DKS Associates
TRANSPORTATION SOLUTIONS

TECHNICAL MEMORANDUM

DATE: May 21, 2008

TO: Katy Brooks, Port of Vancouver

FROM: Alan Snook, AICP
France Campbell

SUBJECT: **Port of Vancouver Freight Route Delay Analysis** P08029-000

The purpose of this memorandum is to summarize findings related to travel times and potential delay along key freight routes that service the Port of Vancouver for existing and future 2013 and 2025 planning horizon years. In addition to the analysis of travel times, the influence of both bus rapid transit (BRT) and light rail transit (LRT) within the study area was evaluated for the potential to create additional delay to freight routes.

STUDY AREA

Currently, there are four primary routes that service freight (truck) activity to/from the Port of Vancouver. These routes are East/West Mill Plain Boulevard, East/West Fourth Plain Boulevard, East/West 39th Street, and Northwest 78th Street. The majority of truck traffic to/from the Port of Vancouver utilizes East/West Mill Plain Boulevard. Access to the primary regional freeway (Interstate 5) can be gained via each of these routes. Figure 1 summarizes the location of these routes in relation to the regional roadway network and the Port of Vancouver.

EXISTING CONDITIONS

The following summarizes the existing conditions for the study area outlining data collection and travel time information.

Data Collection

Several prior studies within the study area have collected traffic counts at intersections in the past several years. An inventory of these counts was taken to determine where potential intersection count data was missing at major signalized intersections along the key freight corridors in the study area. It was determined that the PM peak period typically had the highest volume of traffic on roadways and therefore was selected as the analysis period for existing conditions (as well as future conditions). While higher freight activity typically occurs during the "off-peak" time periods, it is useful to analyze the heaviest traffic flow period in order to assess

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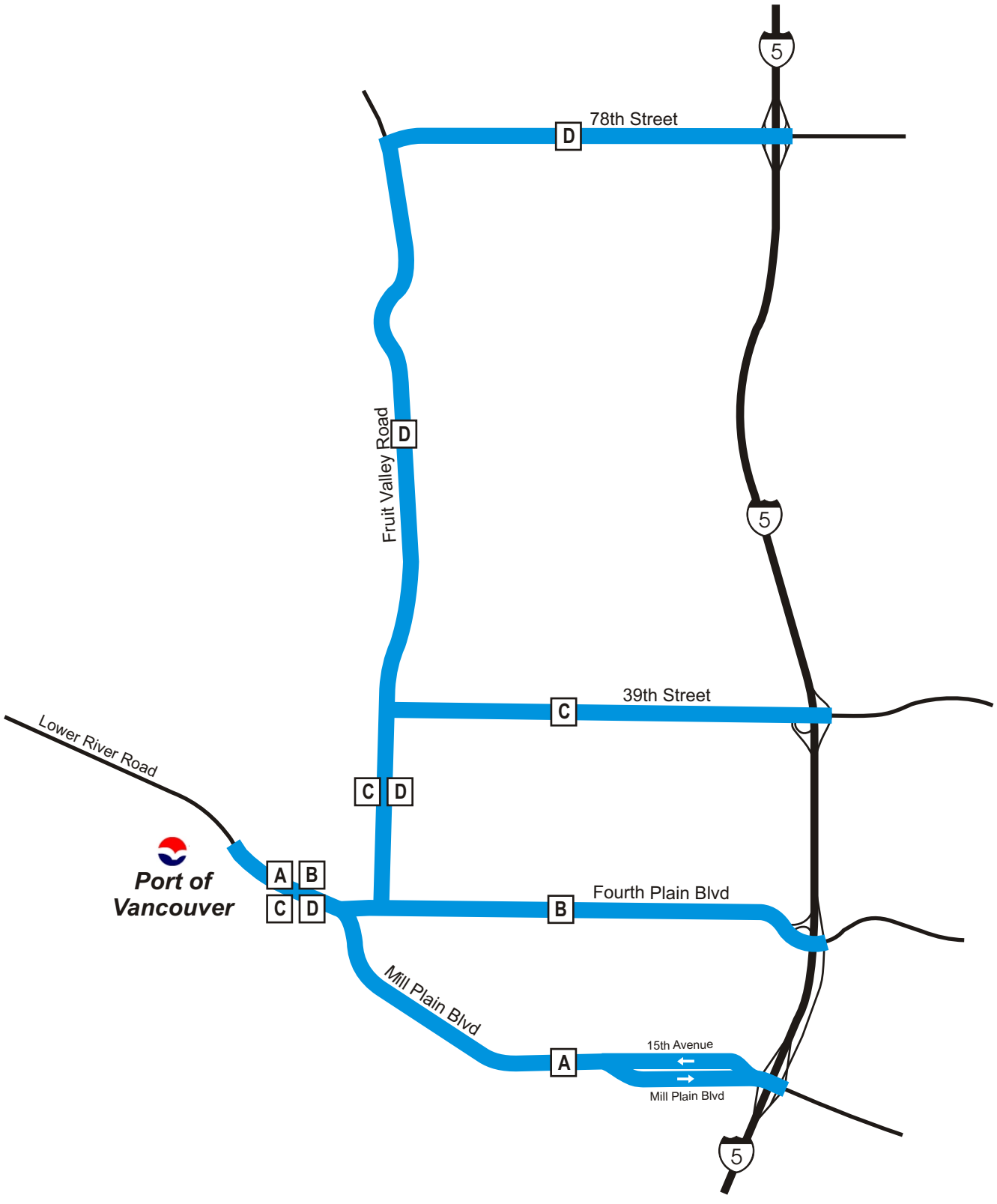

