Appendix P

Assessment of Bicycle Facility Alternatives (2017) and Cycling Reassessment (2019)

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RE: Cycling Assessment – Lakeshore Road West Improvements

An initial assessment of cycling facilities was completed in 2017. Further, in order to reduce conflicts with trees, utilities and property, a reassessment of the appropriate cycling infrastructure was completed in 2019. This appendix provides both, the initial cycling assessment of 2017, as well as the 2019 reassessment.

FINAL

ASSESSMENT OF CROSS-SECTION ELEMENTS
Lakeshore Road, from Mississaga Street to Dorval Drive
Town of Oakville

Submitted to:

Town of Oakville

Submitted by:

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3450 Harvester Road, Suite 100
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September 2017

Project No. TP116147

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1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

The Town of Oakville (Town) is completing a Schedule 'C' Municipal Class Environmental Assessment (EA) for improvements to Lakeshore Road West, from Mississaga Street to Dorval Drive. Amec Foster Wheeler was retained by the town to complete the EA and to recommend improvements to the corridor to meet the needs of road users to 2031.

The EA is considering a wide range of options to satisfy transportation needs along the Lakeshore Road West corridor, including implementation of cycling infrastructure within the study limits, reating a safe, consistent, and efficient network for all users.

A separate memo "*ASSESSMENT OF BICYCLE FACILITY ALTERNATIVES"* was completed to determine the appropriate cycling infrastructure along Lakeshore Road West.

1.2 Study Area

The study area for this assessment is Lakeshore Road West from Mississaga Street to Dorval Drive, ref. **Figure 1.1**. The approximate length of the corridor is 6.2 km. The adjacent sections of Lakeshore Road, east and west of the study limits, provide a three (3) lane cross section, with one (1) through lane in each direction, a two-way center left turning lane, and an on-road bike lane on both sides. The existing cross-section at the west end is shown in **Figures 1.2 and 1.3** and the existing cross-section at the east end is shown in **Figures 1.4 and 1.5**.

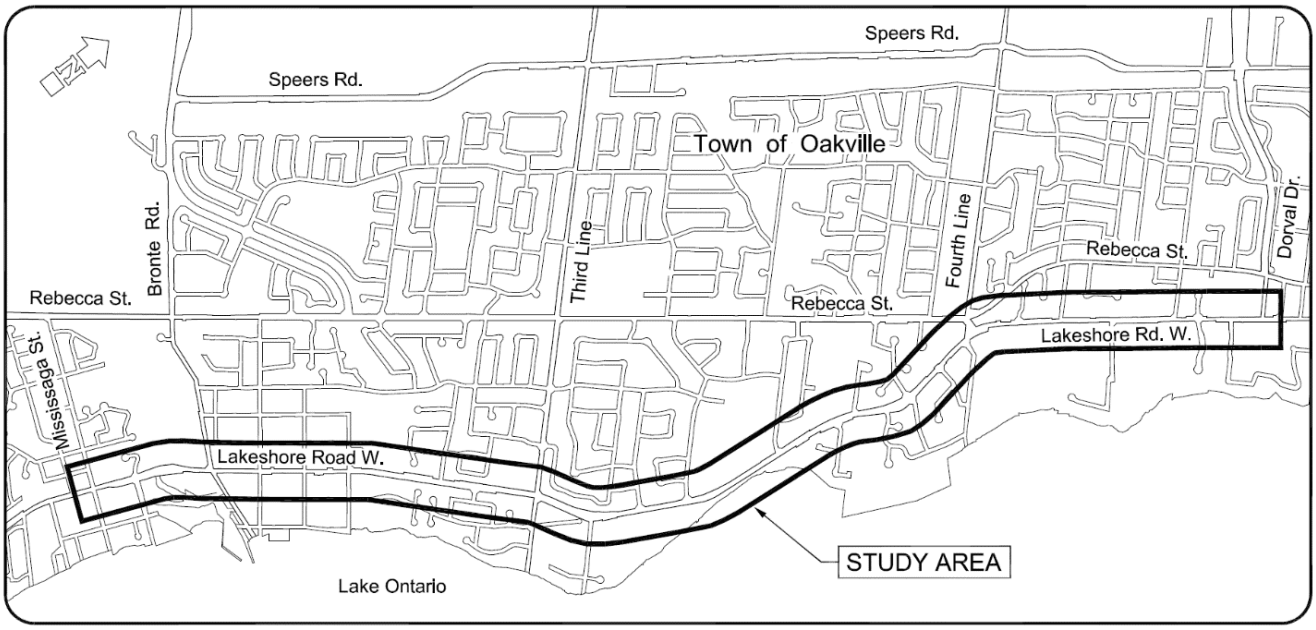


Figure 1.1. Study Area

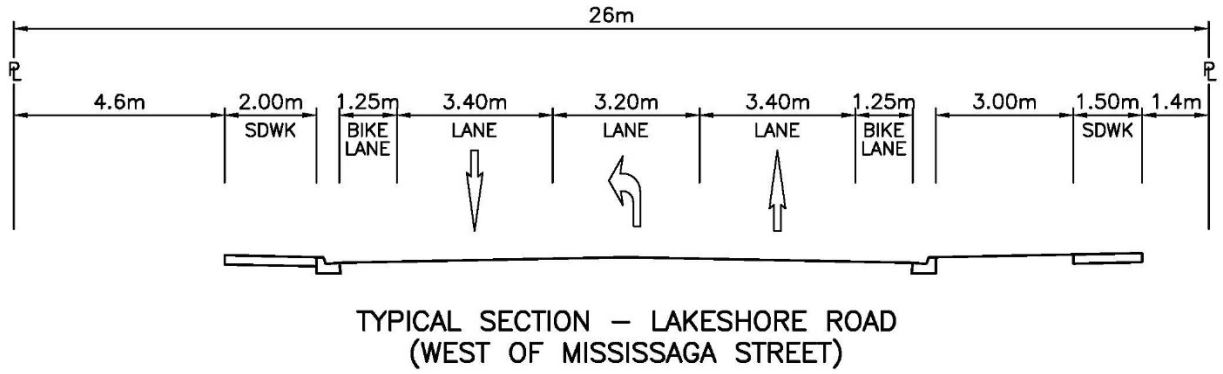


Figure 1.2. Existing Cross-Section West of Mississaga Street

Figure 1.3. Existing Cross-section west of Mississaga Street

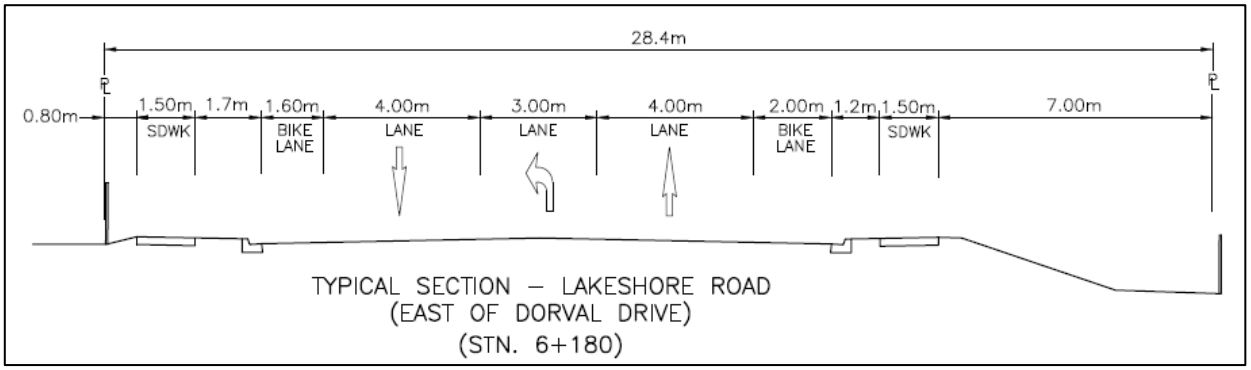


Figure 1.4. Existing Cross-section east of Dorval Drive

Figure 1.5. Existing Cross-section east of Dorval Drive

The cross-section elements being assessed and recommended in this memo are being considered as part of the overall preliminary design of Lakeshore Road West.

2.0 DESIGN CONSIDERATIONS AND ASSESSMENT

2.1 Design Standards and Guidelines

Geometric design guidelines for roadway elements are presented in the Transportation Association of Canada (TAC) *"Geometric Design Guide for Canadian Road", June 2017,* Town of Oakville and the Region of Halton. These guidelines were used in determining the design parameters for each roadway element in this assessment.

2.2 Cross-section Elements

2.2.1. Through Lane Widths

The new, June 2017, TAC guidelines for through lane widths for an urban roadway provides a Design Domain consisting of a practical lower and practical upper limit and a Recommended Range, practical lower and practical upper limit. For Lakeshore Road West, an assessment of through lane widths was completed to evaluate a traditional lane of 3.5m and a 3.3m lane (ref. Table 2.0).

Table 2.0 - Through Lane Assessment - Lakeshore Road West

Component	Evaluation Criteria	Alternative 1: 3.5m Through Lane	Alternative 2: 3.3m Through Lane
Social, Cultural and Economic Environment	Land Use/Property		
	Air Quality		
	Noise		
	Archaeology Resources		
	Agricultural		
	Access considerations		
Natural Environment	Wetlands and Vegetation		
	Wildlife Habitat		
	Surface Water/Drainage		
	Fisheries		
	Water Quality		
Technical	Constructability		
	Construction Disruption		
	Safety		
	Travel Delay/Traffic Capacity		
	Geometric Design Guidelines		
	Capital Cost		
	Maintenance and Operations		
Overall Evaluation			**PREFERRED**

2.2.2. Center Two Way Left Turn Lane Widths

Critical Horizon Year: The critical year for this assessment is year 2021 which was identified in the Traffic and Transportation Report.

Posted Speed: The posted speed on Lakeshore Road West within the study limits is 50km/h, except for a section posted 40km/h from approximately 150 m east of Fourth Line to approximately 300 m east of Suffolk Avenue. The reduction in speed in this section is to accommodate the adjacent school, Appleby College.

85th Percentile Speed: In the absence of recorded speed data for Lakeshore Road West, the 85th percentile speed was used from the Town of Oakville's *"2015 Road System Report", 6.0 Speed Studies.* The town's current speed database consists of over 600 studies take at over 300 locations. For a posted speed of 50 km/hr the 85th percentile speed is 61 km/hr.

Traffic Volumes: Growth rates used in the traffic and transportation report "*Transportation and Traffic Analysis Report Lakeshore Road West Improvements Class April 2017,* were applied to existing average daily traffic (ADT) volumes to generate year 2021 ADT volumes (Ref. Appendix A**)**.

Cyclist Volumes: Existing 2016 cyclist volumes were obtained from the Town of Oakville's *"Strava" Active Transportation Trends Map"* [1] that records pedestrian and cycling trips within the Town of Oakville. Also, cycling volumes were extracted from the 8-hour traffic movement counts for intersections along the corridor. These counts were adjusted using the previously established growth rates to project 2021 cyclist volumes. Count information can be viewed in Appendix A.

Modal Split: The Town of *Oakville's "Transportation Master Plan, Switching Gears",* February 2015, identifies the town's targeted model split for 2031 to be 20%. This includes transit, walking, cycling and carpooling.

[1] Town of Oakville, http://exploreoakville.maps.arcgis.com/apps/MapSeries/index.html?appid=c7467485a681458e876324b2f0c13795

Roadway Classification: Lakeshore Road West is classified as a minor arterial and has an urban section, from Mississaga Street to East Street, and a rural section, from East Street to Dorval Drive. Lakeshore Road West improvements will include the urbanization of the East Street to Dorval Drive section. Therefore, for purposes of this assessment, the roadway type used will be "urban."

Table 2.1 displays a summary of the data used for this assessment.

