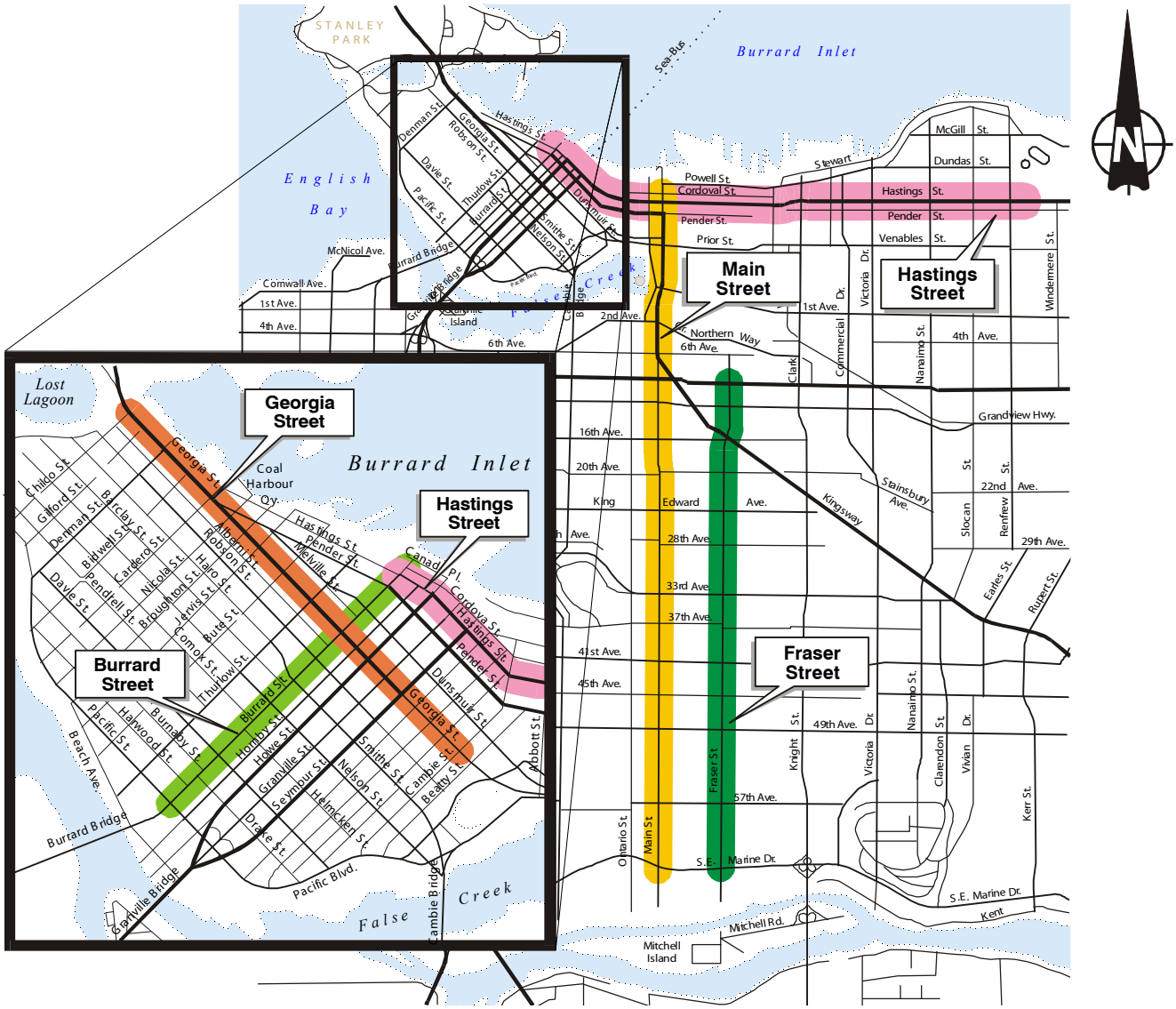


APPENDIX A - STUDY CORRIDOR LOCATIONS

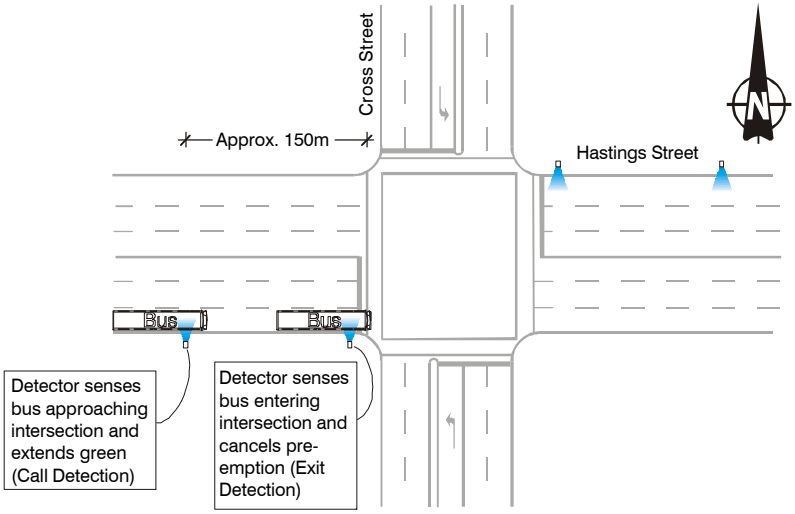
APPENDIX B - TRANSIT PRIORITY MEASURES - DESCRIPTION

Transit priority measures involve managing traffic (with signals, signing and pavement markings) in order to give buses an operational advantage over general traffic.

The primary transit priority measures investigated for the subject study included:

Transit Signal Preemption

Signal preemption systems detect buses approaching an intersection and adjust the signal timings to favour the bus. The City and TransLink are about to conduct a trial of this system for the #98 B-Line express bus system on the Granville corridor. As well there are transit actuated signals at 8 intersections in the City.



Bus Bulges

A bus bulge is a section of sidewalk that has been widened to allow buses to load and unload in the moving travel lane instead of pulling out of traffic into the parking lane. This saves travel time as bus operators do not have to find a gap in traffic when pulling back into the moving traffic lane. Wider sidewalks at bus stops also provide for:

- passenger amenities such as bus shelters, benches and bike racks
- additional space for landscaping and other community amenities that enhance the street environment
- shortened pedestrian crossing distances, and increased pedestrian comfort and safety.

These measures can only be installed on arterials where there is full time on-street parking. The City has implemented trial installations of bus bulges on West 10th Avenue, Pender Street and Commercial Drive.

Bus Bulge on 10th at Sasamat

High Occupancy Vehicle (HOV) Lanes

HOV lanes are travel lanes (usually the curb lane) restricted to vehicles carrying a minimum number of passengers. Typical HOV lanes allow vehicles with a minimum of 2 or 3 occupants. .

Current installations include:

- westbound Georgia Street from Nicola to Stanley Park
- westbound Georgia Street from Burrard to Nicola in the Pm peak traffic period
- southbound Granville Streets in Marpole in the PM peak traffic period
- westbound (AM) and eastbound (PM) Hastings Street, east of Renfrew

Bus-only Lanes

Bus only lanes are an extension of the HOV concept where the lane usage is limited to buses only. Current installations include:

- northbound Granville, peak periods and midday - Arthur Laing Bridge to 70th
- southbound Howe - Nelson to Davie, peak periods and midday
- northbound Seymour - Davie to Robson, peak periods and midday
- eastbound McGill - Renfrew to 2nd Narrows Bridge

Traffic Operational Improvements.

