Traffic Calming Study

Town of Oliver

November 2018

Project No. 306-1761

ENGINEERING ■ PLANNING ■ URBAN DESIGN ■ LAND SURVEYING

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List of Acronyms

TRUE	TRUE Consulting
TAC	Transportation Association of Canada
CITE	Canadian Institute of Transportation Engineers

Units of Measure

ft	feet
km	kilometre
m	metre
mg/L	milligrams per Litre
mm	millimetre
MoTI	Ministry of Transportation

Referenced Reports

City of Toronto. (2016). *Traffic Calming Guide for Toronto-Appendix 9.* City of Toronto.

Institute of Transportation Engineers. (1999). *Traffic Calming: State of Practice.* Institute of Transportation Engineers.

Transportation Association of Canada. (2018). *Canadian Guide to Traffic Calming Second Edition.* TAC.

1.0 Introduction

To continue to address road safety and maintain efficient road networks for all users, the Town of Oliver has identified corridors within the Town to target implementation of traffic calming measures. The purpose of this report is to provide an overview of the identified locations and assess traffic calming measures that may be applied. This report integrates impact to the community and estimated implementation costs. The Town's overall goal is to achieve an integrated and attractive streetscape through design features which accommodate pedestrian, cyclist and motor vehicle needs.

2.0 Background

Traffic calming is often associated with physical features or geometry modifications within the roadway. This includes speed humps, road narrowing, chicanes, traffic circles, raised intersections, bump outs, raised crosswalks, split medians and textured pavement. Implementation of these measures is intended to reduce vehicle traffic speed and improve pedestrian and cyclist safety.

Traffic calming solutions should be generated as a community wide strategy, allowing for homogenous integration and assurance that volume and speed concerns are not transferred to adjacent streets. Implementation of these measures will help alleviate safety issues related to high traffic volumes and speeds on roads that are not designed nor intended to handle these issues. It is important to review different traffic calming measures at each identified location to determine the most suitable, site specific option.

The Transportation Association of Canada (TAC) and Canadian Institute of Transportation Engineers (CITE) published the Canadian Guide to Neighborhood Traffic Calming in 1998. This publication provides guidelines for planning, design and implementation of traffic calming measures, with a focus on local and collector streets. This report was updated in 2018. The new publication further defines traffic calming, the planning and implementation process, physical and non-physical measures, design considerations and cost analysis.

This information has provided guidance in selecting traffic calming measure recommendations for each location. The identified locations presented herein were generated from observations by the Town's Public Works department.

3.0 Types of Traffic Calming

Traffic calming can be categorized as vertical road deflections, horizontal road deflections, visual/passive measures, and surface treatments. Vertical deflections include raised intersections, speed humps and raised crosswalks. Horizontal deflections include curb extensions, chicanes, traffic circles, road narrowing, and split medians. Visual/passive measures include radar speed signs and message boards. Surface treatments can include transverse rumble strips, textured crosswalks and textured pavement.

3.1 Vertical Measures

Vertical measures use forces of vertical acceleration to control vehicle speed. Table 3-1 provides a summary of vertical traffic calming measures. Associated photographs for each design option are presented following Table 3-1.

TABLE 3-1: VERTICAL TRAFFIC CALMING MEASURES

Measure	Description	Advantages	Disadvantages	Applicability	Cost (CAD)
Raised Intersections	Intersection constructed at a higher elevation than the adjacent roadway	▪ Identifies pedestrian area ▪ Speed reduction ▪ Pedestrian-vehicle conflict reduction	▪ Impact on emergency services ▪ Cost ▪ Hazard to snow plows.	▪ Local/Collector	$20,000-$75,000 per intersection
Speed Humps	3" to 4" parabolic shaped raised section in roadway, designed to reduce vehicle traffic speed	▪ Speed reduction and safety ▪ Road traffic reduction ▪ Minimal impact on snow clearing and cyclists	▪ Impact on emergency services ▪ Hazard to snow plows.	▪ Local/Collector	$1000-$10,000/ea.
Speed Cushion	Similar to speed hump but does not cover entire road. Width designed to allow large vehicles (e.g. bus, emergency vehicle) to pass without difficulty.	▪ Reduced vehicle speed and traffic volumes. ▪ Traffic noise may be reduced due to slower speeds.	▪ May impact emergency services. ▪ Maintenance challenges during road maintenance. ▪ Hazard to snow plows.	▪ Local/Collector	$300/l.m.
Raised Crosswalks	Crosswalk raised to sidewalk level	▪ Speed reduction ▪ Increased pedestrian visibility	▪ Impact on emergency services ▪ Hazard to snow plows.	▪ Local/Collector	$2,000 - $10,000/ea.
Rumble Strips	Road grading that creates a noise and vibration when a vehicle passes over	▪ Cost ▪ Increased driver awareness ▪ Reduced fatalities with cyclists in road shoulder	▪ Noise and vibration disturbance to vehicles.	▪ Local/Collector ▪ Rural Arterial	$500-$2,000 per location
Refuge Islands & Medians	Crossing median for pedestrians to wait before completing the road crossing	▪ Pedestrian safety ▪ Vehicle speed reduction	▪ Cost ▪ Impact on emergency services	▪ Local/Collector ▪ Rural Arterial	$3,500-$40,000/ea.
Ground Mounted System	Flexible bollards and upright candlestick delineators	▪ Can indicate local laws in uncontrolled intersections ▪ Vehicle speed reduction ▪ Reduced accidents with cyclists	▪ Damage from vehicles	▪ Local/Collector ▪ Rural Arterial	$400/ea.
Gateways	Combination design that identifies transition transitional zones (e.g. rural/urban)	▪ May increase speed limit compliance ▪ Creates easily identifiable zone	▪ Road markings require maintenance ▪ Not as effective for frequent commuters	▪ Local/Collector ▪ Rural Arterial ▪ Urban Arterial	$2,000-$10,000/ea.