Table 2.1. Assessment Data

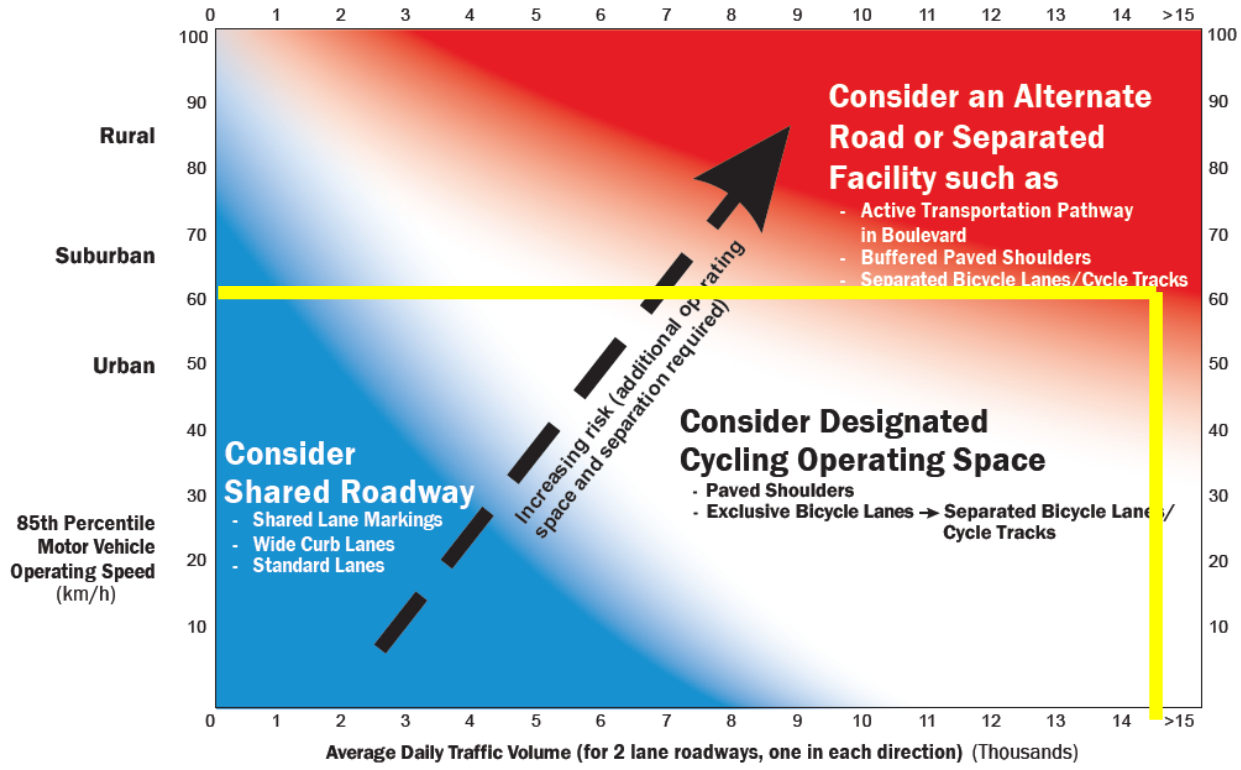
Roadway Classification	85th Percentile Speed (range)	Average Daily Traffic Volume	Average Cyclist Volumes per/hour (peak hour)
Urban	50 km/h to 69 km/h	14,248	<10 cyclists per hour

2.3 OTM Book 18 Bicycle Facility Selection Guideline

Section 3 of OTM Book 18 provides a three-step process for the selection of bicycle facilities:

Step 1 – Facility Pre-selection
Step 2a – Inventory Site-Specific Conditions
Step 2b – Review Key Design Considerations and Application Heuristics
Step 2c – Select Appropriate and Feasible Bicycle Facility Type
Step 3 – Justify Decision and Identify Design Enhancements

Step 1: Facility Pre-selection



Based on the 85th percentile operating speed and ADT volumes, the lines on the nomogram (shown in yellow) fall within the transition zone between *Designated Cycling Operating Space* and *Separated Facility*; therefore, both designated cycling operating space facilities, within the roadway platform, and alternate roadway or separated facility types can be considered.

Step 2: A More Detailed Look

In the second step of the selection process, determining criteria (primary and secondary) are considered, including:

Primary

- 85th percentile operating speeds
- Motor vehicle volumes
- Roadway function
- Vehicle mix
- Collision history
- Space available

Secondary

- Costs
- Cyclist riders and skill level
- Cyclist volumes
- Route function and cycling facility network
- Type of roadway improvements
- On-street parking
- Frequency of accesses

Tables 3.1 to 3.13 from OTM Book 18, provide design considerations for specific site characteristics for each of the determining criteria listed above. In the tables below, the specific site characteristics for Lakeshore Road and the associated design characteristics are circled in red.

Table 3.1 – 85th Percentile Motor Vehicle Operating Speeds

As the speed differential between motorists and cyclists increases, so does the collision risk for cyclists using that roadway. Therefore, when selecting a bicycle facility type, the 85th percentile operating speed should be considered. Higher motor vehicle speeds may negatively influence a cyclist's ability to control their bicycle.

Site Characteristics	Design Considerations and Application Heuristics
Low (30 to 49 km/h)	Speed differential between bicycles and motor vehicles is within 30 km/h, suggesting integration of the two modes as mixed traffic, in standard or wide curb lanes, may be appropriate.
Moderate (50 to 69 km/h)	Exclusive operating space for both bicycles and motor vehicles, in the form of paved shoulders, bicycle lanes or separated facilities is recommended.
High (70 to 89 km/h)	Speed differential between bicycles and motor vehicles exceeds 40 km/h, suggesting physical separation of the two modes is most appropriate such as buffered paved shoulders.
Very high (90 km/h and greater)	Physical separation is preferable, particularly in an urban environment. In rural areas of the province, it may not be practical to provide physically separated facilities on very high speed roadways where bicycles are currently allowed. A painted buffer between the roadway and the paved shoulder is an alternative treatment for such cases. If this is not feasible, provision of a parallel bicycle route should be explored.

Table 3.2 – Motor Vehicle Volumes

As motor vehicle volume increases, so does the collision risk for cyclists using that roadway. For planning purposes, the future year traffic volumes should be used when selecting an appropriate bicycle facility type for a given roadway section. Where AADT volumes are unavailable, rush hour volumes may be used. Some municipalities suggest that as a rule of thumb, rush hour volumes typically represent 10% of the daily volume.

Site Characteristics	Design Considerations and Application Heuristics
Very Low Volume: where two-way daily average volume is less than 500 vpd on a two-lane road	No facility type is typically required.
Low Volume: where two-way daily average volume is 500 to 2,000 vpd on a two-lane road	Mixed traffic may be appropriate if vehicle speeds are low. Lanes should be wide enough to comfortably accommodate shared use by cyclists and motorists. If speeds are moderate, paved shoulders or bicycle lanes should be considered.
Moderate Volume: where two-way daily average volume is 2,000 to 10,000 vpd on a two-lane road	Some level of formal bicycle facility such as a conventional bicycle lane is recommended. If this is not feasible, a signed bicycle route with a paved shoulder may be considered.
High Volume: where two-way daily average volume is greater than 10,000 vpd on a two-lane road	Physical separation of motor vehicle and bicycle traffic may be most appropriate.
Hourly one-way volume in the curb lane exceeds 250 vph	Some level of formal bicycle facility such as a 'signed only' bike route with a paved shoulder or bicycle lanes are recommended.

Table 3.3 – Function of Street or Road or Highway

While generally reflected in motor vehicle volumes, the function of a roadway should also be considered in bicycle facility decisions. The significance of this factor will be higher in cases where volume or speed data are unavailable.	
Site Characteristics	**Design Considerations and Application Heuristics**
Access roads such as local roads and residential streets	Mixed traffic may be appropriate if speeds and volumes are low. Where feasible, design features associated with Bicycle Priority Streets should be applied, as described in **section 5.1.** Otherwise, curb lanes should be wide enough to comfortably accommodate shared use by cyclists and motorists, with dimensions as indicated in **Table 4.1** for a Wide Signed Bicycle Route.
Both mobility and access roads such as minor collectors plus similar roads and streets	Some level of formal bicycle facility such as a signed bike route with paved shoulder or bicycle lane is appropriate. A Narrow Signed Bicycle Route may be implemented, with dimensions as indicated in **Table 4.1**.
Mobility roads such as arterials and major collectors	Some level of formal bicycle facility such as a bicycle lane or separated facility is appropriate.
Motor vehicle commuter route	Separated bicycle facilities should be considered to minimize conflicts with aggressive drivers on the roadway.

Table 3.4 – Vehicle Mix

Heavy vehicles, such as transport trucks and buses have a greater influence on cyclists than passenger vehicles. This is partly due to the larger difference in mass between cyclists and heavy commercial vehicles, and the increased severity of any resulting collision. Air turbulence generated by these high-sided vehicles also has a more significant impact on the difficulty of controlling a bicycle, which requires both greater skill and more caution on the part of the cyclist than in the presence of passenger vehicles. As the volume of heavy vehicles increases, so too does the desirability of providing buffers or physical separation of cyclists from motorized traffic. Stationary trucks and buses may also interfere with cyclist movements, creating a need for lane changes on the part of cyclists. This increases the interaction with vehicular traffic, and at times may obstruct other drivers' view of the cyclist on the road at inopportune moments.	
Site Characteristics	**Design Considerations and Application Heuristics**
More than 30 trucks or buses per hour are present in a single curb lane	Separated bicycle facilities may be preferred by many cyclists. If paved shoulders, wide curb lanes or bicycle lanes are considered, additional width should be provided as a buffer.
Bus stops are located along the route	Facilities should be designed to minimize and clearly mark cyclist conflict areas with buses or pedestrians at stop locations. See **Section 5.4.2** for more details.

*Note there are only bus stops from Third Line to Dorval Drive.

Table 3.5 – Collision History

Where there is evidence of the involvement of cyclists in collisions, historical patterns can sometimes provide valuable indicators of the factors that are present and pose particular challenges for the accommodation of cycling facilities, as well as the mitigating measures that can help resolve them.	
Site Characteristics	**Design Considerations and Application Heuristics**
Bicycle collisions are relatively frequent along the route	A detailed safety study is recommended. Alternate routes should be considered. Separated facilities may be appropriate to address midblock conflicts. If on-road facilities are considered, the operating and buffer space provided to cyclists should be considered.
Bicycle collisions are relatively frequent at specific locations	Localized design improvements should be considered to address contributing factors at high-collision locations, often near intersection and driveway locations.
Noticeable trends emerge from bicycle collisions	The proposed facility and its design should attempt to address noticeable collision trends. For each facility type, safety countermeasures* can be developed. These can be based on road user behaviour and manoeuvres that resulted in the collision, or specific design and policy objectives.
Conflict areas exist between cyclists and motor vehicles or pedestrians	Facilities and crossings should be designed to minimize conflict between different types of users and the conflict area should be clearly marked.

*For detailed scenario-based information, refer to the Bicycle Countermeasure Selection System in the FHWA's BikeSafe guide.

Table 3.6 – Available Space

The space available to serve all functions and users of a roadway is finite. Consequently, practitioners should consider the constraints imposed by curbs, pinch points and physical barriers when choosing the most appropriate facility for a particular section of roadway. Once the facility type has been selected, the adequacy of sightlines, both at intersections and continuously along a roadway should be considered. Please refer to **Section 5.4** for more details.	
Site Characteristics	**Design Considerations and Application Heuristics**
Sufficient curb-to-curb width exists to adequately accommodate motorists and cyclists.	Redistribute roadway space to accommodate bicycle lanes by narrowing or eliminating parking lanes, narrowing travel lanes, or eliminating unnecessary travel or turn lanes. Where bicycle lanes are not feasible, wide curb lanes may be provided. Please refer to **Section 5.2** for guidance on integrating bicycle facilities through road retrofits.
Sufficient curb-to-curb width exists, but pinch points are created where turn lanes are developed at intersections.	There is a higher risk of collisions at intersection compared to other sections of road and less confident cyclists may be deterred by a lack of designated bicycle facilities on the immediate approach to an intersection. Where feasible, localized widening should be undertaken to provide continuous bicycle facilities of constant width entering, through and exiting the intersection. Where this is not possible, bike lanes may be discontinued with appropriate positive guidance or warning measures upstream of the merge point or intersection. Practitioners should carefully and practically consider the way in which cyclists and general traffic will merge. Pavement markings and signage should encourage cooperative merging of cyclists and motorists into a single traffic lane. Sharrow markings can be used to denote a desirable cyclist path, particularly through narrow or atypical intersections. Refer to **Section 4.2.1.4** for design recommendations.
Physical barriers include those created by steep grades, rivers, freeways, railways, narrow bridges.	Separated facilities should be considered to bypass or overcome barriers.
Curb-to-curb width is not adequate to provide sufficient operating space for both motorists and cyclists.	Provide separated facilities adjacent to the roadway or within an independent right-of-way, provide paved shoulders, widen roadway platform to accommodate bicycle lanes. Where this is not feasible, wide curb lanes may be considered or alternate routes may be investigated. If on-street parking is present, explore opportunities for it to be eliminated or reduced.
Adequate sightlines for road users including both motorists and cyclists on rural roads given design and operating speeds.	Horizontal and vertical curves along the roadway as well as roadway width should be considered when providing adequate sightlines for road users. Regular maintenance of vegetation is also important in preserving sightlines throughout the year.
Sight distance is limited at intersections, crossing locations or where cyclists and motor vehicles share limited road space.	Improve sightlines by improving roadway geometry, removing or relocating roadside furniture and vegetation; provide adequate space for cyclists either on or off the roadway. Design intersection crossings to minimize and clearly mark conflicts, and restrict parking in close proximity to intersections.