The improvement of traffic operations for general traffic can also result in travel time savings and improved reliability for transit vehicles. Potential traffic operational improvements include:

- optimizing existing traffic signal timings
- left turn bays
- protected left turn phases
- turn restrictions

APPENDIX C- PUBLIC PROCESS

The public was encouraged to provide input at all stages of the consultant's study through three main forums:

- Downtown

  Public input was provided through the Downtown Transportation Plan process open houses.

- East Hastings - meetings were held at the East Hasting Community Centre.

  - March 27, 2001 Introductory open house
  - June 18, 2001 Community workshop
  - June 18, 2002 Open House regarding results of consultant study

- Main/Fraser

  a presentation was made and input received from the Sunset Community Vision process.

  Meetings were held at the Moberly Arts and Culture Centre.

  - March 28, 2001 Introductory open house
  - June 20, 2001 Community workshop
  - June 19, 2002 Open House regarding results of consultant study and

The open houses and workshops were advertized in the newspapers. Community organisations and property owners affected by specific options were notified by mail.

APPENDIX D - EVALUATION FRAMEWORK

The criteria most appropriate for evaluating potential transit priority measures on the five study corridor were selected based on input from TransLink and the public.

The selected evaluation criteria were:

1. Travel Time

   changes in travel times for buses and general traffic, on a per vehicle basis, using the results of computer modelling and comparisons with measures in other Cities.

2. Reliability

   the impacts to transit reliability in terms of the percentage of buses late, and the change in the standard deviation of arrival times..

3. Safety

   the potential change in collision rates for the corridor

4. On-street Parking -

   the change in the supply of on-street customer parking.

5. Costs

   construction and annual maintenance/operations costs - the estimates are approximate only and not for budgeting purposes.

6. Economic Analysis

   benefit cost ratios were developed using the present value of passengers' travel time, installation costs, and traffic collision costs

7. Diversion of Traffic to Other Arterials and Local Streets

   volume of traffic diverted to other corridors and local streets because of delays caused by transit priority measures (a negative impact on the transit/traffic operation, safety and environment for those streets)

8. Access to and from Services and Cross Streets

the impact of transit priority measures on the ability for vehicles, bicycles and pedestrians to access services and cross streets.

.

9. Transit Ridership

new transit riders that would be attracted if the transit priority measures were implemented.

10. Pedestrian Environment

changes in the pedestrian space, geometry, comfort, aesthetics (e.g. landscaping opportunities), and safety.

11. East of Use by Bus Operators

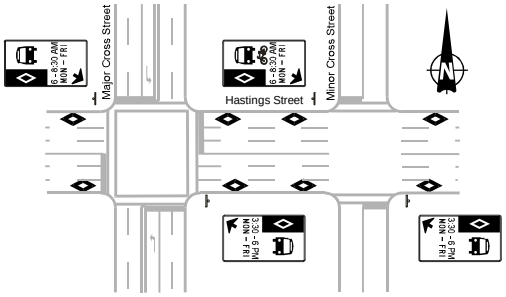
relative ease with which bus operators can adapt to and use the various transit priority strategies.

12. Transit Attractiveness and Prominence

visibility of transit as an attractive and viable transportation option for the public

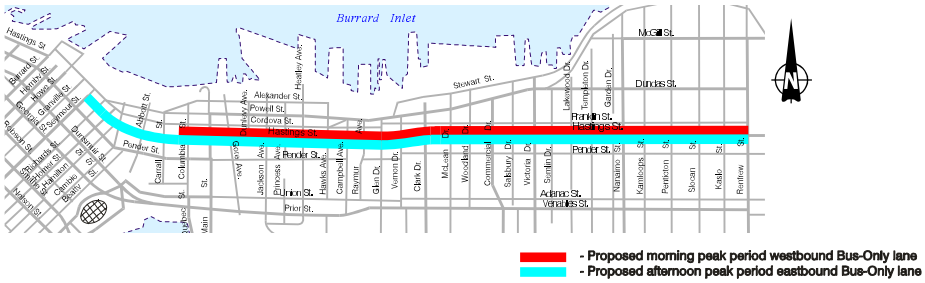
Hastings St. Option #1
Bus-Only Curb Lanes in the Peak Directions

This option would consist of designating the westbound curb lane as a bus-only lane from Renfrew Street to Carrall Street during the morning peak period and the eastbound curb lane from near Seymour Street to Renfrew Street during the afternoon peak period.



Schematic Layout of Bus-Only lane along Hastings Street

Example of Bus Only lane
(Howe St. near Nelson St.)



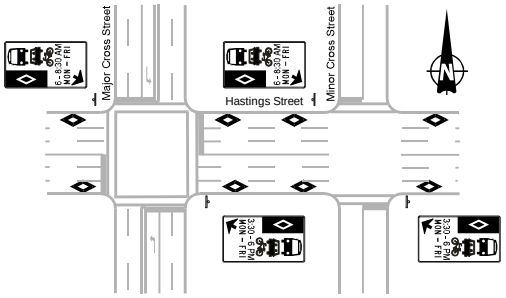
Location of Proposed Bus-Only Lanes

Summary Table of Analysis Results

CATEGORY	IMPACT/CONCLUSION
Description	Curb lane bus-only lane usage (right-turns exempt) between Renfrew St. and Columbia St. westbound from 0600-0830 hrs and between Seymour St. and Renfrew St. eastbound from 1530-1800 hrs.
Travel Time	Travel time improvement of up to 2½ minutes per bus. Delays of up to 4 minutes per general purpose vehicle. Expected annual benefit of $468,000 for bus passengers. Expected additional annual cost of $1.48M for general purpose vehicles.
Reliability	Probability of bus arriving on-schedule improved by up to 7 percent. Standard deviation of arrival times reduced by approximately 1 minute.
Safety	Annual crash savings of less than $4,000 for buses. Additional annual crash cost of $246,000 for general purpose vehicles (25 crashes per year).
Parking	No impact.
Construction and Maintenance Cost	Total capital cost of $200,000, with $20,000 annually for maintenance.
Economic Analysis	Benefit-to-cost ratios are 9.5:1 for buses only, -25.3:1 for all traffic.
Diversion	Potential impact to the Powell St./Cordova St. corridor, with some possible impact to adjacent residential streets such as Franklin St. and Pender St.
Access to & from Services & Cross Streets	Some impact for right-turning vehicles out of accesses and cross streets when lane restrictions in effect.
Transit Ridership	Positive impact, but likely not a significant increase in ridership.
Pedestrian Environment	No impact.
Ease of Use	Higher general purpose vehicle lane changing concentration may reduce driver operating ease.
Transit Attractiveness and Prominence	More attractive due to reduced travel times, higher perceived prominence.