FIGURE 1: RAISED INTERSECTION (SOURCE: GREATER CITY OF PROVIDENCE)

FIGURE 2: SPEED HUMP (SOURCE: CITY OF NORTH VANCOUVER)

FIGURE 3: SPEED CUSHION (SOURCE: BARCO PRODUCTS)

FIGURE 4: RAISED CROSSWALK (SOURCE: CITY OF PROVIDENCE)

FIGURE 5: TEXTURED CROSSWALK (SOURCE: STREETPAINT.COM)

FIGURE 6: REFUGE MEDIAN (SOURCE: ROSEHILL HIGHWAYS)

FIGURE 7: FLEXIBLE BOLLARD (SOURCE: GLOBAL INDUSTRIES AND TOWN OF MILTON)

FIGURE 8: GATEWAYS (SOURCE: STREETSBOLGNYC)

3.2 Horizontal Measures

Horizontal traffic calming measures use forces of lateral acceleration to discourage vehicle speeding. Presented below are traffic calming treatments which can be implemented for vehicle speed reduction.

TABLE 3-2: HORIZONTAL TRAFFIC CALMING MEASURES

Measure	Description	Advantages	Disadvantages	Applicability	Cost (CAD)
Curb Extensions and Radius Reduction	Horizontal intrusion into roadway, creating a narrow section	▪ Multiple design approaches ▪ Speed reduction for right turning vehicles ▪ Pedestrian visibility ▪ Visual appearance	▪ Bike land compatibility ▪ Reduced on-street parking ▪ Reduced vehicle turning radius	Local/Collector Rural Arterial	$10,000-$40,000 /ea.
Chicanes	Series of curb extensions that alternate between sides of the road, forming S-shaped curves	▪ Speed reduction ▪ Visual appearance when landscaped	▪ Challenge for cyclists ▪ Useful on medium volume roads	Local/Collector	Requires road to be rebuilt
Traffic Circles and Roundabouts	Raised islands, placed in intersections, requiring vehicle traffic to circulate around	▪ Speed reduction ▪ Reduce vehicle conflicts ▪ Visual appearance when landscaped	▪ Impact on emergency services ▪ Restricts large vehicle turning movements	Local/Collector Rural Arterial	$50,000-$400,000 /ea.
Road Narrowing	Reduced road width via installation of center islands, split medians, neckdowns, lateral shift, or a design that produces a constriction	▪ Speed reduction ▪ Visual appearance when landscaped ▪ Reduced vehicle speed and traffic volumes	▪ Challenge for cyclists ▪ Potential loss of on-street parking	Local/Collector Urban Arterial	$15,000-$50,000 /ea.
On Street Parking	Parking to reduce roadway width available for vehicle movements	▪ Speed reduction ▪ Increased parking capacity ▪ Traffic reduction	▪ Impacts to cyclists	Local/Collector Urban Arterial	$5,000-$10,000 per block
Directional Closure	Curb extension or vertical barrier extending to the centerline of the road, prohibiting one direction of traffic	▪ Speed reduction ▪ Reduced traffic volumes ▪ Primarily local traffic	▪ Restricts resident's access ▪ Effects on road maintenance and garbage collection routes	Local/Collector	$10,000-$100,000 /ea.
Diverter	Raised barrier placed diagonally that forces traffic to turn and prevents travel straight through an intersection	▪ Speed reduction ▪ Reduced traffic volumes ▪ Primarily local traffic ▪ Reduced conflicts	▪ Restricts access ▪ Effects on road maintenance / garbage collection routes	Local/Collector	$10,000-$100,000 /ea.
Intersection Channelization	Raised islands or bollards used to physically direct traffic	▪ Reduces conflict ▪ Speed reduction ▪ No effect on pedestrians and cyclists	▪ Restricts access ▪ May effect road maintenance / garbage collection routes	Local/Collector Urban Arterial	≥$3,000 /ea.

FIGURE 9: CURB EXTENSION (SOURCE: CITY OF VANCOUVER)

FIGURE 10: CHICANE (SOURCE: CITY OF EUGENE, OREGON)

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FIGURE 15: DIVERTER (SOURCE: STREETSBLOG CHICAGO)

FIGURE 16: INTERSECTION CHANNELIZATION (SOURCE: NYC.GOV)

3.3 Passive Measures and Surface Treatments

Passive traffic calming utilizes visual measures to regulate, warn, guide, inform and educate pedestrians, bicyclists and motorists. Techniques include: road narrowing (by use of painted lines, creating a psycho-perceptive sense of enclosure), increased bike lane width, on-road 'sign' pavement markings, speed feedback signs, message boards and community education.

Surface treatments employ changes to the surface material or texture to alert motorists. The noise and vibration cause an unpleasant sensation in vehicles, generally causing the motorist to reduce traffic speeds. Techniques include: textured crosswalks, textured pavement and transverse rumble strips.

