



ADMINISTRATIVE REPORT

Report Date: June 5, 2012
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Meeting Date: June 13, 2012

TO: Standing Committee on Planning, Transportation and Environment
FROM: General Manager of Engineering Services
SUBJECT: Downtown Separated Bicycle Lanes Status Report, Spring 2012

RECOMMENDATION

THAT the separated bicycle lanes on Hornby Street, Dunsmuir Street and the Dunsmuir Viaduct and connecting streets remain in place as part of the City's regular street infrastructure.

REPORT SUMMARY

The introduction of separated bicycle lanes within and connecting to Vancouver's downtown core has led to both immediate and sustained growth of cycling on these routes. This supports the goals of Vancouver 2020: A Bright Green Future and the project goals of encouraging more people of all ages and abilities to cycle for transportation and recreation. With respect to other travel modes, pedestrians have benefited from an improved walking environment and there has been no impact on transit operations and minimal impact on vehicular traffic. Consequently, staff recommend that the separated bicycle lanes on Hornby Street, Dunsmuir Street and the Dunsmuir Viaduct and connecting streets remain in place as part of the City's regular street infrastructure. Further, staff will pursue modifications to the lanes with the goals of further improving safety, accessibility and pedestrian and cyclist comfort.

COUNCIL AUTHORITY/PREVIOUS DECISIONS

In May 2009, Council approved the construction of trial one-way separated bicycle lanes on the Burrard Bridge by re-allocating one sidewalk and one vehicle lane.

In January 2010, Council approved the construction of a trial two-way separated bicycle lane on the Dunsmuir Viaduct.

In May 2010, Council approved the construction of a trial two-way separated bicycle lane on Dunsmuir Street.

In July 2010, Council ended the trial period for the Burrard Bridge separated bicycle lanes and directed staff to incorporate permanent separated lanes into the design of bridge rehabilitation.

In October 2010, Council approved the construction of a trial two-way separated bicycle lane on Hornby Street and connecting streets.

Vancouver 2020: A Bright Green Future Report was approved by Council in 2010 and highlights ways to facilitate walking and cycling including improving connections between bikeways and improving protected bikeways in the downtown area.

REPORT

Background/Context

Recognizing the reality of confined road space in Vancouver, an expanding economy and an increase in residents can only be supported if transit, walking and cycling take up the associated growth in trips. These transportation priorities were reinforced in 2010 by the Greenest City Action Team's report *Vancouver 2020 "A Bright Green Future"*. The City is currently updating its long-range transportation plan, *Transportation 2040*.

The City of Vancouver has built a strong foundation upon which to further develop walking and cycling as appealing and safe transportation options for residents and visitors. This includes policies in support of walking and cycling, an expanding active transportation network that meets the needs of people of all ages and abilities, and a sustained funding commitment to implement walking and cycling infrastructure.

Draft directions being developed for *Transportation 2040* focus on cycling routes that serve the highest concentration of cyclists and that improve cyclist safety (i.e. high collision locations). In addition, plans include consideration of higher design standards for active transportation infrastructure, to encourage people of all ages and abilities to enjoy walking and cycling safely and more comfortably.

Research published by the University of British Columbia in 2007, entitled *Cycling in Cities*, found that Vancouverites' most preferred cycling route types are paved off-street paths (e.g. Vancouver's seawall), residential streets with traffic calming marked as bike routes (i.e. Vancouver's local street bikeways) and paths next to major streets separated by a barrier (i.e. separated bike lanes). Research by TransLink found that 25% of Metro Vancouver adults are "regular cyclists" who may be comfortable cycling in traffic but that "most still prefer to ride away from motor vehicle traffic". Another 41% are the "interested but concerned" who may want to cycle more and whose "single greatest deterrent... is concern about riding in traffic". European cities that have provided separated bicycle facilities on busy streets see higher bicycle mode

share, more children cycling and more equitable gender splits than Vancouver or any other large North American city.

In early 2009, Council approved the trial installation of separated bicycle lanes on the Burrard Bridge which were opened in July of that year. In November 2009 and July 2010, staff reported to Council that the separated bicycle lanes on the Burrard Bridge had resulted in an increase in cycling on the bridge, a decrease in serious cyclist injuries, no effect on transit and no appreciable negative impact on vehicle traffic.

