

MEMORANDUM

To: Simon Davis - Allnorth

Copy: Steven Gubbels – City of West Kelowna
Rob Hillis – City of West Kelowna

From: Tom Baumgartner, MSc, P.Eng.
Stephen Sargeant, MEng, P.Eng.

Our File #: 2665.B01

Project: Glenrosa Road Improvements

Date: June 11, 2019

RE: Transportation Review

Watt Consulting Group was retained by Allnorth to provide transportation engineering services for the Glenrosa Road Improvements design project with the City of West Kelowna. This memorandum provides a summary of the analysis and key design features. For discussion purposes, Glenrosa Road is considered to run north-south.

The study area is shown in **Figure 1** and includes two roadway segments:

- 1) Glenrosa Road from Glen Abbey Place / Morningside Drive to McGinnis Road for corridor improvements including cross-section, alignment, and drainage; and
- 2) McIver Road from Glenrosa Road to McTaggart Road for drainage and sidewalk.

The design provides opportunity to address key roadway issues including:

- Establishing urban arterial cross-section with pedestrian and cycling facilities along Glenrosa Road;
- Improving sight lines particularly at pedestrian crosswalks and intersections;
- Providing sidewalk along McIver Road; and
- Redesign / Realigning Glenrosa Road / McIver Road Intersection.