TABLE 3-3: PASSIVE MEASURES AND SURFACE TREATMENTS

Measure	Description	Advantages	Disadvantages	Applicability	Cost (CAD)
Radar Speed Signs	Signs that display vehicle speed	▪ Speed reduction ▪ No impact to emergency services ▪ Easy to relocate ▪ Increases driver awareness	▪ Driver becomes desensitized ▪ Must be placed in clear sight distance ▪ More prone to vandalism	▪ Local/Collector ▪ Urban Arterial ▪ Rural Arterial	$2,000-$15,000/ea.
Message Boards	Displays rationale for reduced speed requirement	▪ Speed reduction ▪ Easy to relocate ▪ Multi-purpose	▪ Driver becomes desensitized ▪ Must be placed in clear sight distance ▪ More prone to vandalism	▪ Local/Collector ▪ Urban Arterial ▪ Rural Arterial	$12,000/ea.
Vehicle Activated Sign	Electronic signs that display a hazard when a speed threshold is exceeded.	▪ Vehicle speed reduction ▪ Reduced conflicts	▪ Requires a power source ▪ Regular maintenance ▪ Driver becomes desensitized	▪ Local/Collector ▪ Urban Arterial ▪ Rural Arterial	$5,000-$15,000/ea.
Textured Pavement and Crosswalks	Roadway surface that produces constant changes in vertical alignment	▪ Speed reduction ▪ Increased driver awareness	▪ Pedestrian and cyclist difficulties ▪ Slippery when wet	▪ Local/Collector	$50 -150/l.m.
Transverse Rumble Strips	Raised buttons, bars, or grooves closely spaced at regular intervals that create noise and vibration in vehicles	▪ Speed reduction ▪ Minimal maintenance ▪ No effect on access, parking, street sweeping	▪ Negative impact on cyclists ▪ Impacts on snow plowing ▪ Increased noise in immediate vicinity	▪ Local/Collector ▪ Rural Arterial	$50-150/l.m.
Permanent Striping	Road painting to narrow streets, increase bike lane widths or enhance crosswalk visibility	▪ Speed reduction ▪ Lower cost for implementation ▪ Driver sense of road narrowing/enclosure	▪ Driver becomes desensitized	▪ Local/Collector ▪ Rural Arterial	$1,000-$2,000/km.

Crosswalk Pavement Markings	Prompts drivers to stop further back, allowing pedestrians to see vehicles in other lanes	▪ Pedestrian safety ▪ Pedestrian visibility	▪ Driver becomes desensitized ▪ Must be maintained	▪ Local/Collector ▪ Urban Arterial ▪ Rural Arterial	$300-$600/l.m.
Road Diet	Reconfiguration of roadway so the effective width is reduced, allowing for bike lanes, turning lanes, bus lanes, etc.	▪ Speed reduction ▪ Conflict and collision density reduction	▪ Potential impact to emergency service vehicles	▪ Local/Collector ▪ Urban Arterial	$1,000-$5,000/ea.
Converging Chevrons	Pavement markings painted in V shape, pointing in the roadway direction of travel. Creates illusion that vehicle speed is increasing.	▪ Alerts driver to reduce speeds. ▪ No increase in noise. ▪ Cost effective strategy	▪ Regular maintenance required ▪ Less effective in winter months	▪ Local/Collector ▪ Urban Arterial ▪ Rural Arterial	$1,000-$2,000/km.
Dragon's Teeth	Series of triangular pavement markings that give the impression of road narrowing.	▪ Alerts drivers they are entering a rural community ▪ No increase in noise ▪ Cost effective strategy	▪ Regular maintenance required ▪ Less effective in winter months	▪ Local/Collector ▪ Urban Arterial ▪ Rural Arterial	$300-$2,000/ea.
Full Lane and Peripheral Transverse Bars	Create illusion that vehicle speed is increasing and alerts driver to reduce speeds	▪ Vehicle speed reduction ▪ No increase in noise ▪ Cost effective	▪ Regular maintenance required ▪ Less effective in winter months	▪ Local/Collector ▪ Urban Arterial ▪ Rural Arterial	$300-$2,000/ea.
On Road "Sign" Pavement Markings	Information typically provided on signage is painted on the roadway	▪ Speed reduction ▪ Rapid implementation ▪ No increase in noise ▪ Cost effective	▪ Regular maintenance required ▪ Less effective in winter months	▪ Local/Collector ▪ Urban Arterial ▪ Rural Arterial	$300-$2,000/ea.
LED Signs and Flashing Beacons	Provides enhanced warning at new or high-risk intersections	▪ Location flexibility ▪ Speed reduction ▪ Increases driver awareness	▪ Driver becomes desensitized	▪ Urban Arterial ▪ Rural Arterial	$500-1,000/ea.
Overhead Pedestrian Corridors	Overhead traffic signal for pedestrian crossings	▪ Effectiveness ▪ Speed reduction ▪ Increases driver awareness	▪ Cost	▪ Local/Collector ▪ Urban Arterial	$85,000-$110,000/ea.
Shared Space	Design concept where user priority shifts from vehicles to pedestrians and cyclists	▪ Vehicle speed reduction ▪ Reduced conflicts	▪ Requires substantial redesign of roads ▪ Maintenance requirements	▪ Local/Collector ▪ Rural Arterial	varies per design
Rest on Red Signal Phasing	Red light is displayed on all approaches when there is no vehicle or pedestrian traffic. Will change upon approach of traffic or pedestrian push button.	▪ Vehicle speed reduction ▪ Collision reduction ▪ Low cost for implementation	▪ Possible vehicle delay	▪ Urban Arterial ▪ Rural Arterial	Minimal-Requires setting timer

FIGURE 17: RADAR SPEED SIGN (SOURCE: RADARSIGN.COM)

FIGURE 18: VISUAL MESSAGE BOARD (SOURCE: CBC.CA)

FIGURE 19: VEHICLE ACTIVATED SIGN (SOURCE: PWSSIGNS.COM)

FIGURE 20: TEXTURED PAVEMENT AND CROSSWALKS (SOURCE: SURFACE PREPARATION TECHNOLOGIES)

FIGURE 21: TRANSVERSE RUMBLE STRIPS (SOURCE: US DEPARTMENT OF TRANSPORTATION)

FIGURE 22: PERMANENT STRIPING (SOURCE: BOSTONCYCLISTSUNION)