In late 2009, following up on the initial success of the Burrard Bridge lane trial, and guided by local research into cyclist's preferences and best practices from other leading cycling cities, staff began to develop plans to expand separated bicycle facilities into the downtown core. These improved facilities, separated from vehicle traffic, were designed with the goal of encouraging more people of all ages and abilities to cycle for transportation and recreation.

In early 2010, Council approved the trial installation of separated bicycle lanes on the Dunsmuir Viaduct, Dunsmuir Street, Hornby Street and connecting streets. These facilities were constructed sequentially in 2010 and opened as follows:

Dunsmuir Viaduct	March 2010
Dunsmuir Street	June 2010
Hornby Street*	December 2010

* including portions of Burrard, Drake and Hastings Streets

In July 2011, staff reported to Council that the separated bicycle lanes on Dunsmuir Street, Hornby Street and connecting streets had resulted in:

- an increase in bicycle usage,
- a small but measurable increase in the percentage of women and children cycling,
- no change in pedestrian volumes and improved pedestrian comfort,
- no change in vehicle volumes,
- negligible and localized change in vehicle travel times, and,
- a decrease in vehicle collisions.

Also in July 2011, the Vancouver Economic Development Commission, in partnership with the Downtown Vancouver Business Improvement Association, the Vancouver Board of Trade, The Downtown Vancouver Association and the City of Vancouver, provided Council with a report assessing the effect of the separated bicycle lanes on local business. Council directed staff to "consider... implementing a trial of right turn signals at [the] Dunsmuir and Seymour and [the] Dunsmuir and Hornby intersections" to address concerns of local businesses regarding vehicle access.

Regular, on-going monitoring of bicycle use on these routes began in 2009 on Burrard Bridge and in 2010 on Dunsmuir and Hornby Streets. Construction of the separated bicycle lanes in 2009 and 2010 and monitoring in 2009, 2010 and 2011 was completed on budget at a cost of \$4.1 million.

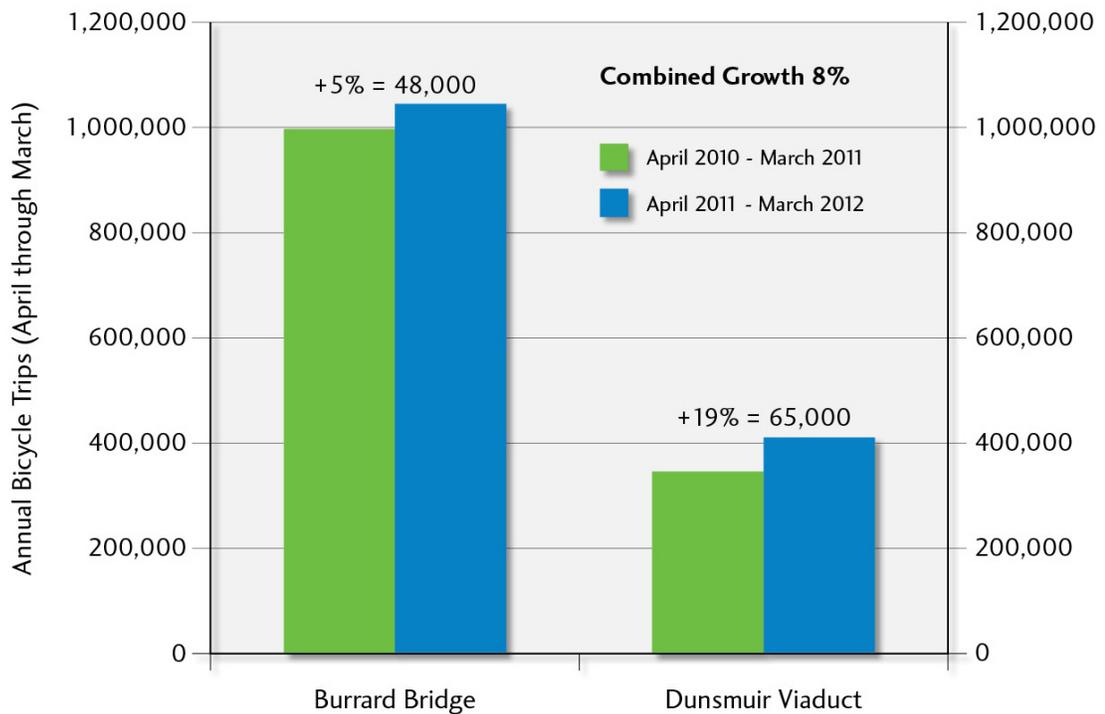
Strategic Analysis

Cycling Growth and Demographics

Each of the elements of the downtown separated bicycle lane network has experienced significant growth in cyclist volumes since opening and this growth has been sustained. The most complete data is available for the Burrard Bridge and Dunsmuir Viaduct. Recent annual growth in cycling trips has been 5% on the Burrard Bridge, 19% on the Dunsmuir Viaduct, and 8% combined.