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LEGEND

- Freight Route Servicing Port of Vancouver
- A - Route Identifyer

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MAP NOT TO SCALE

Information Sources: Port of Vancouver

STUDY AREA AND PRIMARY FREIGHT ROUTES

FIGURE 1

the worst case for traffic conditions during the day. It is assumed that motor vehicle and/or freight travel times and delay would be less than what occurs during the peak period.

Analysis of available data indicated that the study area consisted of approximately 38 intersections that were signalized or were major intersections of roadways. Data from previous studies was available at approximately 32 of the intersections; therefore supplemental counts were taken at the remaining six intersections. These supplemental counts were compared to the previous counts at surrounding intersections and it was determined that the previous data was still within an acceptable range to use for the analysis.

Traffic signal timing data was also collected at the study area intersections. The signal timing data is critical to assess the operations at signalized intersections because delay occurs at these locations and can affect travel times along the study routes. Signal timings at most study intersections were available from previous studies; however some timings were missing and were acquired from the City of Vancouver.

Travel Time Data

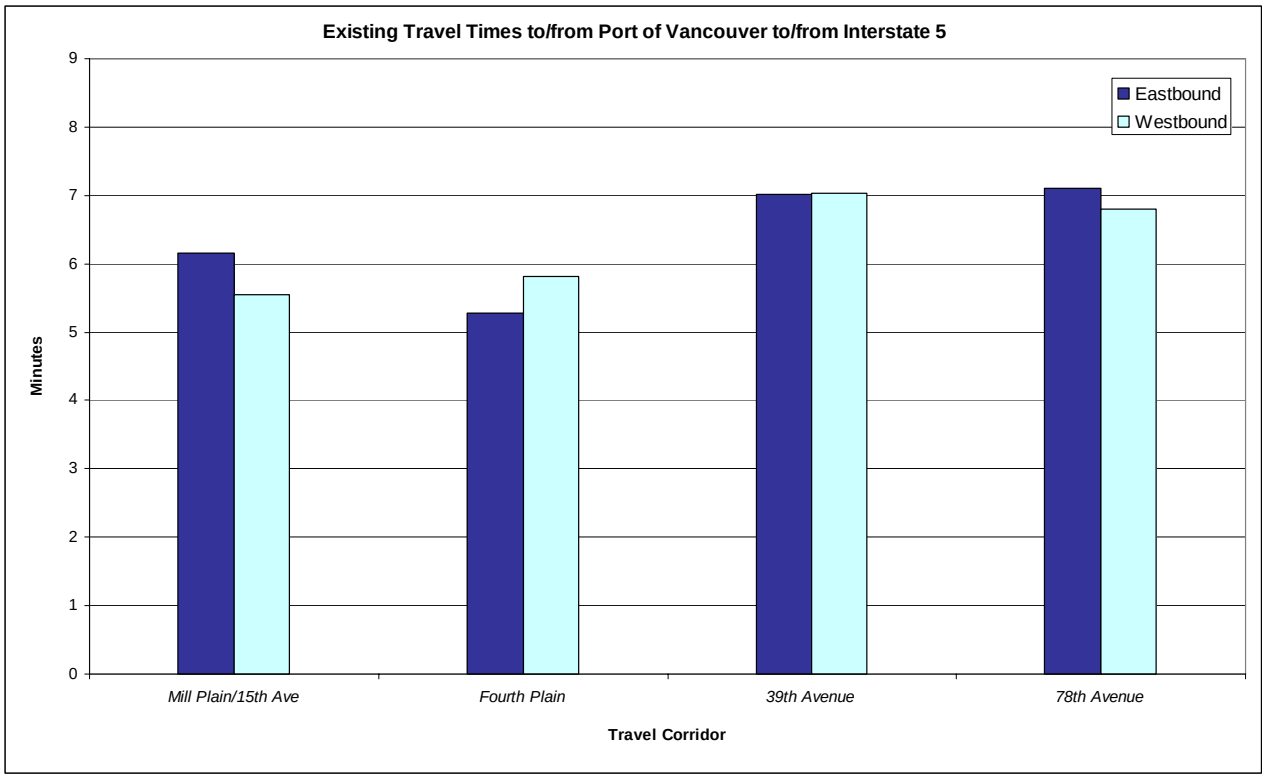
The intersection evaluation allows for assessment of delay at signalized intersections, however it does not portray the full picture of total travel time along corridors in the study area. Evaluation of corridors was conducted via a series of travel time studies during the PM peak period.