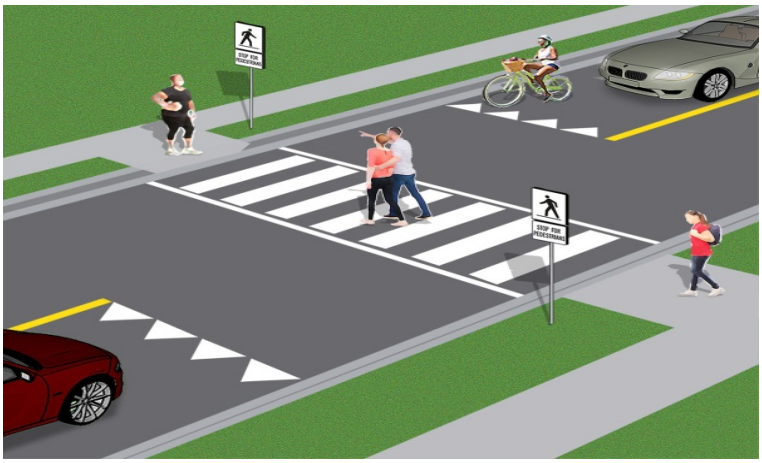

FIGURE 23: CROSSWALK PAVEMENT MARKINGS (SOURCE: ONTARIO MINISTRY OF TRANSPORTATION)

FIGURE 24: ROAD DIET (SOURCE: US DEPARTMENT OF TRANSPORTATION)

FIGURE 25: CONVERGING CHEVRONS (SOURCE: US DEPARTMENT OF TRANSPORTATION)

FIGURE 26: DRAGON'S TEETH (SOURCE: TAC TRAFFIC CALMING GUIDE)

FIGURE 27: FULL-LANE AND PERIPHERAL TRANSVERSE BARS (SOURCES: US DOT AND HSR YELLOW)

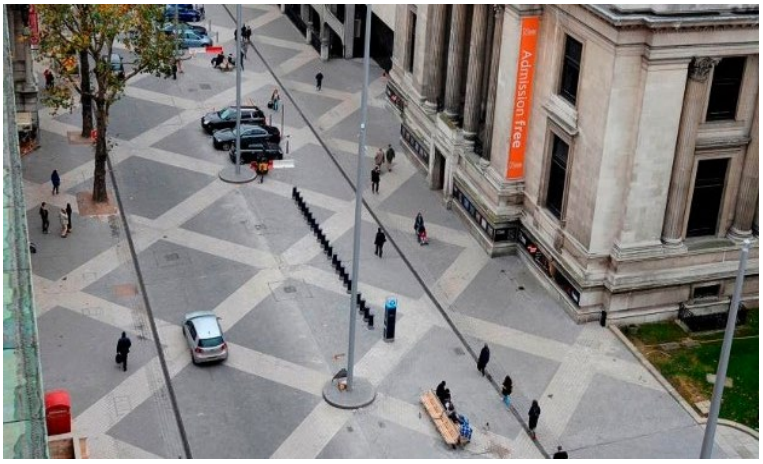

FIGURE 28: SHARED SPACE (SOURCE: ROYAL BOROUGH OF KENSINGTON AND CHELSEA)

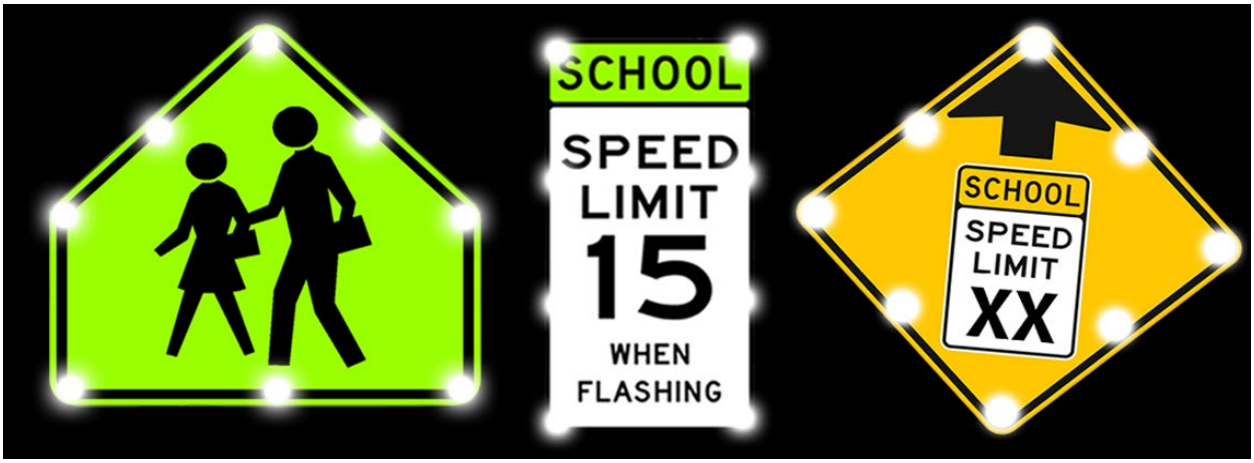

FIGURE 29: LED TRAFFIC SIGN (SOURCE:SOLAR TRAFFIC SYSTEMS INC)

FIGURE 30: OVERHEAD PEDESTRIAN CORRIDOR (MICHIGANCOMPLETESTREETS.FILES.WORDPRESS.COM)

FIGURE 31: OPTICAL ILLUSION PAVEMENT MARKINGS (SOURCE: INDIATIMES.COM)

4.0 Areas of Consideration: Town of Oliver

The Town of Oliver has identified key areas to implement traffic calming strategies. School zones, park areas and the entrances to Town are the highest priority for the program. Within this report, locations within each zone are identified, design principles are applied, and a cost summary generated. Recommendations for each location area based on community response and the aforementioned. The recommendations for each location are not exhaustive.