Table 3.7 – Costs

In reality, provisions for cyclists on roadway projects will be affected by the availability of funding. Designers should seek to ensure that their solutions are cost-effective, meet project objectives and are appropriate for the intended users given the characteristics of the site. However, cost should not eliminate the need for due diligence in providing safe and effective cycling facilities that encourage use.	
Site Characteristics	**Design Considerations and Application Heuristics**
More than one type of bicycle facility appears appropriate	Benefit/cost analysis of alternatives should be conducted.*
Funding levels are not available to provide preferred type of facility	Consider alternate routes or focus on cost-effective improvements to existing facilities such as improved maintenance, pavement and drainage rehabilitation as well as removal of barriers. Poorly designed or constructed facilities may result in increased safety risks for cyclists, and are unlikely to encourage additional use.

*Refer to NCHRP Report 552 - Guidelines for Analysis of Investments in Bicycle Facilities.

Table 3.8 – Anticipated Users in Terms of Skill and Trip Purpose

It is important to consider different user skill levels and trip purposes in the design of bicycle facilities. Therefore, providing a variety of facility types, whose distinguishing feature is the presence of different degrees of separation between motorists and cyclists, helps encourage new or less experienced cyclists. This in turn improves overall cyclist safety within a road network. Research shows that one of the most effective measures for doing this is increasing the number of cyclists using the system. The appropriateness of the existing provision on a particular link can be assessed by undertaking cyclist counts. In addition to recording the number of cyclists, the hourly and daily profile will give an indication as to trip purpose; for example, peaks in use during weekday periods demonstrate commuter demand whereas high volumes on the weekend suggests recreational use.	
Site Characteristics	**Design Considerations and Application Heuristics**
Experienced cyclists (commuter or other utilitarian)	This group generally prefers direct, continuous facilities with minimal delay as is generally provided by the arterial road network. Experienced cyclists may be comfortable on shared use roadways with low motor vehicle volumes and speeds. However, users in this group typically prefer on-street bike lanes or separated facilities where the context warrants it.
Novice cyclists (recreational / beginner utilitarian)	This group generally prefers routes on residential streets with light traffic and low speeds. Bicycle lanes, paved shoulders (with or without buffers) and separated facilities should be considered.
Child cyclists	This group generally requires separated facilities free of conflicts with motor vehicle traffic. Separated facilities should be considered near schools, parks and neighbourhoods. Children under the age of 11 should be permitted to cycle on sidewalks since they may not have the cognitive ability or experience to ride on roads with motor vehicles by themselves.

Table 3.9 – Level of Bicycle Use

As cyclist volumes increase, so does the risk of interactions with motor vehicles. Therefore, as cyclist volume increases, practitioners should consider increased separation between motorists and cyclists.	
Site Characteristics	**Design Considerations and Application Heuristics**
Low bicycle volumes (< 10 cyclists per hour)	Wide curb lanes may be adequate in some cases. However, practitioners should carefully consider whether the low bicycle volumes represent a lack of cyclist demand or inadequate existing facilities. As improvements are made to cycling infrastructure, bicycle volumes tend to increase.
High bicycle volumes (> 50 cyclists per hour)	Paved shoulders, bicycle lanes or separated facilities may be appropriate. The width provided for urban bicycle facilities should accommodate bicycle volumes during peak periods both midblock and at intersections.
Significant bicycle traffic generators are nearby	Latent bicycle demand may exist if there are employment centres, neighbourhoods, schools, parks, recreational or shopping facilities along the route. Transit nodes also provide the opportunity for multi-modal travel, with bicycle trips to and from the node where appropriate end-of-trip facilities are provided (see **Section 7**). Bicycle lanes and separated facilities should be considered to accommodate the anticipated volume of cyclists.

Table 3.10 – Function of Route within the Bicycle Facility Network

The function of the route within the bicycle facility network is very important. Bicycle facilities depend on accessibility and connections between routes, major destinations, residential areas and recreational services. Route segments should be identified as primary or secondary routes, and ease of access to and from such facilities should be a major planning and design consideration.	
Site Characteristics	**Design Considerations and Application Heuristics**
Parallel bicycle routes already exist with bicycle facilities present	Redundancy of bicycle routes may provide an opportunity to provide different types of bicycle facilities within the same travel corridor. This would give cyclists with different skill levels and trip purposes the opportunity to choose the facility most appropriate to their needs.
New route provides a connection between adjacent existing facilities	Facility selection should provide continuity with adjacent bicycle facilities to the extent possible.
New route provides access to a neighbourhood, suburb or other locality.	Bicycle lanes and separated facilities should be considered to encourage cycling for all users.

Table 3.11 – Type of Roadway Improvement Project

The type of roadway improvement project can and most often does affect the type of bicycle facility that is appropriate for a given context. For example, retrofitting existing roads and intersections, platform width and other existing constraints will play a role in selecting the appropriate bicycle facility type. Therefore, consideration must be given to the type of roadway improvement project whether it is new construction, reconstruction or a retrofit. Combining works in this way allows bike facilities to be installed while achieving cost efficiencies. However, practitioners should consider the completeness of the resulting bikeway network. The implementation of small sections of disconnected bicycle facilities is unlikely to provide meaningful connections for cyclists since those facilities may suffer from low cycling volumes. Practitioners should consider using some the resources saved through the aforementioned synergies to provide additional links which will properly integrate the new facilities into the network.

Site Characteristics	Design Considerations and Application Heuristics
New construction	Appropriate bicycle facilities should be planned and integrated with the design and construction of new roads and communities.
Reconstruction	Major roadway reconstruction provides an opportunity to improve provisions for cyclists through the redistribution of existing road space (if reconstruction only involves work between the curbs) or increased roadway width or off-road space. Efficiencies where the two projects overlap will reduce the cost of providing context-appropriate bike facilities.
Resurfacing	Affordable solutions may be limited to redistributing existing road space. Fully paved shoulders may be considered along rural arterials or collectors used by cyclists.

Table 3.12 – On-Street Parking (for urban situations)

The presence of on-street parking has a considerable influence on both the safety and comfort of a cyclist using a bicycle facility. In particular, the configuration of on-street parking, its degree of utilization and its separation from the bicycle facility are of concern selecting a bicycle facility type. Sound engineering judgement must be applied in the design of these facilities. The designer must assess the potential for conflict between cyclists and motor vehicles as a result of vehicles entering or leaving parking spaces. The potential severity and number of conflicts will vary based on the volume of cyclists as well as the parking demand and turnover. In each case, the objective should be to avoid or mitigate conflicts to the extent possible, while recognizing parking needs and alternatives.	
Site Characteristics	**Design Considerations and Application Heuristics**
Parallel on-street parking is not permitted	Opportunities to provide bicycle lanes or, if not feasible, wide curb lanes should be explored and their appropriateness should be evaluated.
Parallel on-street parking is permitted in localized areas along the route	Consistent bicycle lanes may prove difficult to provide since available roadway width is likely to change where parking is provided. Wide curb lanes may be a compromise solution.
Parallel on-street parking is permitted but demand is low	Opportunities to remove, restrict or relocate parking in favour of providing bicycle lanes should be considered.
Parallel on-street parking is permitted but turnover is low	Bicycle lanes may be appropriate. Additional buffer space between bicycle and parking lanes should be provided.
Parallel on-street parking is permitted; turnover and demand is high	Separated bicycle facilities between on-street parking and the edge of the roadway may be most appropriate. Bicycle lanes between vehicle travel lanes and on-street parking are not desirable in this situation. This is due to the frequent occurrence of conflicts between cyclists and vehicles manoeuvring in and out of the parking area. Where separated facilities cannot be accommodated, potential provision for cyclists on alternate routes should be investigated.
Perpendicular or diagonal parking is permitted	On-road facilities are not appropriate unless parking is reconfigured or removed. Alternate routes or opportunities to provide a separated facility should be explored.

*Note: On-street parking only applies to the Bronte Village Growth Area

Table 3.13 – Frequency of Intersections (for urban situations)

The more intersections and access points along a bicycle route, the more conflict points that are present. Therefore, locations with increased intersection and access density require careful consideration when selecting a bicycle facility type for the area. Sound engineering judgement must be applied to determine the characteristics of a particular site and a corresponding facility design. The designer must assess the potential for conflict between cyclists and motor vehicles as a result of vehicles entering and exiting the road. The potential severity and number of conflicts will vary based on cyclist and vehicle turning movement volumes. In each case, the objective should be to avoid or mitigate conflicts to the extent possible. This may involve the application of conflict pavement markings, as described in **Section 4.2.1.4** and **4.2.2.4.**	
Site Characteristics	**Design Considerations and Application Heuristics**
Limited intersection and driveway crossings are present along the route	Separated facilities or bicycle lanes are well suited to routes with few driveways and intersections.
Numerous low volume driveways or unsignalized intersections are encountered	Bicycle lanes may be more appropriate than separated facilities since motorists are more likely to be aware of cyclists on the roadway rather than adjacent to the road. If bicycle lanes are not feasible, wide curb lanes may be provided.
Numerous high volume driveways or unsignalized intersections are present along the route	Separated facilities are generally not preferred in this situation; bicycle lanes may be more appropriate. Crossings should be designed to minimize conflicts; additional positive guidance should be considered to warn cyclists and motorists of conflicts. If bicycle lanes are not feasible, wide curb lanes may be provided.
Major intersections with high speed and traffic volumes are encountered	Consider provision of bicycle lanes, bike boxes, intersection and conflict zone markings as well as special bicycle signal phases at major intersections. Consider indirect left-turn treatments if there is significant bicycle left turn demand conflicting with through motor vehicle traffic. If a separated facility is being considered, crossings should have bicycle traffic signals with exclusive phases, and conflicts should be clearly marked.

As indicated under “design considerations and application heuristics” in the above tables, various facility types may be suitable for Lakeshore Road West. Further assessment of the study area, roadway and intersection geometry and design constraints is required, along with stakeholder consultation and a review of relevant policy documents related to cycling in the study area, to determine the preferred alternative suitable for Lakeshore Road West.

OTM Book 18 provides a guideline for preliminary selection of bicycle facilities, however, as noted in the manual, the final decision on the preferred bicycle facility requires professional judgement:

“The experience and judgement of a qualified engineering designer or practitioner should ultimately influence the bicycle facility type, plus the added design features or enhancements that are selected.”

The following sections of this report further evaluate alternative bicycle facility types.

2.4 Cycling Facility Alternatives

Based on the Book 18 assessment completed above, several alternatives were carried forward for consideration. The Lakeshore Road West study area is approximately 6.2 km long and consequently segments with differing characteristics, including the Bronte Village Growth Area, which should be considered separately. Five (5) alternatives were selected for further evaluation, as follows:

- Alternative 1: On-road Bike Lanes
- Alternative 2: On-road Bicycle Lanes with a buffer
- Alternative 3: Off-road One-Way Cycle Tracks
- Alternative 4: Off-road Multi-Use Path
- Alternative 5: Combination - On-road Bicycle Lanes with a buffer with sidewalk on the north side and a multi-use path on the south side

Figures 2.1 to 2.5 illustrate the alternatives considered.

Figure 2.1. Alternative 1: On-Road Bike Lanes

- On-road adjacent to vehicular traffic lanes, not separated
- Demarcated with pavement markings and regulatory signage
- Intended to provide dedicated space for the exclusive use of cyclists

Figure 2.2. Alterative 2: On-Road Bike Lane with a Buffer

- On-road adjacent to vehicular traffic lanes, separated by a painted buffer, providing greater separation and reduced conflict potential
- Demarcated with pavement markings and regulatory signage
- Intended to provide dedicated space for the exclusive use of cyclists

Figure 2.3. Alterative 3: Off-Road One-way Cycle Track

- Bicycle facility adjacent to, but separated from motor vehicle travelled lanes
- One-way cycle tracks are raised from the roadway by a rollover or barrier curb, and may be located within the boulevard of the roadway
- Designated for exclusive use by cyclists, and distinct from the sidewalk
- Fire hydrants / street lighting can be provided in a buffer between the cycle track and the sidewalk.

Figure 2.4. Alterative 4: Off-Road Multi-Use Path

- Off road (within boulevard), hard surfaced trail
- Intended for shared use by pedestrians, cyclists, inline skaters, etc.
- Accessible for all, including people using wheelchairs, scooters and walkers

Alternative 5 is a combination of on-road bike lane, multi-use path and sidewalk. This combination provides facilities for both recreational cyclists and commuter cyclists.

2.5 Facility Widths and Space Requirements

Desired and suggested minimum widths for on-road bicycle lanes, cycle tracks and multi-use paths are detailed in OTM Book 18. Table 2.1 and Table 2.2 below are excerpted from this manual, and present the desired and suggested minimum widths for on-road bicycle lanes, both conventional and separated. Table 2.3 and Table 2.4 are also taken from OTM Book 18, and note the recommended widths for cycle tracks and multi-use paths. It is recommended that the desired widths be used in the design. However, for context-specific situations on segments or corridors with constrained right-of-way width, a reduction in width to a value greater than or equal to the suggested minimum may be considered.

