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The Corporation of **THE CITY OF NORTH VANCOUVER**
ENGINEERING, PARKS & ENVIRONMENT DEPARTMENT

REPORT

To: Mayor Linda Buchanan and Members of Council

From: Justin Hall, Manager, Public Realm Infrastructure

Subject: ST. ANDREWS AVENUE SAFETY IMPROVEMENTS PROJECT –
RECOMMENDED DESIGN – KEITH ROAD TO 9TH STREET

Date: January 10, 2024 File No: 16-8350-20-0038/1

The following is a suggested recommendation only. Refer to Council Minutes for adopted resolution.

RECOMMENDATION

PURSUANT to the report of the Manager, Public Realm Infrastructure, dated January 10, 2024, entitled “St. Andrews Avenue Safety Improvements Project – Recommended Design – Keith Road to 9th Street”:

THAT staff be authorized to proceed with implementing the recommended option, Design Concept 3, which includes the feedback received from Council and the community through the engagement process;

AND THAT funding to deliver the recommended design be incorporated into the 2024-2028 Financial Plan for Council’s consideration.

ATTACHMENTS

1. St Andrews Keith to 9th Design Concepts (CityDocs [2455793](#))
2. Design Comparison Table (CityDocs [2456212](#))
3. Design Comparison Table Scoring (CityDocs [2455829](#))
4. St Andrews Keith to 9th Recommended Design (CityDocs [2455738](#))

SUMMARY

This report presents a design evaluation and comparison process that has resulted in a recommended design to complete the St. Andrews Avenue Safety Improvements Project. The recommended design received the highest cumulative score and had the most beneficial trade-offs for the final street segment between Keith Road and 9th Street.

The comprehensive process involved comparing and evaluating 16 design concepts applying a range of design approaches. The evaluation process was informed by Council feedback and the Mobility Strategy and relied on series of weighted criteria and comparative trade-offs. The final recommended design provides an uphill, on-road mobility lane with mobility device users travelling southbound sharing the road with drivers.

The recommended design proposes six key changes to the street that incorporate feedback received from the community during phase 3 of engagement:

- 1) Clarify the intersection of St. Andrews Avenue at Keith Road to make transitioning onto the street easier for drivers;
- 2) Increase sightlines at intersections to improve driver-to-driver and driver-to-pedestrian visibility;
- 3) Enhance the pedestrian refuge at crossings to clearly delineate where it is safe for pedestrians to look both ways before proceeding to cross the street;
- 4) Reduce driver speeds by adding one speed bump on each block;
- 5) Increase the roadway width to provide more comfortable conditions for drivers and downhill cyclists sharing the roadway; and,
- 6) Add delineators to better define the parking and sightline zones.

BACKGROUND

In July 2020, Council approved a motion to reduce the speed limit on St. Andrews Avenue, between Keith Road and 13th Street, to 30km/h. Vehicle speeds noted after the posted reduction indicated minimal change and it was apparent that design changes to the street were necessary to achieve the safety improvements desired.

The St. Andrews Avenue Safety Improvements Project was launched in spring 2021 with the goal of providing a safer, more comfortable experience for all road users and sought to achieve the following objectives:

- 1) To fill gaps in the sidewalk network;
- 2) Align driver speed with the posted 30km/h speed limit; and,
- 3) Improve mobility facilities.¹

Following a multi-phased engagement process, street design changes were implemented in July 2022. Based on public feedback on the design, staff conducted a subsequent community engagement phase beginning in March 2023. Community feedback was used to inform design revisions and staff sought Council direction to implement the revised design.

At the July 24, 2023 meeting, Council directed staff to implement the revised design from 9th Street to 13th Street and directed staff to explore further design opportunities between Keith Road and 9th Street (Figure 1). The final design from 9th Street to 13th Street was implemented in October 2023.

¹ The Council approved Mobility Network Strategy (2019) established a practice to improve mobility facilities on identified mobility corridors in the City's Bicycle Master Plan and All ages and Abilities Bicycle Network when delivering other projects (e.g. repaving Brooksbank Avenue incorporated adding mobility lanes)

Council offered the following comments to advise staff on design considerations to explore:

- Elevating the northbound mobility lane to improve clarity of use;
- Reconfiguring the boulevard on the east side of the street to provide an off-street northbound mobility lane and return parked vehicles to the curb;
- Providing protection for southbound mobility device users;
- Corridor couplets to reduce the amount of space needed on any one street for mobility lanes;
- Options for the application of diverters as a traffic calming and vehicle volume management strategy; and,
- Retaining more curbside space to support business access.

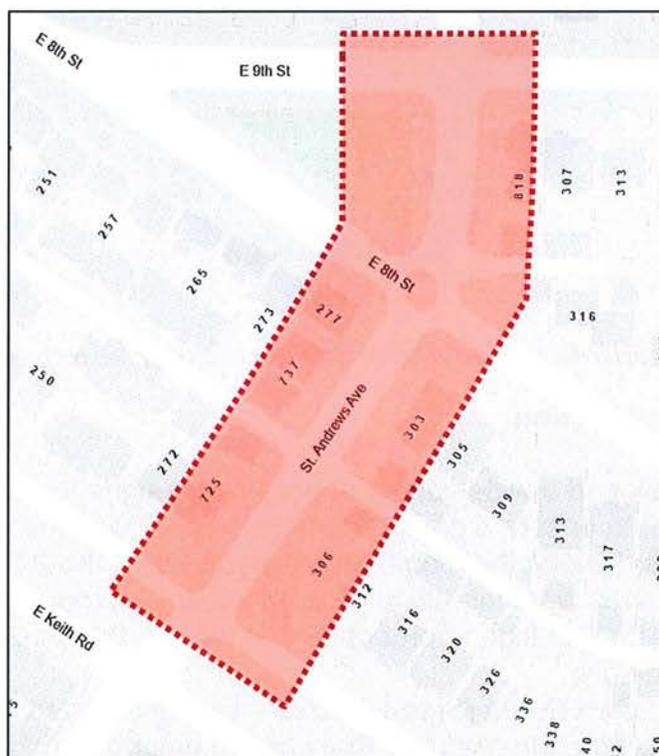


Figure 1: Project area from East Keith Road to East 9th Street

Full project background can be found in the compendium report title “St Andrews Safety Improvement Project Background”

DISCUSSION

Following the July 24, 2023 Council meeting, as per Council direction, staff began work to further explore design concepts on St. Andrews Avenue between Keith Road and 9th Street. Comments from Council, in combination with other relevant policy such as the Mobility Strategy, were used to help shape concepts for consideration and establish evaluation criteria to be used to compare the trade-offs between designs.

Council's comments highlighted a number of possible designs, therefore it was important that the project team to take a comprehensive approach in evaluating all design possibilities to address the more complex challenges of this segment of St. Andrews Avenue. To this end, staff retained an external consultant to join the project team to contribute a valuable external perspective and additional technical expertise. Given the number of possible designs that could conceivably fit the street context, the team developed a multi-phased process to consistently evaluate each possibility to compare trade-offs between them. The following section outlines the approach taken to examine possible designs and evaluate designs against one another to ultimately reach a recommended design.



Figure 2: Process map illustrating the steps followed to establish a recommended option for Council's consideration

Design Concept Identification

The project team developed a wide variety of possible designs for consideration utilizing the external consultant to ensure a comprehensive suite of designs were considered. Ultimately, 16 possible designs that could physically fit within the 24 metre right-of-way between the property lines were identified. The concepts incorporated *Comfortable for Most* mobility infrastructure design approaches that fall into three configuration typologies described below:

- *Neighbourhood Bike Route (Shared Lane)* – Designs that reduce vehicle volumes by incorporating diverters that change neighbourhood access and restrict circulation patterns for drivers; *On-road Separated Bike Lane* – Designs that utilize basic materials like paint, curbs, and delineators to protect mobility device users; and,
- *Off-road Separated Bike Lane* – Off-street designs that reconstruct the boulevard to maximize the use of space to accommodate all users.



Figure 3: Comfortable for most mobility facilities

Many concepts that the project team explored incorporated hybrid designs that drew components from multiple infrastructure design approaches divided by the direction of travel (e.g. Off-road facilities on one side of the street and on-road separated facilities on the other or on-road separated facilities paired with a shared lane from a neighbourhood bike route). For ease of classification, hybrid designs were categorized under the typology with the greater level of effort required to deliver (e.g. The off-street and on-road separated facility example mentioned previously would be categorized under the *Off-road Separated Bike Lane* concepts due to the level of effort associated with reconstructing one side of the street).

Concept design drawings were developed including basic plan-view drawings and typical cross-sections for each possibility. Concept designs illustrate layout with typical dimensions, but do not include details around grading, site specific adjustments to typical dimensions that may be required at pinch points, or other elements like property access that are best addressed through detailed design. All concept designs with annotations describing the features of the design can be found in Attachment 1.

Design Evaluation & Comparison

The project team evaluated each design concept based on a series of weighted criteria informed by the Mobility Strategy and Council feedback. Scores were assigned to each criteria based on whether the design would make the existing conditions² better or worse. A cumulative score was calculated enabling the project team to consistently compare trade-offs associated with each concept and highlight the concept with the most favorable outcomes for the context. The Design Comparison Table found in attachments 3 and 4 document the criteria scoring and components of the design that informed each score.

Weighting favoured improvements for vulnerable road users and contextual considerations like curbside access and neighbourhood transportation impacts. Criteria and their weighting used for the evaluation were:

- User Safety and Comfort (50%) – A combination of impact on pedestrians (20%), mobility device users (20%), and drivers (10%) including considerations for sightlines, street crossings, user separation and treatments at conflict areas;
- Parking and Loading (15%) – Impact on driver access for loading as well as short-term and long-term vehicle parking;
- Cost (15%) – Approximate financial cost to deliver the infrastructure;
- Network Impact (10%) – Degree of change to the function of St. Andrews Avenue and neighbouring streets; and,
- Encroachment Impacts (10%) – Degree of change to private use of public spaces like fences, gardens, decorative trees and other plantings in the City boulevard.

² The existing condition consists of a narrowed roadway shared with southbound mobility device users and a parking protected uphill mobility lane defined by paint.

The criteria scoring and explanations informing each score were vetted by multiple technical professionals including the external consulting team to ensure consistent and defensible scoring. The project team performed a series of sensitivity analyses to establish the stability of the cumulative scores. This involved adjusting criteria weighting and criteria scoring up and down to reflect different design priorities to observe the impact to the cumulative score. Changes to criteria weighting and scoring had limited impact on the top designs – some changed positions amongst one another, but the top designs remained the same.

Design Concept Elimination

While all designs evaluated are technically feasible, only concepts that provided greater positive benefits were advanced to a short list. Concepts that did not advance typically had more significant negative impacts to the transportation network or parking with only neutral or modest improvement for people walking and rolling. The remainder of this section will outline the justification for design concepts eliminated in the first round of evaluation.

Concepts 1A, 1A+, 1B, 1B+, 1C, and 1C+

These concepts apply a Neighbourhood Bike Route Design approach by introducing traffic diverters. The diverters would reduce the vehicle volume on St. Andrews Avenue, making slight improvements for the safety and comfort of drivers and cyclists, but would divert vehicle volumes to other streets and restrict travel patterns for residents and visitors traveling in a car. These concepts scored low because:

- They result in higher vehicle volumes on Ridgeway Avenue next to Ridgeway Elementary School which is not a desirable outcome;
- To deliver a Neighbourhood Bike Route design, significant efforts would be required to develop a neighbourhood wide access management plan that incorporates coordinated traffic diversion elements. A successful access management plan would be a considerable change to how drivers access and travel to reach destinations in the neighbourhood. Facilitating neighbourhood level changes exceeds the scope of the St. Andrews Avenue project and staff’s current capacity to deliver effectively.

