2

QUEBEC AT FIRST

The intersection of First Avenue at Quebec Street is where the streetcar turns the corner at the eastern end of False Creek. There are two different options for placing the tracks on First Avenue and three for Quebec Street, resulting in up to six possible combinations, shown below.

Traffic Impacts		Quebec		
		West Side (Tracks Off Street)	Centre (Tracks in Median)	Split (SB Track Off Street + NB Track Next to Curb Lane)
1 st Avenue	North Side (Tracks Adjacent to Street)	<ul style="list-style-type: none"> • Lowest Impact • No signal priority required • Ped. Mgmt required 	<ul style="list-style-type: none"> • Moderate Impact • Priority treatment required to manage SB traffic • Ped. Mgmt required 	<ul style="list-style-type: none"> • High Impact • Requires near-full override of intersection to accommodate EB/NB Streetcar; could keep EB traffic moving but requires safety assessment
	RATING	1	4	5
	Centre (Tracks in Median)	<ul style="list-style-type: none"> • Low Impact • Some priority treatment required to manage SB right-turns • Ped. Mgmt required 	<ul style="list-style-type: none"> • Moderate Impact • Priority treatment required to manage SB traffic • Ped. Mgmt required 	<ul style="list-style-type: none"> • Highest Impact • Requires full override of intersection to accommodate EB/NB Streetcar and priority treatment to manage SB right turns
RATING	SELECTED	3	6	