Table 2.1. Bicycle Lane Widths (to the face of the curb)

Facility	Desired Width	Suggested Minimum
Conventional Bicycle Lane[e]	1.8 m[a]	1.5 m[b]
Conventional Bicycle Lane splitting two travel lanes[c]	2.0 m	1.8 m
Conventional Bicycle Lane adjacent to on-street parking	1.5 m lane + 1.0 m buffer	1.5 m lane + 0.5 m[d] buffer

[a]Up to 2.0 metres where high volumes of cyclists are anticipated, to facilitate overtaking within the bike lane.

[b]In a low volume, low speed constrained corridor with no gutter, this may be reduced to 1.2 metres. Cyclists may have to cross into the adjacent travel lane with little warning to avoid any debris or pavement defects.

[c]Includes bike lanes between through lanes and turn lanes on the approach to an intersection. Also applies to bike lanes between through lanes and merge lanes downstream of an intersection.

[d]Assumes a parking lane width of 2.5 metres, although where possible the buffer width should be increased by reallocating road space from the parking lane. This is to encourage motorists to park closer to the curb, thus reducing the conflict zone between cyclists and car doors that may open without warning. In a low volume, low speed constrained corridor, a minimum 1.8-metre wide bicycle lane may be provided without a buffer. However, the practitioner should consider the increased risk of collisions between cyclists and opening car doors or alighting passengers.

[e]Includes bicycle lanes alongside continuous barriers such as guiderails and underpass walls. Where intermittent obstructions (for example, sign posts) are present alongside the bicycle lane, a width of 1.8 – 2.0 metres is recommended.

Source: Based on the AASHTO Guide for the Planning, Design and Operation of Bicycle Facilities, 2012

Table 2.2. Separated Bicycle Lane Width

Facility	Desired Width	Suggested Minimum
Marked Buffer	1.8 m lane + 1.2 m buffer	1.5 m lane + 0.5 m[b] buffer
Flexible Bollards	2.0 m[c] lane + 1.2 m buffer	1.5 m[d] lane + 0.5 m buffer
Planters / Concrete Curb / Median	2.0 m[c] lane + 1.2 m buffer	1.8 m[d] lane + 0.5 m buffer
On-Street Parking	1.8 m lane + 1.2 m buffer	1.5 m lane + 0.8 m[e] buffer

[a]For bidirectional separated facilities, the same desired and minimum lane widths apply (per lane). Barrier widths are independent of the number of lanes. Where facilities are vertically separated, practitioners should refer to Table 4.6 – Desired and Suggested Minimum Widths for Raised Cycle Tracks.

[b]Maintenance standards for marked buffers should be the same as for lanes since cyclists may use them for overtaking.

[c]Practitioners should provide a minimum of 2.0 m effective width between the curb and the physical component of the barrier where high volumes of cyclists are anticipated. This will reduce the risk of cyclists clipping the physical buffer or curb while overtaking other cyclists.

[d]Maintenance procedures and costs should be considered since small street sweeper vehicles typically require 2.0m of unobstructed running width, otherwise the removal of flex bollards may be required before they can be used. Designers should check the requirements for their municipality and factor in higher maintenance costs should their chosen facility widths require the use of specialized equipment or manual sweeping. See Section 8 for further information on maintenance considerations. Impacts on drainage and garbage collection should also be taken into account.

[e]Practitioners should provide the widest buffer possible to reduce the risk of a cyclist colliding with an opening car door, recognizing that the space available for avoiding debris or imperfections and overtaking is limited.

Source: Adapted from AASHTO Guide for Planning, Design and Operation of Bicycle Facilities, 2012

Table 2.3. Cycle Track Widths

Facility	Desired Width	Suggested Minimum
One-Way Raised Cycle Track	2.0 m	1.5 m[b]
Two-Way Raised Cycle Track	4.0 m	3.0 m

[a]Where there is on-street parking alongside the raised cycle track, a minimum clearance of 1.0m should be provided between the raised cycle track and the face of the barrier curb. This is to reduce the risk of cyclists colliding with opening car doors and alighting passengers.

[b]Maintenance procedures and costs should be considered since small street sweeper vehicles typically require 2.0m of unobstructed running width. Designers should check the requirements for their municipality and factor in higher maintenance costs should their chosen facility widths require the use of specialized equipment or manual sweeping. See Section 8 for further information on maintenance considerations.

Source: Based on information from AASHTO Guide for Planning, Design and Operation of Bicycle Facilities, 2012 and the NACTO Urban Bikeway Design Guide, 2011

Table 2.4. Multi-Use Path Widths

Facility	Desired Width	Suggested Minimum
One-Way In-Boulevard Bicycle Facility	2.0 m	1.8 m
Two-Way In-Boulevard Bicycle Facility	4.0 m	3.0 m[b]
Two-Way In-Boulevard Shared Facility	4.0 m	3.0 m[b]

[a]Excludes splash strip (typical width 1.0 metre) where the in-boulevard facility abuts the curb.

[b]This may be reduced to 2.4 metres over very short distances in order to avoid utility poles or other infrastructure that may be costly to relocate.

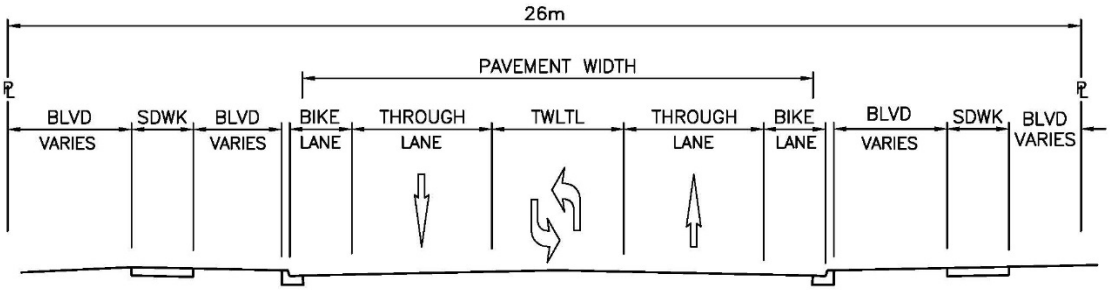
Source: Based on AASHTO Guide for Planning, Design and Operation of Bicycle Facilities, 2012; NACTO Urban Bikeway Design Guide, 2011

2.6 Lakeshore Road West - Alternatives - Typical Cross-sections

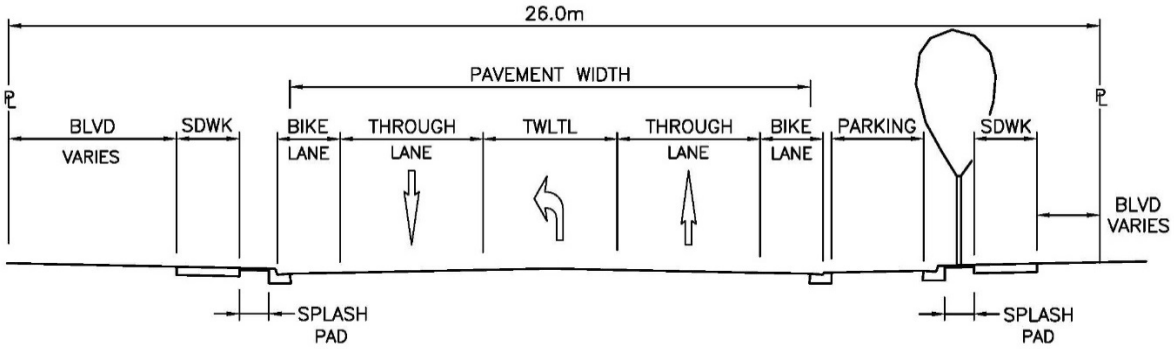
To evaluate the space requirements and appropriateness of the facility relative to the proposed conditions for each of the alternatives carried forward, typical cross-sections were created, as presented below. Dimensions of cross-sections elements for Lakeshore Road West are being evaluated separately and have not yet been confirmed. Consequently, a range of values acquired from the *Transportation Association of Canada (TAC) "Geometric Design Guide for Canadian Roads", June 2017, various OTM's, and the Town of Oakville standards* are shown in the table below:

Cross-section Elements (ranges)	
Through Lanes	3.0m - 3.7m
Two-Way Left Turning Lane	3.5m - 3.7m
On-Road Bike Lane	1.5m - 2.1m
Buffer	0.3m to 0.9m
Sidewalk	1.5m - 2.0m
Multi-Use Trail	2.4m to 6.0m
Splash Pad	0.0m to 1.0m
Parking Lane - Length	5.6m to 6.4m
Parking Lane - Width	2.7m

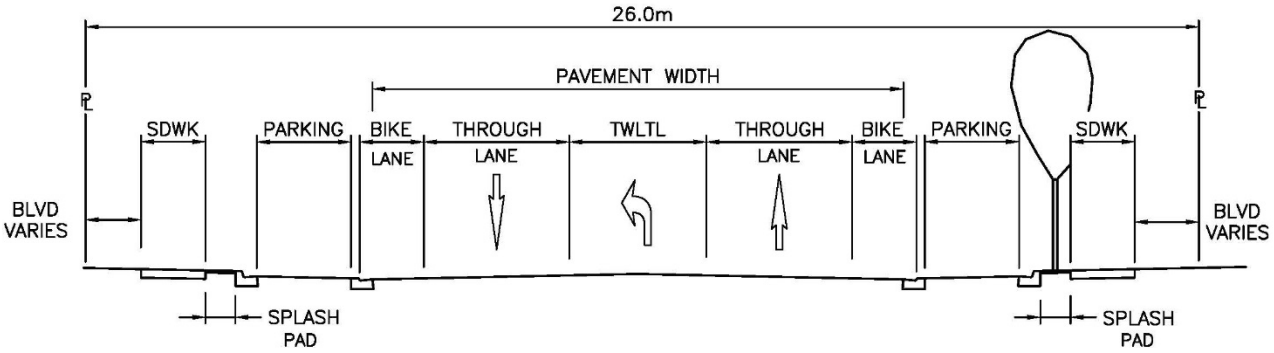
Alternative 1: On-Road Bike Lanes



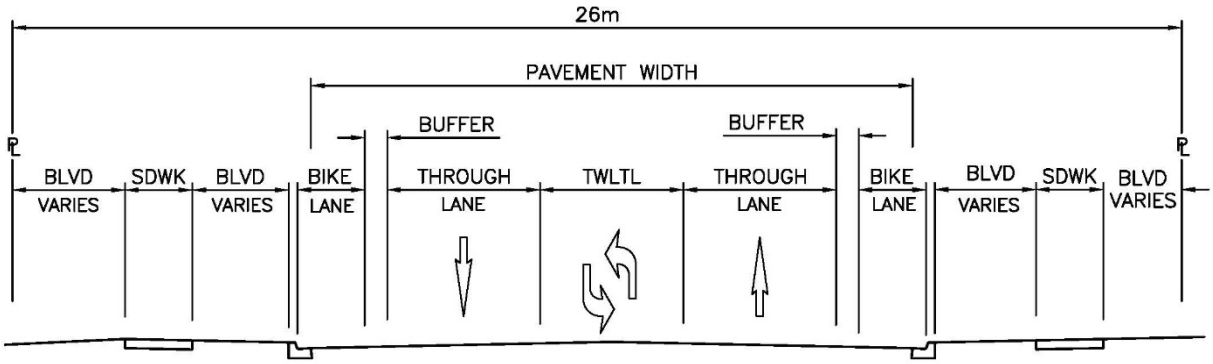
Alternative 1a: On-Road Bike Lanes with the provision for on-street parking on south side



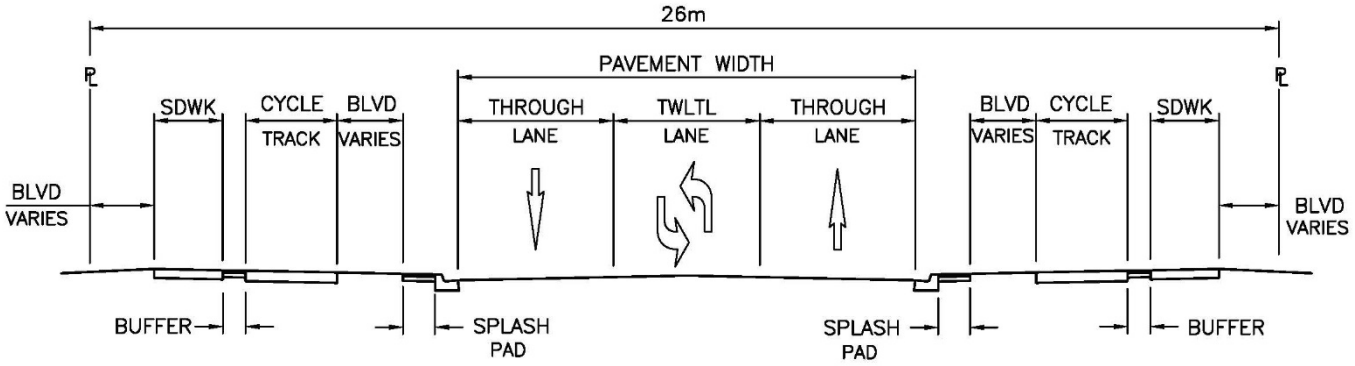
Alternative 1b: On-Road Bike Lanes with the provision for on-street parking on both sides