Eliminated Design Concepts (shaded cells)															
1A	1A+	1B	1B+	1C	1C+	2	3	4	5A	5B	6	7	8	9	10

Concepts 5A and 5B

These concepts reduce the amount of mobility (cycling) infrastructure on any one street by creating a couplet paired with St. Andrews Avenue. St. Andrews Avenue provides separated infrastructure for mobility device users traveling uphill and St Georges Avenue or Ridgeway Avenue provides separated infrastructure for users travelling downhill. These concepts scored low because:

- Couplets are an unfamiliar condition on the North Shore (and regionally) that cyclists may not find easy to navigate. This could lead to wrong-way travel within the facility increasing the risk of an incident;
- With either couplet corridor option the concept requires complete parking removal on one side of the street; and

- Concept 5A on St Georges Avenue requires changes to intersection operations (e.g. restricting right turns) causing other network impacts or significant costs to protect users at intersections.

Eliminated Design Concepts (shaded cells)															
1A	1A+	1B	1B+	1C	1C+	2	3	4	5A	5B	6	7	8	9	10

Low scoring On-Road and Off-Road Separated Concepts

This series of concepts yielded low scores with more competitive concepts developed within each design typology category.

- Concept 2 – Eliminates driver queuing by widening the travel-way to establish dedicated north- and southbound travel lanes. This is achieved through the removal of parking on the west side. A northbound mobility lane is provided and southbound mobility device users are directed to share the southbound travel lane with drivers. This concept scored low due to the impacts to parking with only marginal comfort and safety improvements.
- Concept 6 – Builds a new curb on the east side of the street to shift the northbound mobility lane off-road. While providing some improvement to people walking and rolling by establishing a separate space for mobility devices off-road, it did not score well because the cost to deliver the design is high.
- Concept 9 – Creates a bi-directional off-road mobility lane on the east side of the street. This concept did not score well because it introduces safety and navigational challenges for cyclists, significantly impacts private encroachments on one side of the street, and is expensive to implement.

Eliminated Design Concepts (shaded cells)															
1A	1A+	1B	1B+	1C	1C+	2	3	4	5A	5B	6	7	8	9	10

Concept 8

Provides a downhill off-road mobility lane on the west side of the street and a northbound on-road parking protected mobility lane through the reconstruction of the west side boulevard. The design improves the comfort and safety of all users and particularly mobility device users traveling downhill. To achieve the off-road downhill mobility lane parking is eliminated south of the laneway on the 700 block and further restrictions to parking north of the laneway on the west side are required. While performing well for cycling safety this concept did not make the short list because:

- Significant impacts to parking and loading space;
- High costs to deliver the work (\$1-\$1.25 million); and
- Relatively high impacts to private encroachments in the boulevard.

Eliminated Design Concepts (shaded cells)															
1A	1A+	1B	1B+	1C	1C+	2	3	4	5A	5B	6	7	8	9	10

Concept 4

Provides on-road separated bike lanes both uphill and downhill resulting in high user comfort and safety scores. This is achieved by removing all parking on the west side and partial parking removal on the east side. This design is a cost effective option to deliver a downhill protected mobility lane, but did not make the short list because it requires significant parking removal.

Eliminated Design Concepts (shaded cells)															
1A	1A+	1B	1B+	1C	1C+	2	3	4	5A	5B	6	7	8	9	10

Design Concept Short List

The three remaining design concepts all received similar cumulative scores. Breaking down how the scores were reached reveals variations in trade-offs and design priorities between them. The greatest variations exist between the design concept costs, as well as pedestrian and cycling safety and comfort.

Table 1: Condensed table of the short listed design concepts.

Criteria		Weighting	ON-ROAD SEPARATED BIKE LANE	OFF-ROAD SEPARATED BIKE LANE	
			Concept 3 NB On-road Separated Bike Lane, SB Cyclists Share with Drivers	Concept 7 NB Off-road Separated Bike Lane, SB On-road Separated Bike Lane	Concept 10 NB and SB Off-road Separated Bike Lanes
Safety and Comfort	Pedestrian Safety and Comfort	20	2	3	4
	Cycling Safety and Comfort	20	1	4	4
	Driving Safety and Comfort	10	2	1	1
Parking and Loading		15	-1	-2	-1
Cost		15	0	-3	-4
Network Impacts		10	0	0	0
Encroachment Impacts		10	0	-2	-4
Cumulative Score		100	65	55	55

To reach a recommended design, staff applied three assumptions to establish the trade-offs that were most beneficial for the context. Those assumptions were:

- The Mobility Strategy design objectives for a local street emphasize making streets more family-friendly by improving the comfort and safety of walking and rolling; in the context of the 700 and 800 blocks of St. Andrews Avenue providing parking has an elevated priority for street design.

- Substantial changes to the neighbourhood street network or private encroachments like removing fences, hedges, and decorative plantings would be impactful; this is not necessary to deliver mobility network improvements in this context and should be avoided.
- St Andrews is not a Mobility Network priority and a more complete corridor approach could happen in the future. While the St. Andrews Avenue corridor offers a north-south connection through the City; the Mid-town and Chesterfield Corridors have much higher existing mobility device user volumes and further investment will yield greater progress toward increasing the City’s 50% active mode share target by 2030 identified in the Mobility Strategy.

When these assumptions are applied, two concepts can be eliminated to establish a recommended design.

Concept 10

Delivers an off-road separated mobility lane in both directions, similar to Esplanade, requiring the complete reconstruction of the right-of-way between the property lines. The design receives the highest comfort and safety scores by creating separate travel spaces for all modes with limited impact to parking. The design was not recommended because:

- It would cause a substantial change to private encroachments on both sides of the street, which is not required to deliver mobility network improvements in this context; and
- Implementation requires an expenditure of approximately \$2,000,000 to construct. This design would improve the comfort and safety of cyclists on the corridor, but is unlikely to yield the equivalent progress toward increasing the City’s active mode share as the Mid-town or Chesterfield Corridors.

Eliminated Design Concepts (shaded cells)															
1A	1A+	1B	1B+	1C	1C+	2	3	4	5A	5B	6	7	8	9	10

Concept 7

Delivers an off-road separated mobility lane uphill and an on-road parking protected mobility lane downhill. The design requires the reconstruction of the east boulevard and the removal of some parking on the west side on the 700 block north of the lane to improve sightlines for downhill cyclists. This design was not recommended because:

- It would cause substantial change to private encroachments, which is not required to deliver mobility network improvements in this context; and
- Implementation requires an expenditure of approximately \$1,250,000 to construct. This design would improve comfort and safety of cyclists on the corridor, but is unlikely to yield the equivalent progress toward increasing the City’s active mode share as the Mid-town or Chesterfield Corridors.

Eliminated Design Concepts (shaded cells)															
1A	1A+	1B	1B+	1C	1C+	2	3	4	5A	5B	6	7	8	9	10

Recommended Design – Concept 3

This concept is consistent with the design applied to St. Andrews Avenue from 9th to 13th Street. It provides an uphill on-road parking protected mobility lane and incorporates changes in response to the feedback from the community received throughout the engagement process. The project team recommends advancing this option as it:

- Improves the comfort and safety of pedestrians by creating a paint defined pedestrian refuge to improve visibility when crossing.
- Improves the comfort and safety of cyclists and other mobility device users by better defining the mobility lane from the parking area with delineators and increasing the travel way to create more space for downhill cyclists and drivers to pass one another.
- Responds to aesthetic concerns by adding a planting in the transition zone on St. Andrews Avenue at Keith.
- Is consistent with the design delivered on St. Andrews Avenue between 9th and 13th Streets.
- Is aligned with City Policy and design best practices.
- Incorporates the key recommendations from the design peer review.
- Is a cost effective design to deliver safety improvements appropriate for the context.

Five key changes identified below would be made to the 700 and 800 blocks to the street design to address the community’s main concerns. For a complete view of the design, please see Attachment 5.

- 1) Clarify the Keith Road and St. Andrews Avenue Intersection (Figure 4) – The design incorporates concrete barriers, signage and paint to improve legibility of the transition to the street. Staff will explore options for further aesthetic improvements including a planting bed as a gateway feature to the neighbourhood. The lateral shift of the road has been reduced and the centre line extended to the lane to create a distinct north and southbound travel lane.

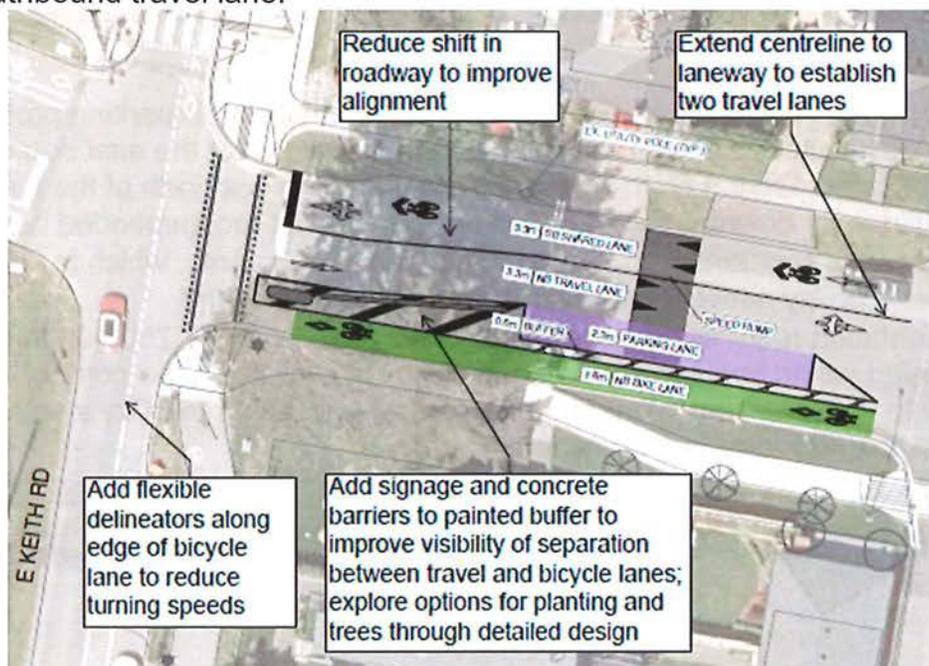


Figure 4: Summary of recommended design changes to improve the Keith and St Andrews intersection



Figure 6: Improvements to pedestrian crossing refuge at the intersection of St. Andrews Avenue at 8th Street

- 4) Add Speedbumps (Figure 7) – Speedbumps will be added to each block in response to community feedback to help slow drivers.

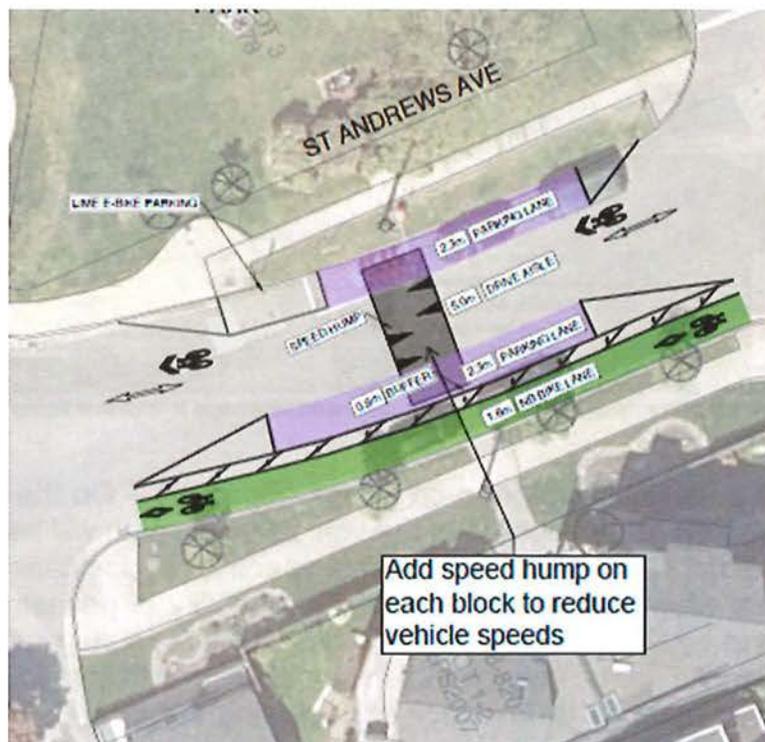


Figure 7: New speed hump added. Placement varies block to block to maintain 60m separation to other driver speed management features

- 5) Increase the roadway width (Figure 8) – The mobility lane will be reduced from 2.2 metres to 1.8 metres plus buffer (which meets minimum standard in the design guidelines) to reallocate the space to the shared roadway. This is in response to drivers and downhill mobility device users feeling constrained using the street. This

change will offer more space, but continue to be aligned with the upper end of the best practice widths for a shared street. The tradeoff means the mobility device users in the uphill parking protected lane will not have as much space in the lane to pass slower moving users however there will be no increased risk of dooring with an adequate door zone buffer retained.