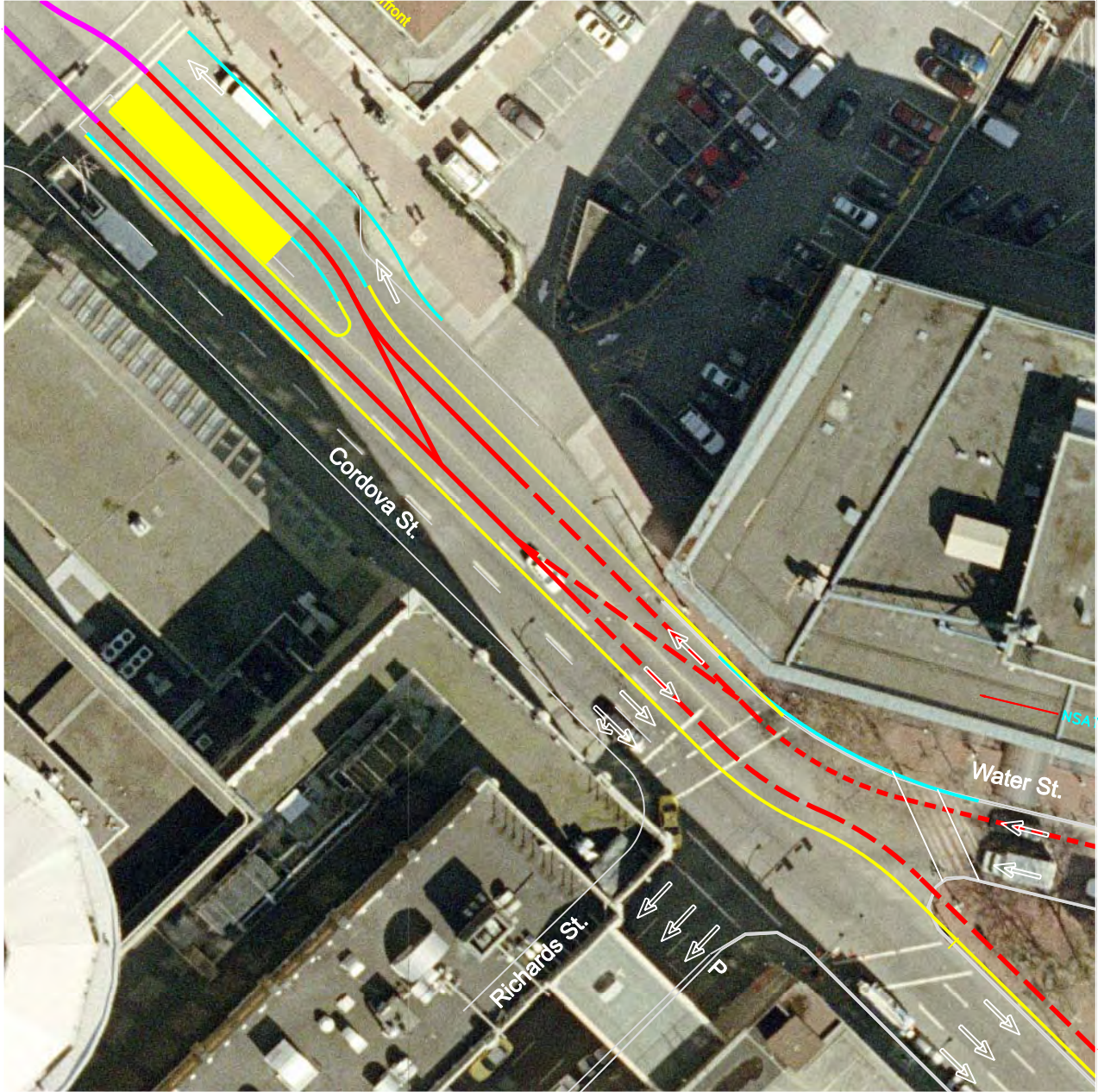
APPENDIX C - INTERSECTION TREATMENTS

FIRST AVENUE

The primary design issue on First Avenue is where to locate the tracks: off-street along the alignment of the existing historic streetcar, or in a semi-exclusive median. Signals would be at two stations and two other locations, and the other intersections would have stop signs on the cross streets.

Impacts at Signalised Locations	First Avenue Layout Option	
	North Side (Off Street)	Centre (Semi-exclusive median)
Road Configuration	<ul style="list-style-type: none"> Street parallel to tracks. Cross section is alternating directions of WB/EB trolley and WB/EB traffic. 	<ul style="list-style-type: none"> EB and WB traffic separate by exclusive trolley in median. Traffic can cross tracks at intersections only.
Traffic on First	<ul style="list-style-type: none"> Left turns across tracks controlled by signal, some risk when trolley is approaching from same direction. Right turns across tracks are a risk; drivers may not yield to streetcar. 	<ul style="list-style-type: none"> Left turns across tracks controlled by traffic signal. Could reduce conflicts between turns and trolley by using signal to stop streetcar.
Cross Traffic	<ul style="list-style-type: none"> Stop bar for traffic from north set back behind tracks and not at street; may confuse drivers. 	<ul style="list-style-type: none"> Minimal impact.
Streetcar Operations	<ul style="list-style-type: none"> Streetcar makes numerous grade crossings but only controlled at signalised locations. 	<ul style="list-style-type: none"> Streetcar may get its own phase to proceed through signal and separate it from through traffic and turn movements off First. Signal locations are mostly at stations; therefore time penalty would be less.
RATING	SECOND CHOICE	RECOMMENDED

Impacts at Non-Signalised Locations	First Avenue Layout Option	
	North Side (Off Street)	Centre (Semi-exclusive median)
Road Configuration	<ul style="list-style-type: none"> Street parallel to tracks. Cross section is alternating directions of WB/EB trolley and WB/EB traffic. 	<ul style="list-style-type: none"> EB and WB traffic separate by exclusive trolley in median. Traffic can cross tracks at intersections only.
Traffic on First	<ul style="list-style-type: none"> Left turns 	<ul style="list-style-type: none"> Left turns prohibited, reducing potential conflicts with streetcar.
Cross Traffic	<ul style="list-style-type: none"> Movements controlled by stop sign – some risk in area crossing tracks before entering intersection 	<ul style="list-style-type: none"> Movements controlled by stop sign.
Streetcar Operations	<ul style="list-style-type: none"> Streetcar makes numerous grade crossings but only controlled at signalised locations. Operator may have to stop suddenly to allow other traffic across tracks. 	<ul style="list-style-type: none"> Streetcar unrestricted at non-signalised locations, with operator discretion to stop if crossing traffic needs to clear. Fewer conflicts expected than off-street option.
RATING	SECOND CHOICE	RECOMMENDED



Vancouver Streetcar
 Intersection Exhibit
 Richards/Water
 at Cordova, Option 1
 Apr 8, 2005

- Legend:
- - - - - Streetcar Track Centerline (Mixed Use)
 - Proposed Curb Line
 - Limit of Dynamic Envelope
 - Streetcar Track Centerline (Exclusive)