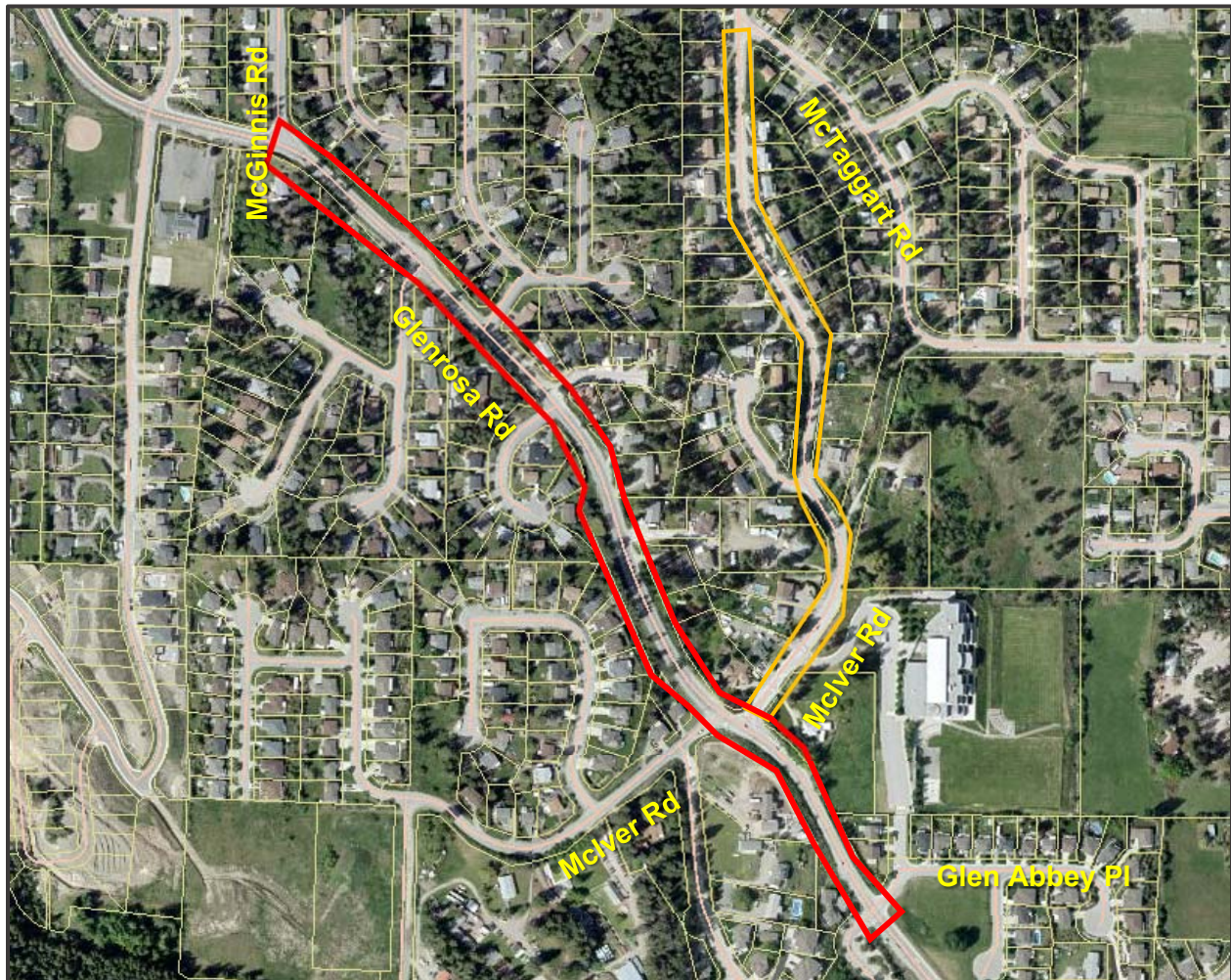


Figure 1: Study Area

1.0 ROADWAY CHARACTERISTICS

Glenrosa Road is classified as an arterial roadway. Sections between Morningside Drive / Glen Abbey Place to McGinnis Road vary in cross-section for the presence of ditch and shoulder versus curb and gutter. There are vertical and horizontal curves throughout the study area with most of the intersections having slight to moderate skews. The grade of Glenrosa Road varies with an average of 6% grade in the study area.

There are superelevated horizontal curves along Glenrosa Road. Superelevation is typically not accommodated in urban roadways and can be removed if there are no major impacts to adjoining roadways. Removal of superelevation can improve intersection transitions (when located in a superelevated curve) and lower operating speeds.

2.0 ROAD SAFETY

2.1 Collision History

Table 1 shows the intersection collisions in the study corridor including McIver Road and McTaggart Road for five years from 2014 to 2018. There were no pedestrian- or bicycle-related collisions in the dataset. The following trends on collisions were identified from the data:

- 40% involved wildlife;
- 30% were during slippery road surface conditions;
- 40% were single vehicle collisions;
- 30% were rear end collisions; and
- 20% were side impact collisions (turning from intersections).

Table 1: 2014-2018 ICBC Intersection Collision Statistics

INTERSECTION	Collisions			Collision Frequency (Collisions / Year)	% Casualty
	PDO	Casualty	Total		
Glenrosa Rd / Glen Abbey Pl / Morningside Dr	5	3	8	1.60	38%
Glenrosa Rd / McIver Rd	4	0	4	0.80	0%
Glenrosa Rd / Parkhurst Rd	0	1	1	0.20	100%
Glenrosa Rd / Country Pines Gate	1	0	1	0.20	0%
Glenrosa Rd / McGinnis Rd	3	1	4	0.80	25%
McIver Rd / McTaggart Rd	2	0	2	0.40	0%

2.2 Observations

The following observations were made during traffic counts and site visits:

- Northbound right-turn movements from Glenrosa Road to McGinnis Road happen at higher speeds. This is due to the large curb radius and intersection skew.
- Several near misses were noted for eastbound left-turning vehicles from McIver Road to southbound Glenrosa Road. Sight lines are constrained and Glenrosa Road operating speeds were observed to be high.
- A few compliance issues with vehicles yielding to pedestrians at the crosswalk on Glenrosa Road at McIver Road were observed. Sight lines are limited for pedestrians to the roadway and drivers to the pedestrian crossing.

2.3 Sight Lines

The curvilinear alignment of Glenrosa Road in combination with the grades in the area creates significant barriers for pedestrian and driver sight lines. The large corner radii used at some intersections also creates scenarios where the sidewalk crossing is set back from Glenrosa Road which requires the stop bar of the side street to be located further back than if it the intersection used smaller radii. The location of the stop bar is directly related to the available sight lines.