4.1 School Zones

4.1.1 School Avenue at Oliver Elementary School

School Avenue has been identified as a location which could benefit from additional traffic calming measures. On School Avenue, the intersection of Haven Street, Gala Street and Spartan Street have been identified as locations with high pedestrian and bicycle traffic (see Figures 32 to 35). The Town recently installed bump outs at the Haven Street intersection (see Figure 33). Additional treatments within this school zone include:

i. Extend the sidewalk and curb approaching Oliver Elementary School from the southwest, narrowing the road width entering the school parking lot (see Figure 33).
ii. Raise the crosswalk at the intersection of Gala Street and School Avenue, creating a speed hump. This would decrease motor vehicle speed and increasing pedestrian visibility (see Figure 34).
iii. Pavement markings (e.g. road narrowing, on-road 'sign' markings, converging chevron)
iv. Transverse rumble strips in advance of and within the school zone indicating to motorist to reduce speeds.

FIGURE 32: SCHOOL AVENUE CROSSWALK LOCATIONS

FIGURE 33: OLIVER ELEMENTARY CROSSWALK AND BUMP OUT AT THE HAVEN STREET INTERSECTION

FIGURE 34: INTERSECTION OF GALA STREET AND SCHOOL AVENUE

FIGURE 35: INTERSECTION OF SPARTAN STREET AND SCHOOL AVENUE

A cost estimate for these treatments is presented below:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Curb and Sidewalk Extension	22	$450/m	40 years	$10,000
Raised Crosswalks	20	$350/m	20 years	$7,000
Speed Hump	2	$1,500/ea.	20 years	$3,000
Two on-Road Painted Signs (“School Zone”)	2	$750/ea.	1 years	$1,500
Transverse Rumble Strips	60	$150/m^2	10 years	$9,000
Converging Chevrons	270	$2/m	1 years	$540
Dragon Teeth	270	$2/m	1 years	$540
On-Street Parking Paint	270	$2/m	1 years	$540

4.1.2 Spartan Street at Rockcliffe Road

Spartan Street at Rockcliffe Road is adjacent to School District 53. A location map is presented in Figure 36. A sidewalk was constructed on the northeast side of Spartan Street to the entrance of the School District 53 in 2016 (see Figure 37). A curb bump out was installed in September 2018.

To further reduce traffic speeds and increase pedestrian safety, the Town could install an elevated crosswalk at the School District entrance or apply road paint to narrow motorist perceived road width.

The performance of the curb bump out should be evaluated. Additional treatments may be required to enhance safe pedestrian traffic by increasing pedestrian visibility and promote overall speed reduction.

FIGURE 36: SPARTAN STREET AT ROCKCLIFFE ROAD

FIGURE 37: SIDEWALK ON SPARTAN STREET

Costs associated with each measure are presented below:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Curb Bump Out	2	$15,000/ea.	40 years	$30,000
Raised Crosswalk	8	$350/m	20 years	$2,800
Road Paint Narrowing Lane	330	$2,000/km	1 years	$660
Two On-Road Placement Signs (“School Zone”)	2	$750/ea.	1 years	$1,500
Converging Chevrons	330	$2,000/km	1 years	$660
Dragon Teeth	330	$2,000/km	1 years	$660

4.1.3 Fairview Road and Nicola Street

The intersection of Fairview Road and Nicola Street has been identified as an area with high pedestrian traffic (see Figure 40). This location currently has a pedestrian crosswalk. Road narrowing, through the application of road paint, was completed along this section of Fairview Road (see Figure 41). Its proximity to the rainbow crosswalk to the south at Southern Okanagan Secondary School has prompted discussion of its removal, allowing for pedestrian traffic to be focused to one crosswalk.

To maintain safe access from Nicola Street to the rainbow crosswalk, pedestrian improvements will be required. Road improvements include construction of an access from the east corner of Nicola Street and Fairview Road to the crosswalk. This may be achieved through construction of a sidewalk or installation of a barrier between vehicle and pedestrian traffic.

Estimated costs for installation are as follows:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Curb and Sidewalk	56	$400/m	40 years	$22,400
Concrete Barrier	56	$435/m	40 years	$24,360

FIGURE 38: INTERSECTION OF FAIRVIEW ROAD AND NICOLA STREET

FIGURE 39: STREET VIEW OF INTERSECTION OF FAIRVIEW ROAD AND NICOLA STREET

4.1.4 Park Drive at Tuc-el-Nuit Elementary

Tuc-el-Nuit Elementary School is located on Park Drive (see Figure 42). As seen in Figure 43, this road segment is a long, straight corridor prone to high traffic speeds. The current road layout includes a sidewalk on the west side of the road and a zebra striped crosswalk at the intersection of Park Drive and Tuc-el-Nuit Drive. Merlot Avenue to the north also has issues with high traffic speeds within a school zone. It is proposed to enhance traffic calming in this corridor. To achieve this, the following treatments could be applied:

- Installation of a raised crosswalk at the school entrance
- Installation of curb, gutter and sidewalk on the east side of Park Drive with bump outs on each side of street, pedestrian crosswalks and parallel parking.
- Installation of flexible bollard medians on each side of school entrance
- Construction of a textured crosswalk
- In-street pedestrian crosswalk signs
- LED school crossing signs and crossing guards
- School zone signage

Estimated cost for installation of the traffic calming treatments are as follows:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Raised Crosswalk	9	$1,200/m	20 years	$10,800
Flexible Bollards	7	$400/ea.	15 years	$2,800
Textured Crosswalk	22	$280/$m^2$	20 years	$6,160
Overhead Pedestrian Corridor (Signal)	2	$85,000/ea.	20 years	$170,000
LED Crossing Signs	2	$2,000/ea.	100,000 hrs	$4,000
School Zone Signage	4	$2,000/ea.	20 years	$8,000
Curb, Gutter, Sidewalk, Bumpouts and Crosswalks.	1	$66,000/ea.	20 years	$66,000