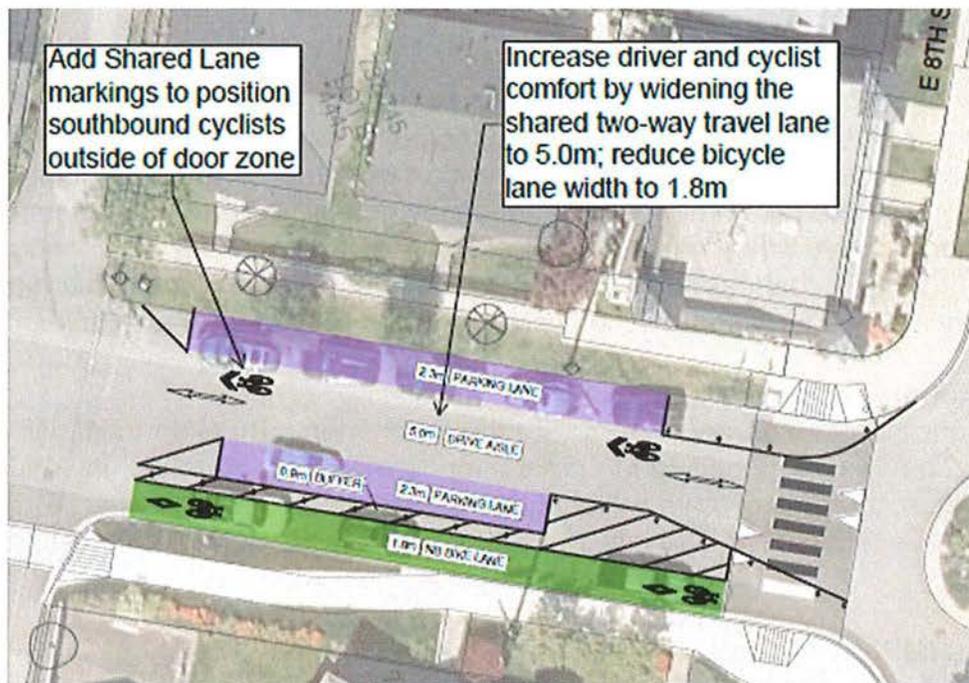


Figure 8: Roadway width adjustment

- 6) Add delineators to better define parking and sightline zones (Figure 9) – Delineators will be added within the door zone buffer and at sightline triangles. Feedback indicated that when parked cars are not present drivers have been observed using the parking and sightline space as driving lanes. Added delineators will give drivers a reference point to assist them in parking in the correct location. This will also prevent incorrectly parked vehicles from obstructing sightlines and better define the roadway when no cars are parked on the road.



Figure 9: Adjustments to improve parking efficiency and clarify separation between parking and mobility lane.

Communicating Next Steps

Per the City's current practices, the project team will inform community (through established channels) to share how their feedback has been incorporated into the final design and the path forward. . Before any changes to the street are made, interested parties will be provided with information on the expected construction activities and impacts. The project team will keep the community informed throughout the change process.

Community input has been considered along with City policy, industry standards and physical constraints of the roadway. The resulting options were carefully analyzed using weighted criteria. While the recommended option best meets the community's needs, staff acknowledge the recommended changes may not satisfy all interested parties in the neighbourhood. Staff welcome feedback as part of the ongoing monitoring process focused on the new changes to the street, but will not be able to maintain dialogue on subjects previously addressed or where there is information readily available.

Implementation Timeline

Should Council direct staff to proceed with the recommended option, staff will schedule implementation as weather and contractor availability permits in 2024. Post implementation, the project team will continue to monitor the street to ensure changes to the street have effectively addressed feedback received during the re-engagement process.

FINANCIAL IMPLICATIONS

Staff anticipate that implementation of the recommended design will cost approximately \$40,000. Staff will continue to pursue external funding options to reduce the project costs associated with design implementation from Keith Road to 9th Street. CNV's Council approved 2023-2027 Financial Plan includes \$1,645,000 of CNV funding for a Priority Mobility Networks Improvements project. Funding to deliver the recommended design will also be incorporated into the 2024-2028 Financial Plan for Council's further consideration.

INTER-DEPARTMENTAL IMPLICATIONS

The Communications and Engagement and Public Realm Infrastructure Teams work in partnership to support the St. Andrews Avenue project. This partnership ensures all components of the project, design, construction and engagement are delivered utilizing best practices and remaining consistent with the City's standard approach to projects.

The City's Fire department has been engaged on the updated design to ensure revisions minimize impacts on their mobility and to ensure response times are met.

STRATEGIC PLAN, OCP OR POLICY IMPLICATIONS

This project supports the Council Strategic Plan goal of a "Connected City," providing active and sustainable ways for people to move to, from and within the City safely and

efficiently by increasing the number of kilometers of protected bike lanes. In addition, the project aligns with and advances policy objectives in the Mobility Strategy, including:

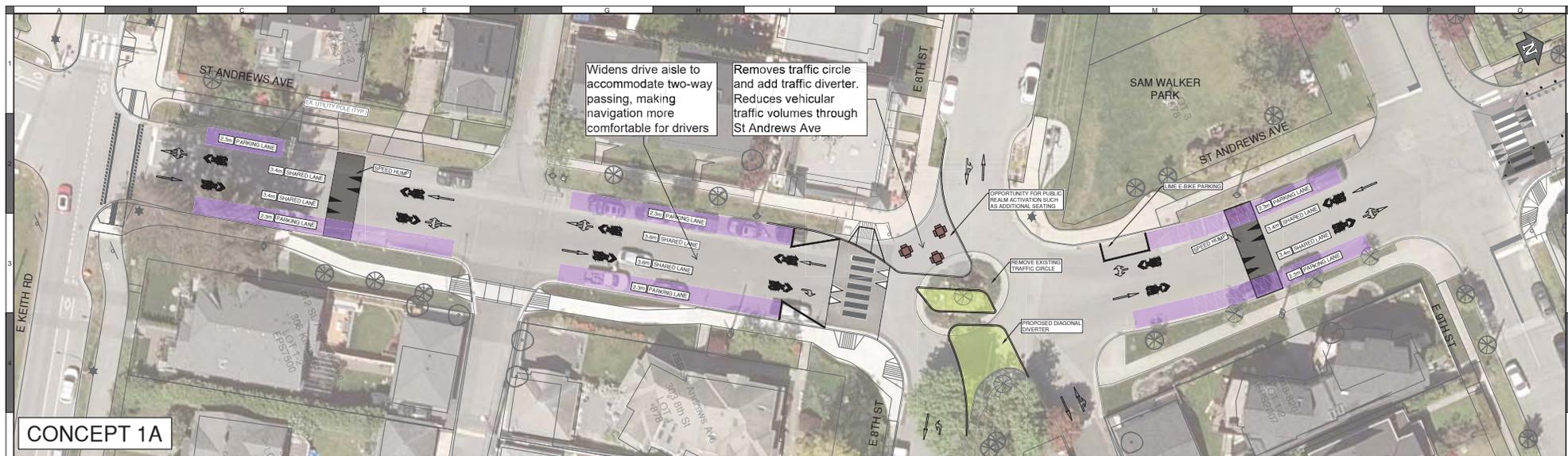
- Action 1A: Deliver a complete, accessible, and high-quality pedestrian network;
- Action 1B: Deliver a AAA Mobility Lane Network that connects all our neighbourhoods and key destinations;
- Action 5B: Manage travel speeds and access to improve neighbourhood safety and livability;
- Action 5D: Make it easier for everyone to be seen while travelling; and
- Action 6B: Ensure there are sufficient loading zones, pick-up and drop-off zones, and accessible parking spots in high-demand locations.

The St. Andrews Avenue Safety Improvement project is consistent with the goals and objectives in the City's Official Community Plan, specifically Chapter 2, (Transportation, Mobility and Access) – 2.1.1 Invest in cycling and pedestrian networks and facilities to make these more attractive, safer, and convenient transportation choice for all ages and abilities with an aim to increase these ways of travelling over single-occupant vehicle use.

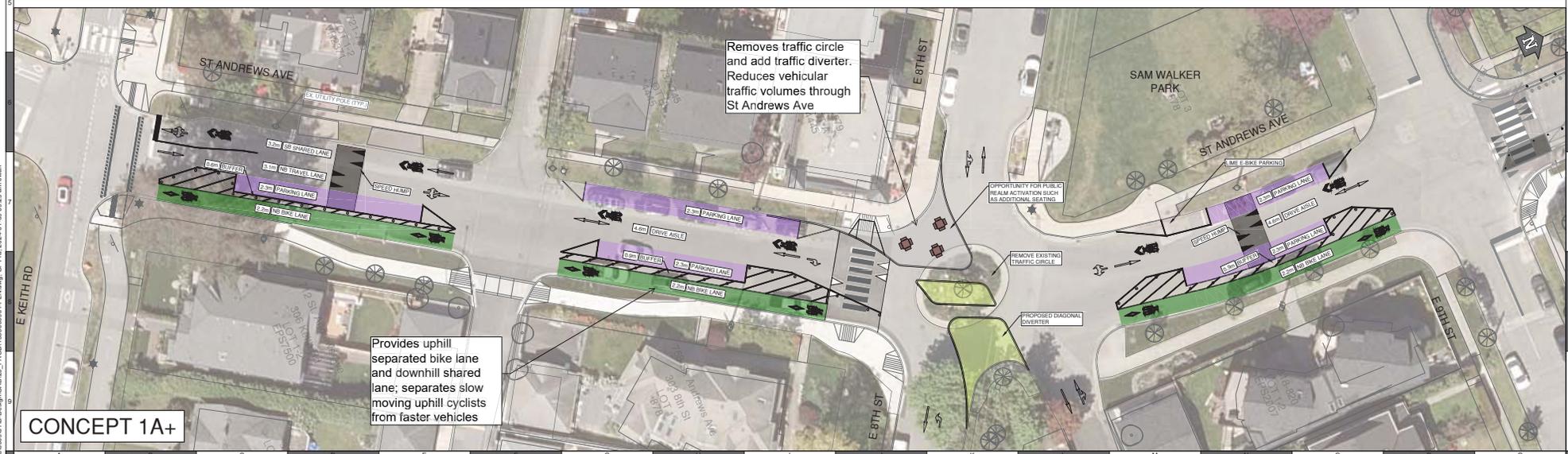
RESPECTFULLY SUBMITTED:



Justin Hall
Manager, Public Realm Infrastructure



CONCEPT 1A



CONCEPT 1A+

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ISSUED FOR
 CONCEPTUAL PLANS
 2024-01-09
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Professional Seals