The required stopping sight distance for a posted speed of 50 kilometres per hour is 65 metres. This adjusts to 70 metres for a 6 percent downgrade and 59 metres for a 6 percent upgrade.

More discussions on sight lines are provided in **Section 3.0**.

3.0 INTERSECTION REVIEW

Weekday AM and PM peak hour traffic counts were collected at the Glenrosa Road intersections with Glen Abbey Place / Morningside Drive, McIver Road, and McGinnis Road on May 15 and May 16, 2019. Count data indicates that left-turn lanes are not warranted at these locations. Intersection movements operate at level of service (LOS) D or better. The LOS D occurs during the AM peak hour at the east leg of McIver Road and at Glen Abbey Road for left-turning traffic waiting for a gap in Glenrosa Road traffic. Clear sight lines are critical to ensure drivers can judge the gap in approaching traffic prior to joining the southbound Glenrosa Road traffic.

3.1 Glen Abbey Place / Morningside Drive Intersection

The Glen Abbey Place / Morningside Drive intersection with Glenrosa Road has good turning sight lines from the east and west approaches. South of the intersection, the posted speed transitions from 60 kilometres per hour to 50 kilometres per hour northbound (see **Figure 2**). Higher speeds in advance can lead to drivers increasing speed prior to the speed change. It is recommended that the posted speed on Glenrosa Road between Glen Abbey Place / Morningside Drive and Webber Road be posted at 50 kilometres per hour. This could be implemented with relocating the southbound speed radar sign to the northbound approach to Glen Abbey Place / Morningside Drive. This will help to manage speeds approaching the crosswalk at Glen Abbey Place / Morningside Drive.



Figure 2: 50 km/h Approaching Glen Abbey PI (Left) & Speed Radar Sign (Right)

3.2 McIver Road Intersection

The McIver Road intersection with Glenrosa Road has a negative offset where there is insufficient space between the two offset intersection legs to store opposing left-turning vehicles. The offset is about 28 metres. The TAC Geometric Design Guide recommends offsets be less than 1.5 metres and more than 45 metres. The combination of the negative offset and horizontal curve creates challenges with sight lines for mainline traffic, side street traffic, and crossing pedestrians.



Figure 3: McIver Road Negative Offset Intersection Alignment with Glenrosa Road

The east leg of McIver Road has a large corner radius for the northbound right-turn movement (Glenrosa Road to McIver Road) shown in **Figure 4**. This facilitates for higher speed turns and forces the stop bar on the McIver Road approach to be located approximately seven (7) meters away from the edge of the traveled way on Glenrosa Road. The current sight distance for a vehicle properly stopped at the stop bar is only ~40 meters to the north. Vegetation (a hedge and large tree) is the cause of the obstruction (see **Figure 5**). To the south, the sight distance is ~125 meters. As a result of the obstructions, drivers must stop past the stop bar to achieve adequate sight lines.



Figure 4: Northbound Glenrosa Road Large Radius Corner at McIver Road



Figure 5: Constrained Sightline to the North from East Leg of McIver Road

On the west leg of McIver Road, the sight distance to the south is about 60 meters with the hillside on the west side of Glenrosa Road causing the obstruction (see **Figure 6**). To the north, the sight distance is greater than 200 meters.



Figure 6: Constrained Sightline to the South from West Leg McIver Road

The marked pedestrian crosswalk on Glenrosa Road between the two McIver intersections has rapid rectangular flashing beacons which can be seen by drivers approximately 100 meters (northbound) and 135 meters (southbound) from the crossing. The sign on the west side is incorrectly facing away from the roadway. This can be fixed by swapping back-to-back signs on the pole.

Potential remedies for the McIver Road intersection with Glenrosa Road are outlined below. Options need to investigate design further to establish functionality of realigning roadways.