Travel times were collected by driving between the Port of Vancouver and Interstate 5 along the four primary routes and recording the time elapsed to reach either the Port of Vancouver or Interstate 5. Travel time data is collected by driving along a road and traveling at the average speed of other drivers along the roadway, while collecting the time taken to travel between points.

A minimum of four inbound and outbound travel runs were conducted along each route. Conducting multiple travel times along each route allowed for a better representation of the average travel time during the PM peak period.

Existing travel time data collected for motor vehicles indicates that typically during the PM peak period the eastbound travel routes (those accessing Interstate 5) have higher travel times than westbound travel routes (heading away from Interstate 5). This is expected due to heavier vehicle volumes during the PM peak accessing Interstate 5. The exception to this is the Fourth Plain Boulevard route where the westbound route has slightly higher travel times than the eastbound direction. In addition, the Fourth Plain Boulevard route has the lowest travel time of the four routes. The 39th Street and 78th Street corridors are expected to have higher travel times due to the distance necessary to travel to access Interstate 5. Figure 2 summarizes the existing travel times by route and by direction.

Figure 2
Existing Travel Times by Route and Travel Direction



SOURCE: ***DKS*** *Associates*

As can be seen in Figure 2, the travel times range from approximately five to seven minutes depending on the corridor selected. The majority of freight users access Interstate 5 along Mill Plain Boulevard/15th Avenue which has a slightly higher delay (eastbound) than Fourth Plain Boulevard.

When comparing the travel distance for the four corridors, most are within ½ mile of the same distance, with the exception of 78th Avenue which is over double the distance than other routes. Most routes have a similar number of signals which can influence delay along the corridor. Table 1 summarizes the travel distance and number of signals for each route.

Table 1
Total Distance in Miles from each Corridor

Route	Distance (miles)	Number of Signals
Mill Plain Boulevard/15th Avenue	2.14	13
Fourth Plain Boulevard	2.03	11
39th Avenue	2.69	10
78th Avenue	4.54	10

SOURCE: ***DKS*** *Associates*

In addition to the motor vehicle travel times collected, supplemental freight travel time was provided by the Port of Vancouver. This freight travel time was collected by freight drivers and was limited in nature, but does allow for a useful comparison of freight travel times in comparison to motor vehicle travel times. The freight travel times supplied by the Port of Vancouver indicated that in comparison to the average motor vehicle travel time of approximately 6 ½ minutes (eastbound and westbound) the freight travel time was approximately 10 minutes for similar routes. This is an increase in travel time of approximately 50% in comparison to motor vehicles.