#	Date	Issue / Revision	App



St Andrews Avenue 700 - 800
 Blocks
 Diverter Across NE to SW
 at E 8th St

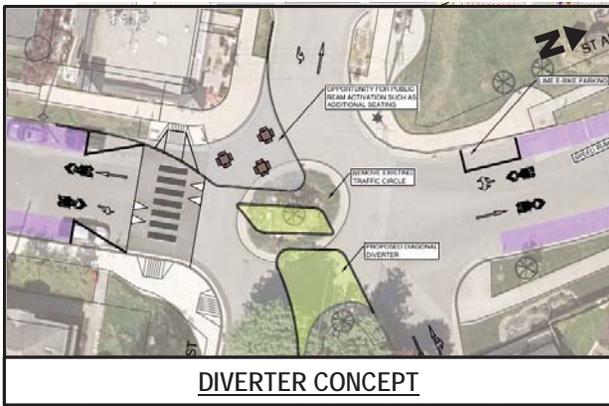
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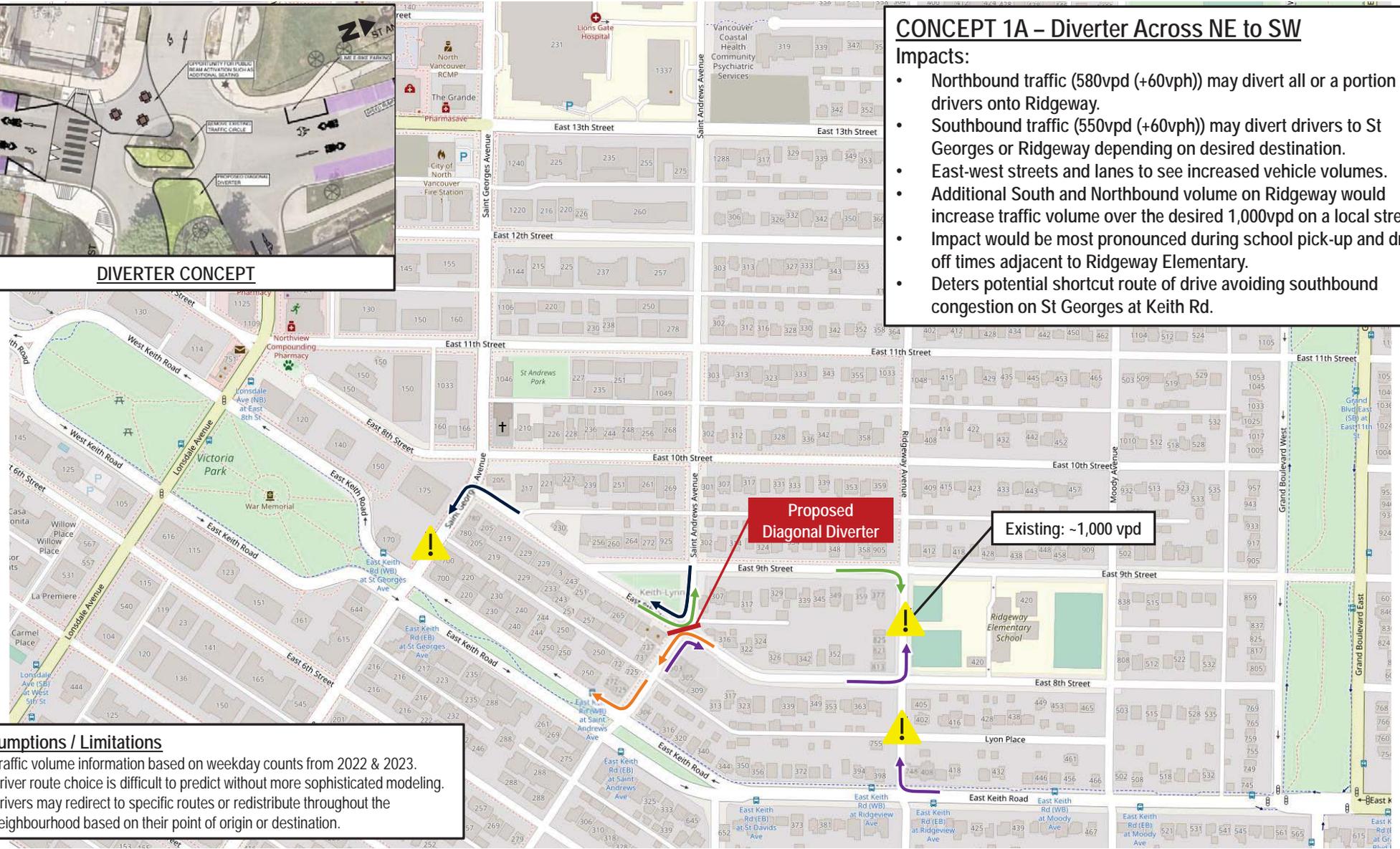
CONCEPT 1A – Diverter Across NE to SW

Impacts:

- Northbound traffic (580vpd (+60vph)) may divert all or a portion of drivers onto Ridgeway.
- Southbound traffic (550vpd (+60vph)) may divert drivers to St Georges or Ridgeway depending on desired destination.
- East-west streets and lanes to see increased vehicle volumes.
- Additional South and Northbound volume on Ridgeway would increase traffic volume over the desired 1,000vpd on a local street.
- Impact would be most pronounced during school pick-up and drop-off times adjacent to Ridgeway Elementary.
- Deters potential shortcut route of drive avoiding southbound congestion on St Georges at Keith Rd.



DIVERTER CONCEPT



Assumptions / Limitations

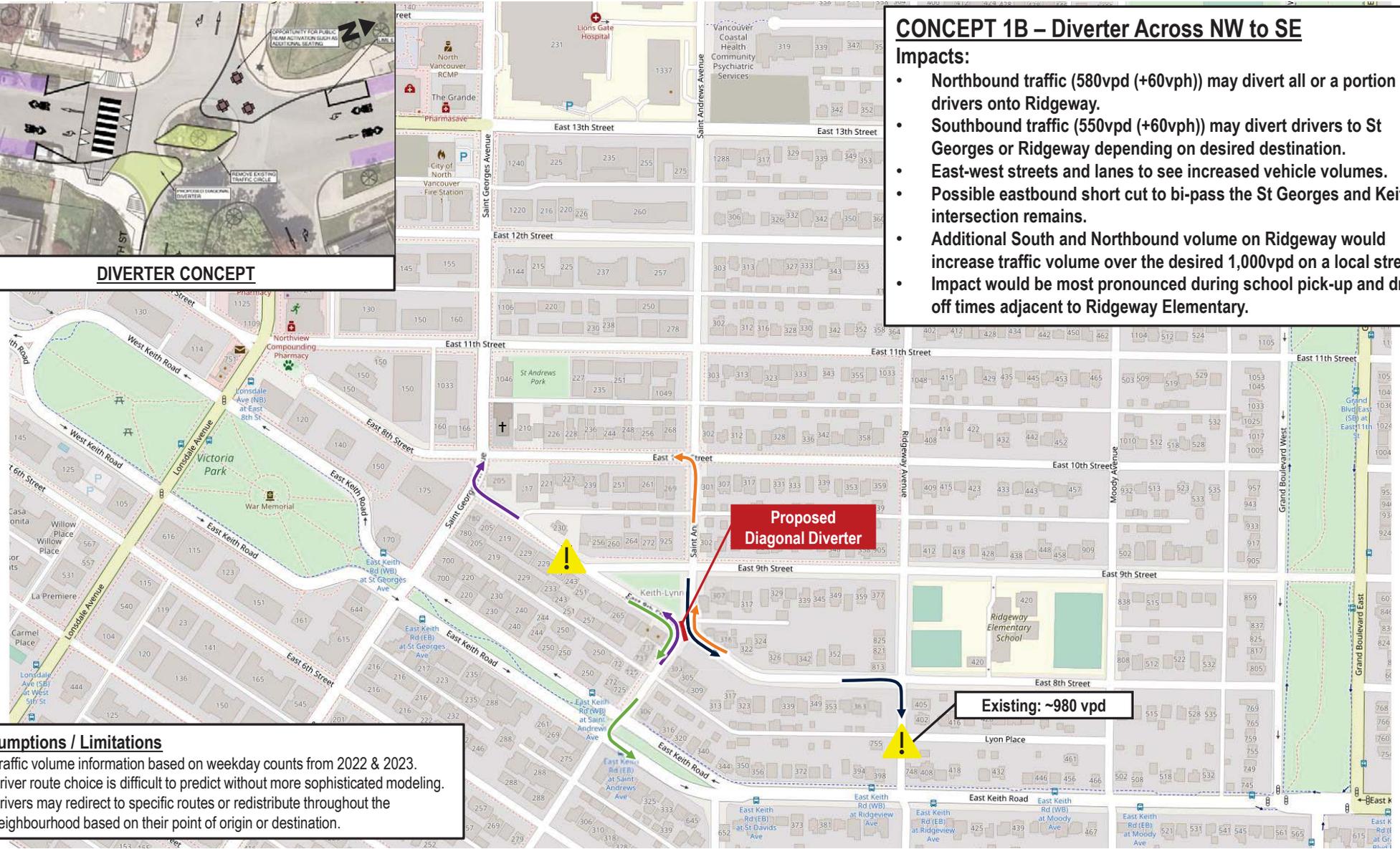
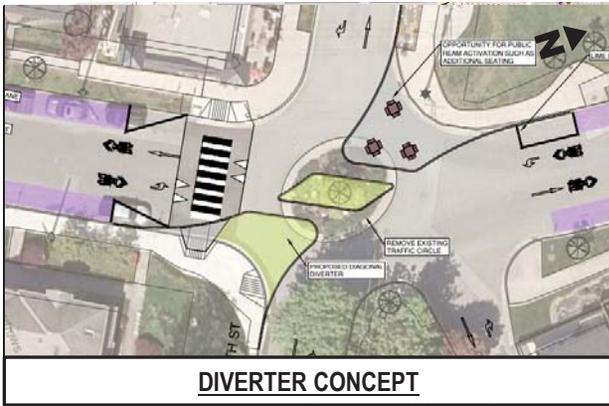
- Traffic volume information based on weekday counts from 2022 & 2023.
- Driver route choice is difficult to predict without more sophisticated modeling. Drivers may redirect to specific routes or redistribute throughout the neighbourhood based on their point of origin or destination.

CONCEPT 1B – Diverter Across NW to SE

Impacts:

- Northbound traffic (580vpd (+60vph)) may divert all or a portion drivers onto Ridgeway.
- Southbound traffic (550vpd (+60vph)) may divert drivers to St Georges or Ridgeway depending on desired destination.
- East-west streets and lanes to see increased vehicle volumes.
- Possible eastbound short cut to bi-pass the St Georges and Keith intersection remains.
- Additional South and Northbound volume on Ridgeway would increase traffic volume over the desired 1,000vpd on a local street.
- Impact would be most pronounced during school pick-up and drop-off times adjacent to Ridgeway Elementary.

DIVERTER CONCEPT



Assumptions / Limitations

- Traffic volume information based on weekday counts from 2022 & 2023.
- Driver route choice is difficult to predict without more sophisticated modeling. Drivers may redirect to specific routes or redistribute throughout the neighbourhood based on their point of origin or destination.