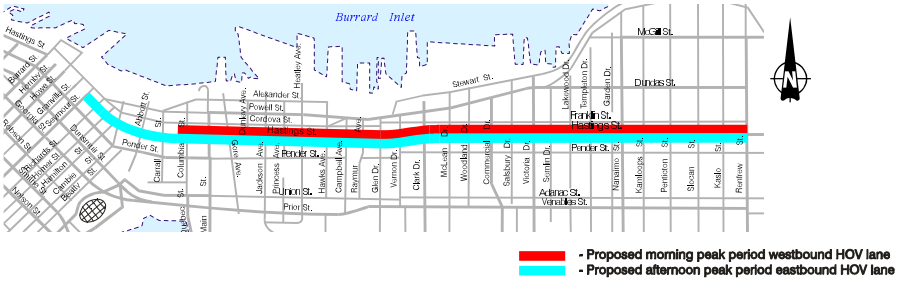
Hastings St. Option #2
Extension of Existing High Occupancy Vehicle (HOV) Curb Lane Designation in the Peak Directions

This option would consist of designating the westbound curb lane as an HOV (bus and carpool vehicles only) lane from Renfrew Street to Carrall Street during the morning peak period and the eastbound curb lane from near Seymour Street to Renfrew Street during the afternoon peak period.



Schematic Layout of HOV lane along Hastings Street

Existing HOV Lane along Hastings St. near PNE



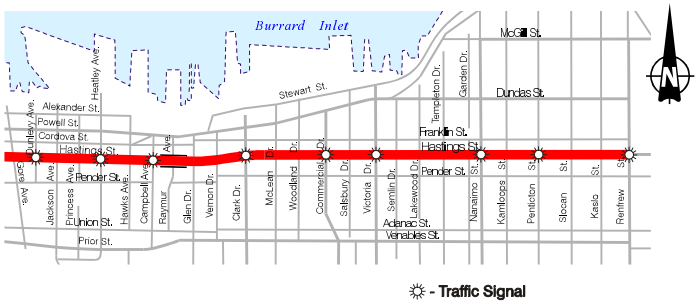
Location of Proposed HOV Lanes

Summary Table of Analysis Results

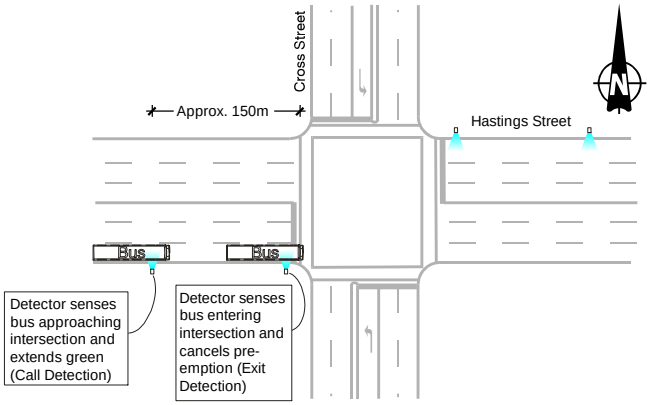
CATEGORY	IMPACT/CONCLUSION
Description	2+ HOV lane usage (right-turns exempt) between Renfrew St. and Columbia St. westbound from 0600-0830 hrs and between Seymour St. and Renfrew St. eastbound from 1530-1800 hrs.
Travel Time	Travel time improvement of up to 35 seconds per bus. Delays of up to one minute per general purpose vehicle. Expected annual benefit of $44,000 for bus passengers. Expected additional annual cost of $562,000 for general purpose vehicles.
Reliability	Probability of bus arriving on-schedule improved by less than 1 percent for both local and suburban buses. Standard deviation reductions for arrival times are negligible.
Safety	Annual crash savings of less than $3,000 for buses. Annual crash cost of $124,000 for general purpose vehicles (13 crashes per year).
Parking	No Impact.
Construction and Maintenance Cost	Total capital cost of $200,000, with $20,000 annually for maintenance.
Economic Analysis	Benefit-to-cost ratios are 0.9:1 for buses only, -12.8:1 for all traffic.
Diversion	None expected.
Access to & from Services & Cross Streets	Some impact for right-turning vehicles out of accesses and cross streets when lane restrictions in effect.
Transit Ridership	Positive impact, but likely not a significant increase in ridership.
Pedestrian Environment	Some decrease in pedestrian comfort with potential for higher vehicle speeds in the curb lane.
Ease of Use	More general purpose vehicle lane changing near intersections may reduce driver operating ease.
Transit Attractiveness and Prominence	More attractive due to reduced travel times, higher perceived prominence due to signs and pavement markings.

Hastings St. Option #3
Signal Pre-emption between
Dunlevy Avenue and Renfrew Street

Traffic signal pre-emption extends the green signal or advances the start of the green phase to allow a transit vehicle to enter an intersection when buses are behind schedule. Traffic signal pre-emption can be provided at every signalized intersection between Dunlevy Avenue and Renfrew Street, for a total of nine intersections.



Locations of Intersections Proposed for Signal Pre-emption Devices



Schematic of Signal Pre-emption Device Locations

Example of Signal Pre-emption Devices in Vancouver (71st Avenue at Oak Street)

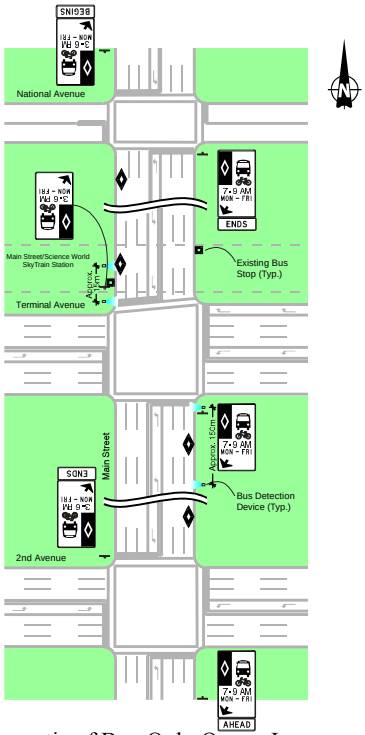
Summary Table of Analysis Results

CATEGORY	IMPACT/CONCLUSION
Description	Signal pre-emption between Dunlevy Ave. and Renfrew St. A green phase extension of 10 seconds was assumed.
Travel Time	Travel time improvement of up to 32 seconds per bus, resulting in up to 6% travel time reduction between Dunlevy Ave. and Renfrew St. Negligible effects on general purpose vehicle traffic. Expected annual benefit of $218,000 for bus passengers. Negligible costs on general purpose vehicles.
Reliability	Probability of bus arriving on-schedule improved by up to 3 percent. Standard deviation of arrival times reduced by approximately 1 minute or less.
Safety	No impact.
Parking	No impact.
Construction and Maintenance Cost	Total capital cost of $220,000, with $5,000 annually for maintenance.
Economic Analysis	Benefit-to-cost ratios are 5.8:1 for both buses only and for all traffic.
Diversion	None.
Access to & from Services & Cross Streets	No impact.
Transit Ridership	Positive impact, but likely not a significant increase in ridership.
Pedestrian Environment	No impact.
Ease of Use	Facilitates driving task.
Transit Attractiveness and Prominence	More attractive due to reduced travel times, but not visibly prominent.