It is assumed that the provided freight travel times were for typical semi-truck vehicles and not for longer vehicles. The longer vehicles that carry goods to/from the Port of Vancouver can be up to 150 feet in length (up to three times longer than a typical semi-truck trailer). It would be expected that these types of vehicles traveling along Mill Plain Boulevard/15th Avenue corridor may have a longer travel time to/from regional facilities because typical signal spacing in the couplet portion of the corridor is approximately 200 feet, so only one longer truck at a time would be able to store between the signals, and they may need to wait to allow queues in front of them to clear out of the storage space to move forward so they do not block a signalized intersection.

The existing traffic counts collected were input into a traffic analysis model (Synchro) to determine delay at intersections, and then the existing travel times collected on corridors were utilized to help calibrate the traffic analysis model so that the model was representative of existing conditions in the study area.

ASSUMPTIONS AND METHODOLOGY

A variety assumptions and methodology were established to evaluate the future conditions within the study area. The following summarizes these assumptions and methodology to outline the future analysis process.

Future Planning Horizon

Two planning horizon years were selected for analysis. The first planning horizon was 2013, and was selected to coincide with the planning horizon of the Columbia River Crossing (CRC) project that is currently being analyzed. The Columbia River Crossing project is evaluating a new (or supplemental) bridge crossing the Columbia River with the potential of bus rapid transit (BRT) or light rail transit (LRT) servicing the downtown Vancouver area.

The second planning horizon selected was 2025, which corresponds to an approximate 20-year planning period. This 20 year planning period includes potential growth in development/land use for all of Clark County.

Future Roadway Projects

There are a number of potential projects included in the study area that can affect the future forecasting of volumes on the roadway network, as well as affect the potential travel times forecasted along freight routes. These projects include a number of conversions of streets from one-way to two-way operation, as well as the completion of the CRC project which has the potential to modify freeway interchange areas.

A major component of potential improvements in the downtown Vancouver area was completed as part of the Vancouver City Center Vision Environmental Impact Statement. This study was adopted in June 2007. Figure 3 shows roadways that are expected to be improved or modified to two way (in red and green), as well as new connections in/out of the downtown area.

For the purpose of this analysis, it was assumed that SW Fourth Plain Boulevard was retained as a three lane cross-section (one travel lane in each direction with a center turn lane). Currently there is the potential to restripe the roadway to be a four lane cross-section (two travel lanes in each direction with no center turn lane). Left turns would occur in the inner travel lane under this scenario. The additional lane in each direction could help improve travel times by adding additional capacity along the corridor, however utilizing the inner travel lane as a shared turn lane could create some additional delay for that travel lane. Both options still allow for one unimpeded travel lane in each direction.

Future Volumes Forecasting

The prior VCCV project forecasted intersection volumes at a number of study area intersections. The planning horizons for the VCCV project were 2010 and 2023, and included future development and growth in the downtown Vancouver area corresponding to those two time periods. Rather than reforecast many of the study area intersections, these prior forecast were utilized and adjusted based on growth rate per year by corridor using the regional travel demand model to determine the growth rates.