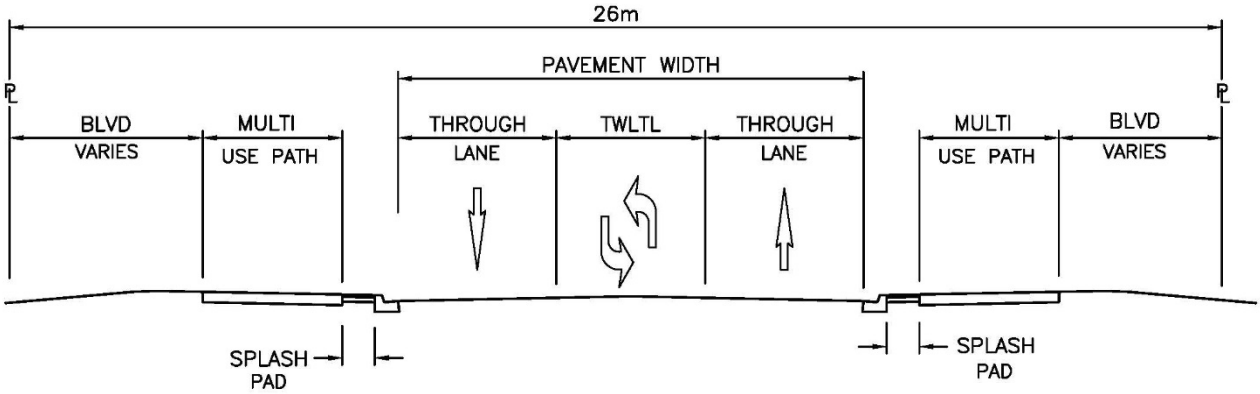
Alternative 2: On-Road Bike Lane with a Buffer



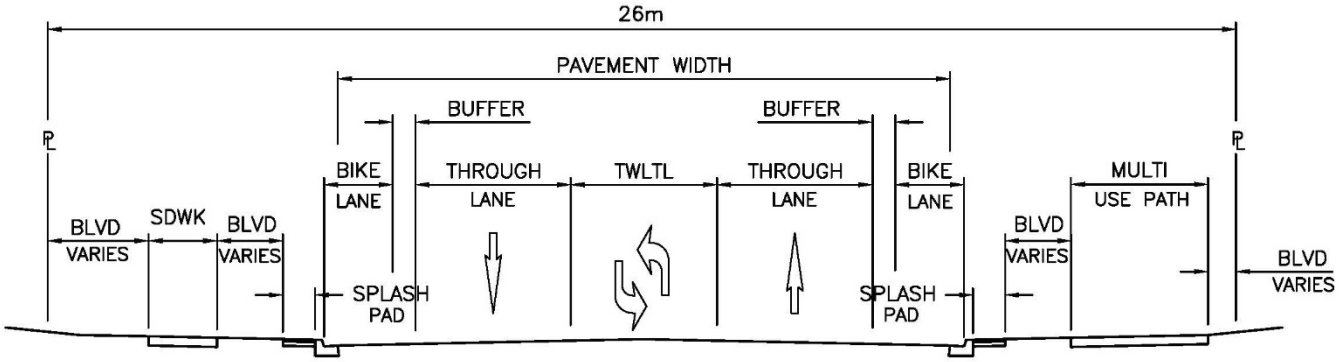
Alternative 3: Off-Road One-way Cycle Tracks



Alternative 4: Off-Road Multi-Use Path



Alternative 5: On-Road Bike Lane with a Buffer and Multi-Use Path on south side



As noted previously, the Lakeshore Road West corridor is approximately 6.2 km in length and includes sections with varying characteristics. The existing boulevard houses many objects such as trees, utilities, bus infrastructure and must be considered as part of the final alignment and lane width design. However, the alternatives can fit within the 26m right-of-way with varying alignment, facility width and boulevard space.

For purposes of further assessment, the corridor was split into two (2) separate sections, Mississaga Street to East Street, and East Street to Dorval. The Mississaga Street to East Street section is already urbanized, with existing curb and gutter and with some sections having on-road bike lanes. This section also includes the Bronte Village Growth Area, which currently has some on-street parking.

The East Street to Dorval Drive existing cross-section is primarily rural with ditches, varying paved and gravel shoulders and signed bike lanes from Bronte Road to Third Line.

3.0 ALTERNATIVES ASSESSMENT AND PREFERRED DESIGN

3.1 Detailed Alternatives Assessment

Each alternative was assessed based on a following factors:

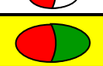
- roadway constraints and constructability
- property impacts
- utility impacts
- environmental and vegetation impacts
- safety and operations
- capital and maintenance costs

Table 3.1 and **Table 3.2** summarize the assessment of alternatives for each of the two roadway sections.

Table 3.1 - Alternative Assessment - Lakeshore Road West from Mississaga Street to East Street

Factors	Criteria	Alternative 1: On-Road Bike Lanes	Alternative 2: On-Road Bike Lanes with Painted Buffer	Alternative 3: One-way Off-road Cycle Tracks	Alternative 4: Multi-use Path
Roadway and Right-of-Way (ROW) Requirements	*Roadway and right-of-way requirements for cycling facility. *Proposed ROW width along Lakeshore Road West is 26.0m	*Proposed lane reductions between Mississaga Street and Bronte Road will provide space for on-road bike lanes in both directions without platform widening. *Will fit with in the proposed ROW.	* Proposed lane reductions between Mississaga Street and Bronte Road will provide space for on-road bike lanes with painted buffer in both direction without platform widening. *Will fit with in the proposed ROW.	*Proposed lane reductions between Mississaga Street and Bronte Road will provide additional space on the boulevard to accommodate a cycle track in the boulevard. *Will fit with in the proposed ROW.	*Proposed lane reductions between Mississaga Street and Bronte Road will provide additional space on the boulevard to accommodate a multi-use trail in the boulevard. *Will fit with in the proposed ROW
Property Impacts	*Potential impacts to existing properties adjacent to the roadway and with in the 26.0m ROW.	*No impacts to properties.	*No impacts to properties.	*Possible property acquisition may be required where the 26m ROW has not been maintained.	*Possible property acquisition may be required where the 26m ROW has not been maintained.
Utility Impacts	*Potential impacts to existing utilities within the ROW, including overhead Hydro. *Existing Hydro line and light standards along Lakeshore Road West.	*Little to no impact to utilities.	*Little to no impact to utilities.	*At isolated locations, minor overhead utility relocations will be required, such as individual poles or guy wires. *Potential for underground conflicts on boulevard.	*At isolated locations, minor overhead utility relocations will be required, such as individual poles or guy wires. *Potential for underground conflicts on boulevard.
Environmental/ Vegetation Impacts	*Potential Impacts and loss of vegetation	*No impacts to greenspaces. *Opportunity to provide additional green space.	*No impacts to greenspaces. *Opportunity to provide additional green space.	*Little to no impacts to greenspace by avoiding key features. *Tree trimming/ removals may be required with this option in the boulevard.	*Little to no impacts to greenspace by avoiding key features. *Tree trimming/ removals may be required with this option in the boulevard.

Table 3.1 - Alternative Assessment - Lakeshore Road West from Mississaga Street to East Street (continued)

Factors	Criteria	Alternative 1:	Alternative 2:	Alternative 3:	Alternative 4:
		On-Road Bike Lanes	On-Road Bike Lanes with Painted Buffer	One-way Off-road Cycle Tracks	Multi-use Path
Safety/ Bicycle Traffic Operations	*Separation between motorized vehicles and cyclists. *Routing and connectivity of bicycle traffic	* No Separation between vehicles and cyclists. *Preferred by commuter cyclists. *Not preferred by recreational cyclists. *At accesses, drivers are more aware of cyclists on the roadway.	* A buffer provides separation between vehicles and cyclists reducing conflict potential compared to Alternative 1. * Preferred by commuter cyclists. *Not preferred by recreational cyclists. *At accesses, drivers are more aware of cyclists on the roadway.	*Provides a separate facility for cyclists away from vehicular traffic resulting in reduced vehicle/cyclist conflict potential compared to Alternatives 1 and 2. *Not preferred by commuter cyclists. *At accesses, drivers are more likely to be aware of cyclists on the roadway rather then adjacent the road .	* Provides a separate facility for cyclists and pedestrians away from vehicular traffic resulting in reduced vehicle/cyclist conflict potential compared to Alternatives 1 and 2. *Lane is shared by pedestrian and cyclists. *The pathway provides vertical and horizontal separation between vehicles and cyclists. *Possible conflicts between pedestrians and cyclists. *Not preferred by commuter cyclists. *At accesses, drivers are more likely to be aware of cyclists on the roadway rather then adjacent the road .
					
Vehicular Traffic Operations	*Potential adverse effect to traffic operations	*Conflict zone at intersections from right turning vehicles. *Conflict zone in advance of intersections with dedicated vehicular right turn lane are provided as vehicles must merge into the right lane crossing through the bike lane. *At accesses, drivers are more aware of cyclists on the roadway.	*Conflict zone at intersection from right turning vehicles. *Conflict zone in advance of intersections with dedicated vehicular right turn lane are provided as vehicles must merge into the right lane crossing through the bike lane. *At accesses, drivers are more aware of cyclists on the roadway. *Buffer provides level of comfort for cyclists and drivers	*Conflict zones at intersections from right turning vehicles. *Separated from vehicle traffic on roadway. * At accesses, drivers are more likely to be aware of cyclists on the roadway rather than on the road .	*Conflict zones at intersections from right turning vehicles. *Separated from vehicle traffic on roadway. * At accesses, drivers are more likely to be aware of cyclists on the roadway rather than on the road .
					
Capital and Maintenance Costs	*Capital cost of the proposed improvements and costs of maintaining the facility.	*Maintenance (snow removal) of facility to be completed as part of roadway snow removal. *Moderate construction costs.	*Moderate construction costs, marginally more than Alternative 1. *Maintenance (snow removal) of facility to be completed as part of roadway snow removal. *Additional painting of the buffer resulting in marginal increase in maintenance costs.	*Highest construction cost. *Requires separate operation for snow removal due to separation between cycle track and roadway, resulting in additional maintenance costs.	*Lowest construction costs. *Requires separate operation for snow removal on multi-use path, resulting in additional maintenance costs.
					
Overall Evaluation					

Legend

 Positive

 Neutral-Positive

 Neutral

 Negative-Neutral

 Negative

Table 3.2 - Alternative Assessment - Lakeshore Road West from East Street to Dorval Drive

Factors	Criteria	Alternative 1: On-Road Bike Lanes	Alternative 2: On-Road Bike Lanes with Painted Buffer	Alternative 3: One-way Off-road Cycle Tracks	Alternative 4: Multi-use Path
Roadway and Right-of-Way (ROW) Requirements	*Roadway and right-of-way requirements for cycling facility. *Proposed ROW width along Lakeshore Road West is 26.0m	*Urbanization required to accommodate cycle track as existing boulevards have stormwater ditches and gravel shoulders. *Frequent accesses and driveways are accommodated without compromising cycle facility. *Will fit with in the proposed ROW with urbanization.	*Urbanization required to accommodate cycle track as existing boulevards have stormwater ditches and gravel shoulders. *Frequent accesses and driveways are accommodated without compromising cycle facility *Will fit with in the proposed ROW with urbanization..	*Urbanization required to accommodate cycle track as existing boulevards have stormwater ditches and gravel shoulders. *Frequent accesses and driveways are accommodated without compromising cycle facility *Will fit with in the proposed ROW with urbanization..	*Urbanization required to accommodate multi-use trail as existing boulevards have stormwater ditches and gravel shoulders. *Frequent accesses and driveways are accommodated without compromising cycle facility *Will fit with in the proposed ROW with urbanization..
Property Impacts	*Potential impacts to existing properties adjacent to the roadway and with in the 26.0m ROW.	*No impacts to properties.	*No impacts to properties.	*Possible property acquisition may be required where the 26m ROW has not been maintained.	*Possible property acquisition may be required where the 26m ROW has not been maintained.
Utility Impacts	*Potential impacts to existing utilities within the ROW, including overhead Hydro. *Existing Hydro line and light standards along Lakeshore Road West.	*Little to no impact to utilities.	*Little to no impact to utilities.	*At isolated locations, minor overhead utility relocations will be required, such as individual poles or guy wires. *Potential for underground conflicts on boulevard.	*At isolated locations, minor overhead utility relocations will be required, such as individual poles or guy wires. *Potential for underground conflicts on boulevard.
Environmental/ Vegetation Impacts	*Potential Impacts and loss of vegetation	*Little to no impact to greenspace	*Little to no impact to greenspace	* Impacts to greenspace will be required to construct cycle track in the boulevard. *Tree trimming/ removals may be required with this option in the boulevard.	*Impacts to greenspace, less than Alternative 3, will be required to construct multi-use trail in the boulevard. *Tree trimming/ removals may be required with this option in the boulevard.