Main St. Option #1
Bus-Only Queue Jumper lanes with Signal Pre-emption between National Ave. and 2nd Ave.

This option allows buses to bypass traffic congestion at Terminal Avenue in the peak periods by providing a queue jumper (buses only in curb lane) and traffic signal pre-emption (detecting buses and giving them more signal 'green time'). The queue-jumper lane would be provided during the morning peak period in the northbound direction between 2nd Avenue and Terminal Avenue, and during the afternoon peak period between National Avenue and Terminal Avenue.

Example of Signal Pre-emption Devices in Vancouver
(71st Avenue at Oak Street)



Schematic of Bus-Only Queue Jumper & Signal Pre-emption Layout

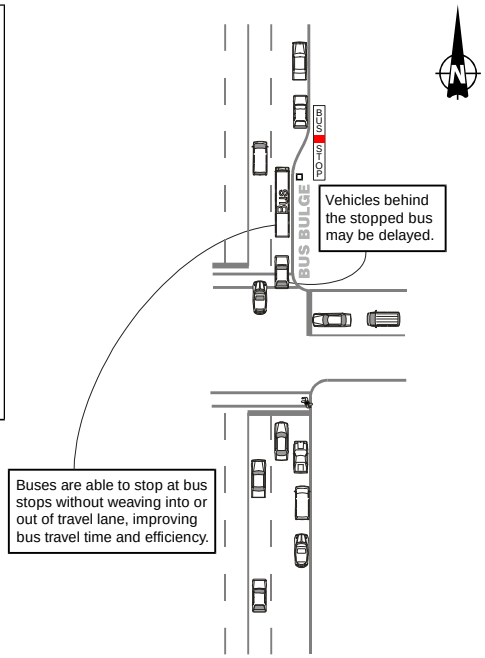
Summary Table of Analysis Results

CATEGORY	IMPACT/CONCLUSION
Description	Bus-only queue jumper lane along Main St. (right-turns exempt) between National Ave. and 2nd Ave. northbound from 0700-0900 hours and southbound from 1500-1800 hours (times may be modified). Signal pre-emption for northbound & southbound buses with above-ground detectors.
Travel Time	Travel time improvement of up to 38 seconds per bus. Delays of up to 45 seconds per general purpose vehicle. Expected annual benefit of $74,000 for bus passengers. Expected additional annual cost of $240,000 for general purpose vehicles.
Reliability	Probability of bus arriving on-schedule improved by less than 1 percent. Standard deviation of arrival times reduced by less than 1 minute
Safety	Annual crash savings of approximately $1,000 for buses. Annual cost of $18,000 for general purpose vehicles (two collisions per year).
Parking	No Impact.
Construction and Maintenance Cost	Total capital cost of $35,000, with $6,500 annually for maintenance.
Economic Analysis	Benefit-to-cost ratios are 6.4:1 for buses only, -15.6:1 for all traffic.
Diversion	None expected.
Access to & from Services & Cross Streets	Some impact for right-turning vehicles out of accesses and cross streets when lane restrictions in effect.
Transit Ridership	Positive impact, but not likely a significant increase in ridership.
Pedestrian Environment	Reduction in general purpose traffic exposure to pedestrians.
Ease of Use	Less vehicles on the curb lane would facilitate driving task.
Transit Attractiveness and Prominence	More attractive due to reduced travel times, higher prominence due to signs and pavement markings.

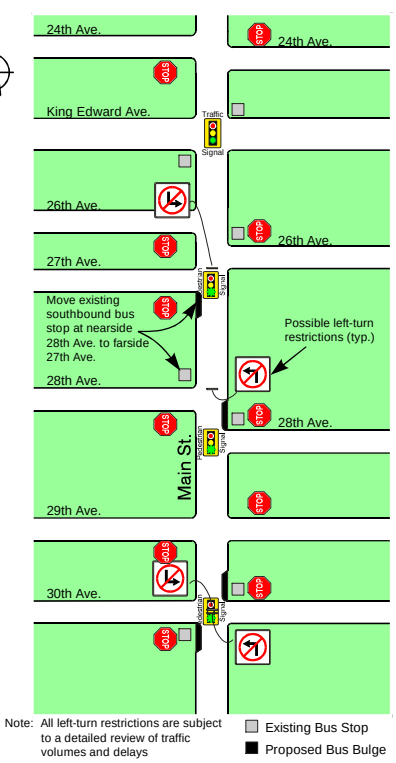
Main St. Option #2
Bus bulges between King Edward Avenue and 30th Avenue

Widening the sidewalks at bus stops (bus bulges) eliminates the need for buses to swerve to the curb and then back into traffic. Bus bulges are proposed at several locations between King Edward Avenue and 30th Avenue as illustrated on this display board.

Bus Bulge along W. 10th Ave. near Blanca St.



Schematic Layout of Bus Bulge along Main Street



Location of Proposed Bus Bulges

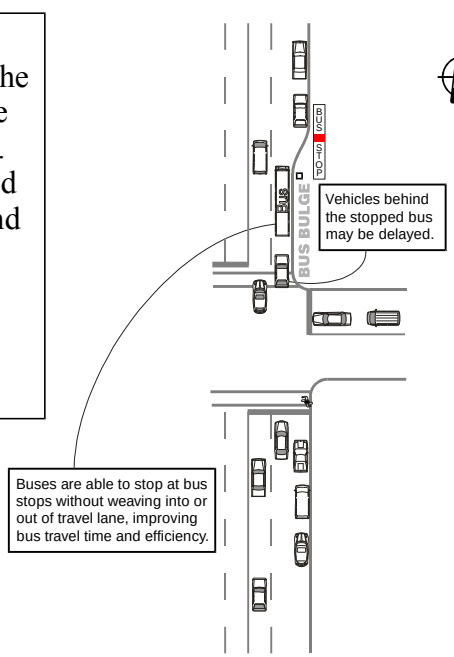
Summary Table of Analysis Results

CATEGORY	IMPACT/CONCLUSION
Description	Northbound bus bulges at 28th and 30th Avenues and southbound at 27th ad 30th Avenues. Possible northbound left-turn restrictions at 28th and 30th Avenues, and southbound left-turn restrictions at 26th and 30th Avenues.
Travel Time	Travel time improvement of up to 6 seconds per bus. No measurable delay to general purpose traffic. Expected annual benefit of $21,000.
Reliability	Probability of bus arriving on-schedule improved negligibly. Standard deviation reductions for arrival times are negligible.
Safety	Negligible crash savings for buses. Additional annual crash cost of $2,500 for general purpose vehicles (less than one collision per year).
Parking	No Impact.
Construction and Maintenance Cost	Capital cost of $100,000, with $4,000 annually for maintenance, streetscaping, and landscaping. Note that costs indicated are for a basic bus bulge only, can be significantly higher depending on local physical conditions, amenities/landscaping provided, and design details such as a matching pedestrian bulge on opposite side of street.
Economic Analysis	Benefit-to-cost ratios are 1.1:1 for buses only and 0.9:1 for all traffic.
Diversion	Some diversion of left-turn movements if turn restrictions are implemented.
Access to & from Services & Cross Streets	Left-turn restrictions if implemented present some inconvenience to cross street access.
Transit Ridership	Positive impact, but not likely a significant increase in ridership.
Pedestrian Environment	Increased pedestrian comfort and space, improved attractiveness.
Ease of Use	Improve transit operating environment.
Transit Attractiveness and Prominence	More attractive due to reduced travel times and improved pedestrian environment, higher perceived prominence.