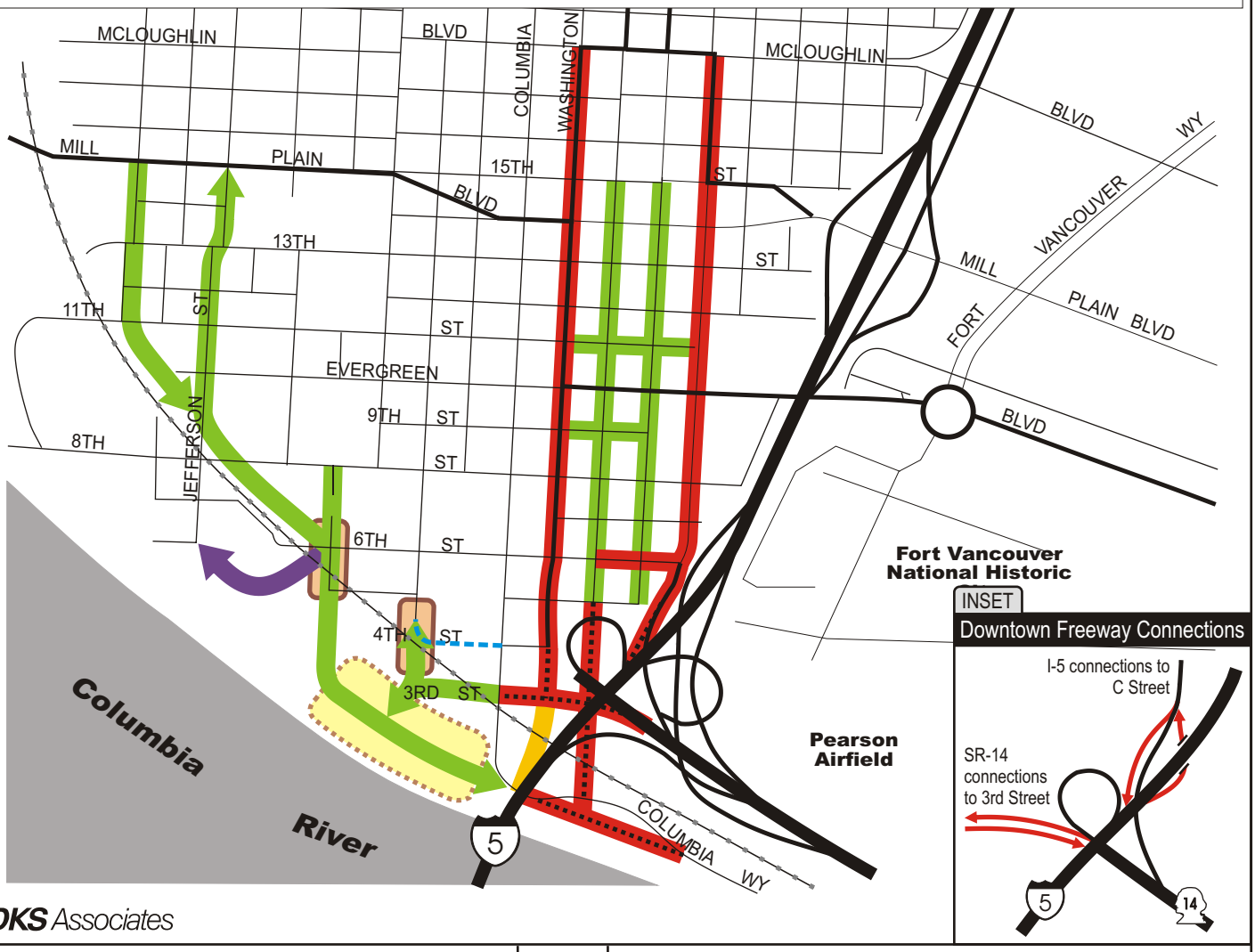
The regional travel demand model indicated growth rates in the range of approximately 1 to 2.5 percent per year within the study area along key routes. This growth rate was applied to intersections to help forecast future year volumes.

Transit Assumptions

As previously mentioned, the CRC project is expected to bring some form of high capacity transit into the downtown Vancouver area. For the purpose of this analysis it was assumed that this high capacity transit could be in the form of bus rapid transit (BRT) or light rail transit (LRT) and would travel along Washington Street (two-way) and cross over Mill Plain Boulevard and 15th Avenue. It is not expected that transit would cross over any of the other key freight routes in the study area being analyzed.

BRT could be operated with or without signal priority, and was assumed to have headways of 2.5 minutes (approximately 24 buses per direction during the peak hours). LRT would typically