Realigning the West Leg of McIver Road to the South

This can be accomplished by shifting the road alignment to the south (see sketch in **Figure 7**). This largely resolves some crossing conflicts, but not sightline constraints without resloping the southwest property and clearing on the northeast property.

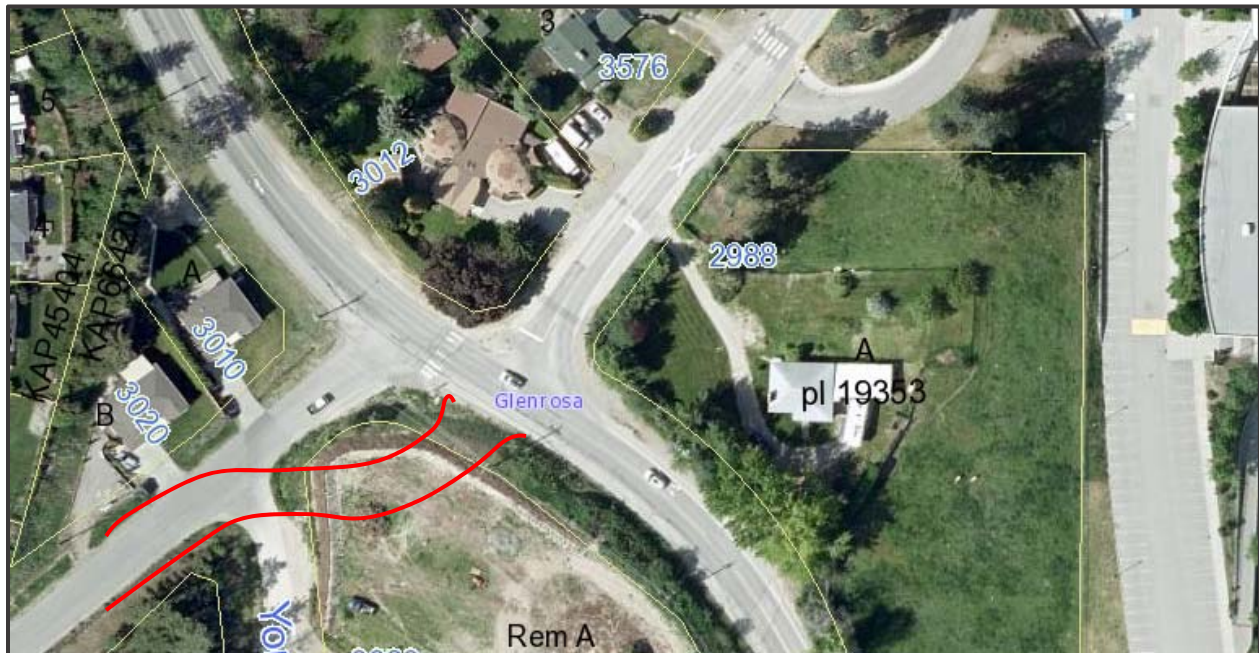


Figure 7: Sketch of Mclver Road West Leg Realignment

- Advantages:
 - Elimination of the negative offset T intersections of Mclver Road thereby removing existing conflicting vehicle movements between offset intersection legs.
 - Reduction of the southeast corner radius to calm traffic entering the east leg of Mclver Road.
- Disadvantages:
 - Would require the purchase of part or all of the southwest property.
 - The sight distance to the south would not be resolved without purchasing the entire property and then cutting back the slope significantly.
 - Creates alignment challenge with Yorkton Road.

Realigning Glenrosa Road and the East Leg of Mclver Road to the North

Realignment of Glenrosa Road and the east leg of Mclver Road can increase the horizontal radii through the intersection thus improving sight distances, extend the west leg of Mclver Road to improve sight distances to the south, and align the east leg of Mclver across from the west leg. A sketch is shown in **Figure 8**.