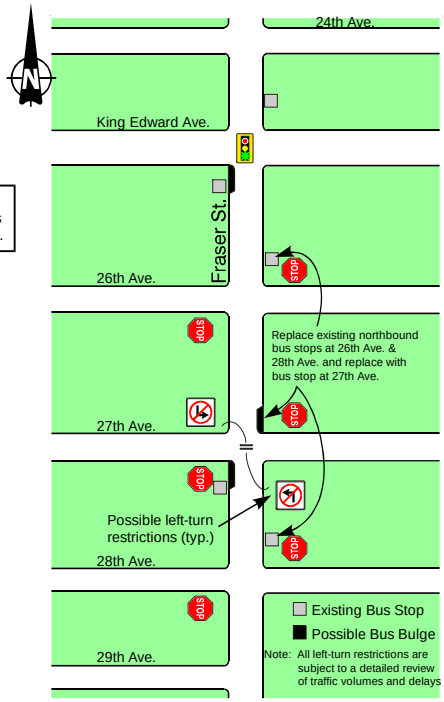
Fraser St. Option #1
Bus Bulges at King Edward Avenue and 27th Avenue

Widening the sidewalks at bus stops (bus bulges) eliminates the need for buses to swerve to the curb and then back into traffic. Bus bulges could be considered at the King Edward Avenue and 27th Avenue intersections as shown on this display board. The relocation of several bus stops is also considered.

Bus Bulge along W. 10th Ave. near Blanca St.



Schematic Layout of Bus Bulge along Fraser Street



Location of Potential Bus Bulges

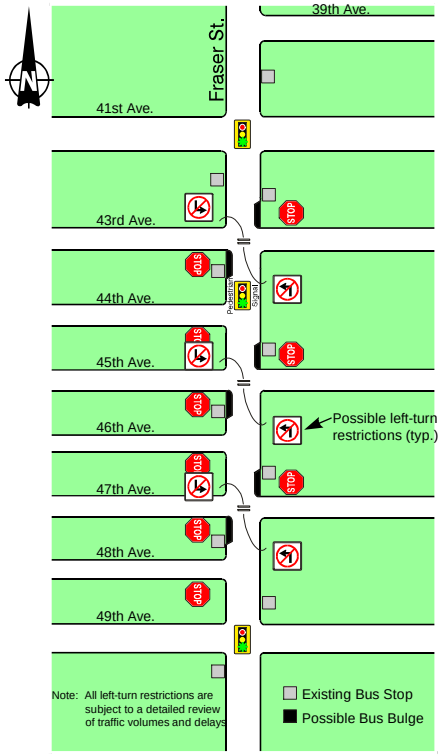
Summary Table of Analysis Results

CATEGORY	IMPACT/CONCLUSION
Description	Northbound bus bulges at 27th Avenue, southbound at King Edward & 27th Avenues. Possible left-turn restrictions at 27th Avenue (subject to review). Southbound King Edward bulge location considered in context of left-turn bay on Fraser Street at King Edward Avenue proposed by City.
Travel Time	Travel time improvement of up to 6 seconds per bus. No measurable delay to general purpose traffic. Expected annual benefit of $16,000.
Reliability	Probability of bus arriving on-schedule improved negligibly. Standard deviation reductions for arrival times are negligible.
Safety	Negligible crash savings for buses. Additional annual crash cost of $9,000 for general purpose vehicles (approximately one crash per year).
Parking	No Impact.
Construction and Maintenance Cost	Capital cost of $100,000, with $4,000 annually for maintenance, streetscaping, and landscaping. Note that costs indicated are for a basic bus bulge only, can be significantly higher depending on local physical conditions, amenities/landscaping provided, and design details such as a matching pedestrian bulge on opposite side of street.
Economic Analysis	Benefit-to-cost ratios are 0.9:1 for buses only and 0.4:1 for all traffic.
Diversion	Some diversion of left-turn movements if turn restrictions are implemented.
Access to & from Services & Cross Streets	Left-turn restrictions if implemented present some inconvenience to cross street access.
Transit Ridership	Positive impact, but not likely a significant increase in ridership.
Pedestrian Environment	Increased pedestrian comfort and space, improved attractiveness.
Ease of Use	Improve transit operating environment.
Transit Attractiveness and Prominence	More attractive due to reduced travel times and improved pedestrian environment, higher perceived prominence.

Fraser St. Option #2
Bus bulges between 41st Avenue and 49th Avenue

Widening the sidewalks at bus stops (bus bulges) eliminates the need for buses to swerve to the curb and then back into traffic. Bus bulges are proposed at several locations between 41st and 49th Avenues as illustrated on this display board.

Bus Bulge along W. 10th Ave.
near Sasamat St.