Table 3.2 - Alternative Assessment - Lakeshore Road West from East Street to Dorval Drive (continued)

Factors	Criteria	Alternative 1:	Alternative 2:	Alternative 3:	Alternative 4:
		On-Road Bike Lanes	On-Road Bike Lanes with Painted Buffer	One-way Off-road Cycle Tracks	Multi-use Path
Safety/ Bicycle Traffic Operations	*Separation between motorized vehicles and cyclists. *Routing and connectivity of bicycle traffic	* No Separation between vehicles and cyclists. *Preferred by commuter cyclists. *Not preferred by recreational cyclists. *At accesses, drivers are more aware of cyclists on the roadway.	* A buffer provides separation between vehicles and cyclists reducing conflict potential compared to Alternative 1. * Preferred by commuter cyclists. *Not preferred by recreational cyclists. *At accesses, drivers are more aware of cyclists on the roadway.	*Provides a separate facility for cyclists away from vehicular traffic resulting in reduced vehicle/cyclist conflict potential compared to Alternatives 1 and 2. *Not preferred by commuter cyclists. *At accesses, drivers are more likely to be aware of cyclists on the roadway rather then adjacent the road .	* Provides a separate facility for cyclists and pedestrians away from vehicular traffic resulting in reduced vehicle/cyclist conflict potential compared to Alternatives 1 and 2. *Lane is shared by pedestrian and cyclists. *The pathway provides vertical and horizontal separation between vehicles and cyclists. *Possible conflicts between pedestrians and cyclists. * At accesses, drivers are more likely to be aware of cyclists on the roadway rather then adjacent the road. *Preferred by recreational cyclists. *Demand for a separated cycling facility on south side for this section Lakeshore Road West is high due to the Lake access and parks.
					
Vehicular Traffic Operations	*Potential adverse effect to traffic operations	*Conflict zone at intersections from right turning vehicles. *Conflict zone in advance of intersections with dedicated vehicular right turn lane are provided as vehicles must merge into the right lane crossing through the bike lane. *At accesses, drivers are more aware of cyclists on the roadway.	*Conflict zone at intersection from right turning vehicles. *Conflict zone in advance of intersections with dedicated vehicular right turn lane are provided as vehicles must merge into the right lane crossing through the bike lane. *At accesses, drivers are more aware of cyclists on the roadway. *Buffer provides level of comfort for cyclists and drivers	*Conflict zones at intersections from right turning vehicles. *Separated from vehicle traffic on roadway. *At accesses, drivers are more likely to be aware of cyclists on the roadway rather than on the road .	*Conflict zones at intersections from right turning vehicles. *Separated from vehicle traffic on roadway. * At accesses, drivers are more likely to be aware of cyclists on the roadway rather than on the road .
					
Capital and Maintenance Costs	*Capital cost of the proposed improvements and costs of maintaining the facility.	*Maintenance (snow removal) of facility to be completed as part of roadway snow removal. *Moderate construction costs.	*Moderate construction costs, marginally more than Alternative 1. *Maintenance (snow removal) of facility to be completed as part of roadway snow removal. *Additional painting of the buffer resulting in marginal increase in maintenance costs.	*Highest construction cost. *Requires separate operation for snow removal due to separation between cycle track and roadway, resulting in additional maintenance costs.	*Lowest construction costs. *Requires separate operation for snow removal on multi-use path, resulting in additional maintenance costs.
					
Overall Evaluation					

Legend

 Positive

 Neutral-Positive

 Neutral

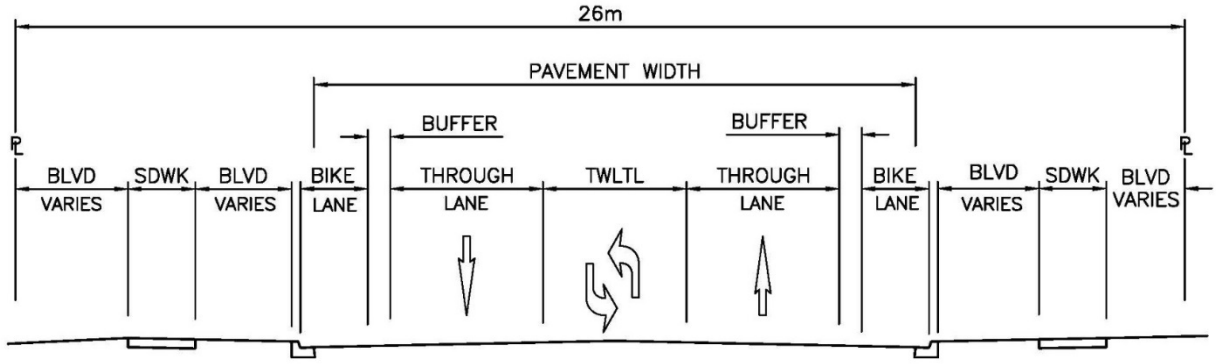
 Negative-Neutral

 Negative

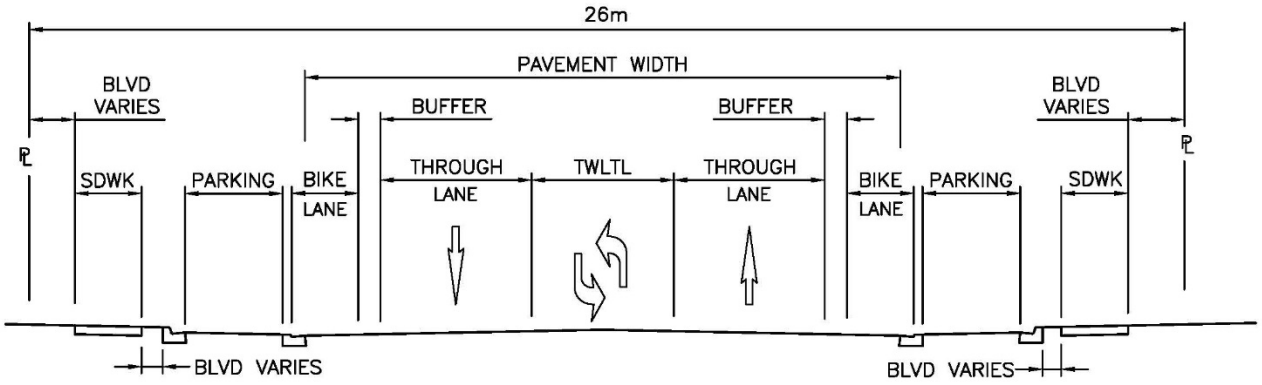
3.2 Preferred Alternative

Section 1 - Mississaga Street to East Street

Based on the assessment table completed in Section 3.1 (Mississaga Street to East Street), the preferred alternative for this section is on-road bike lanes with a painted buffer. On street parking, will be provided in certain locations between Bronte Road and Nelson Street (Typical with Parking).



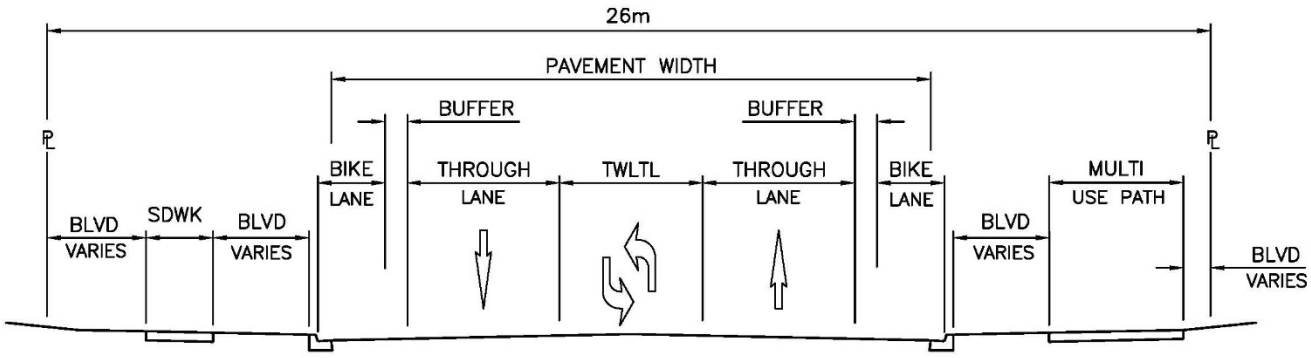
Typical with Parking



Section 2 - East Street to Dorval Drive

The nature of this section of Lakeshore Road West changes and the need for cycling infrastructure is split between commuter cyclists and recreational cyclists, including small children. There are numerous opportunities for trail connections in this section, including the Coronation Park area.

Based on the assessment table completed in Section 3.2 (East Street to Dorval Drive) of this report, consultation with the Town of Oakville and a review of the current use of the roadway by vehicles, pedestrians and cyclist, the preferred alternative for this section is on-road bike lanes (including the 0.3m gutter) with a painted buffer with a multi-use path on the south side (Lake Ontario side).



4.0 CONCLUSIONS AND RECOMMENDATIONS

This report summarized the process taken to select the preferred cycling facilities for Lakeshore Road West, from Mississaga Street to Dorval Drive. The preferred alternatives were generated based on various factors, relevant policies, guidelines from OTM Book 18, input from the Town of Oakville and sound engineering judgement.

In summary, the preferred cycling facility for the section of Lakeshore Road West from Mississaga Street to East Street consists of an On-Road Bike Lanes (including 0.3m gutter) with a painted buffer.

Within the Bronte Village Growth Area (Triller Place / West River Street to East Street), on-street parking will be accommodated where possible (further review of parking is required).

The preferred cycling facilities for the section of Lakeshore Road West from East Street to Dorval Drive consists of on-road bike lanes with a painted buffer and a multi-use path on the south side.

It is also recommended that the catch basins be recessed so they do not impact the cyclists.

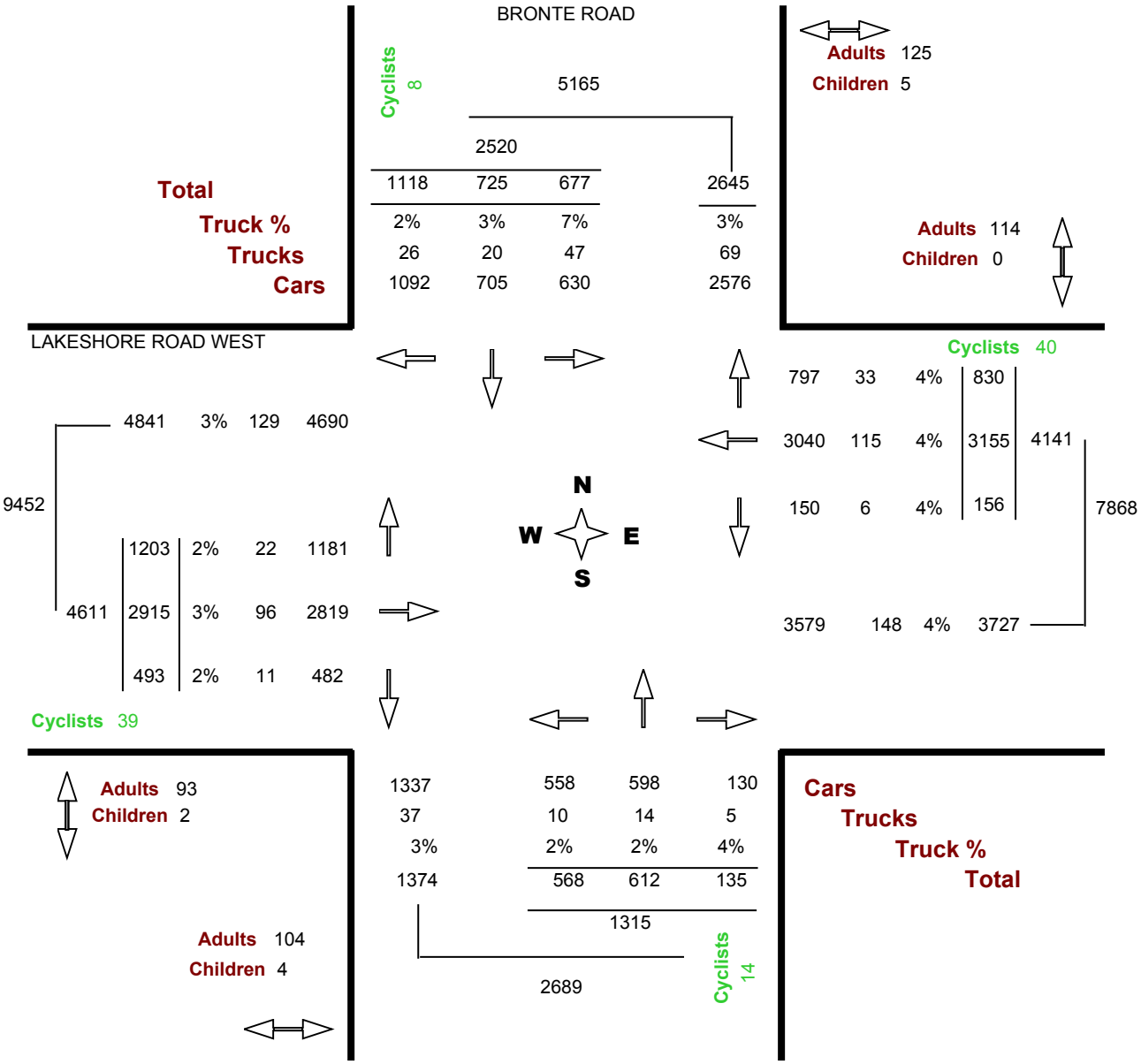
In section 2.6 above, ranges in width were provided for the cross-section elements of the roadway. The width of these elements will be assessed through the recommended plan for the entire right-of-way, Section 6.0 of the Environmental Study Report (ESR).