Figure 8: Sketch of Glenrosa Road and McIver Road East Leg Realignment

- Advantages:
 - Elimination of the negative offset T intersections.
 - Reduction of the southeast corner radius.
 - Improvement to the sight distances on the east leg.
 - Opportunity to realign Glenrosa Road to the east thereby improving the alignment south of McIver Road.
- Disadvantages:
 - Purchase of the north east property.

Installing a Roundabout at McIver Road

A roundabout has been discussed in the past as an alternative to address the skewed road approaches and horizontal alignment constraints. The placement of the roundabout would still require minor realignment of roadway approaches and property acquisition.

- Advantages:
 - Improved access to/from McIver Road at peak periods.
 - Elimination of the negative offset T intersections.
 - Reduced speeds on Glenrosa Road.
 - Safer pedestrian crossings with staged movements and lower speed traffic.
- Disadvantages:
 - Roundabout is not warranted for traffic operations and has increased operational costs (lower than a traffic signal).

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- Would require purchase of one or more properties (likely the northeast corner and potentially the southwest corner).
 - Would require re-grading of a significant portion of Glenrosa Road to establish acceptable grades approaching and through the roundabout. This will be substantially difficult as the elevation of the intersection would need to be raised and grades would need to be chased beyond the roundabout potentially creating higher grades on Glenrosa Road approaching the roundabout.

Install a Traffic Signal at Mclver Road

Apart from the realignment options, installation of a traffic signal could be used for mitigation, but the device is unwarranted and may create more challenges.

- Advantages:
 - Safer pedestrian crossings.
 - Guaranteed access for Mclver Road traffic onto Glenrosa Road during peak periods.
- Disadvantages:
 - Traffic signal not warranted which will decrease safety particularly with an increase in rear end collisions.
 - Would require special timings to deal with the offset T configuration.
 - Will not resolve sight distance issues without additional geometric improvements and sight distance to the signals.
 - Will require additional pre-warning system (i.e. advance warning flashers) due to inadequate sight distances.

Install Median on Glenrosa Road through Mclver Road Intersection

The installation of a center island on Glenrosa Road with a refuge for pedestrians would restrict vehicular left-turns to and from Mclver Road. An example is shown in **Figure 9**.



Figure 9: Raised Median through Intersection

- Advantages:
 - Elimination of the conflicting left-turn movements associated with the negative offset T intersections.
 - Elimination of the need for minimum sight distances for left turns at the intersections.
- Disadvantages:
 - Elimination of all left turns would relocate those movements to alternate routes within Glenrosa Road neighbourhood streets and increase frustration to drivers.
 - Eliminates the shortest egress from the middle school to Glenrosa Road,
 - Would require additional right-of-way to construct the median.

Closure of the West Leg of Mclver Road

This would reroute the traffic associated with ~77 existing homes, ~30 future homes and the Morningstar Bible Camp from Mclver Road to Yorkton Road and Morningside Drive (see **Figure 10**).

- Advantages:
 - Would not require the purchase of any properties.
 - Elimination of the negative offset T intersections.
 - Would maintain the pedestrian and cycling connections.
- Disadvantages:
 - Would permanently reroute approximately 1000 vehicles per day
 - Would not resolve sight distance at the east leg of Mclver Road or pedestrian crossings without additional construction.