FIGURE 40: PLAN VIEW AT TUC-EL-NUIT ELEMENTARY SCHOOL

FIGURE 41: INTERSECTION OF PARK DRIVE AND TUC-EL-NUIT DRIVE

4.1.5 Lakeside Drive at Lakeview Place

The crosswalk located at the intersection of Lakeside Drive and Lakeview Place receives high volumes of pedestrian traffic commuting to Tuc-el-Nuit Elementary School (see Figures 44 and 45). Presently, there is a zebra crosswalk at the intersection. Further traffic calming measures which may be implemented at this location include:

- Refuge Island
- Pedestrian activated amber flashers
- Transverse rumble strips approaching the crosswalk
- Road paint markings posting speed limit

A cost estimate for the proposed measures is presented as follows:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Refuge Island	1	$20,000/ea.	40 years	$20,000
Overhead Activated Amber Flashers	1	$20,000/ea.	20 years	$20,000
Transverse Rumble Strips	96	$150/m^2	10 years	$14,400
Two On-Road Painted Speed Limit Signs	2	$750/ea.	1 years	$1,500

FIGURE 42: SITE OVERVIEW LAKESIDE DRIVE AND LAKEVIEW PLACE CROSSWALK

FIGURE 43: PROPOSED LOCATION OF CROSSWALK UPGRADES AT LAKEVIEW PL. AND LAKESIDE DR.

4.2 Park Areas

4.2.1 Rotary Beach

The northern entrance to Rotary Beach, accessed from Lakeside Drive is a high pedestrian traffic area. As seen in Figure 46, beach access from Lakeside Drive currently consist of a zebra crosswalk and ground mounted pedestrian crosswalk signs.

Applications to enhance pedestrian visibility and reduce motor vehicle speeds includes:

- Rainbow crosswalk design
- Advanced yield markings or activated amber flashers
- Raised crosswalk
- Transverse rumble strips
- Radar speed signs

Estimated costs for implementation of each of these measures is presented below:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Raised Crosswalk	10	$1,200/m	20 years	$12,000
Advanced Yield Markings	2	$500/ea.	1 years	$1,000
Overhead Activated Amber Flashers	1	$20,000/ea.	100,000 hrs	$20,000
Transverse Rumble Strips	96	$150/m^2	10 years	$14,400
Radar Speed Sign	2	$2,000/ea.	15 years	$4,000
Two On-Road Painted Signs with Speed Limit	2	$750/ea.	1 years	$1,500

FIGURE 44: NORTHERN ENTRANCE TO ROTARY BEACH

4.2.2 Kiwanis Parks and Recreation at Park Drive

The Kiwanis Parks and Recreation site receives large volumes of motor vehicle traffic area. The crosswalk located at the south end of the site is a high exposure area for pedestrians due the proximity to the Fairview Road to Park Drive transition (see Figures 47 and 48). Traffic calming treatments to reduce vehicle speeds and decrease pedestrian exposure include:

- Elevated crosswalk
- Rainbow painted crosswalk
- Crosswalk removal due to the proximity of nearby, more controlled crosswalks
- Sidewalk bumpouts
- Radar speed sign
- Signage indicating playground zone
- Pedestrian activated amber flashers

Estimated costs for the design options can be seen below.

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Raised Crosswalk	14	$1,200/m	20 years	$4,900
Radar Speed Sign	2	$2,000/ea.	100,000 hrs	$4,000
Crosswalk Removal	14	$400/L.S.	n/a	$400
Sidewalk Bumpouts	2	$15,000/ea.	40 years	$30,000
Overhead Activated Amber Flashers	1	$20,000/ea.	20 years	$20,000
Two On-Road Painted Signs with Speed Limit	2	$750/ea.	1 years	$1,500

FIGURE 45: SITE OVERVIEW KIWANIS PARKS AND RECREATION AT PARK DRIVE

FIGURE 46: KIWANIS PARKS AND RECREATION AT PARK DRIVE

4.2.3 Hike and Bike

The Hike and Bike trail in Oliver is an 18.4 km long trail traversing the west side of the Okanagan River. As denoted in Figures 49 and 50, the trail crosses Fairview Road, at which point there is an existing pedestrian flashing amber crosswalk signal. This location is well designed for pedestrian traffic. However, due to the high volume of pedestrians and cyclists using the trail, the Town would like to consider a raised crosswalk at the amber lights and the use of road paint to remind vehicles of road speeds. This treatment would increase pedestrian and cyclist visibility to motor vehicles.

Costs associated with these works are presented below. It should be noted that the implementation of further traffic calming measures to this location should be a lower priority than other locations identified in this report.

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Raised Crosswalk	10	$1,200/m	20 years	$12,000
Two On-Road Painted Signs with Speed Limit	2	$750/ea.	1 years	$1,500

FIGURE 47: SITE OVERVIEW HIKE AND BIKE AT FAIRVIEW ROAD

FIGURE 48: STREET VIEW OF HIKE AND BIKE AT FAIRVIEW ROAD

4.2.4 Fairview Park

The Town of Oliver painted a rainbow crosswalk in front of Southern Okanagan Secondary School in 2016 (see Figures 51 and 52). This crosswalk serves as a pedestrian corridor to and from the secondary school. To increase pedestrian safety and reduce traffic speeds near the school, the Town would like to consider further traffic calming treatments. Applications include:

- Radar speed sign in each direction, promoting traffic calming in the area
- Elevated crosswalk
- On road painted signs indicating a School Zone
- Overhead activated amber flashers

Implementation of any treatments should work in conjunction with works at the four-way intersection of Spartan Street, Fairview Road and Similkameen Avenue. Planning and integration of traffic calming design measures at these locations would promote traffic control and pedestrian safety in this corridor.