Annual Bicycle Trips

	April 2010 - March 2011	April 2011 - March 2012	Year-over-Year Growth
Burrard Bridge	997,000	1,045,000	+5%
Dunsmuir Viaduct	346,000	411,000	+19%
Combined	1,343,000	1,456,000	+8%



These two bridges carry a large portion of the bicycle trips in and out of the downtown peninsula. Growth on these routes is representative of growth in cycling to and from downtown. See Appendix A for more detail.

Studies in summer 2011 also found that a broader demographic of cyclists were cycling into and through downtown. The portion of women cycling on Hornby Street had grown from 28% to 32% of cyclists with the introduction of separated bicycle lanes. Dunsmuir Street had 35% women cyclists. 2.5% of cyclists on the Burrard Bridge on summer weekends were children. Women make up 51% of Vancouver's population and children 5-10%. Follow-up demographics studies are scheduled for Summer 2012.

Seasonally, year-over-year cycling growth has varied, from a high of 50% in early fall (Dunsmuir Street, September 2011 vs. September 2010 mid-week daily average) to a low of 7% in winter months (Dunsmuir Street, December 2011 vs. December 2010 mid-week daily average).

Sustained growth on all elements of the downtown separated bicycle lane network, by all demographics and at all times of year, suggests that they have been and continue to be successful in attracting new cyclists and more cycling trips.

Pedestrians and Transit

The volume of pedestrians on Hornby Street and Dunsmuir Street has not changed. Cycling on sidewalks has been reduced 80% with less than 1% of cyclists now using the sidewalks on Hornby and Dunsmuir Streets.

Transit operations were largely unaffected by the downtown separated bike lanes. In 2009, TransLink conducted a study of transit operations on the Burrard Bridge and found "little to no negative effect on bus running time since the introduction of the [separated] bike lane".

Vehicles

The number of vehicles using the streets and bridges with separated bicycle lanes has not changed. Vehicle travel times have not changed with the exception of minor peak period delays for southbound vehicles approaching the Burrard Bridge from Pacific Street and for northbound vehicles turning right from Hornby Street onto Georgia or Hastings.

With the introduction of separated bicycle lanes, some vehicle right turns were prohibited for safety reasons. This has meant that some driving trips require alternate, and in some cases longer, routes. A study completed in Fall 2011 found that driving trips from the Dunsmuir Viaduct to the northern three blocks of Hornby Street take an average 90 seconds longer when routed via Georgia Street.

Safety

An analysis of bicycle count data and ICBC-supplied collision data revealed the following:

- Collisions of all types (involving vehicles, bicycles and pedestrians) are down 19% on Dunsmuir Street and down 18% on Hornby Street (2008 and 2009 vs. 2011).

- In 2011, ICBC reported one (1) collision involving a cyclist using the Hornby Street separated bike lanes. 380,000 bicycle trips were made on Hornby in 2011.
- In 2011, ICBC reported nine (9) collisions involving cyclists using the Dunsmuir Street separated bike lanes. These collisions occurred at six different locations, with one, two or three collisions at each location. 500,000 bicycle trips were made on Dunsmuir in 2011.
- In 2011, the number of bicycle-involved collisions at the Burrard and Pacific intersection is up significantly, from 1 to 4 per year (2001-2010) to 13 in 2011. Of the 13 collisions in 2011, 10 were the result of prohibited vehicle right-turns across the bike lane. Between 300,000 to 400,000 bicycle trips occurred at this location in 2011.