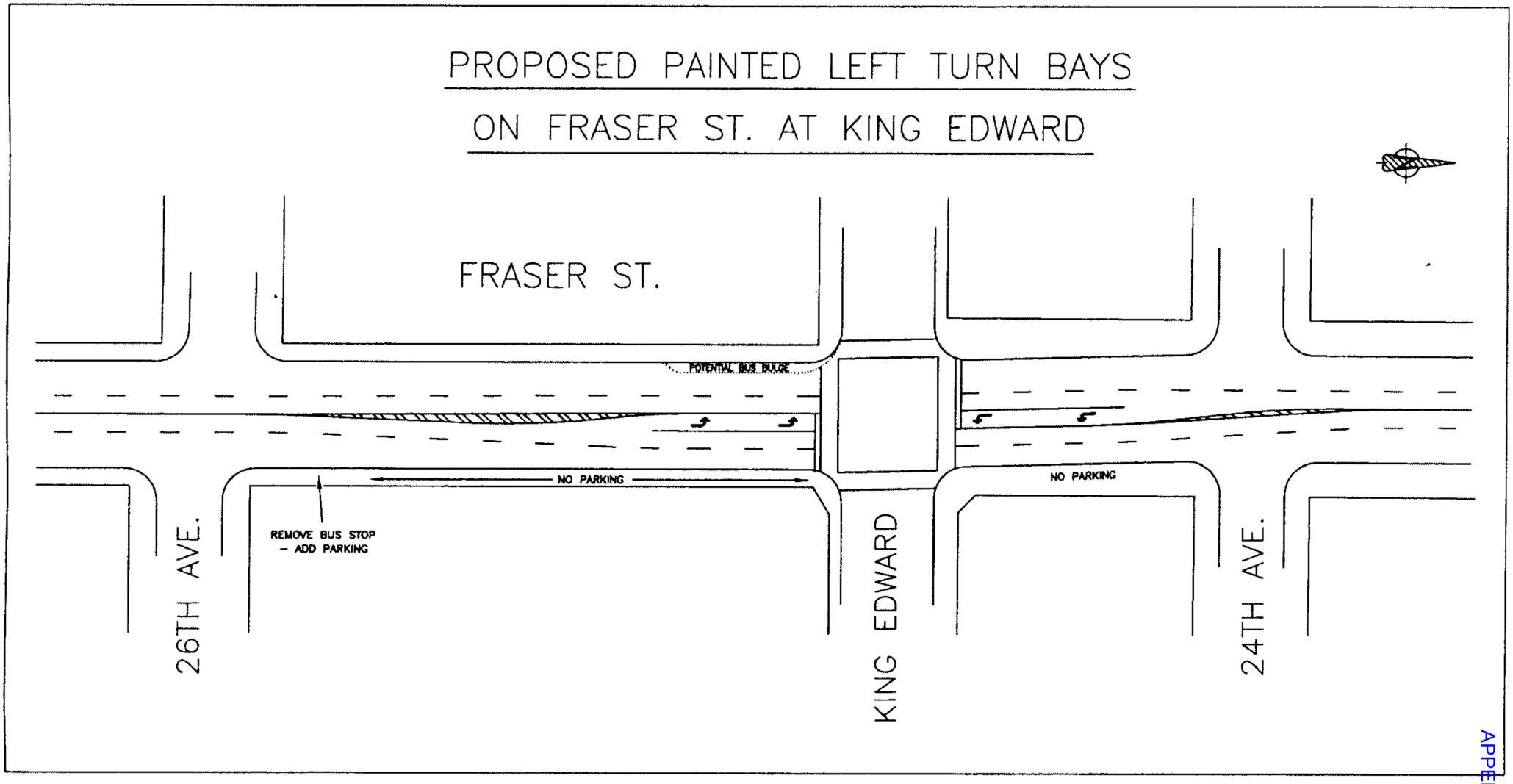


Location of Proposed Bus Bulges

Summary Table of Analysis Results

CATEGORY	IMPACT/CONCLUSION
Description	Northbound and southbound bus bulges at 43rd Ave., 45th Ave., and 47th Ave. Left-turn restrictions at 43rd Ave. 45th Ave. & 47th Ave. for northbound and southbound (subject to further review).
Travel Time	Travel time improvement of up to 9 seconds per bus. Delays of up to 1 second for general purpose traffic. Expected annual benefit of $16,000 for buses, additional annual cost of $9,000 for general purpose vehicles.
Reliability	Probability of bus arriving on-schedule improved negligibly. Standard deviation reductions for arrival times are negligible.
Safety	Annual crash savings of $2,000 for buses. Additional annual cost of $1,000 for general purpose vehicles (less than one crash per year).
Parking	No Impact.
Construction and Maintenance Cost	Capital cost of $148,000, with $6,000 annually for maintenance, streetscaping, and landscaping. Note that costs indicated are for a basic bus bulge only, can be significantly higher depending on local physical conditions, amenities/landscaping provided, and design details such as a matching pedestrian bulge on opposite side of street.
Economic Analysis	Benefit-to-cost ratios are 0.7:1 for buses only and 0.4:1 for all traffic.
Diversion	Some diversion of left-turn movements if turn restrictions are implemented.
Access to & from Services & Cross Streets	Left-turn restrictions if implemented present some inconvenience to cross street access, especially for southbound left-turning traffic.
Transit Ridership	Positive impact, but not likely a significant increase in ridership.
Pedestrian Environment	Increased pedestrian comfort and space, improved attractiveness.
Ease of Use	Improve transit operating environment.
Transit Attractiveness and Prominence	More attractive due to reduced travel times and improved pedestrian environment, higher perceived prominence.

PROPOSED PAINTED LEFT TURN BAYS
ON FRASER ST. AT KING EDWARD



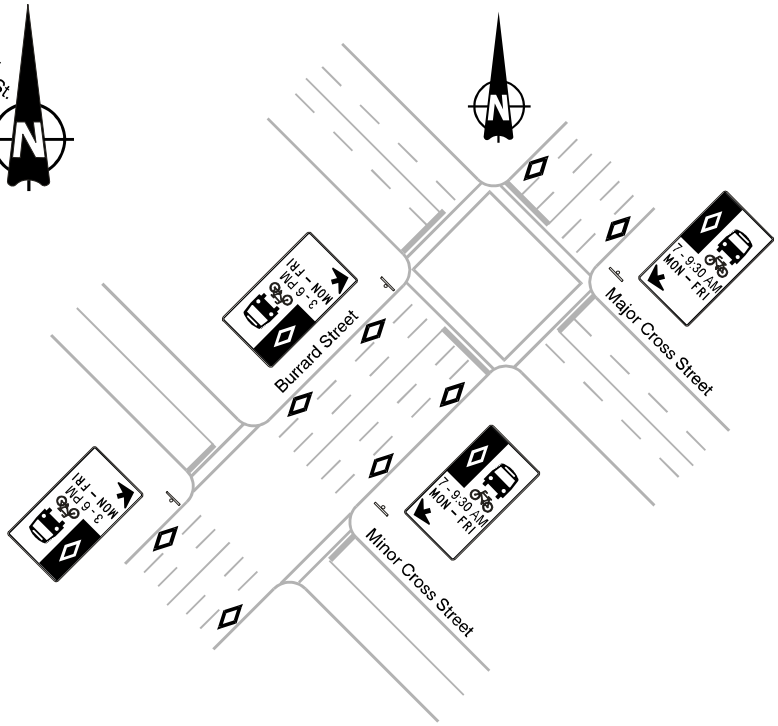
APPENDIX G.3

Burrard St. Option #1
Bus-Only Curb Lanes in the Peak Directions

This option would consist of designating the northbound curb lane as a bus-only lane from Pacific Street to Pender Street during the morning peak period and the southbound curb lane from Pender Street to Pacific Street during the afternoon peak period.

Location of proposed Bus Only lanes

Existing Bus Only lane on Howe St.