APPENDIX A

TMC Data & Cycle Counts

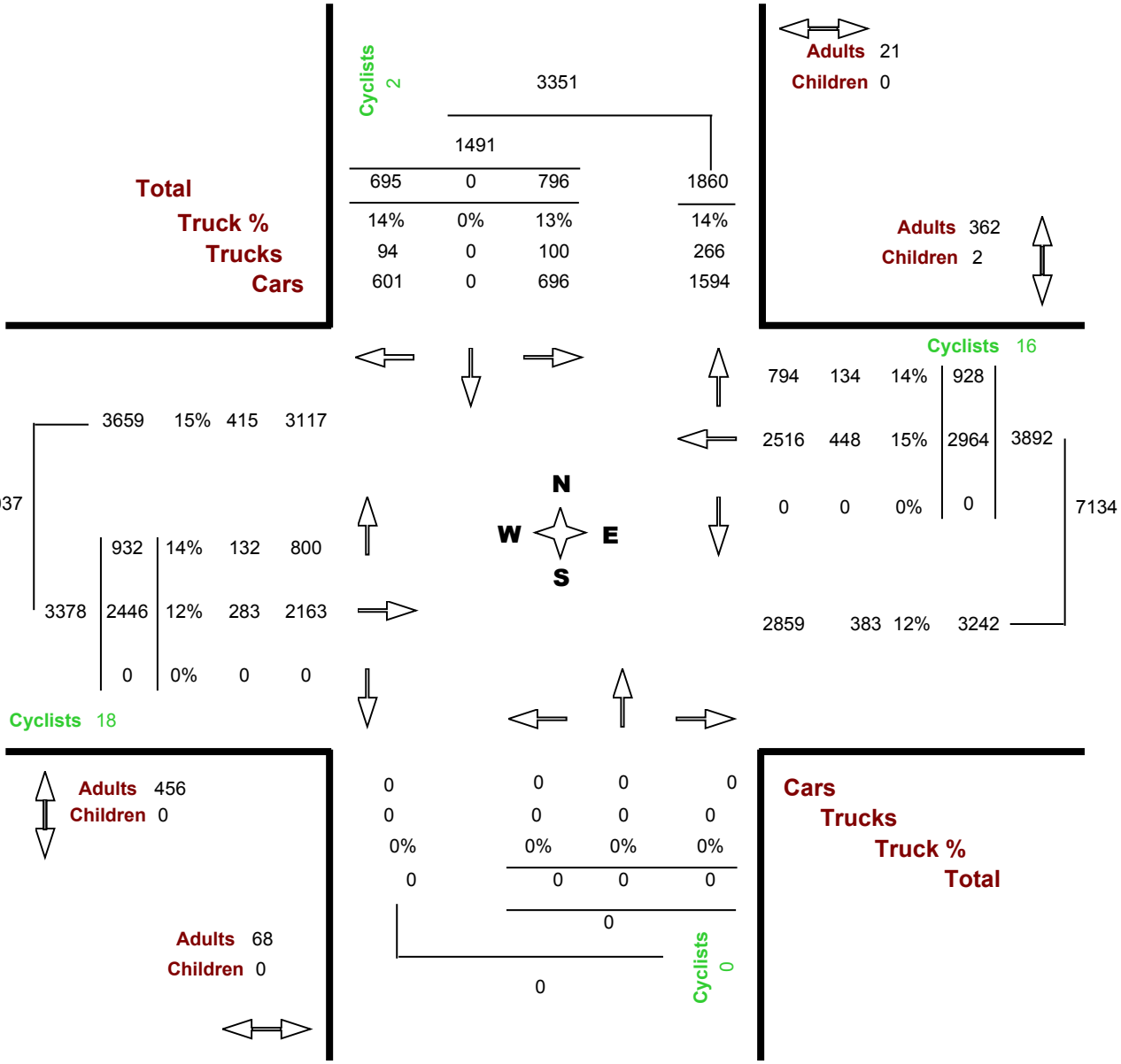
Turning Movements Count - Full Study Report

Location..... BRONTE ROAD @ LAKESHORE ROAD WEST
Municipality..... OAKVILLE
GeoID..... 30271101
Count Date..... Monday, 29 May, 2017



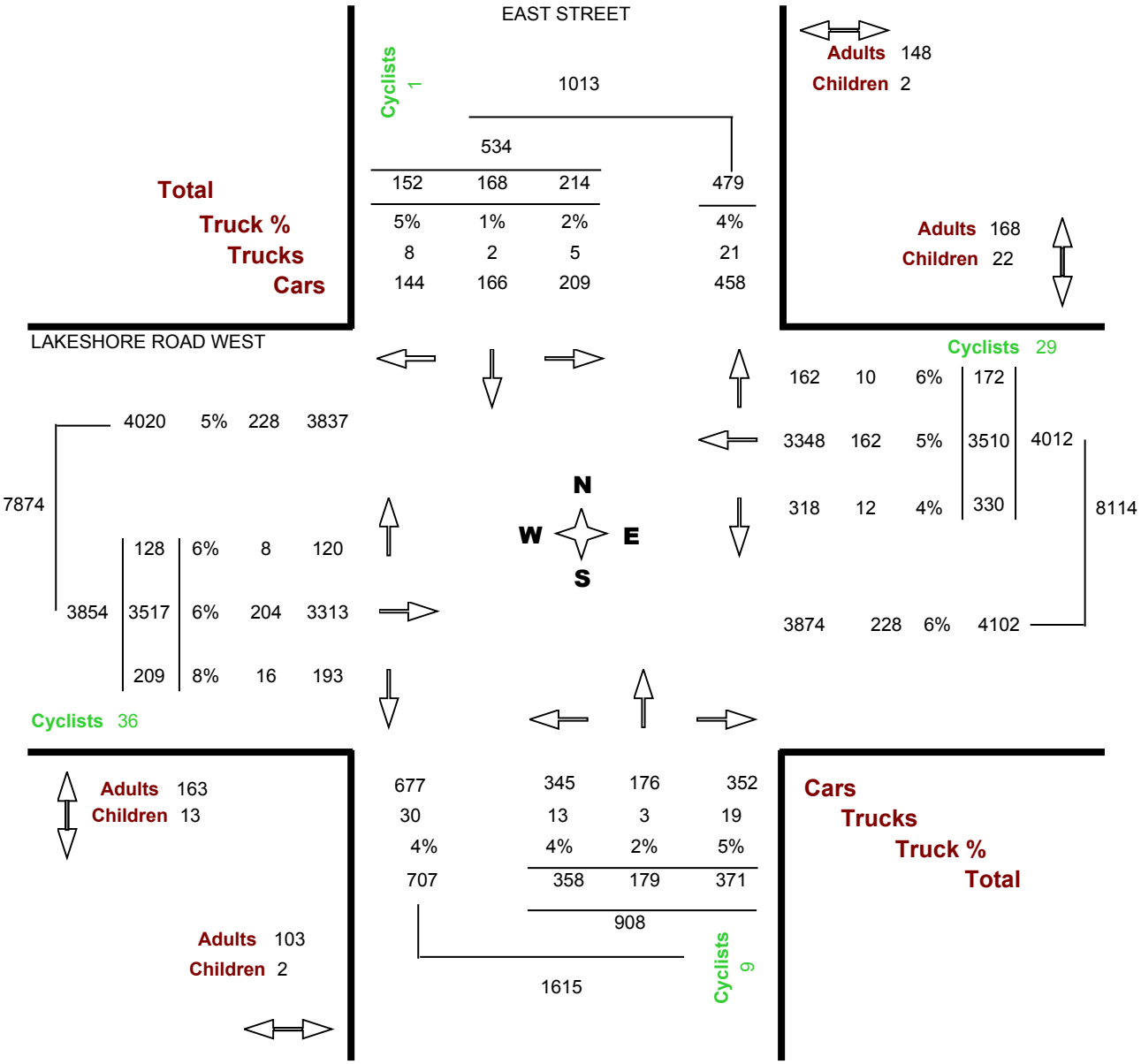
Turning Movements Count - Full Study Report

Location..... DORVAL DRIVE @ LAKESHORE ROAD WEST
Municipality..... OAKVILLE
GeoID..... 32650001
Count Date..... Monday, 17 October, 2016



Turning Movements Count - Full Study Report

Location..... EAST STREET @ LAKESHORE ROAD WEST
Municipality..... OAKVILLE
GeoID..... 30078701
Count Date..... Thursday, 27 April, 2017



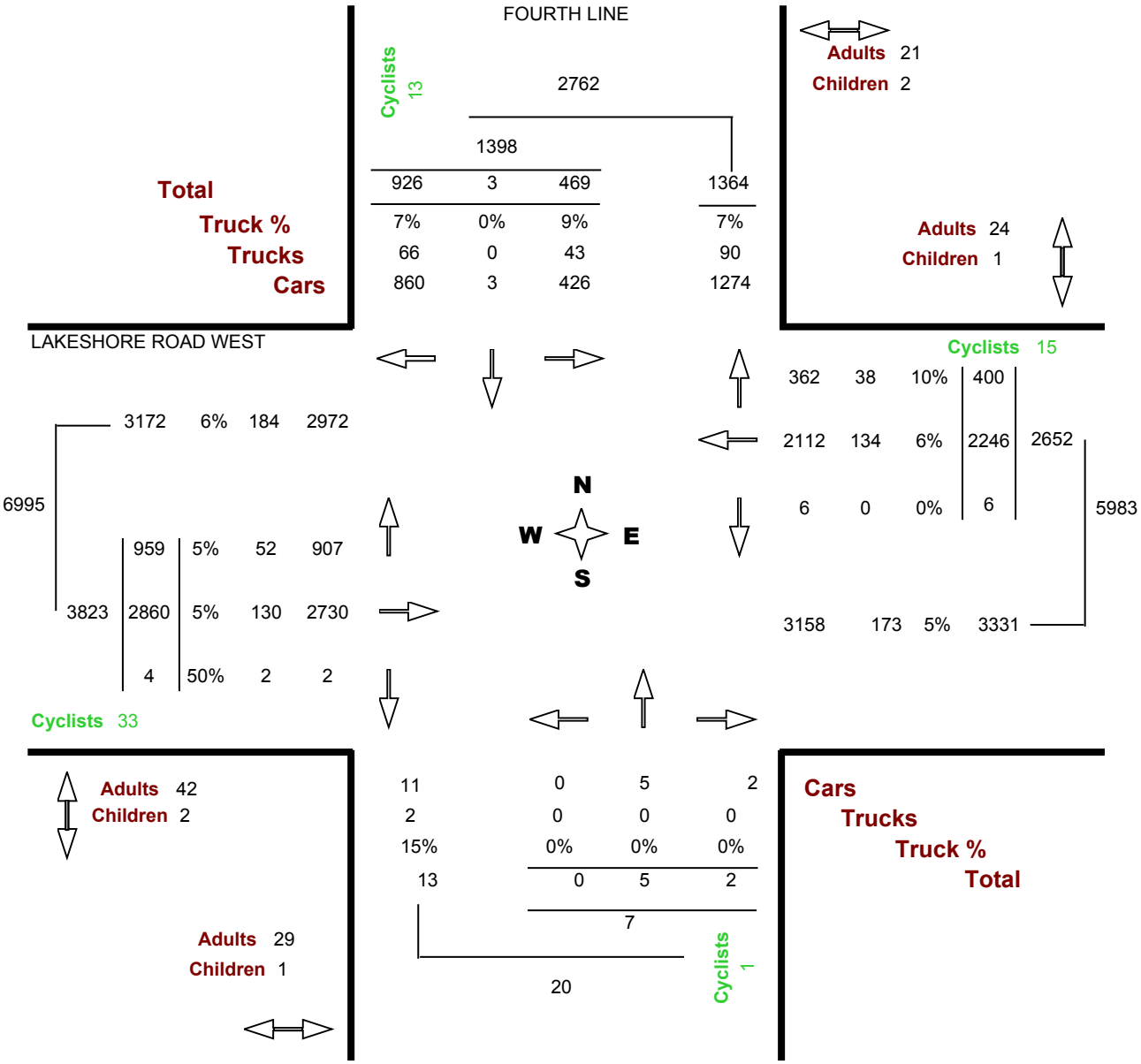
Turning Movements Count - Full Study Report