Safety and Access Modifications

Since the opening of the first separated bike lanes on the Burrard Bridge, a number of modifications to all these facilities have been made with the aim of improving safety and convenience for pedestrians, cyclists and motorists, including:

- construction of a new driveway access off Hornby, north of Drake,
- modifications to signal timing and signage at Georgia and Hornby to aid right-turning vehicles,
- adjustments to lane widths on Dunsmuir to improve transit operations,
- changes to the Pacific Street entrance to the Burrard Bridge, and,
- changes at the northwest corner of Burrard and Pacific to support a vehicle right-turn prohibition which was being frequently ignored, resulting in cyclist injuries.

The safety and access improvements noted above are largely complete or well underway, and staff will continue to monitor pedestrian, cyclist and vehicle safety and operations. In particular, staff are working with ICBC and other safety experts to better understand the situations at locations where cyclist-involved collisions have happened and to make safety-related improvements as warranted.

Some of the additional modifications being considered are:

- Signal or other modifications to improve safety at vehicle right-turn lane(s) and/or to aid cyclist turning at some intersections
- Raising sections of the Dunsmuir separated bike lanes to improve accessibility for vehicle passengers

Staff propose making all or some of these improvements to the separated bike lanes over the next few years, prioritizing changes in 2012 which will improve safety, accessibility and pedestrian and cyclist comfort. Enhanced public realm, improved monitoring, and reduction of vehicle delay and congestion will also be important considerations. Staff will finalize the scope and details of changes once additional and sufficient safety data and analysis is available or cost sharing opportunities become available.

With respect to Council's July 2011 request to further consider right turn access from Dunsmuir Street onto Hornby and Seymour Streets, staff have investigated several options and have discussed them with downtown business associations and affected business owners. The safety and access merits of these options have been assessed in addition to their relative costs (see Appendix B). As well, the impact on vehicle travel time was measured, and congestion impacts and costs were estimated. Of the six alternatives to the existing right turn prohibition, one option is considerably more expensive (over \$2 million) and would require narrowing the sidewalks and the loss of trees, two options would be expected to decrease safety for pedestrians, cyclists and motorists, two options would be expected to increase congestion and vehicle delay, and one option was seen by the local businesses as having no benefit.

After assessing all of these options from a multiple account perspective, staff recommend retaining the existing right turn prohibitions at both Hornby and Seymour Streets.

Implications/Related Issues/Risk (if applicable)

Financial

No capital expenditures are needed to have the separated bike lanes remain in place. However, staff are assessing a number of possible changes to improve safety, accessibility and pedestrian and cyclist comfort. Modifications to the downtown separated bicycle lanes completed this year would be funded from the Council-approved 2012 Active Transportation Corridors and Spot Improvements Program.

On-going maintenance of the existing downtown separated bicycle lanes is expected to incur approximately \$50,000 of annual operating costs, which will be managed in the context of the annual budget process for future years. If the separated bicycle lanes were to be removed, an expected capital cost of \$1.0 to 1.5 million would be incurred.

CONCLUSION

The introduction of separated bicycle lanes within and connecting to Vancouver's downtown core has led to both immediate and sustained growth of cycling on these routes. This supports the goals of Vancouver 2020: A Bright Green Future and the project goals of encouraging more people of all ages and abilities to cycle for transportation and recreation. This has been accomplished with improvements to pedestrian comfort, no impact on transit operations and minimal impact on vehicular traffic.

Staff recommend that the separated bicycle lanes on Hornby Street, Dunsmuir Street and the Dunsmuir Viaduct and connecting streets remain in place as part of the City's regular street infrastructure. Further, staff will pursue modifications to the lanes with the goals of further improving safety, accessibility and pedestrian and cyclist comfort.

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Downtown Separated Bicycle Lane Statistics

The table below lists bicycle volumes on a monthly and daily basis.