Columbia River Crossing Projects	Location
SR 14 Eastbound/Westbound Connection	Columbia Street to Interstate 5
C Street Two-way	Mill Plain Boulevard to 6th Street
C Street Southbound Connection to I-5 southbound	6th Street to Interstate 5
Main Street Connection to South Waterfront Arterial	5th Street to Columbia Way
Washington Street Two-way High Capacity Transit	McLoughlin Boulevard to 4th Street and Interstate 5
6th Street Two-way	Main Street to C Street
Washington Street Two-way Motor Vehicle*	McLoughlin Boulevard to 4th Street
Straighten Columbia Way	Columbia Street to C Street alignment
City of Vancouver Projects	**Location**
South Waterfront Arterial Roadway	Approximately Grant St. alignment east to Columbia
SR14 – 3rd/4th Street Connection	Esther Street to Columbia Street
Ester Street extension	4th Street to South Waterfront Arterial
Westside Connector Arterial	From Jefferson Street just north of 8th Street connecting southeast to 6th Street.
Lincoln Street – Jefferson/Kauffman Street Couplet	Between approximately 9th Street and Mill Plain Boulevard. A couplet from 8th Street north to Mill Plain was one of the options considered. Other option keeps all traffic on either Lincoln or K auffman. Either corridor will work for traffic purposes.
Main Street Reconstruction & Two-way	Mill Plain Boulevard to 5th Street
Broadway Two-way	Mill Plain Boulevard to 5th Street
9th Street Two-way	Washington Street to Broadway
11th Street Two-way	Washington Street to C Street
Vacate/Realign 4th Street	Esther Street to Columbia Street
Port of Vancouver Projects	**Location**
Rail Spur	not shown
West Port Access Road	6th Street/Grant Street intersection to the west
Joint Jurisdiction Project	**Location**
South Waterfront Arterial Roadway Connection (Vancouver and Port of Vancouver)	8th Street/Grant Street intersection south along Grant Street to new South Waterfront Arterial Roadway



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LEGEND

- Columbia River Crossing Network Improvements
- Columbia River Crossing HCT Connector
- City of Vancouver Network Improvements
- Port of Vancouver Network Improvements
- Proposed Street Vacation
- New Roadway Connection/Alignment
- Grade Separated Crossing with Special Design Concern
- Waterfront Redevelopment Street Network

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Information Sources: City of Vancouver
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VCCV ASSUMED ROADWAY NETWORK MODIFICATIONS

FIGURE 3

have signal priority and was assumed to have headways of 7.5 minutes (approximately 8 trains per direction during the peak hours).

Signal priority could disrupt eastbound and westbound movements on Mill Plain Boulevard and 15th Avenue where either BRT or LRT cross along Washington Street. This would create some additional delay for those movements at the intersection. Average impact delay was calculated based on signal cycle length (number of cycle in an hour), headways and probability of arrival for transit vehicles. The additional "lost time" associated with transit was added to those movements affected by the transit service.

Future Travel Times

Using the existing traffic analysis model, future volumes were input into intersections to evaluate the future travel times along key routes. This allowed for future forecasted delay at intersections as well as travel times between intersections. While these forecasts were developed for motor vehicles, they do include increase freight traffic in the study area. In addition, future freight travel times were estimated based on the existing ratio of motor vehicle travel times to existing freight travel times. This was done to get an estimate of future freight travel times.

FUTURE CONDITIONS

Using the assumptions and methodology outlined previously, the 2013 and 2025 planning years were evaluated for the future PM peak conditions (without high capacity transit). The highest level of delay increase is experienced on Mill Plain Boulevard/15th Avenue with approximately 2 ½ minutes of additional travel time by 2025 from existing conditions during the PM peak hour. The corridors of Fourth Plain Boulevard and 39th Avenue experience an increase in travel time of approximately 1 minute by 2025 from existing conditions during the PM peak hour, and 78th Avenue has an increase in travel time of approximately 30 seconds over existing conditions by 2025 in the PM peak hour. Figures 4 and 5 summarize the results of the future travel time forecasts for 2013 and 2025 for the PM peak hour under a No-build (no high capacity transit) condition, and compare the travel times to the existing conditions.

Congestion along Mill Plain Boulevard/15th Avenue has created growth in travel time, and consequently delay, for all vehicles using that route. The growth in delay/travel time far surpasses growth in potential delay/travel time on all other three routes. The existing eastbound travel time on Fourth Plain Boulevard (peak direction) was the lowest of all four key routes, and even with growth in delay/travel time, the future 2025 conditions are only slightly higher than the existing eastbound travel times on Mill Plain Boulevard.

The further away a corridor was from the Port of Vancouver, the increment of potential delay generally decreased. For example, the westbound travel times on all corridors increased in smaller increments the farther away from the Port of Vancouver the corridor was located.