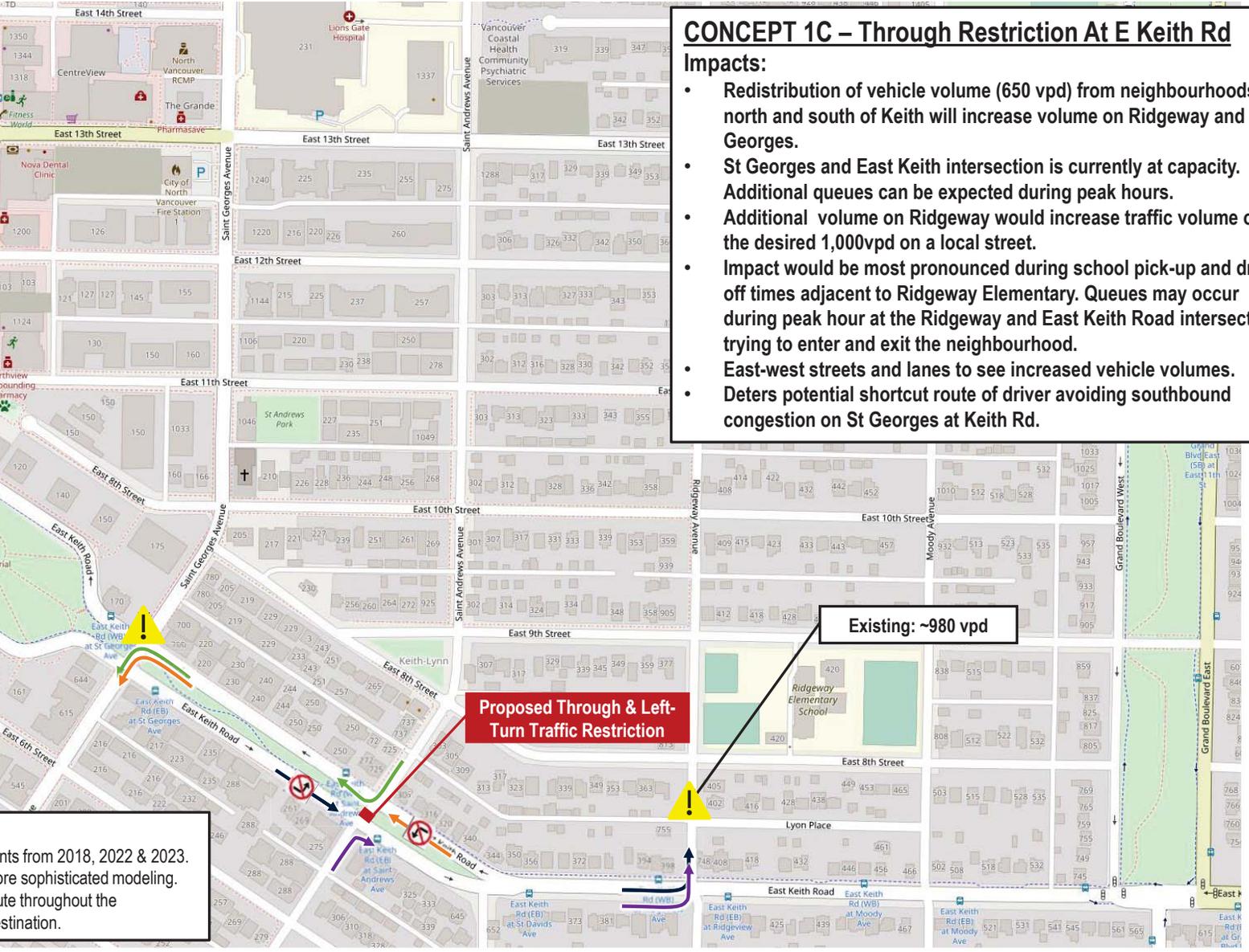
CONCEPT 1C – Through Restriction At E Keith Rd

Impacts:

- Redistribution of vehicle volume (650 vpd) from neighbourhoods north and south of Keith will increase volume on Ridgeway and St Georges.
- St Georges and East Keith intersection is currently at capacity. Additional queues can be expected during peak hours.
- Additional volume on Ridgeway would increase traffic volume over the desired 1,000vpd on a local street.
- Impact would be most pronounced during school pick-up and drop-off times adjacent to Ridgeway Elementary. Queues may occur during peak hour at the Ridgeway and East Keith Road intersection trying to enter and exit the neighbourhood.
- East-west streets and lanes to see increased vehicle volumes.
- Deters potential shortcut route of driver avoiding southbound congestion on St Georges at Keith Rd.



THROUGH & LEFT-TURN RESTRICTIONS

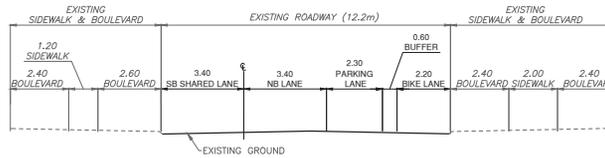


Proposed Through & Left-Turn Traffic Restriction

Existing: ~980 vpd

Assumptions / Limitations

- Traffic volume information based on weekday counts from 2018, 2022 & 2023.
- Driver route choice is difficult to predict without more sophisticated modeling. Drivers may redirect to specific routes or redistribute throughout the neighbourhood based on their point of origin or destination.



ST ANDREWS AVENUE 700-800 BLOCKS
NORTH OF LANEWAY
CONCEPT 2

SCALE 1:100

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URBAN SYSTEMS

Scale: 0 5 10m
1:250

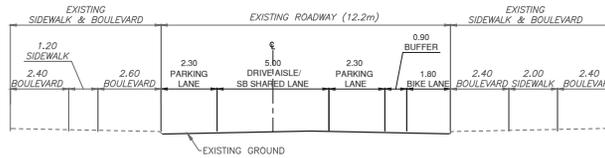
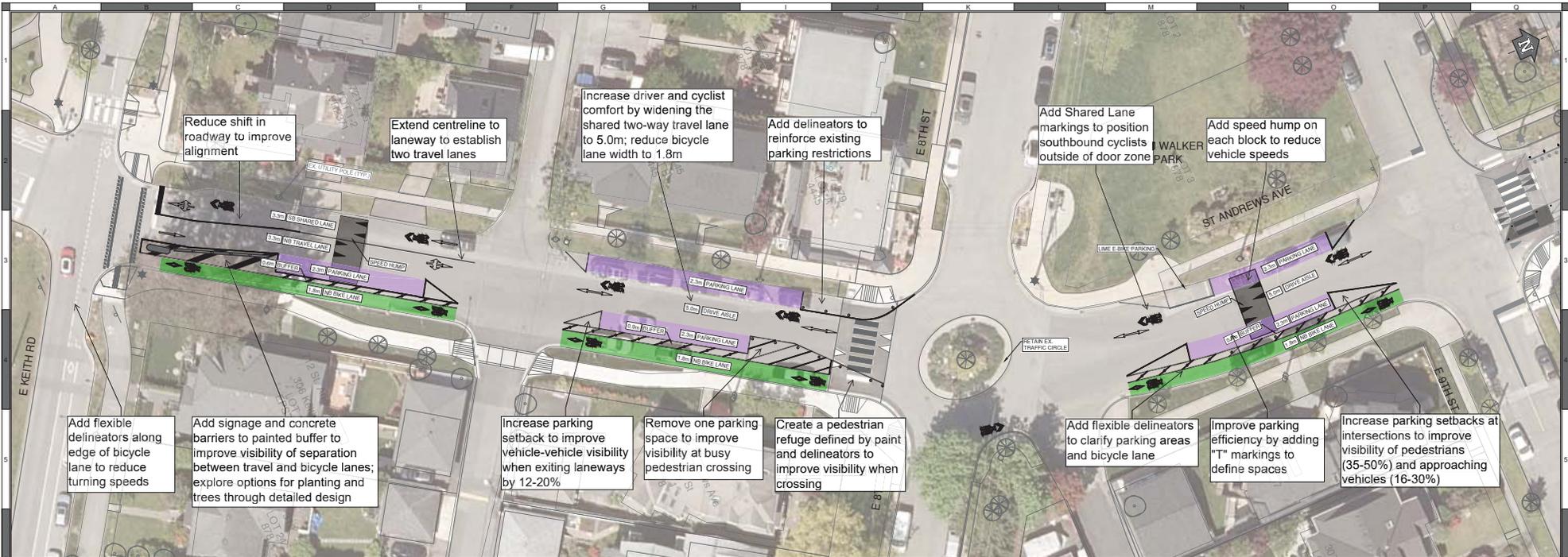
Quality Control by: B.FAN
 Designed by: C.WAN
 Drawn by: C.WAN

St Andrews Avenue 700 - 800 Blocks
 Dedicated Travel Lanes in Both Directions, NB On-road Segregated, SB Cyclists Share with Drivers

Sheet Number: 04 of 11
 Project Number: 1308.0069.01
 Drawing Number: Concept 2
 Revision: ---

ANSI expand D (94.00 x 22.00 inches) 25mm

NOT FOR CONSTRUCTION



ST ANDREWS AVENUE 700-800 BLOCKS
NORTH OF LANEWAY
CONCEPT 3

SCALE 1:100

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URBAN SYSTEMS

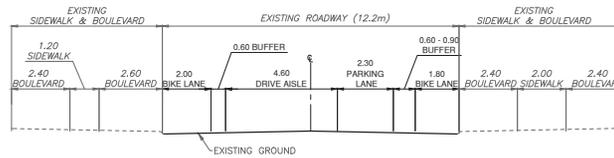
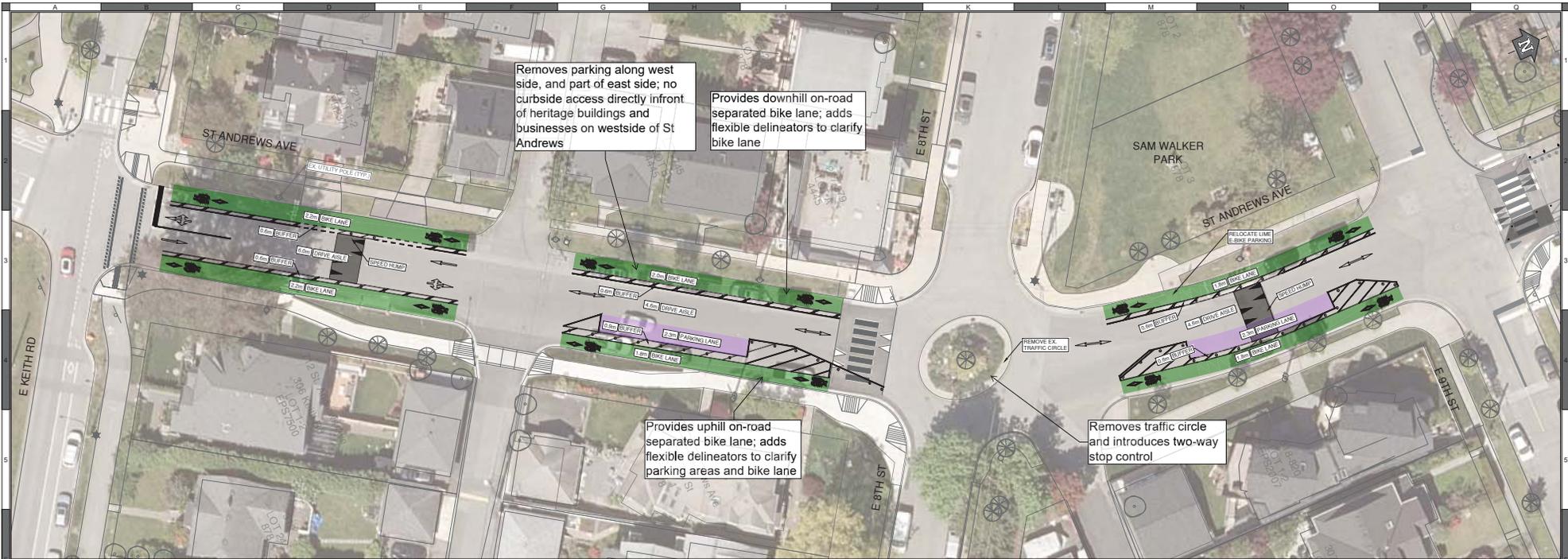
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Quality Control by: B.FAN
 Designed by: C.WAN
 Drawn by: C.WAN

St Andrews Avenue 700 - 800 Blocks		Sheet Number	05 of 11
NB On-road Separated Bike Lane, SB Cyclists Share with Drivers		Project Number	1308.0069.01
		Drawing Number	Concept 3
		Revision	---

ANSI expand D (94.00 x 22.00 inches) 25mm

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ST ANDREWS AVENUE 700-800 BLOCKS
NORTH OF LANEWAY
CONCEPT 4

SCALE 1:100

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 Designed by: C.WAN
 Drawn by: C.WAN

St Andrews Avenue 700 - 800 Blocks		Sheet Number	06 of 11
NB and SB On-road Separated Bike Lanes		Project Number	1308.0069.01
		Drawing Number	Concept 4
		Revision	---
ANSI expand D (94.00 x 22.00 inches) 25mm			

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CONCEPT 5 CYCLING COUPLET

DOWNHILL MOBILITY LANE – CONCEPT 5B

- Further from Key Destinations (i.e. into Shipyard District)
- Narrow ex. roadway width would require parking removal on one side for dedicated mobility lane
- Protection required around school to avoid drivers parking in the bike lane