	Total Monthly Bike Trips				Mid-Week Daily Bicycle Trips ¹			
	Burrard Bridge	Hornby Street	Dunsmuir Street	Dunsmuir Viaduct	Burrard Bridge	Hornby Street	Dunsmuir Street	Dunsmuir Viaduct
Aug 2009	130,000							
Sep 2009	107,000							
Oct 2009	70,000							
Nov 2009	43,000							
Dec 2009	34,000							
Jan 2010	46,000							
Feb 2010	71,000							
Mar 2010	68,000			14,000				600
Apr 2010	77,000			15,000				600
May 2010	103,000			20,000				800
Jun 2010	117,000			34,000	4,200			1,600
Jul 2010	162,000		46,000	43,000	6,000		1,900	1,800
Aug 2010	139,000		48,000	44,000	5,000		1,900	1,800
Sep 2010	100,000		37,000	39,000	4,000		1,600	1,700
Oct 2010	80,000		35,000	35,000	3,000		1,400	1,500
Nov 2010	45,000		24,000	25,000	1,800		1,000	1,000
Dec 2010	36,000		21,000	20,000	1,300		800	800
Jan 2011	41,000	14,000	23,000	21,000	1,500	700	900	900
Feb 2011	42,000	19,000	24,000	22,000	1,800	900	1,100	1,000
Mar 2011	55,000	23,000	30,000	28,000	1,900	900	1,100	1,100
Apr 2011	74,000	27,000	35,000	32,000	2,500	1,200	1,500	1,300
May 2011	98,000	34,000	43,000	38,000	3,500	1,400	1,700	1,500
Jun 2011	129,000	45,000	58,000	50,000	4,300	1,700	2,200	1,900
Jul 2011	153,000	48,000	60,000	52,000	4,800	1,800	2,300	2,000
Aug 2011	165,000	54,000	68,000	57,000	5,600	2,100	2,600	2,200
Sep 2011	122,000	45,000	59,000	44,000	4,200	1,800	2,400	1,800
Oct 2011	79,000	34,000	44,000	24,000	2,800	1,400	1,800	1,000
Nov 2011	52,000	20,000	33,000	23,000	2,100	900	1,400	1,000
Dec 2011	39,000	19,000	22,000	22,000	1,400	800	900	900
Jan 2012	36,000	17,000	24,000	20,000	1,400	700	1,000	800
Feb 2012	48,000	20,000	28,000	24,000	1,800	800	1,200	1,000
Mar 2012	51,000	22,000	32,000	26,000	1,800	900	1,300	1,100

1. Average of all Tuesdays, Wednesdays and Thursdays

The table below lists year-over-year changes in bicycle volumes at four downtown locations. The twelve most recent months, or as much of that period as possible, are compared with the same period one year prior.

	Prior period		Current Period		
Burrard Bridge	Apr 2010 - Mar 2011	997,000	Apr 2011 - Mar 2012	1,045,000	+5%
Hornby Street	Jan 2011 - Mar 2011	57,000	Jan 2012 - Mar 2012	59,000	+4%
Dunsmuir Street	Jul 2010 - Mar 2011	288,000	Jul 2011 - Mar 2012	370,000	+28%
Dunsmuir Viaduct	Apr 2010 - Mar 2011	346,000	Apr 2011 - Mar 2012	411,000	+19%

Studies in summer 2011 found the following gender splits among adult cyclists.

		Men	Women
Burrard Bridge	(Aug 2011)	63%	37%
Hornby Street	(Jun 2011)	68%	32%
Dunsmuir Street	(Jul 2011)	65%	35%

Vehicle Right Turns at Dunsmuir & Hornby and at Dunsmuir & Seymour

In the design of the Dunsmuir and Hornby separated bicycle lanes, safety was a primary consideration. The greatest risk to cyclists in this type of bicycle facility comes from vehicles turning across the separated lanes. To address safety concerns related to vehicles turning across the bicycle lanes from parallel vehicle lanes, three different measures were used at intersections to manage vehicle/cyclist conflicts:

1. Where vehicle right turns were permitted, a dedicated right-turn lane was provided. This treatment is the best practice for separated bicycle lanes and is supported by research. At intersections with high right-turn volumes and where a dedicated right-turn lane could be provided, traffic signals control the movement of bicycles and vehicle to minimize conflict.
2. At intersections with lower right-turn volumes and where a dedicated right-turn lane could be provided, vehicle turn movements are governed by signage requiring drivers to yield to bicycles.
3. Where a dedicated right-turn lane could not be provided without unduly affecting other traffic, vehicle right turns across the separated bicycle lanes were prohibited.

The third treatment, prohibiting vehicle right turns, was applied at the Dunsmuir Street intersections with Hornby and Seymour Streets. This has required that drivers destined for the blocks of Hornby and Seymour north of Dunsmuir may need to choose alternate routes. A study completed in fall 2011 found that driving trips from the Dunsmuir Viaduct to the northern three blocks of Hornby Street take an average 90 seconds longer when routed via Georgia Street.