Figure 4
Existing and Future Eastbound Travel Times by Route – No High Capacity Transit

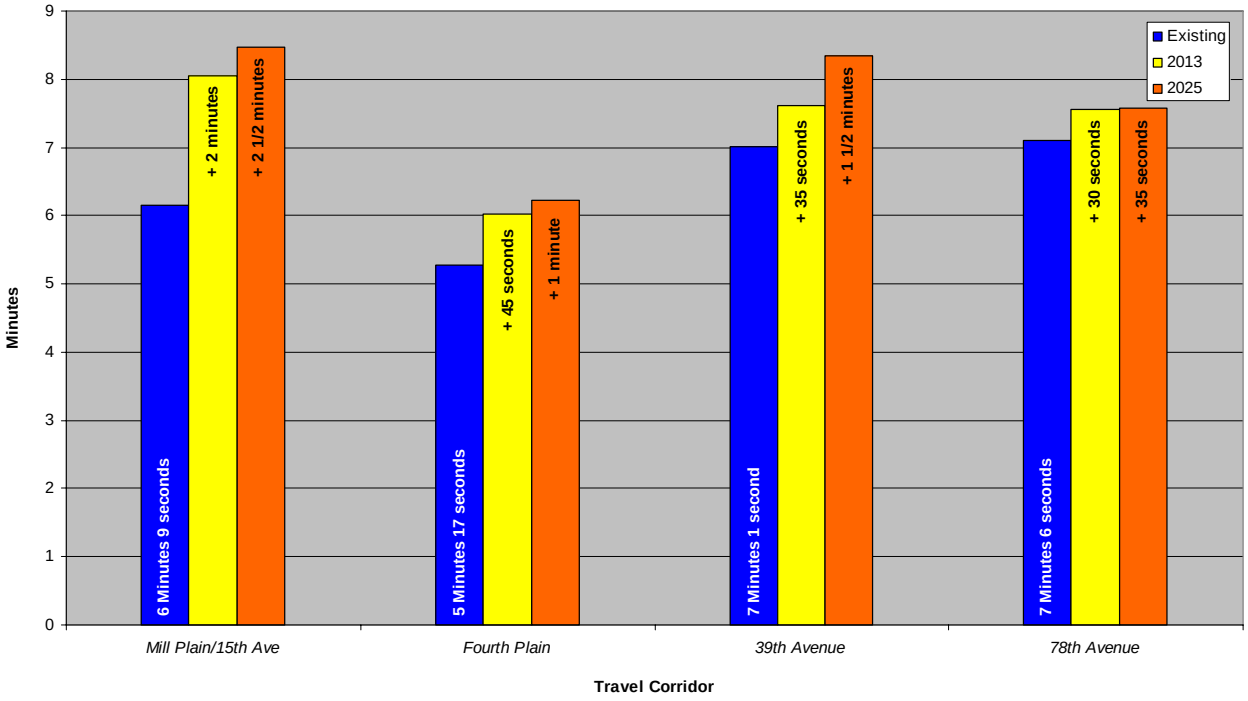
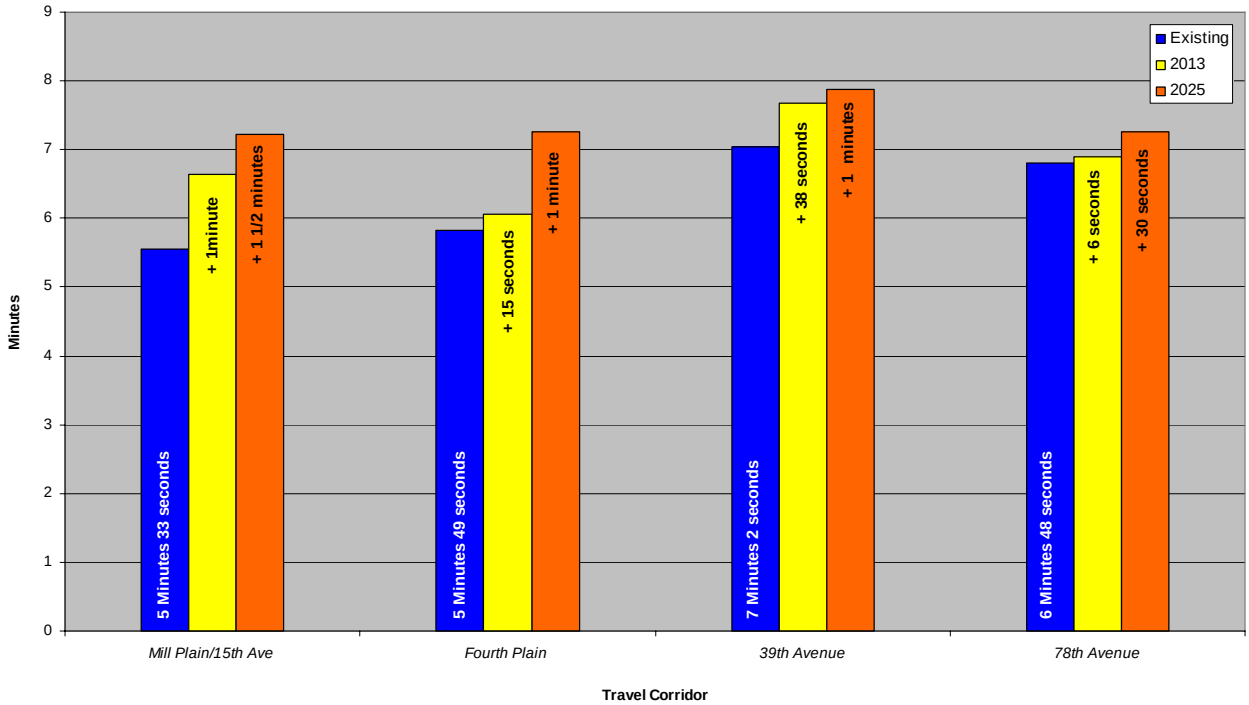