Not to Scale



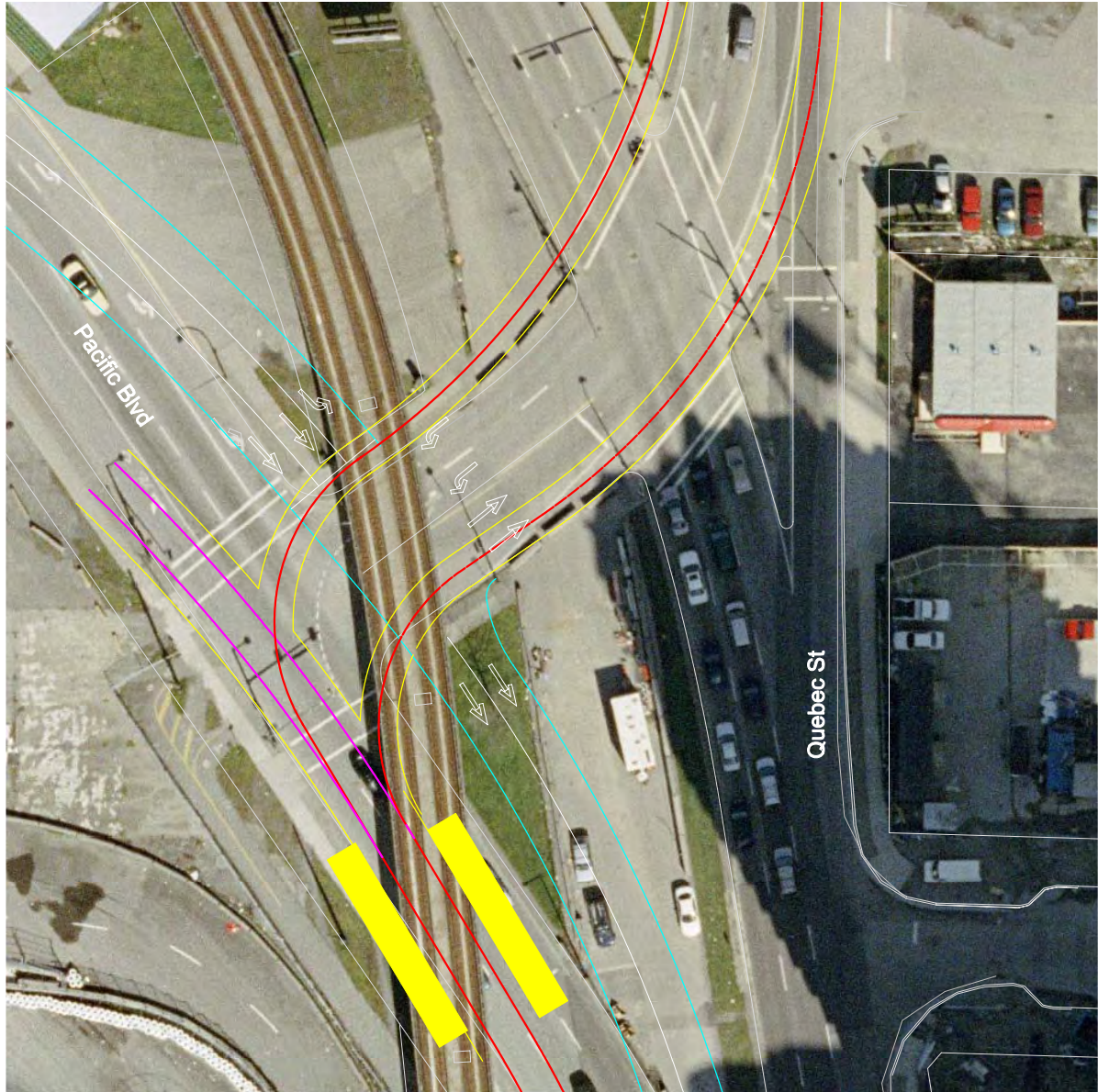
Vancouver Streetcar
 Intersection Exhibit
 Cordova at Columbia
 Apr 8, 2005

Legend:

- - - Streetcar Track Centerline (Mixed Use)
- Proposed Curb Line
- Limit of Dynamic Envelope
- Streetcar Track Centerline (Exclusive)