Some businesses located on Hornby and Seymour, north of Dunsmuir, have expressed concern about the reduced vehicle access to these blocks. In July 2011, the Vancouver Economic Development Commission provided Council with a report (RTS 9289) assessing the effect of the separated bicycle lanes on local business. In response, Council directed staff to “consider... implementing a trial of right turn signals at Dunsmuir and Seymour and Dunsmuir and Hornby intersections” to address concerns of local businesses regarding vehicle access.

Staff followed up by developing a number of options and completing a thorough data collection exercise in Fall 2011. This was followed by a review of options, analysis of data, including vehicle travel times and, in Spring 2012, meetings with stakeholders to discuss the options.

These options and their implications are discussed below.

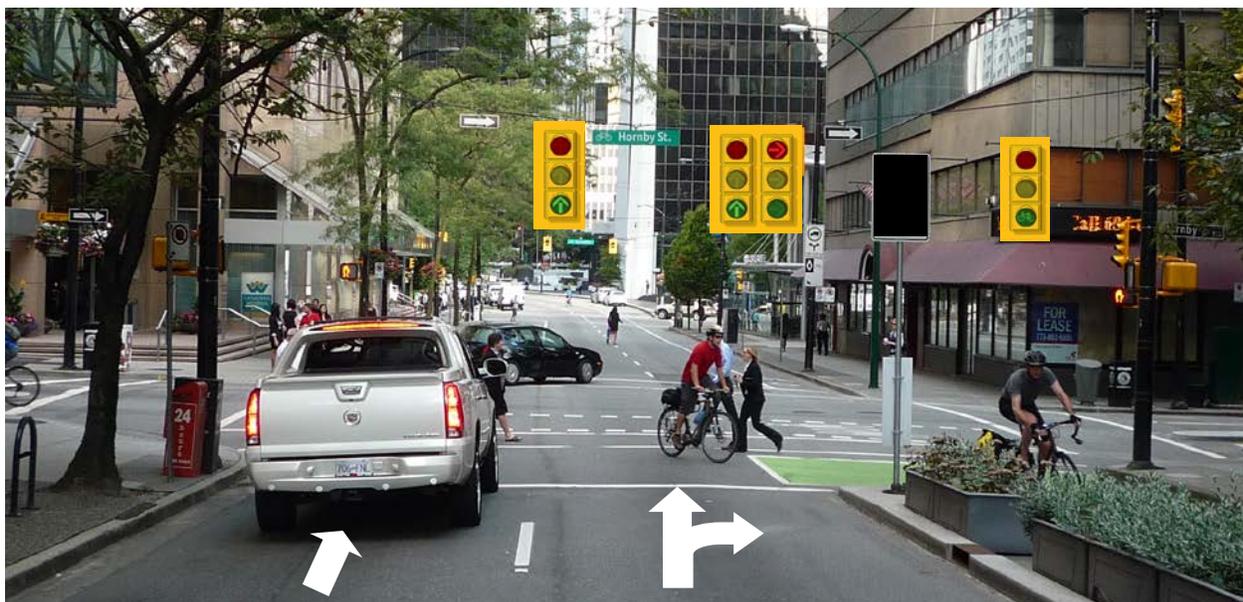
1) Vehicle right turns remain prohibited (status quo)

Right turns across the separated bicycle lanes are prohibited at Seymour and at Hornby. The two westbound vehicle lanes carry approximately 14,000 vehicles per day, unchanged from before the separated bicycle lanes were installed.



2) Right-turns and through movements allowed from the right lane, with signal control

This concept envisioned a complex signal operation which would allow right turns from the right lane of Dunsmuir for only a portion of the signal cycle, while bicycles would be stopped.



At other times, only through movements would be allowed from the right lane while bicycles could proceed. Queued right-turning vehicle would be expected to block through movements at most times of day, with the right lane acting as a de facto right-turn-only lane. The capacity of Dunsmuir would be expected to drop to about 10,000 vehicles per day and travel times on Dunsmuir increase. Vehicle collision rates would likely increase due to increased lane changing. Design guidelines recommend against such an operation. Retrofitting the existing signals would cost approximately \$500,000.

3) Vehicle and bicycle movements completely separated, with signal control

In this concept, a signal phase would permit all vehicle movements while stopping all bicycles, followed by a signal phase allowing all bicycle movements while stopping all vehicles. Such an arrangement would likely see the right lane acting as a de facto right-turn-only lane and have a lower vehicle capacity than option 2, but may have a better vehicle safety performance. Retrofitting the existing signals would cost approximately \$500,000.