A cost estimate for each treatment is seen as follows:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Radar Speed Sign	2	$7,000/ea.	100,000 hrs	$14,000
Raised Crosswalk	18	$1,200/m	20 years	$6,300
Two On-Road Painted Signs (“School Zone”)	2	$750/ea.	1 years	$1,500
Overhead Activated Amber Flashers	1	$20,000/ea.	20 years	$20,000

FIGURE 49: SITE OVERVIEW FAIRVIEW PARK RAINBOW CROSSWALK

FIGURE 50: STREET VIEW FAIRVIEW PARK RAINBOW CROSSWALK

4.3 Entrances to Town

4.3.1 Fairview Road

Fairview Road serves as the transition from rural Oliver to the Town core (see Figure 53). The intersections at Fairview Road & Princess Place and Panorama Crescent & Dividend have been identified as locations that would benefit from the application of traffic calming measures, as the road is prone to speeding vehicles due to its straight alignment and rural location. Recommendations to reduce vehicle speed included:

- Construction of a two-lane chicane on the west end of the road. This road is owned by MoTI and would require their approval.
- LED speed signs
- Road paint to narrow road lanes and include a bike lane through the entire corridor
- Elevate intersections near Town entrance
- Construct a 4-way stop at Road 2 or Panorama Crescent
- Transverse rumble strips
- Traffic Circles

Traffic circles can be constructed at one or both of the identified locations to lower the speeds at these minor uncontrolled intersections. This road is under MoTI jurisdiction and will require their coordination and approval. Estimated construction costs are as follows:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Two-lane Chicane	740	$500,000/L.S.	20 years	$500,000
Radar Speed Signs	2	$7,000/ea.	100,000 hrs	$14,000
Road Painting	1,500	$2,000/km	1 years	$3,000
Raised Intersection	1	$50,000/ea.	20 years	$50,000
4-Way Stop	1	$8,000/ea.	20 years	$8,000
Transverse Rumble Strips	96	$150/m^2	10 years	$14,400
Traffic Circles	2	$60,000/ea.	20 years	$120,000

FIGURE 51: FAIRVIEW ROAD AND PRINCESS PLACE

4.3.2 Highway 97 from North Side

Traffic entering the Town from the north on Highway 97 has been identified as an area of increased driver speeds (Figures 54 and 55). The Town would like to design an entrance feature or implement a strategy which will reduce motor vehicle speeds entering town. Options include:

- Entrance feature
- Radar speed signs
- Traffic light or blinking amber lights
- Transverse rumble strips

Design of an entrance feature would include a median and curb flares. This would create a bottleneck, leading to increased driver attentiveness and require reduced vehicle speeds. As development occurs in the area, the Town also has the opportunity to work with developers to signalize the intersection at Highway 97 and Leighton Crescent. This traffic calming approach was successful on Main Street, at the southern entrance of Oliver. This intersection has a Tim Horton's which generates the traffic required to prompt the light to change frequently. Proposed future development in this area would allow for a similar design strategy.

Irrespective of the traffic calming strategy employed, this road is under MoTI jurisdiction and will require their coordination and approval. Cost estimates for implementation of this above-mentioned treatments are as follows:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Entrance Feature-Constriction	1	$60,000/L.S.	20 years	$60,000
Radar Speed Sign	1	$7,000/ea.	100,000 hrs	$7,000
Traffic Light	3	$300,000/ea.	20 years	$900,000
Overhead Activated Amber Flashers	1	$20,000/ea.	20 years	$20,000
Transverse Rumble Strips	96	$150/m^2	10 years	$14,400

FIGURE 52: SITE PLAN HIGHWAY 97 FROM NORTH SIDE OF TOWN

FIGURE 53: STREET VIEW HIGHWAY 97 FROM NORTH SIDE OF TOWN

4.3.3 Tuc-el-nuit Drive

Tuc-el-nuit Drive has historically been known for speeding vehicles (see Figures 56 and 57). Traffic calming treatments identified for this location are presented below:

- Removal of passing lanes
- Narrow road paint lines
- Radar speed sign
- Median (rigid or flexible bollards)
- Bike lanes

A simple traffic calming treatment could be implemented by removing passing lanes on the roadway and narrowing road paint lines. This would generate the perception of a more closed-in residential road, promoting drivers to reduce their speed on this through fare. A median or flexible bollards within the corridor would also promote speed reduction. However, it would reduce road dedication for bicycles and pedestrians.

Installing rumble strips perpendicular to the roadway in increments down the corridor would also prompt drivers to reduce speeds. This approach could be coupled with radar speed signs to reinforce the permitted speed limit. Tuc-el-Nuit Drive transitions from Town property to First Nations lands. Any proposed traffic calming measures would require discussion and coordination with the Osoyoos Indian Band and MoTI. Cost estimates associated with the traffic calming options are as follows:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Pavement Markings	4.8	$2,000/km	1 years	$9,600
Narrow Road Paint Lines/Bike lanes	4.8	$2,000/km	1 years	$9,600
Radar Speed Sign	6	$7,000/ea.	100,000 hrs	$42,000
Median (Rigid or Flexible Bollards)	32	$400/ea.	10 years	$12,800

FIGURE 54: SITE PLAN TUC-EL-NUIT DRIVE

FIGURE 55: STREET VIEW TUC-EL-NUIT DRIVE

4.3.4 Sawmill Road from South

Sawmill Road enters the Town through the industrial area where Co-op Avenue intersects with Main Street (see Figures 58 and 59). Increased traffic speeds are prevalent between Oak Avenue and Co-op Avenue. Sawmill Road at this location has residential homes directly fronting the road.