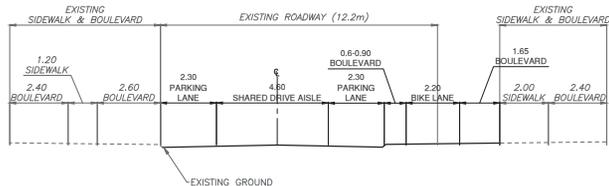
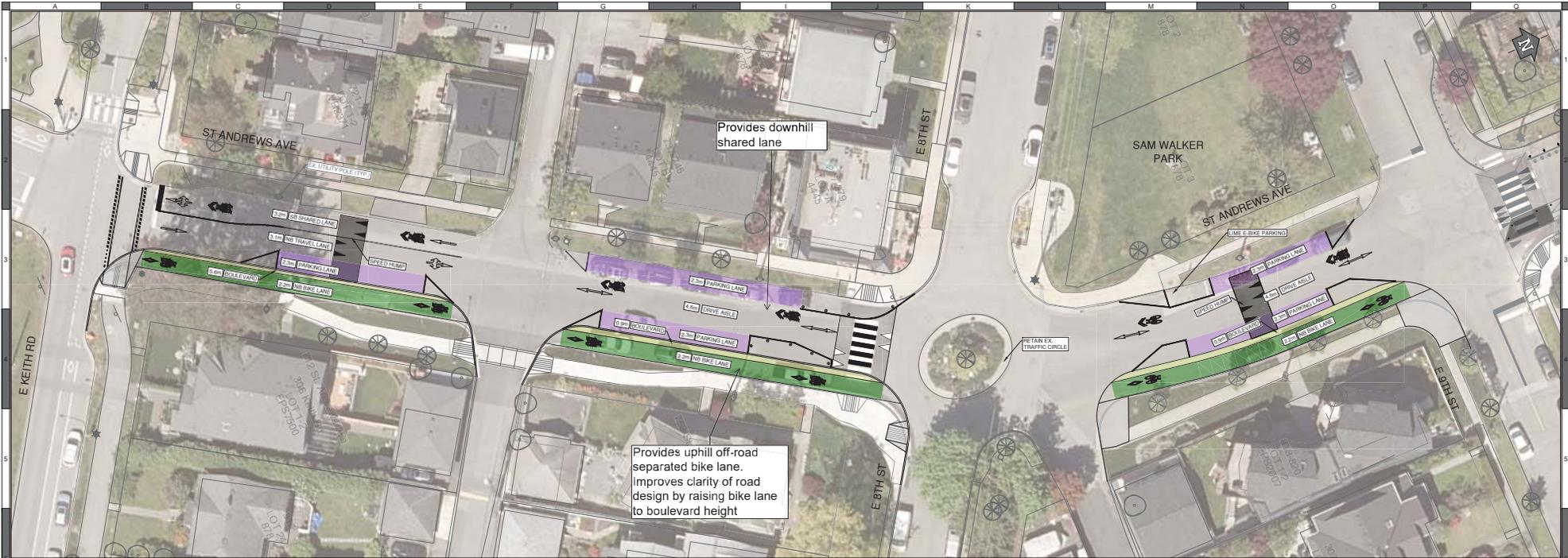
**FUTURE FACILITY
PROPOSED**

DOWNHILL MOBILITY LANE – CONCEPT 5A

- Located on Minor Arterial
- Ex. roadway width would require parking removal on one side and auxiliary lanes at intersections for dedicated mobility lane

EXISTING UPHILL MOBILITY LANE





ST ANDREWS AVENUE 700-800 BLOCKS
NORTH OF LANEWAY
CONCEPT 6

SCALE 1:100

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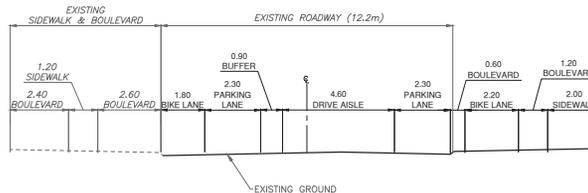
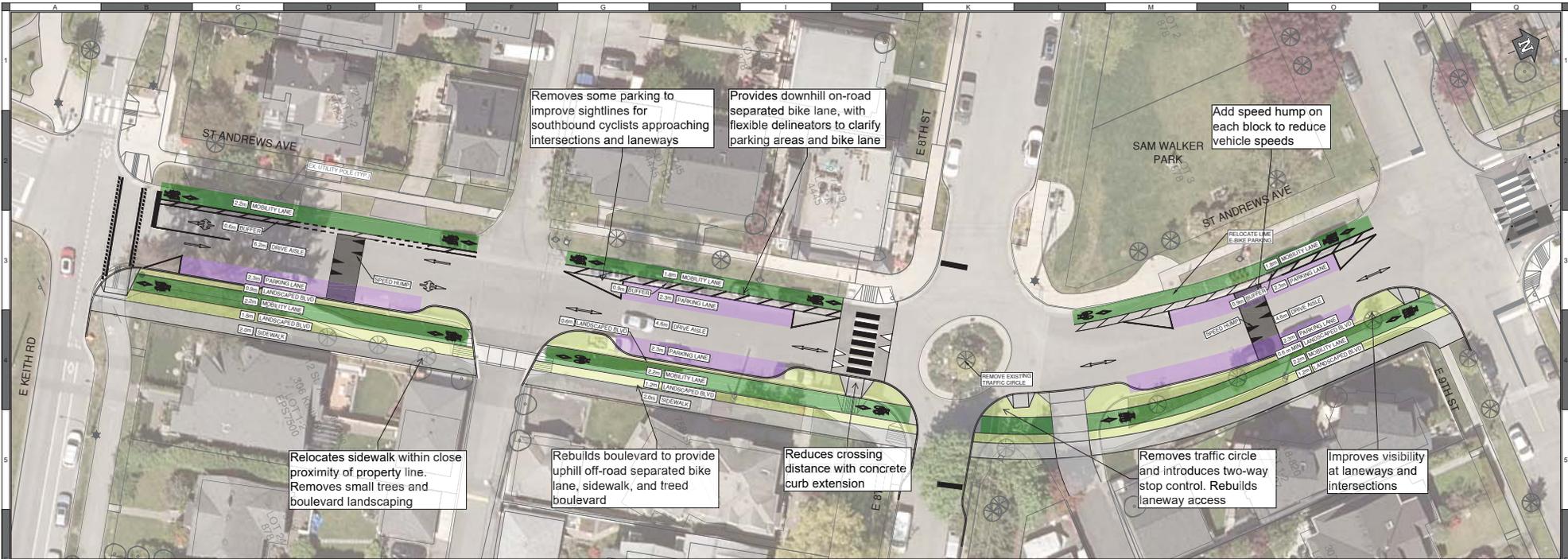
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Scale: 1:250
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Quality Control by: B.FAN
 Designed by: C.WAN
 Drawn by: C.WAN

St Andrews Avenue 700 - 800 Blocks	
NB Off-road Separated Bike Lane, SB Cyclists Share with Drivers	
Sheet Number	07 of 11
Project Number	Drawing Number
1308.0089.01	Concept 6
ANSI expand D (94.00 x 22.00 inches) 25mm	

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ST ANDREWS AVENUE 700-800 BLOCKS
NORTH OF LANEWAY
CONCEPT 7

SCALE 1:100

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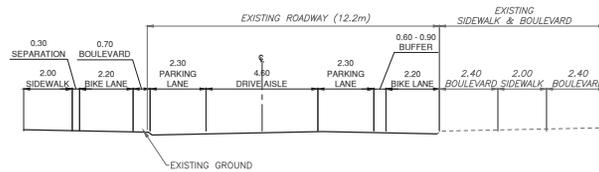
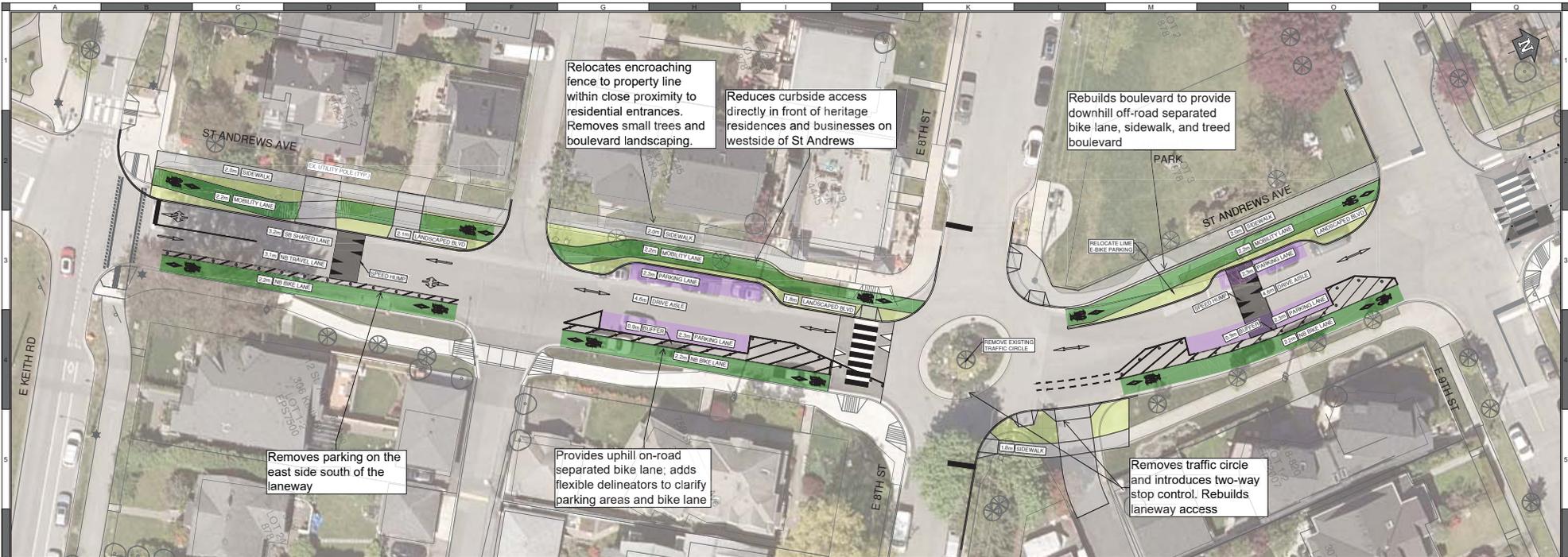
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Quality Control by: B.FAN
 Designed by: C.WAN
 Drawn by: C.WAN

St Andrews Avenue 700 - 800 Blocks		Sheet Number: 08 of 11
NB Off-road Separated Bike Lane, SB On-road Separated Bike Lane		Project Number: 1308.0069.01
		Drawing Number: Concept 7
		Revision: ---