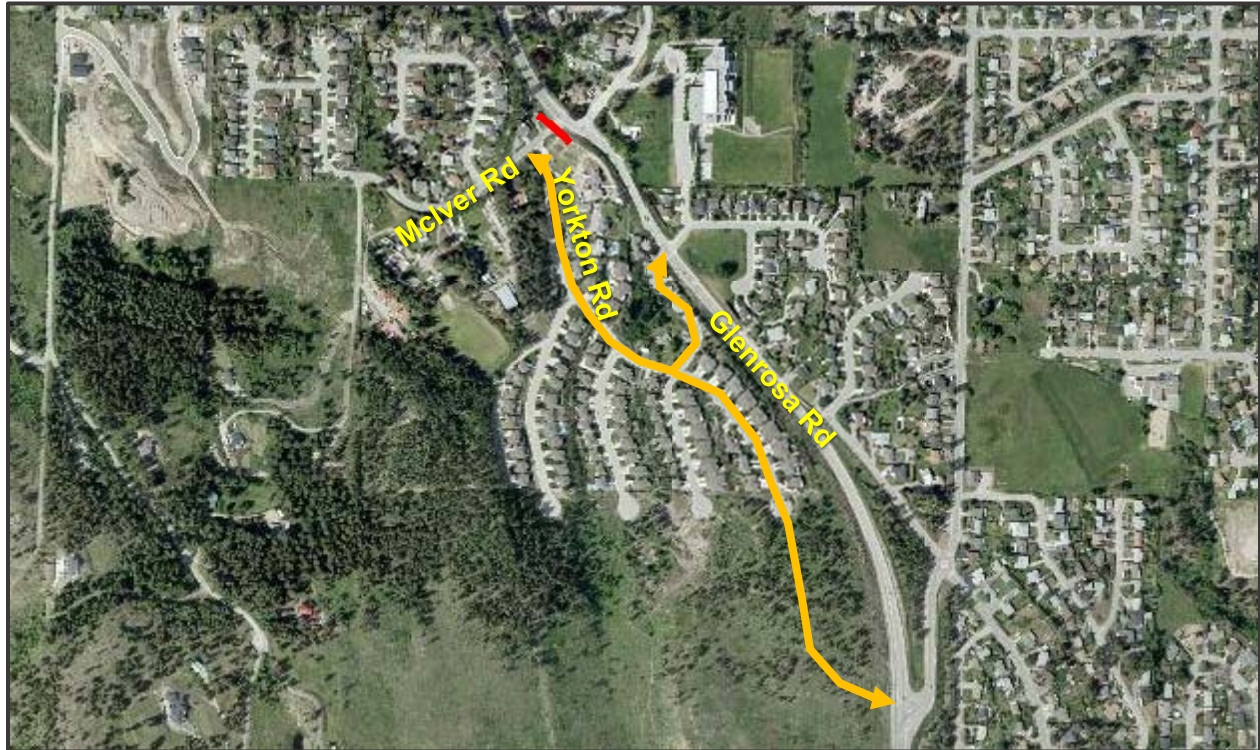


Figure 10: Reassignment of Traffic Movements with Closure of West McIver Road

Based upon all of the considered options, we recommend realigning the east leg of McIver Road to the north with the realignment of Glenrosa Road.

3.3 McGinnis Road

The intersection of McGinnis Road and Glenrosa Road features vertical, horizontal curves, and superelevation through the junction (see **Figure 11**). The large corner radius of the northbound right turn (Glenrosa Rd to McGinnis Rd) pushes the stop bar farther north than a tighter corner radius would. The current sight distance from the stop bar on McGinnis is approximately 65 meters to the north and greater than 200 meters to the south. The obstruction to the south is vegetation.

The intersection should be urbanized with curb and gutter, provision of sidewalks and a twin parallel line crosswalk at McGinnis Road. The design should use a reduced radius on the southeast corner to shorten the pedestrian crossing distance, reduce speeds for turning vehicles, and enable the stop bar to be located closer to the traveled way of Glenrosa Road for better sight lines.



Figure 11: Northbound Glenrosa Road Approach to McGinnis Road

4.0 GEOMETRIC DESIGN PARAMETERS

As Glenrosa Road does not meet the existing arterial road standards (from the Works and Services Bylaw No. 0249) and is constrained by topography and adjacent development, it is challenging to develop the roadway corridor to the arterial alignment. The arterial road alignment is set for a design speed of 60 to 70 kilometres per hour. It is considered that the posted speeds will likely not exceed 50 kilometres per hour in this segment and road safety principles recommend reducing speeds to reduce collision severity. As such, it is recommended that the following 50km/h design speed and collector road standards be applied to Glenrosa Road:

- 115-metre minimum centerline horizontal radius;
- Minimum 9.0-metre curb radius at intersections; and
- Consideration for minimum $K = 8$ sag curves and $K = 10$ crest curves with review of potentially constrained sight lines.