4) Convert right-turn lane to dedicated right-turn-only lane

Separating through traffic from right-turning traffic and from bicycle traffic would allow each to be controlled by separated signal phases and would likely provide the safest operation for these intersections which see 300-400 bicycles an hour and could see 200-300 right turning vehicles per hour.

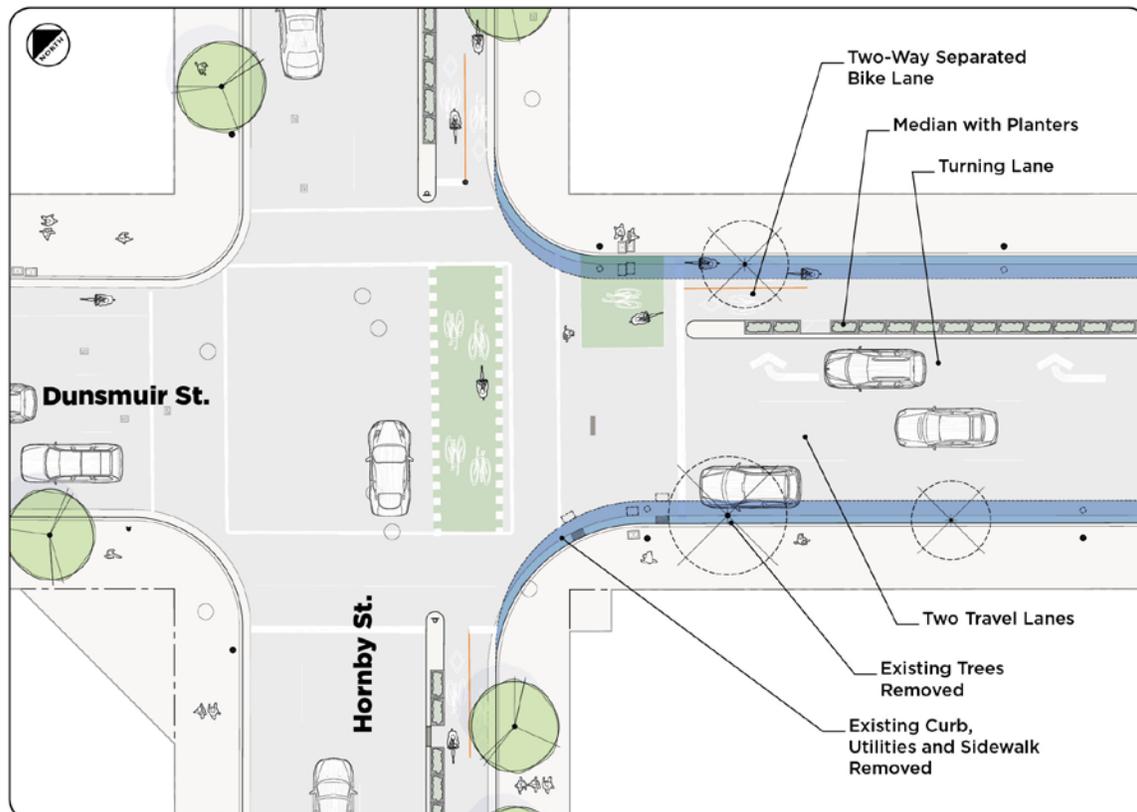


In this arrangement the right lane is converted to a dedicated right-turn-only lane. Staff believe that such a configuration could operate safely, but that the vehicular capacity of Dunsmuir would be reduced, increasing vehicle congestion and affecting the surrounding street network. Retrofitting the existing signals would cost approximately \$500,000.