ANSI expand D (94.00 x 22.00 inches) 20mm

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ST ANDREWS AVENUE 700-800 BLOCKS
NORTH OF LANEWAY
CONCEPT 8

SCALE 1:100

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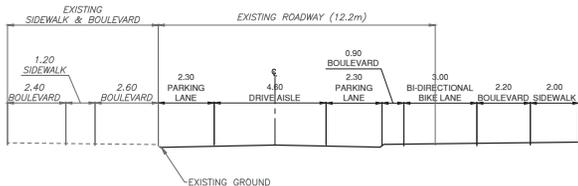
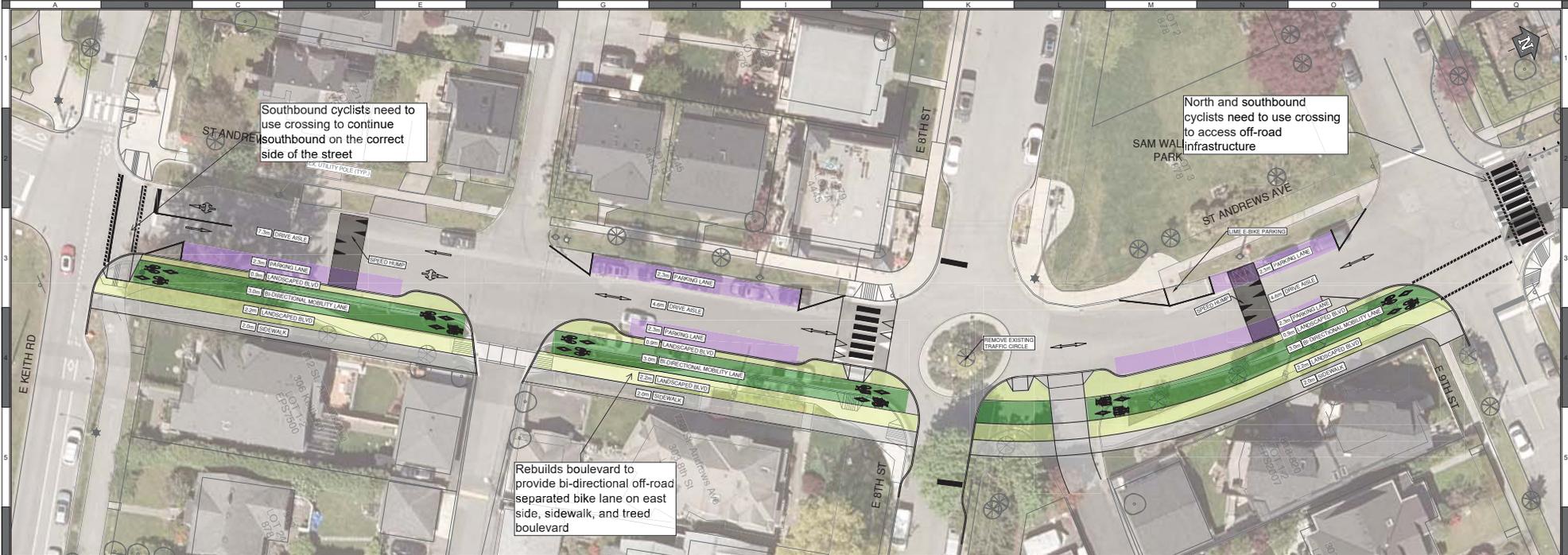
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Quality Control by: B.FAN
 Designed by: C.WAN
 Drawn by: C.WAN

St Andrews Avenue 700 - 800
 Blocks
 NB On-road Separated Bike Lane,
 SB Off-road Separated Bike Lane

Sheet Number: 09 of 11
 Project Number: 1308.0069.01
 Drawing Number: Concept 8
 Revisions: ---
 ANSI expand D (94.00 x 22.00 inches) 25mm

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ST ANDREWS AVENUE 700-800 BLOCKS
NORTH OF LANEWAY
CONCEPT 9

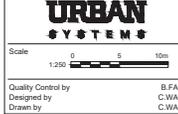
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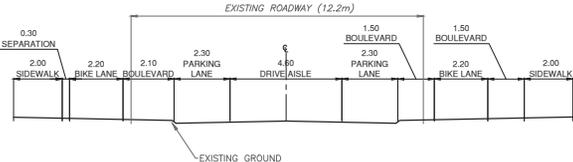
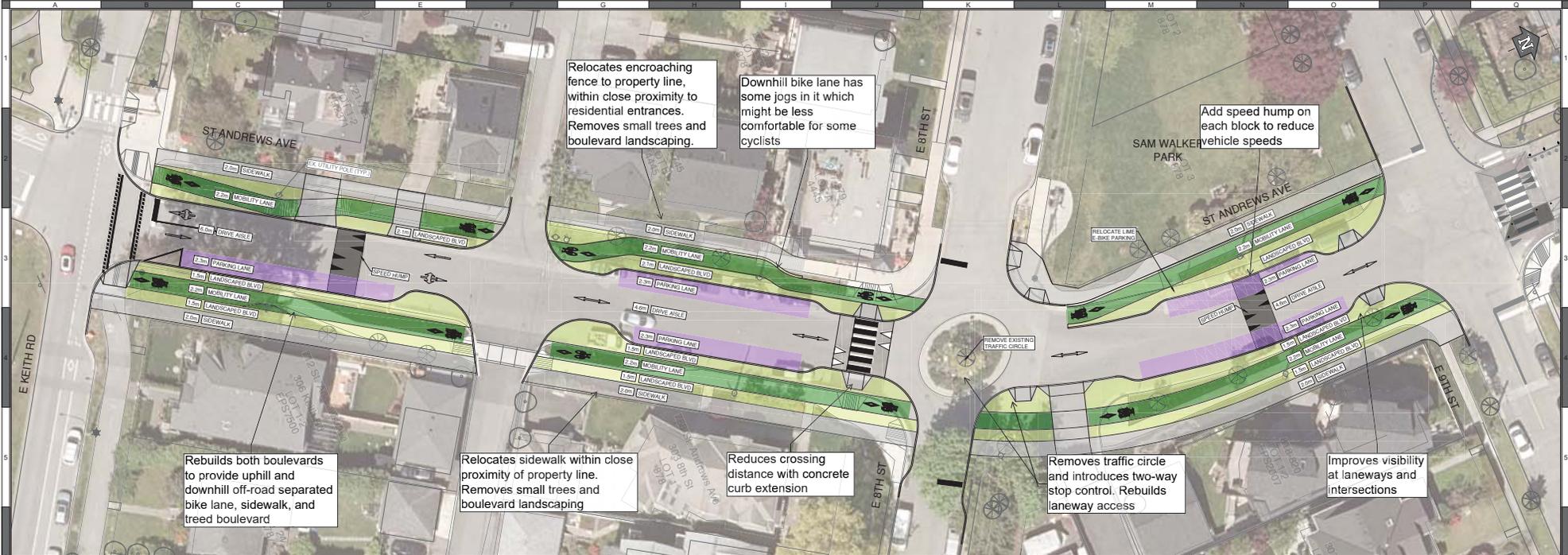


St Andrews Avenue 700 - 800
Blocks
Bi-directional Off-road Separated Bike
Lane on East Side

Sheet Number 10 of 11
 Project Number 1308.0089.01 Drawing Number Revision
 1308.0089.01 Concept 9

ANSI expand D (94.00 x 22.00 inches) 25mm

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ST ANDREWS AVENUE 700-800 BLOCKS
NORTH OF LANEWAY
CONCEPT 10
SCALE 1:100

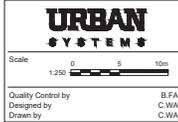
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St Andrews Avenue 700 - 800
 Blocks
 NB and SB Off-road Separated Bike
 Lanes

Sheet Number: 13 of 11
 Project Number: 1308.0069.01
 Drawing Number: Concept 10
 Revision: ---
 ANSI expand D (94.00 x 22.00 inches) 25mm

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Attachment 2 - Design Comparison Table Scoring Descriptions

Worse -4	Neutral 0	Better +4
-------------	--------------	--------------

Criteria		ON-ROAD SEPARATED BIKE LANE				
		Concept 2	Concept 3	Concept 4	Concept 5A	Concept 5B
		Dedicated Travel Lanes in Both Directions, NB On-road Separated, SB Cyclists Share with Drivers	NB On-road Separated Bike Lane, SB Cyclists Share with Drivers	NB and SB On-road Separated Bike Lanes	St Georges Ave SB On-road Separated Bike Lane, St Andrews NB On-road Separated Bike Lane	Ridgeway Ave SB On-road Separated Bike Lane, St Andrews NB On-road Separated Bike Lane
Safety and Comfort	Pedestrian Safety and Comfort	<ul style="list-style-type: none"> Reduces crossing distance on east side of the street with paint and delineators at 8th St Improves visibility at crossings by increasing parking setbacks on east side, and parking removal on west side 	<ul style="list-style-type: none"> Reduces crossing distance on both sides of the street with paint and delineators at 8th St Improves visibility at crossings by increasing parking setbacks 	<ul style="list-style-type: none"> Reduces crossing distance on east side of the street with paint and delineators at 8th St Improves visibility at crossings by increasing parking setbacks on east side, and parking removal on west side 	<ul style="list-style-type: none"> Reduces crossing distance on both sides of the street with paint and delineators at 8th St Improves visibility at crossings by increasing parking setbacks 	<ul style="list-style-type: none"> Reduces crossing distance on both sides of the street with paint and delineators at 8th St Improves visibility at crossings by increasing parking setbacks
	Cycling Safety and Comfort	<ul style="list-style-type: none"> Provides uphill separated bike lane and downhill shared lane Increases comfort sharing travel lane due to wider drive aisle and no west side parking; more room to pass and eliminates door zone risk Increases visibility of uphill and downhill cyclists approaching intersections due to parking removal 	<ul style="list-style-type: none"> Provides uphill separated bike lane and downhill shared lane Reduces comfort for uphill cyclists due to reduced bike lane width creating less space needed for weaving to navigate grades Increases comfort sharing travel lane due to wider drive aisle; provides more room to pass and space to cycle outside of door zone Increases visibility of uphill cyclists due to parking removal near intersections 	<ul style="list-style-type: none"> Provides uphill and downhill on-road separated bike lanes Reduces comfort for uphill cyclists due to reduced bike lane width creating less space needed for weaving to navigate grades Increases visibility of downhill cyclists approaching intersections due to parking removal 	<ul style="list-style-type: none"> Provides uphill on-road separated bike lane (on St Andrews Ave) and downhill on-road separated bike lane (on St Georges Ave) Reduces comfort for uphill cyclists due to reduced bike lane width creating less space needed for weaving to navigate grades Increases visibility of uphill cyclists due to parking removal near intersections 	<ul style="list-style-type: none"> Provides uphill on-road separated bike lane (on St Andrews Ave) and downhill on-road separated bike lane (on Ridgeway Ave) Reduces comfort for uphill cyclists due to reduced bike lane width creating less space needed for weaving to navigate grades Increases visibility of uphill cyclists due to parking removal near intersections
	Driving Safety and Comfort	<ul style="list-style-type: none"> Widens drive aisle to accommodate two-way passing, making navigation more comfortable for drivers; higher potential to increase vehicle speeds with no parking on one side Improves visibility at laneways and intersections Speed reduction benefits from additional speed humps 	<ul style="list-style-type: none"> Widens existing drive aisle slightly, but does not accommodate two-way passing north of laneway Improves visibility at laneways and intersections Speed reduction benefits from additional speed humps 	<ul style="list-style-type: none"> Drive aisle does not accommodate two-way passing north of laneway Improves visibility at laneways and intersections Speed reduction benefits from additional speed humps 	<ul style="list-style-type: none"> Widens existing drive aisle slightly, but does not accommodate two-way passing north of laneway Improves visibility at laneways and intersections Speed reduction benefits from additional speed humps 	<ul style="list-style-type: none"> Widens existing drive aisle slightly, but does not accommodate two-way passing north of laneway Improves visibility at laneways and intersections Speed reduction benefits from additional speed humps
Parking and Loading	<ul style="list-style-type: none"> Removes parking along west side; no curbside access directly in front of heritage residences and businesses on west side of St Andrews Ave Increases risk of vehicles stopping in travel lane to load, or pickup/drop-off 	<ul style="list-style-type: none"> Removes parking minimally on east side to improve visibility at intersections 	<ul style="list-style-type: none"> Removes parking along west side, and part of east side; no curbside access directly in front of heritage residences and businesses on west side of St Andrews Increases risk of vehicles stopping in travel lane to load, or pickup/drop-off 	<ul style="list-style-type: none"> Removes parking along one or both sides of St Georges Removes parking minimally on east side of St Andrews Ave to improve visibility at intersections 	<ul style="list-style-type: none"> Removes parking along one side of Ridgeway; parking removal on both sides where two travel lanes retained Removes parking minimally on east side of St Andrews Ave to improve visibility at intersections 	
Cost	<ul style="list-style-type: none"> Low cost with road space reallocation Approx: \$30,000 - \$50,000 	<ul style="list-style-type: none"> Low cost with road space reallocation Approx: \$30,000 - \$50,000 	<ul style="list-style-type: none"> Moderate cost with removal of traffic circle and road space reallocation Approx: \$100,000 - \$200,000 	<ul style="list-style-type: none"> High cost with construction of on-road separated bike lane on arterial roadway, removal of concrete curb extensions, and relocation of pedestrian signal poles (from Keith Rd to 13th St) Approx: \$500,000 - \$1,000,000 	<ul style="list-style-type: none"> Moderate cost with road space reallocation, traffic circle removal, and improvement along both St Andrews and Ridgeway (from Keith Rd to 13th Street) Approx: \$250,000 - \$500,000 	
Network Impacts	<ul style="list-style-type: none"> Provides a direct connection between existing bike facilities north of 9th St and on E Keith Rd Consistent cycling facility type connecting to the northern segment on St Andrews Ave 	<ul style="list-style-type: none"> Provides a direct connection between existing bike facilities north of 9th St and on E Keith Rd Consistent cycling facility type connecting to the northern segment on St Andrews Ave 	<ul style="list-style-type: none"> Provides a direct connection between existing bike facilities north of 9th St and on E Keith Rd 	<ul style="list-style-type: none"> Removes auxiliary lanes (left or right turn lanes) at intersections to accommodate on-road separated bike lane, reducing vehicle capacity on arterial roadway and creating potential for traffic diversion to neighbouring streets Less intuitive for cyclists to navigate as corridors are 200m apart; likely to increase wrong-way riding. 	<ul style="list-style-type: none"> Further from key destinations such as Lower Lonsdale and Lions Gate Hospital, which potentially reduces cycling demand Less intuitive for cyclists to navigate as corridors are 200m apart; likely to increase wrong-way riding. 	
Encroachment Impacts	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None 	