A variety of traffic calming treatments could be applied at this location. These include:

- Bollards in the centerline of the road at the intersection of Oak Avenue and Sawmill Road. This would indicate vehicle entrance into a residential area.
- Traffic circle at Oak Avenue
- Raised intersection at Oak Avenue
- Road paint narrowing road
- Radar speed sign

Cost estimates associated with the traffic calming options are as follows:

Measure	Number of Units	Unit Price	Useful Life	Total Cost
Median Bollards	28	$400/ea.	15 years	$11,200
Traffic Circle	1	$50,000/ea.	20 years	$50,000
Raised Intersection	1	$50,000/ea.	20 years	$50,000
Radar Speed Sign	4	$7,000/ea.	100,000 hrs	$8,000
Pavement Markings	1	$3,500/km	1 years	$3,500
Road Narrowing	2	$3,500/km	1 years	$7,000

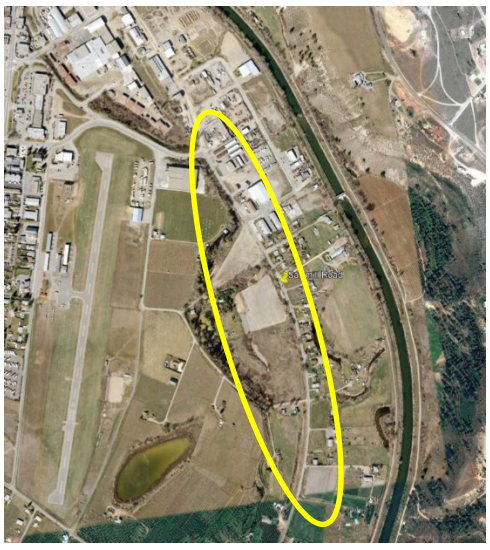

FIGURE 56: SITE PLAN SAWMILL ROAD FROM SOUTH

FIGURE 57: STREET VIEW SAWMILL ROAD FROM SOUTH

5.0 Conclusions and Recommendations

Continued implementation of traffic calming measures within the Town of Oliver can be achieved through prioritization of the above described. These measures are a key step in moving towards safer neighborhood design for all modes of transportation. Decision making should include:

- Quantifying the problem via traffic counts, speed studies and license plate tracing accident history. It should be noted that speed reduction is only necessary if the 85th percentile speed is a minimum of 10km/h over the posted limit.
- Consider improvement to arterial roads first, as their impact will affect a larger volume of people.
- Incorporation of cost to benefit analysis for each traffic calming measure.
- Consider temporary or trial devices, staged installation, or full permanent installation depending on the location where traffic calming measures are to be implemented.
- Include community education as part of the traffic calming program.

Use of a roaming traffic speed sign could be employed at various locations throughout the Town. These radar signs are effective in lowering average driver speeds and improving roadway safety. They are an easy to deploy method and can be optimized by rotating their location as to avoid driver desensitization.

Community engagement should be integrated throughout the process to identify priorities within the community at large. This can be completed through public open houses, polling and/or survey questionnaires. Overall, the intention of traffic calming projects will be to restore streets to their intended function. This will address mobility and accessibility at different capacities, depending on the specific location and classification of the street.

TRUE recommends the following prioritization for site selection and traffic calming implementation. The locations were ranked based on capital costs, useful life and impact to the community.

Priority Ranking	Site Location and Implementation Strategy	Cost Estimate
1	Roaming Radar Speed Sign	$12,000
2	Tuc-el-Nuit Line Repainting	$9,600
3	Curb and Sidewalk Extension on School Avenue	$10,000
4	Remove Nicola Crosswalk & Enhance Pedestrian Safety to Rainbow Crosswalk	$22,400
5	Curb, Gutter, Sidewalk, Bumpouts, Crosswalk, and Parking on Park Drive at Tuc-el-Nuit Elementary.	$66,000
6	Kiwanis Sidewalk Bump outs	$30,000
7	Fairview Road Traffic Circles	$120,000
8	Sawmill Road Median Bollards and Line Painting	$21,700
9	Merlot Avenue School Zone Signage	$8,000

APPENDIX A

Fairview Roundabout

EXISTING DRIVEWAY

PROPERTY LINE

EDGE OF EXISTING PAVEMENT

EXISTING DRIVEWAYS

EXISTING FENCE

1.50m SIDEWALK (TYP.)

EXISTING POWER POLE

EXISTING STORM DRYWELL

EXISTING STORM CATCH BASIN

EDGE OF EXISTING PAVEMENT

EXISTING WATER UTILITIES

EXISTING DRIVEWAY (NEW LETDOWN REQ'D)

SIDEWALK LET DOWN (TYP.)

XERISCAPE (RAISED ISLAND)

17.5m (radius)

8.5m (radius)

4.0m (APRON)

5.0m

RAISED MEDIAN (TYP.)

EXISTING POWER POLE

1.50m SIDEWALK (TYP.)

EXISTING SANITARY UTILITIES

EXISTING STORM CATCH BASIN

EXISTING STORM CATCH BASIN

PROPERTY LINE

EXISTING FENCE

1 12823

2 12823

3 12823

4 12823

3 7736

A 15108

2, PLAN 7728

1 18845

No.	DATE	DESCRIPTION	BY	APPD
1	MAY 30/14	ISSUED FOR APPROVAL	DF	SU

ISSUES / REVISIONS

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TOWN OF OLIVER

FAIRVIEW ROUNDABOUT

CONCEPTUAL ROUNDABOUT LAYOUT

SCALE	1:250
DESIGN BY	SU
DRAWN BY	EEE/DF
DATE	MAY 30, 2014
PROJECT REFERENCE No.	306-1561
DRAWING No.	306-1561 FIG1
SHEET	01 OF 02
REVISION	01

FILE: C:\clients\2013\306-1561\01 drawings\autocad\01 design drawings\dwg\306-1561.dwg