Schematic Layout of Bus Only lane along Burrard Street

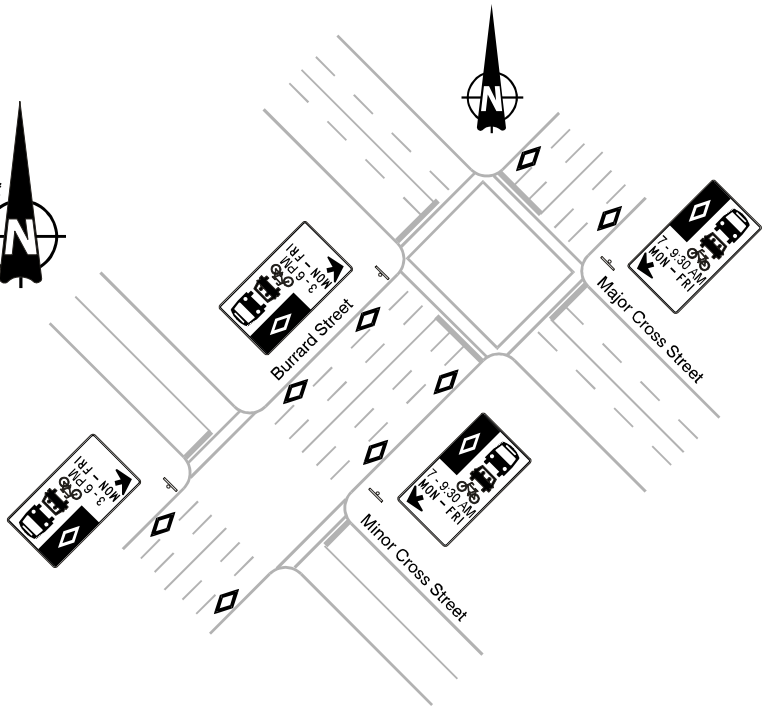
Summary Table of Analysis Results

CATEGORY	IMPACT/CONCLUSION
Description	Bus-only lane usage (right-turns exempt) between Pacific St. and Pender St. northbound from 0700-0930 hrs and southbound from 1500-1800 hrs.
Travel Time	Travel time improvement of up to 35 sec. per bus. Delays of up to 10 sec. per general purpose vehicle. Expected annual benefit of $62,000 for bus passengers. Expected annual cost of $45,000 for general purpose vehicles.
Reliability	Probability of bus arriving on-schedule improved by up to 6 percent. Standard deviation of arrival times reduced by less than 1 minute.
Safety	Annual crash savings of approximately $4,000 for buses. Annual cost of $35,000 for general purpose vehicles.
Parking	No Impact.
Construction and Maintenance Cost	Total capital cost of $40,000, with $4,000 annually for maintenance.
Economic Analysis	Benefit-to-cost ratios are 6.6:1 for buses only, -1.4:1 for all traffic.
Diversion	None.
Access to & from Services & Cross Streets	Some impact for right-turning vehicles out of accesses and cross streets when lane restrictions in effect.
Transit Ridership	Positive impact, but not a measurable increase in ridership.
Pedestrian Environment	Some increase in pedestrian comfort with less traffic in the curb lane.
Ease of Use	Higher general purpose vehicle lane changing concentration may reduce driver operating ease.
Transit Attractiveness and Prominence	More attractive due to reduced travel times, higher perceived prominence due to signs and pavement markings.

Burrard St. Option #2
HOV Curb Lanes in the Peak Directions

This option would consist of designating the northbound curb lane as an HOV (bus and carpool vehicles only) lane from Pacific Street to Pender Street during the morning peak period and the southbound curb lane from Pender Street to Pacific Street during the afternoon peak period.

Location of Proposed HOV Lanes



Schematic Layout of HOV lane along Burrard Street

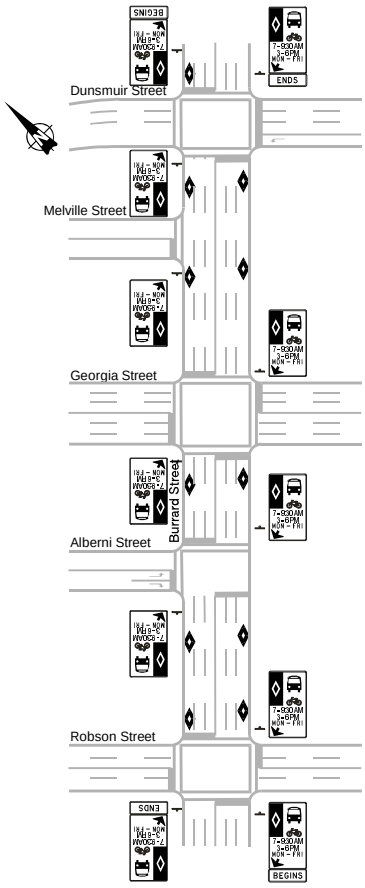
Summary Table of Analysis Results

CATEGORY	IMPACT/CONCLUSION
Description	HOV lane usage (right-turns exempt) between Pacific St. and Pender St. NB from 0700-0930 hrs and SB from 1500-1800 hrs. Minimum 2+ or 3+ occupancy can be implemented.
Travel Time	Travel time improvement of up to 30 sec. per bus for 3+, 10 sec. per bus for 2+. Delays of less than 10 sec. per general purpose vehicle for both scenarios. Expected annual benefit of $54,000 for bus passengers for 3+, $14,000 for 2+. Expected annual cost of $45,000 for general purpose vehicles for 3+, $31,000 for 2+.
Reliability	Probability of bus arriving on-schedule improved by up to 5 percent. Standard deviation of arrival times reduced by less than 1 minute.
Safety	Annual crash savings of less than $4,000 for buses. Additional annual crash cost of $18,000 for general purpose vehicles. (2 collisions per year, both scenarios)
Parking	No Impact. (both scenarios)
Construction and Maintenance Cost	Total capital cost of $40,000, with $4,000 annually for maintenance. (both scenarios)
Economic Analysis	Benefit-to-cost ratios are 1.0:1 for buses only, -3.1:1 for all traffic. (2+ scenario) Benefit-to-cost ratios are 5.7:1 for buses only, -0.5:1 for all traffic. (3+ scenario)
Diversion	None expected. (both scenarios)
Access to & from Services & Cross Sts.	Some impact for right-turning vehicles out of accesses and cross streets when lane restrictions in effect. (both scenarios)
Transit Ridership	Positive impact, but not a measurable increase in ridership. (both scenarios)
Pedestrian Environment	Some increase in pedestrian comfort with less traffic in the curb lane. (both scenarios)
Ease of Use	Higher general purpose vehicle lane changing concentration may reduce driver operating ease (both scenarios).
Transit Attractiveness and Prominence	More attractive due to reduced travel times, and higher perceived prominence due to signs and pavement markings (both scenarios).

Burrard St. Option #3
Queue Jumper Lanes during Morning and Afternoon Peak Periods between Robson Street and Dunsmuir Street

This option would consist of designating the northbound and southbound intersection approaches as bus queue jumper lanes from Robson Street to Dunsmuir Street during the morning and afternoon peak periods, essentially designating the northbound and southbound curb lanes as Bus Only lanes.

Location of Proposed Queue Jumper Lanes



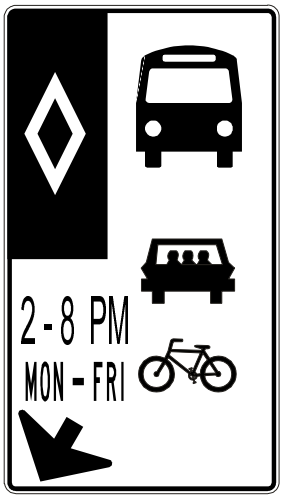
Schematic Layout of Queue Jumper Lanes along Burrard Street

Summary Table of Analysis Results

CATEGORY	IMPACT/CONCLUSION
Description	Bus-only lane usage (right-turns exempt) between Robson St. and Dunsmuir St. from 0700-0900 hrs and from 1500-1800 hrs.
Travel Time	Travel time improvement up to 8 sec. per bus. Delays of up less than 2 sec. per general purpose vehicle. Expected annual benefit of $16,000 for bus passengers. Expected annual cost of $14,000 for general purpose vehicles.
Reliability	Probability of bus arriving on-schedule improved by up to 2 percent. Standard deviation of arrival times reduced by less than 1 minute.
Safety	Annual crash savings of less than $3,000 for buses. Annual cost of $18,000 for general purpose vehicles.
Parking	15 spaces removed for up to three additional hours, at an annual coast of $12,000.
Construction and Maintenance Cost	Total capital cost of $20,000, with $2,000 annually for maintenance.
Economic Analysis	Benefit-to-cost ratios are 3.6:1 for buses only, -5.0:1 for all traffic.
Diversion	None expected
Access to & from Services & Cross Sts.	Some impact for right-turning vehicles out of accesses and cross streets when lane restrictions in effect.
Transit Ridership	Positive impact, but not a measurable increase in ridership.
Pedestrian Environment	No net change in pedestrian comfort.
Ease of Use	Higher general purpose vehicle lane changing concentration may reduce driver operating ease.
Transit Attractiveness and Prominence	More attractive due to reduced travel times, higher perceived prominence due to signs and pavement markings.