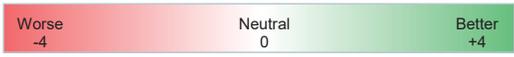
Attachment 2 - Design Comparison Table Scoring Descriptions

Worse -4 Neutral 0 Better +4

Criteria		OFF-ROAD SEPARATED BIKE LANE				
		Concept 6 NB Off-road Separated Bike Lane, SB Cyclists Share with Drivers	Concept 7 NB Off-road Separated Bike Lane, SB On-road Separated Bike Lane	Concept 8 NB On-road Separated Bike Lane, SB Off-road Separated Bike Lane	Concept 9 Bi-directional Off-road Separated Bike Lane on East Side	Concept 10 NB and SB Off-road Separated Bike Lanes
Safety and Comfort	Pedestrian Safety and Comfort	<ul style="list-style-type: none"> Reduces crossing distance on both sides of the street with paint and delineators at 8th St Improves visibility at crossings by increasing parking setbacks Sections of no separation between bike lane and sidewalk at the same grade. 	<ul style="list-style-type: none"> Reduces crossing distance on east side with concrete curb extensions at majority of intersections Improves visibility at crossings by increasing parking setbacks 	<ul style="list-style-type: none"> Reduces crossing distance on both sides of the street with concrete curb extension and paint and delineators Improves visibility at crossings by increasing parking setbacks Increases comfort by adding new wider sidewalk on west side 	<ul style="list-style-type: none"> Reduces crossing distance on east side with concrete curb extension at 8th Improves visibility at crossings by narrowing crossing and increasing parking setbacks Pedestrians have to cross two-way bicycle traffic 	<ul style="list-style-type: none"> Reduces crossing distance on both sides of the street with concrete curb extension at majority of intersections Improves visibility at crossings by narrowing crossing Increases comfort by adding new wider sidewalk on west side
	Cycling Safety and Comfort	<ul style="list-style-type: none"> Provides uphill off-road separated bike lane; retains downhill shared lane Less separation between cyclists and pedestrians where sidewalk and mobility lane are adjacent Increases visibility of uphill cyclists due to parking removal near intersections Improves clarity of road design by raising bike lane to boulevard height 	<ul style="list-style-type: none"> Provides uphill off-road separated bike lane, and downhill on-road separated bike lane Increases visibility of uphill cyclists due to parking removal near intersections 	<ul style="list-style-type: none"> Provides uphill on-road separated bike lane and downhill off-road separated bike lane Downhill bike lane has some jogs in it which might be less comfortable for some cyclists Increases visibility of uphill cyclists due to parking removal near intersections 	<ul style="list-style-type: none"> Provides bi-directional off-road separated bike lane on east side; Bi-directional bicycle traffic on two-way St can introduce safety challenges as road users may not expect cyclists on opposite side of roadway and is less desirable on steep hills due to increased speed Challenging transition for SB cyclists at E 9th St; many cyclists may end up continuing to use the vehicle lanes instead of making this transition; while some may not make the two-stage turn and will cross diagonally, potentially introducing safety issues 	<ul style="list-style-type: none"> Provides uphill and downhill off-road separated bike lanes Downhill bike lane has some jogs in it which might be less comfortable for some cyclists
	Driving Safety and Comfort	<ul style="list-style-type: none"> Drive aisle does not accommodate two-way passing north of laneway Improves visibility at laneways and intersections Speed reduction benefits from additional speed humps 	<ul style="list-style-type: none"> Drive aisle does not accommodate two-way passing north of laneway Improves visibility at laneways and intersections Speed reduction benefits from additional speed humps 	<ul style="list-style-type: none"> Drive aisle does not accommodate two-way passing north of laneway Improves visibility at laneways and intersections Speed reduction benefits from additional speed humps 	<ul style="list-style-type: none"> Drive aisle does not accommodate two-way passing north of laneway Improves visibility at laneways and intersections Speed reduction benefits from additional speed humps 	<ul style="list-style-type: none"> Drive aisle does not accommodate two-way passing north of laneway Improves visibility at laneways and intersections Speed reduction benefits from additional speed humps
Parking and Loading	<ul style="list-style-type: none"> Removes parking minimally on east side to improve visibility at intersections 	<ul style="list-style-type: none"> Removes some parking along west side to improve sightlines for southbound cyclists approaching intersections and laneways 	<ul style="list-style-type: none"> Removes some parking along west side and part of east side; Reduces curbside access directly in front of heritage residences and businesses on west side of St Andrews 	<ul style="list-style-type: none"> Removes parking minimally on east side to improve visibility at intersections 	<ul style="list-style-type: none"> Removes parking minimally on east side to improve visibility at intersections 	
Cost	<ul style="list-style-type: none"> High cost with rebuild on the east side Approx: \$1,000,000 - \$1,250,000 	<ul style="list-style-type: none"> High cost with rebuild on the east side Approx: \$1,000,000 - \$1,250,000 	<ul style="list-style-type: none"> High cost with rebuild on the west side Approx: \$1,000,000 - \$1,250,000 	<ul style="list-style-type: none"> High cost with rebuild on the east side Approx: \$1,000,000 - \$1,250,000 	<ul style="list-style-type: none"> Highest cost with rebuild on both sides Approx: \$1,500,000 - \$2,000,000 	
Network Impacts	<ul style="list-style-type: none"> Provides a direct connection between existing bike facilities north of 9th St and on E Keith Rd 	<ul style="list-style-type: none"> Provides a direct connection between existing bike facilities north of 9th St and on E Keith Rd 	<ul style="list-style-type: none"> Provides a direct connection between existing bike facilities north of 9th St and on E Keith Rd 	<ul style="list-style-type: none"> Provides a direct connection between existing northbound bike lane north of 9th St and shared lane south of Keith Rd for uphill direction only. Downhill cyclists wanting to use the protected bike lane must cross St Andrews at E 9th St, crossing back to the west side at E Keith to continue southbound; this introduces potential conflict at intersections for less confident riders Confident downhill cyclists prioritizing efficiency may choose to continue using the roadway 	<ul style="list-style-type: none"> Provides a direct connection between existing bike facilities north of 9th St and on E Keith Rd 	
Encroachment Impacts	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Removes small trees and boulevard landscaping. Relocates sidewalk within close proximity of property line 	<ul style="list-style-type: none"> Relocates residential fence to property line, within close proximity to residential entrances. Removes small trees and boulevard landscaping 	<ul style="list-style-type: none"> Removes small trees and boulevard landscaping. Relocates sidewalk within close proximity of property line 	<ul style="list-style-type: none"> Relocates residential fence to property line, within close proximity to residential entrances. Relocates sidewalk within close proximity of property line. Removes small trees and boulevard landscaping 	

Attachment 3 - Design Comparison Table Scoring

Criteria		Weighting	NEIGHBOURHOOD BIKE ROUTE - SHARED TRAVEL LANE						
			Concept 1A Diverter Across NE to SW at E 8th St, Dedicated Travel Lanes in Both Directions Shared by Drivers and Cyclists	Concept 1A+ Diverter Across NE to SW at E 8th St, NB On-road Separated Bike Lane, SB Cyclists Share with Drivers	Concept 1B Diverter Across NW to SE at E 8th St, Dedicated Travel Lanes in Both Directions Shared by Drivers and Cyclists	Concept 1B+ Diverter Across NW to SE at E 8th St, NB On-road Separated Bike Lane, SB Cyclists Share with Drivers	Concept 1C Access Restriction at E Keith Rd, Dedicated Travel Lanes in Both Directions Shared by Drivers and Cyclists	Concept 1C+ Access Restriction at E Keith Rd, NB On-road Separated Bike Lane Maintained, SB Cyclists Share with Drivers	
Safety and Comfort	Pedestrian Safety and Comfort	20	2	2	2	2	2	3	
	Cycling Safety and Comfort	20	0	2	0	2	0	2	
	Driving Safety and Comfort	10	3	1	3	1	3	1	
	Parking and Loading	15	1	-1	1	-1	1	-1	
	Cost	15	-1	-1	-1	-1	-1	-1	
	Network Impacts	10	-4	-4	-4	-4	-4	-4	
	Encroachment Impacts	10	0	0	0	0	0	0	
Cumulative Score		100	30	20	30	20	30	40	



Attachment 3 - Design Comparison Table Scoring

Criteria		Weighting	ON-ROAD SEPARATED BIKE LANE				
			Concept 2 Dedicated Travel Lanes in Both Directions, NB On-road Separated, SB Cyclists Share with Drivers	Concept 3 NB On-road Separated Bike Lane, SB Cyclists Share with Drivers	Concept 4 NB and SB On-road Separated Bike Lanes	Concept 5A St Georges Ave SB On-road Separated Bike Lane, St Andrews NB On-road Separated Bike Lane	Concept 5B Ridgeway Ave SB On-road Separated Bike Lane, St Andrews NB On-road Separated Bike Lane
Safety and Comfort	Pedestrian Safety and Comfort	20	1	2	1	2	2
	Cycling Safety and Comfort	20	2	1	4	4	4
	Driving Safety and Comfort	10	2	2	1	2	2
Parking and Loading		15	-4	-1	-4	-4	-4
Cost		15	0	0	-1	-2	-1
Network Impacts		10	0	0	0	-4	-3
Encroachment Impacts		10	0	0	0	0	0
Cumulative Score		100	20	65	35	10	35



Attachment 3 - Design Comparison Table Scoring

Criteria		Weighting	OFF-ROAD SEPARATED BIKE LANE				
			Concept 6 NB Off-road Separated Bike Lane, SB Cyclists Share with Drivers	Concept 7 NB Off-road Separated Bike Lane, SB On-road Separated Bike Lane	Concept 8 NB On-road Separated Bike Lane, SB Off-road Separated Bike Lane	Concept 9 Bi-directional Off-road Separated Bike Lane on East Side	Concept 10 NB and SB Off-road Separated Bike Lanes
Safety and Comfort	Pedestrian Safety and Comfort	20	2	3	3	3	4
	Cycling Safety and Comfort	20	2	4	4	-1	4
	Driving Safety and Comfort	10	1	1	1	1	1
Parking and Loading		15	-1	-2	-3	-1	-1
Cost		15	-3	-3	-3	-3	-4
Network Impacts		10	0	0	0	-1	0
Encroachment Impacts		10	0	-2	-2	-2	-4
Cumulative Score		100	30	55	40	-40	55