5.0 PEDESTRIAN ACCOMMODATION

The section of Glenrosa Road between McIver Road and Morningside Drive has a steep and high slope on the west side of the road. The pedestrian demand for that side of Glenrosa Road is low due to the lack of destinations at the same elevation as the roadway. Therefore, the cross-section through this segment could omit the sidewalk from the west side (if needed) in conjunction with improving the pedestrian crossings at McIver Road and Morningside Drive.

Sidewalk extends along the west side of Glenrosa Road north of the Webber Road roundabout, but does not link to Morningside Drive. There is also a southbound bus stop on that would benefit its users with a sidewalk. Consideration should be made to adding this sidewalk. The sidewalk on the east side of Glenrosa Road south of Glen Abbey Road departs Glenrosa Road to a pathway connecting to Lower Glenrosa Road and Walnut Glen Drive.

5.1 Pedestrian Crossings

Pedestrian crosswalk warrants were reviewed for the Glenrosa Road crossings at McIver Road and Glen Abbey Place / Morningside Drive according to the TAC Pedestrian Crossing Guide 3rd Ed. Traffic count data indicated that:

- McIver Road crossing had 34 pedestrian crossings in the school AM peak and 33 in the school PM peak hours of activity.
- Glen Abbey Place / Morningside Drive crossing had 11 pedestrian crossings in the school AM peak and 45 in the school PM peak hours of activity.

With traffic volumes in the order of 6,500 to 7,000 vehicles per day it was determined that both crosswalks are warranted for general signage and zebra markings. The RRFB should remain at the McIver Road crosswalk as removal may reduce compliance with the crosswalk.

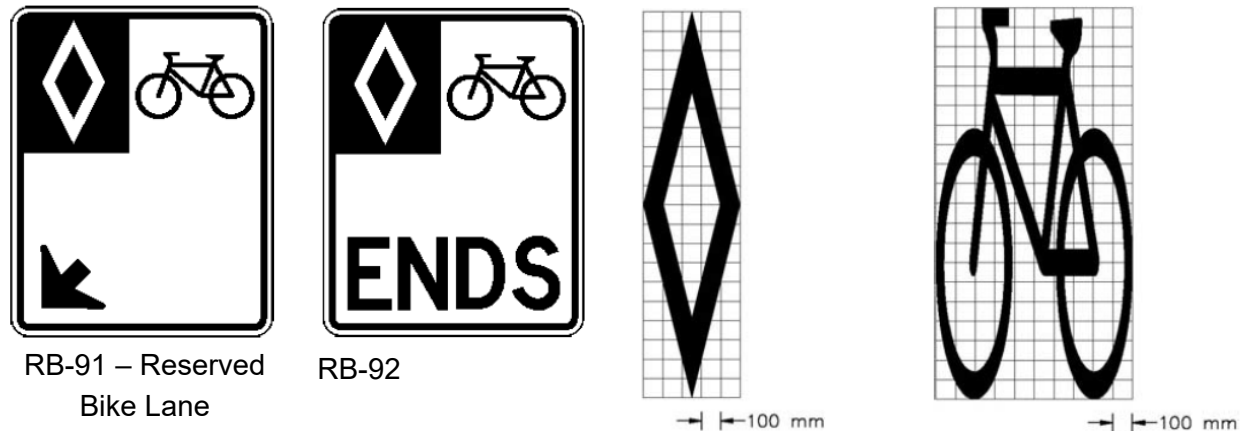
An RRFB may be considered at the Glen Abbey Place / Morningside Drive crosswalk in consideration of operating speeds on the approach to the crosswalk. It is recommended that the speed reader board be relocated to the northbound approach to the intersection first.