Not to Scale



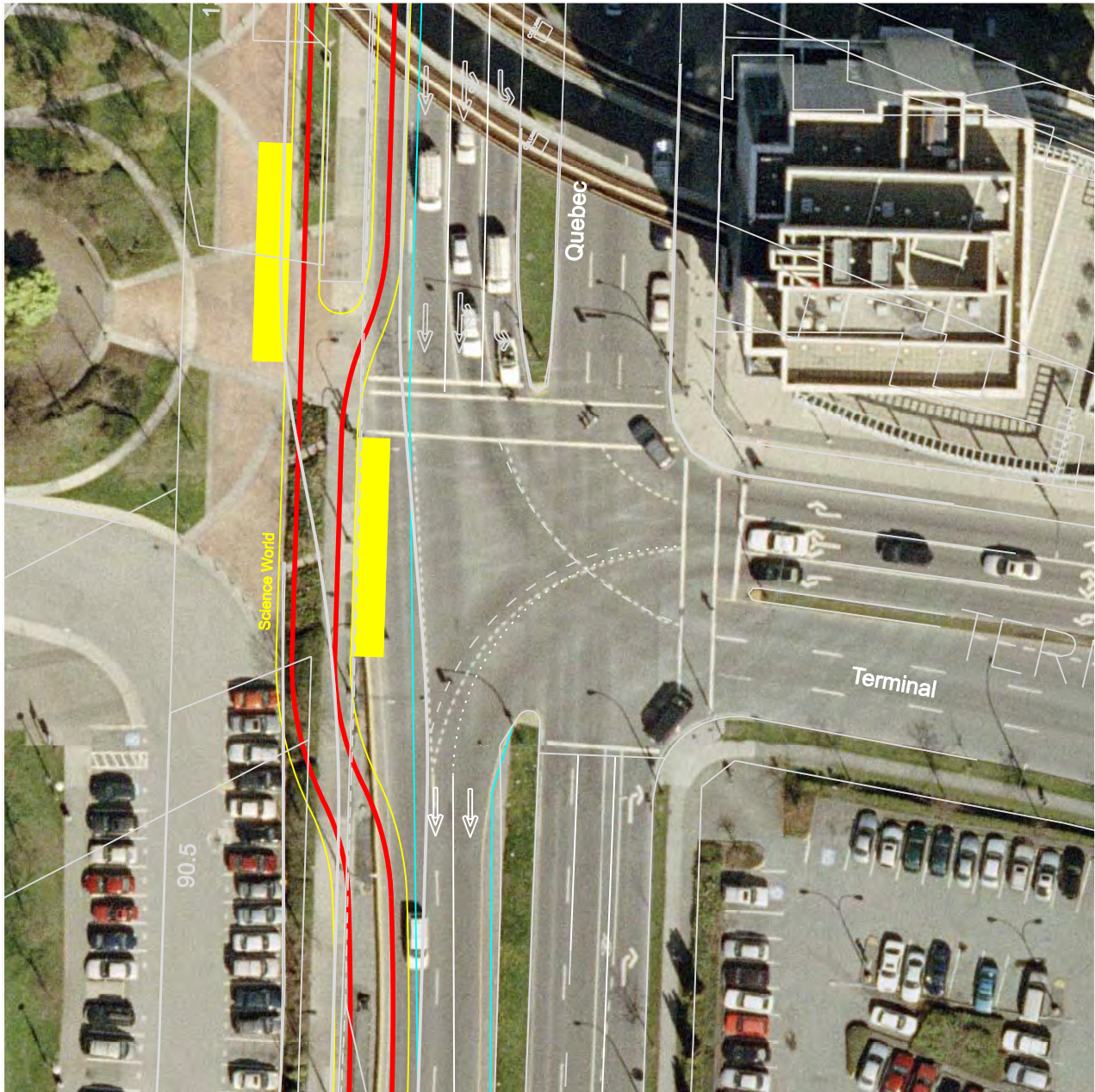
**Vancouver Streetcar
 Intersection Exhibit
 Quebec at Pacific, Option 1
 Mar 18, 2005**

Legend:

- Streetcar Track Centerline (Mixed Use)
- Proposed Curb Line
- Limit of Dynamic Envelope
- Streetcar Track Centerline (Exclusive)
- Future Extension