Figure 5
Existing and Future Westbound Travel Times by Route – No High Capacity Transit



Transit Influence

In addition to the No-build condition previously analyzed, analysis was conducted to determine the potential influence on delay to travel times high capacity transit may have for corridors where high capacity transit crosses. The only corridor in the study area where this is expected to occur is Mill Plain Boulevard/15th Avenue. High capacity transit is assumed to occur along SW Washington Street and assumed signal priority at the crossing points of Mill Plain Boulevard and 15th Avenue. Signal priority would have the highest potential for delay due to the fact that it allows for transit service (north/south movement) to receive preferential signal timing which does not require the transit service to stop. This can take green time away from the eastbound/westbound movements to better service northbound/southbound transit service. Table 2 summarizes the results from this signal priority environment.

Table 2
Effect on Potential Delay of High Capacity Transit on Washington Street at Mill Plain Boulevard/15th Avenue

	2013 Additional Travel Time		2025 Additional Travel Time	
Type of HCT	Eastbound	Westbound	Eastbound	Westbound
Bus Rapid Transit	9 seconds	5 seconds	9 seconds	15 seconds
Light Rail Transit	5 seconds	3 seconds	5 seconds	10 seconds

SOURCE: ***DKS*** *Associates*

As shown in Table 2, the estimated travel times for freight vehicle along Mill Plain Boulevard can vary based on the type of high capacity transit implemented. Higher headways (more frequent service), as well as signal priority, can create additional delay to eastbound/westbound travel. BRT service with signal priority has the highest level of impact, while LRT service has a lower level of potential delay to eastbound/westbound travel time. Both types of transit service have minimal additional delay in comparison to the total future travel times along the Mill Plain Boulevard/15th Avenue corridor.

FREIGHT RELIABILITY

The ability to deliver freight reliably in the future determines heavily on the ability to have reliable travel times as well as minimizing delay along key freight corridors. Analysis of future conditions (growth in land use and vehicle trips along corridors) indicates that the current corridor of Mill Plain Boulevard/15th Avenue will start to experience additional delay that could impact freight reliability. Based on this initial planning level analysis some movements at the interchange of Mill Plain Boulevard/Interstate 5 would be reaching capacity near the 2015 time period and would indicate that alternative routes that would benefit freight mobility may need to be explored. Improvements to parallel corridors such as Fourth Plain Boulevard (which are forecasted to have less delay associated with them) could be beneficial to freight reliability and travel times. This analysis performed for this memorandum was done at a sketch planning level and it would be beneficial to perform more detailed analysis to define when future improvements may be necessary along these corridors that service freight.