6.0 CYCLING ACCOMMODATION

The West Kelowna Pedestrian and Bicycle Infrastructure Plan anticipated the accommodation of bicycle lanes along Glenrosa Road in accordance with standard cross-sections for an urban arterial roadway. This cross-section designates a 1.8-metre bike lane from the fog/bike lane line to the lip of gutter. It is recommended that a 0.3-metre buffer line be painted within the 1.8-metre bike lane. This buffer line marking reinforces the conspicuity to the bike lane. The buffered bike lane is designed for more confident cyclists rather than encouraging an all ages and abilities design that may be better suited to a lower speed corridor within the neighbourhood.

Grades remain a challenge on Glenrosa Road. As such, a 1.95-metre buffered bike lane may be provided where grades are equal to or exceed 8.0 percent and where reasonable to construct.

Bike lanes should be signed with the TAC MUTCD RB-91 Reserved Bike Lane sign. This treatment will be consistent with the established features of the Glenrosa Road / Webber Road roundabout to the south. Signage should be repeated following intersections at 15 metres past the curb radius and at 200-metre intervals. Pavement markings for the reserved lane diamond and bike stencil should be placed approximately 10m downstream from each intersection and/or crosswalk.



7.0 TRANSIT ACCOMMODATION

There are four (4) bus stops in the project area as follows:





- 103640 – NB Glenrosa Rd at Parkhurst Rd
- 103639 – SB Glenrosa Rd at McIver Rd W
- 103637 – SB Glenrosa Rd at Glen Abbey Rd
- 103634 – SB McIver Rd at Glenrosa Rd

Improvements for bus stops generally include accessible boarding platforms, signs and sleeves, tactile pads, and waste receptacles. Benches and shelters are typically added when warranted, requests from public, and average boardings in excess of 10 per weekday. Benches may also be warranted by the presence of lawn furniture added by the public. Lighting for transit stops is important for user safety and security and street lighting will be added with the roadway upgrade.

BC Transit boarding and alighting data was reviewed from the Fall 2018 Weekday Average Bus Activity dataset. This data summarizes the average weekday boardings and alightings at bus stops within the Kelowna Transit System. The following table provides a summary of bus activity and site characteristics to justify improvements. All stops shall include new:

- Accessible boarding platforms;
- Bus stop signs and sleeves;
- Tactile pads; and
- Waste receptacles.

Table 2: Summary of Boardings/Alightings and Additional Amenities

Stop ID	Location	Average Weekday		Stop Photo	Additional Amenities to Provide
		Boarding	Alighting		
103640	NB Glenrosa @ Parkhurst	0.9	5.4		Add bench in consideration of lawn furniture
103639	SB Glenrosa @ Mclver	5.4	0.9		Add bench in consideration of lawn furniture
103637	SB Glenrosa @ Glen Abbey	18.4	3.9		Relocate & Reuse Shelter
103634	SB Mclver @ Glenrosa	7.4	30.6		Add bench in consideration of school zone

Bus activity is insufficient to warrant a bus pullout on Glenrosa Road. The topography may be too challenging to achieve additional space if desired.

8.0 SUMMARY OF RECOMMENDATIONS

The following summary of recommendations for the design is provided:

- Reduce the 60 kilometre per hour speed segment on Glenrosa Road between Webber Road and Glen Abbey Place / Morningside Drive. Relocate speed reader board to this northbound approach;
- McIver Road / Glenrosa Road intersection: Realign McIver Road to the north and Glenrosa Road to the east to enhance sight lines, tighten curb radii, and resolve turning conflicts;
- Tighten curb radii at McGinnis Road / Glenrosa Road and other side street intersections with urbanization.
- Use geometric design parameters for horizontal and vertical curves consistent with 50 kilometre per hour design speed of City collector roadways. Remove superelevation through urbanized curves where possible.
- Establish buffered 1.8-metre bike lanes along Glenrosa Road. Consider 1.95-metre buffered bike lane when grades are equal to or exceed 8.0 percent.
- Include transit stop improvements as outlined in report.

Please contact us if you have any questions at 778-313-1014. Thank you.

Sincerely,

Watt Consulting Group

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