Not to Scale



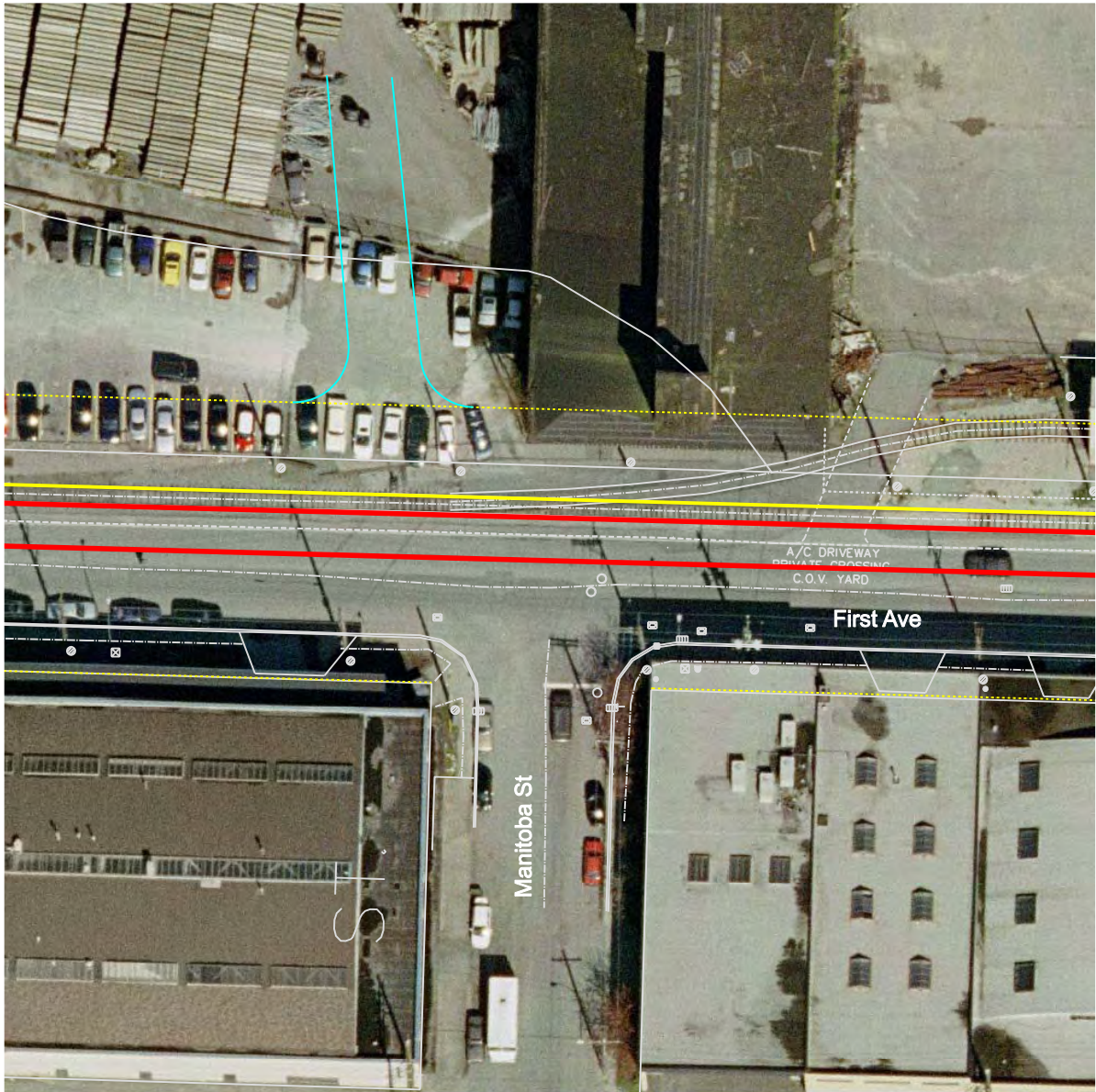
Vancouver Streetcar
 Intersection Exhibit
 Quebec at Terminal, Option 1
 Mar 18, 2005

Legend:

- - - Streetcar Track Centerline (Mixed Use)
- Proposed Curb Line
- Limit of Dynamic Envelope
- Streetcar Track Centerline (Exclusive)