5) Widened roadway and narrowed bike lanes and sidewalks to create a right-turn lane

The existing vehicular capacity of Dunsmuir could be retained while providing right turns onto Hornby and Seymour if the street were completely reconstructed with:

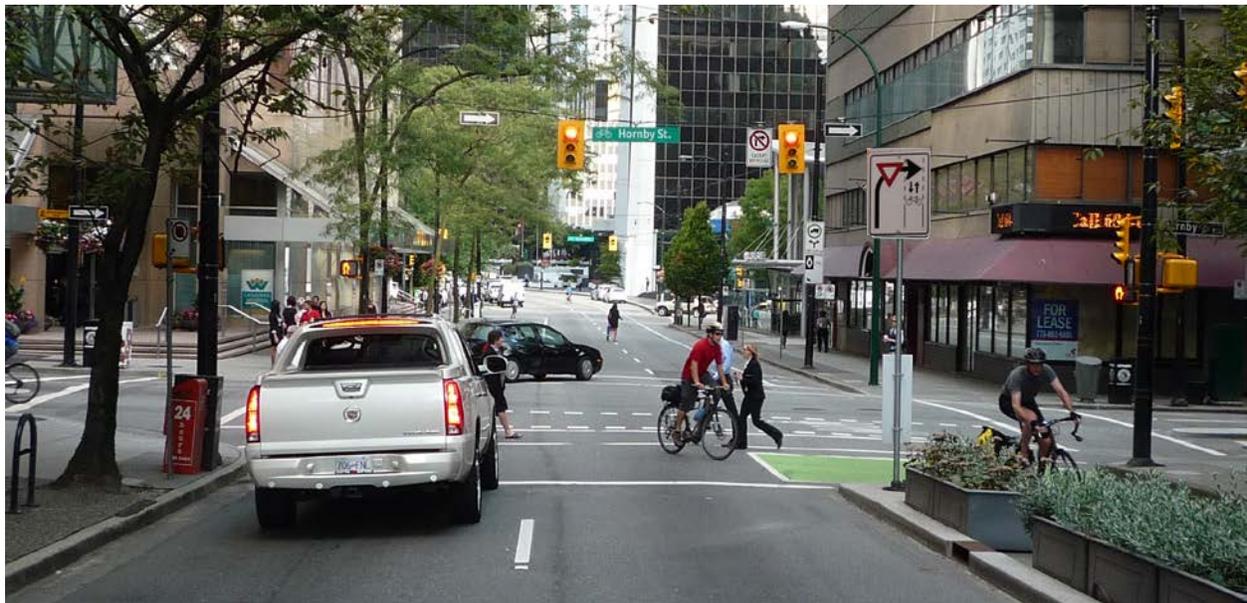
- Narrower sidewalks
- Narrower bicycle lanes
- Street trees removed
- Relocated signals, lamp standards and trolley poles



This approach would require the complete reconstruction of at least two blocks of Dunsmuir Street at a cost of over \$2 million. Retrofitting the existing signals would cost an additional \$500,000.

6) Yield Sign controlled right turns

Staff assessed the viability of simply replacing the turn prohibitions with a yield signs as has been done at intersections with lower right-turn demand. The volume of cyclist (300-400 per hour) and the demand for right turns (200-300 per hour, based on historic data) are, in the opinion of staff, incompatible with cyclist safety with such an arrangement.



7) Yield Sign controlled right turns, late night only

Bicycle and right-turn volumes are low enough between midnight and 6AM to mitigate the risk of conflict between cyclists and turning vehicles. Staff could support a yield-controlled vehicle right turn permitted during those hours. However, local businesses told staff that such a limited provision of right turns would be of little or no value.

The relative merits of the options are summarized in the table following.

	Driver travel time	Driver ability to turn right	Downtown vehicle network	Pedestrian Safety	Cyclist Safety	Vehicle Safety	Cost	
1) no vehicle right turns (status quo)	●	○	●	●	●	●	●	\$0.0M
2) complex signal	○	◐	○	◐	◐	○	◐	\$0.5M
3) vehicle scramble	○	◐	○	◐	◐	◐	◐	\$0.5M
4) <i>signalized right-turn with one through lane</i>	○	◐	○	●	●	◐	◐	\$0.5M
5) signalized right-turn with two through lanes	●	●	●	◐	●	●	○	\$2.5M

6) yield signs (24 hrs) ○ ● ○ ○ ○ ● ● \$0.0M

7) late night yield signs ● ○ ● ● ● ● ● \$0.0M

○
worst



●
best

Of the options evaluated, staff believe that three could provide safe intersection operations without excessive capital expense:

- 1) Prohibited right turns (status quo)
- 4) Convert one lane to right-turn-only with signals
- 7) Late night yield-sign controlled right turns

Conclusion

The cost of option 5, the expected vehicle capacity reduction and related congestion and impact on the downtown vehicle network of option 4 and the lack of support from local businesses for option 7 lead staff to recommend only one option, the status quo.