Georgia St. Option #1
Extending Existing Westbound High Occupancy Lane Hours

This option would consist of increasing the existing HOV lane hours of operation from between 3:00-7:00 pm to between 2:00-8:00pm.



HOV sign layout indicating proposed operating hours along Georgia Street

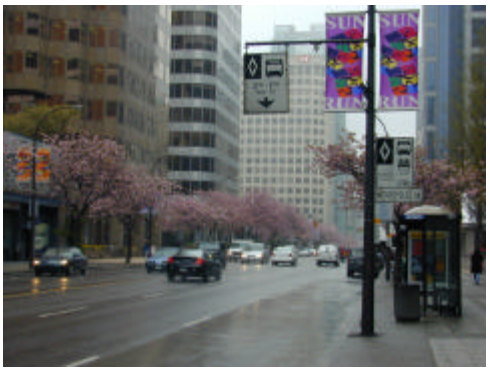
Existing HOV lane near Denman St.

Summary Table of Analysis Results

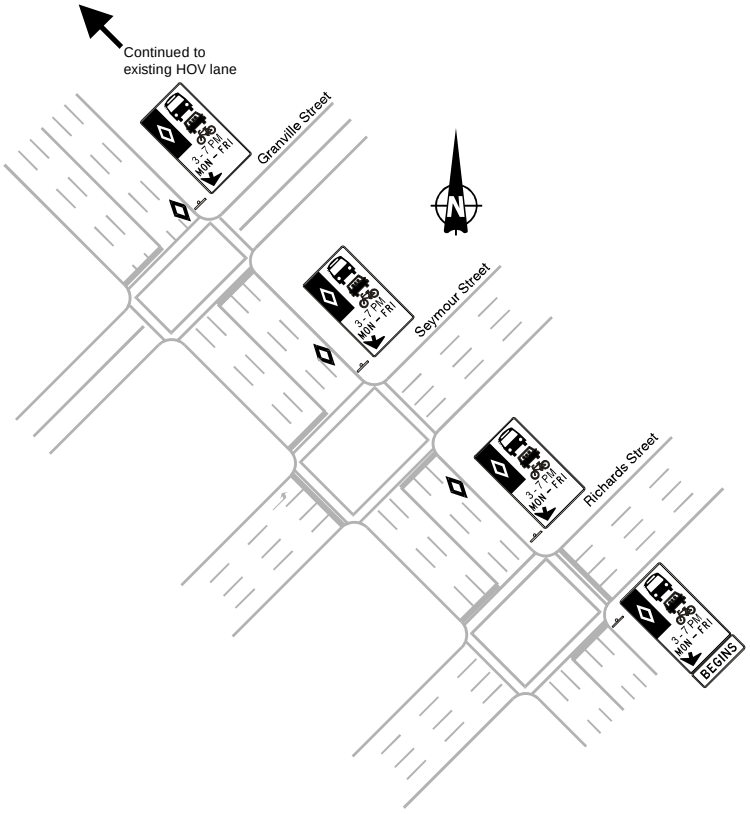
CATEGORY	IMPACT/CONCLUSION
Description	Increasing the hours of the existing westbound 3+ HOV lane (between 1500 and 1900 hours) to between 1400 and 2000 hours.
Travel Time	Travel time improvement of up to 5 seconds per bus and 2 seconds per vehicle for general purpose traffic. Expected annual benefit of $2,000 for buses and $3,000 for general purpose vehicles.
Reliability	Not likely to be any significant improvement in arrival times or variance.
Safety	Annual benefits of less than $1,000 for buses. Additional annual cost of $5,000 for general purpose vehicles.
Parking	40 spaces between Burrard St. & Nicola St. removed for two additional hours, at an annual cost of $23,000.
Construction and Maintenance Cost	Capital cost of $20,000, with $2,000 annually for maintenance.
Economic Analysis	Benefit-to-cost ratios are 0.7:1 for buses only, -5.2:1 for all traffic.
Diversion	None.
Access to & from Services & Cross Streets	Some impact for southbound right-turning vehicles out of alleys and cross streets when lane restrictions in effect.
Transit Ridership	Positive impact, but not a measurable increase in ridership.
Pedestrian Environment	Some increased pedestrian risk with higher vehicle volumes and speeds.
Ease of Use	Overall improvement due to reduced bus weaving manoeuvres.
Transit Attractiveness and Prominence	More attractive due to reduced travel times, higher perceived prominence due to signs and pavement markings.

Georgia St. Option #2
Extension of Existing Westbound High Occupancy Lane to Richards Street

This option would consist of extending the existing westbound HOV (bus and carpool vehicles only) curb lane (currently west of Burrard Street) to Richards Street during the afternoon peak period.



Beginning of existing
HOV lane near Burrard St.



Schematic Layout of HOV lane extension along Georgia Street

Summary Table of Analysis Results

CATEGORY	IMPACT/CONCLUSION
Description	Extension of the existing westbound HOV lane (3+ passengers between 1500 and 1900 hours) along Georgia Street to Richards Street.
Travel Time	Travel time improvement of up to 15 seconds per bus. Delays of up to 10 seconds per general purpose vehicle. Expected annual benefit of $29,000 for buses, annual cost of $25,000 for general purpose vehicles. No measurable improvement in bus reliability.
Reliability	Not likely to be any significant improvement in arrival times or variance.
Safety	Annual benefits of $2,000 for buses. Annual crash cost of $1,000 for general purpose vehicles.
Parking	Four parking spaces between Burrard St. & Hornby St. to be removed for one additional hour, at an annual cost of $1,000 (1 crash per year)
Construction and Maintenance Cost	Capital cost of $15,000, with $2,000 annually for maintenance.
Economic Analysis	Benefit-to-cost ratios are 7.3:1 for buses only, 1.2:1 for all traffic.
Diversion	None.
Access to & from Services & Cross Streets	Some impact for southbound right-turning vehicles out of alleys and cross streets when lane restrictions in effect.
Transit Ridership	Positive impact, but not a measurable increase in ridership.
Pedestrian Environment	Some increased pedestrian comfort with reduced vehicle volumes along the curb lane between Richards St. and Burrard St. but some increased risk with higher vehicle speeds and loss of buffer from loss of parking.
Ease of Use	Higher general purpose vehicle lane changing concentration may reduce driver operating ease.
Transit Attractiveness and Prominence	More attractive due to reduced travel times, higher perceived prominence due to signs and pavement markings.