Not to Scale



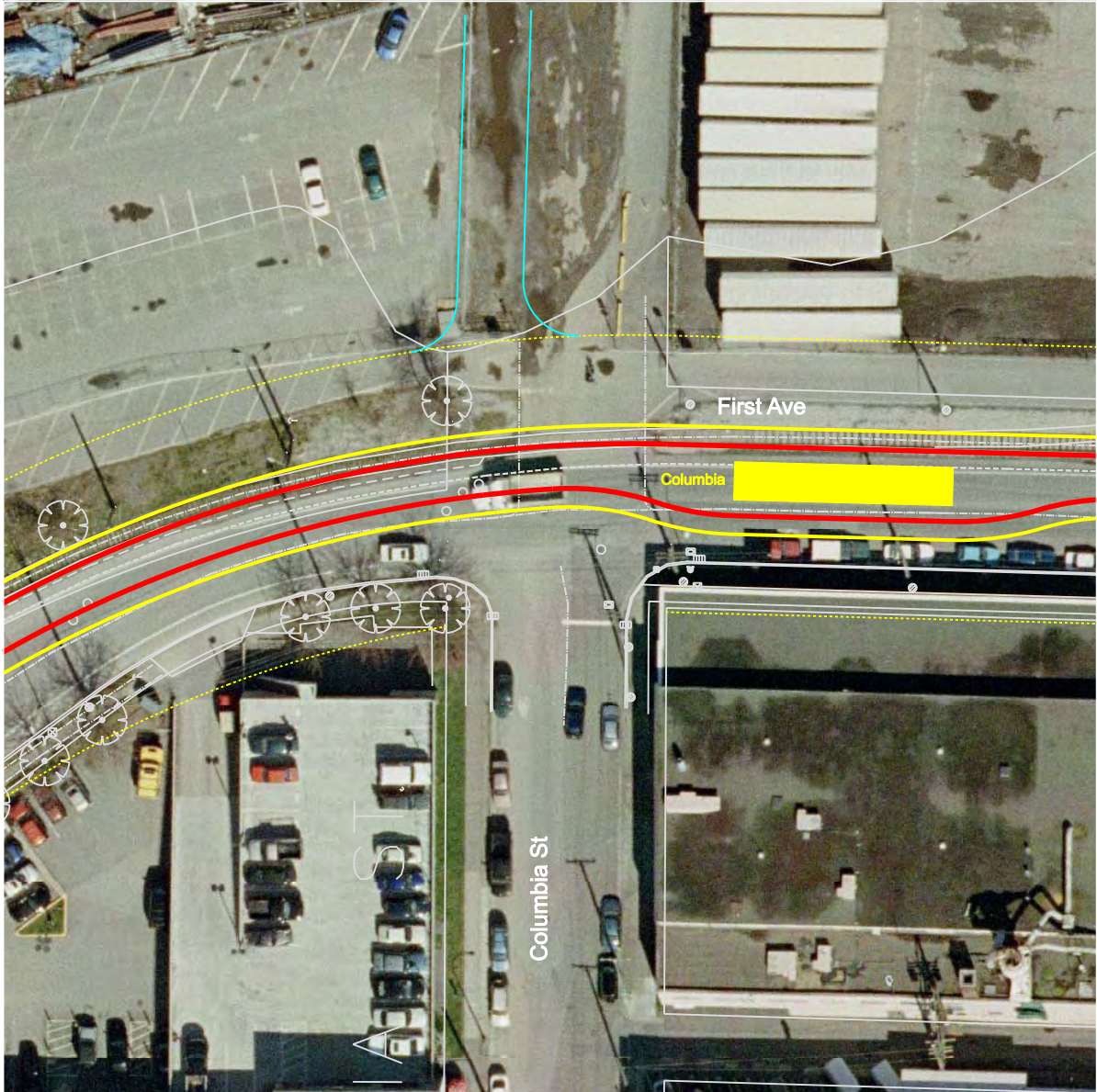
Vancouver Streetcar
Intersection Exhibit
First at Manitoba (Centre)
Mar 4, 2005

Legend:

- Proposed Curb Line
- Limit of Dynamic Envelope
- Streetcar Track Centerline (Exclusive)



Not to Scale



Vancouver Streetcar
Intersection Exhibit
First at Columbia (Centre)
Mar 4, 2005

Legend:

-  Proposed Curb Line
-  Limit of Dynamic Envelope
-  Streetcar Track Centerline (Exclusive)



Not to Scale