Location..... LAKESHORE ROAD WEST @ FOURTH LINE

Municipality..... OAKVILLE

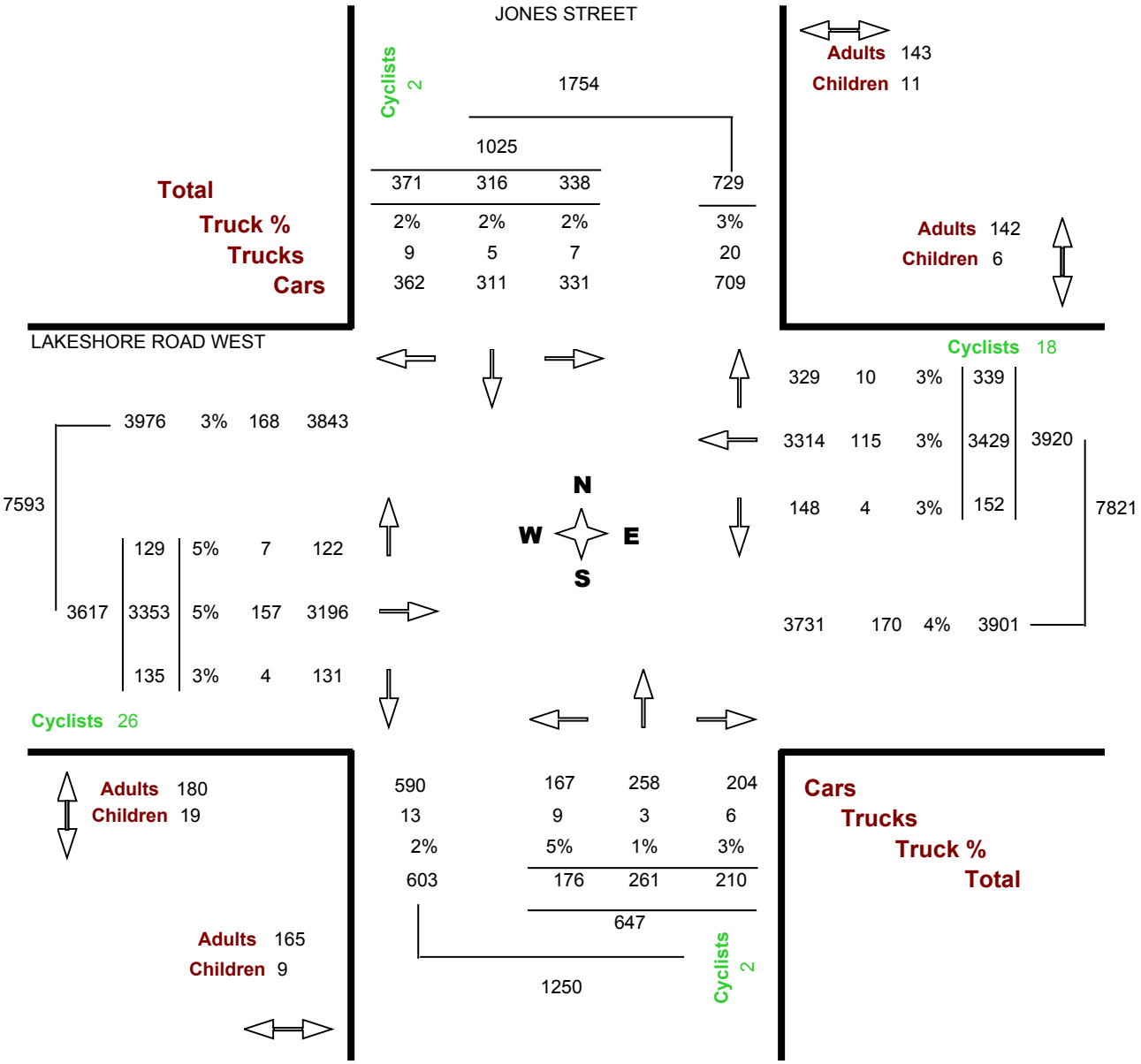
GeoID..... 30080401

Count Date..... Tuesday, 09 May, 2017



Turning Movements Count - Full Study Report

Location..... LAKESHORE ROAD WEST @ JONES STREET
Municipality..... OAKVILLE
GeoID..... 30078501
Count Date..... Monday, 16 May, 2016



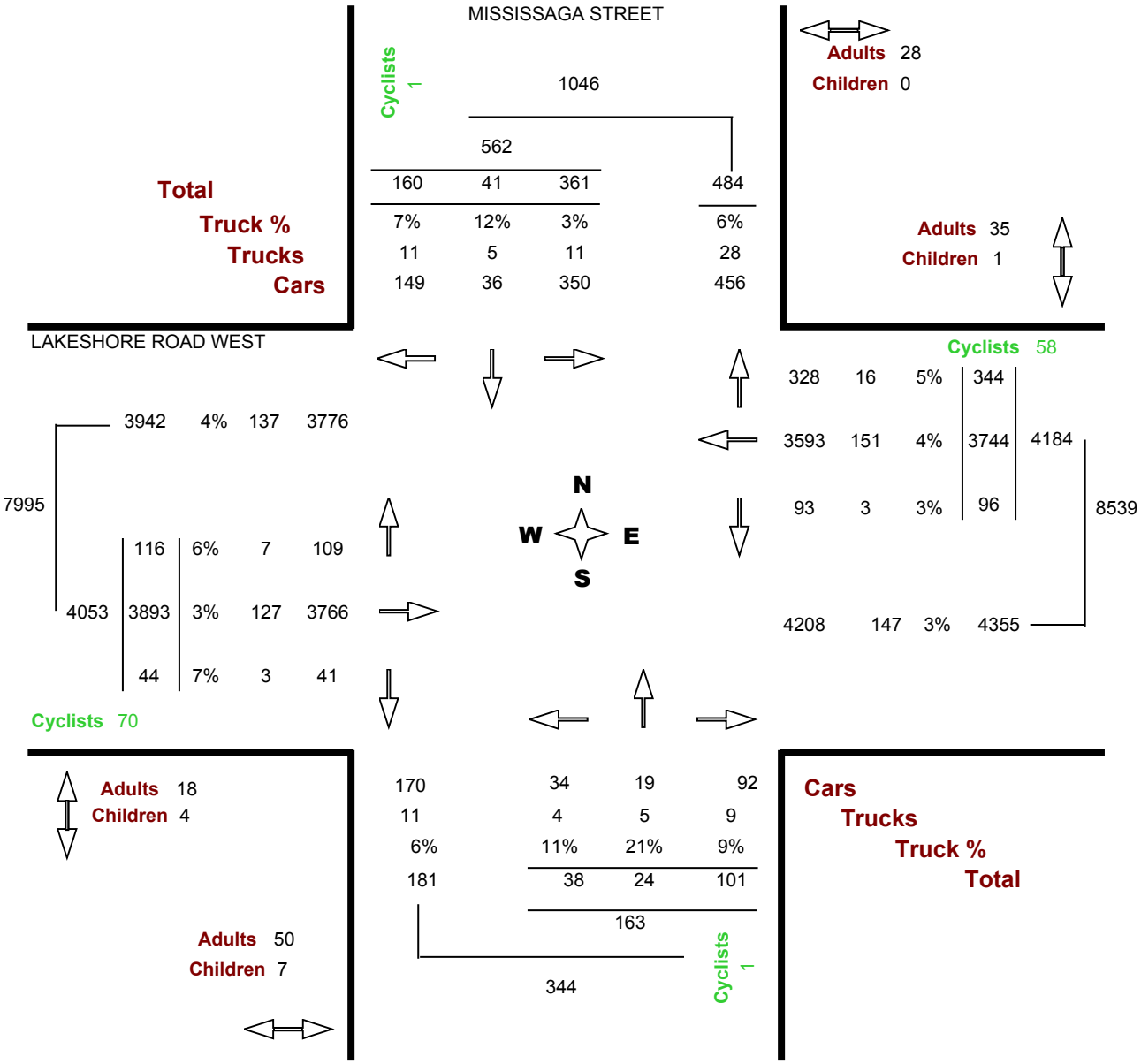
Turning Movements Count - Full Study Report

Location..... LAKESHORE ROAD WEST @ MISSISSAGA STREET

Municipality..... OAKVILLE

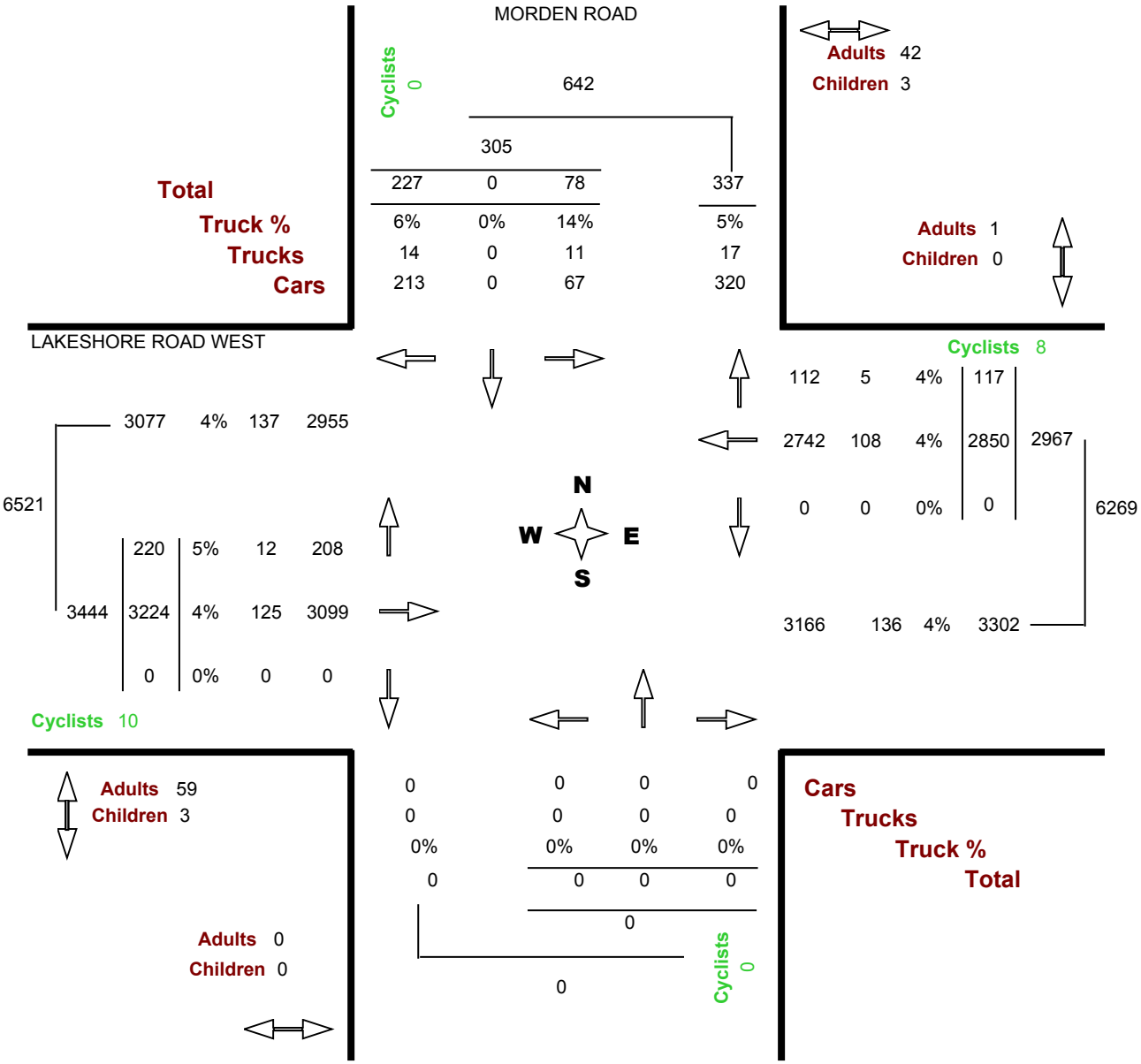
GeoID..... 30078201

Count Date..... Tuesday, 15 September, 2015



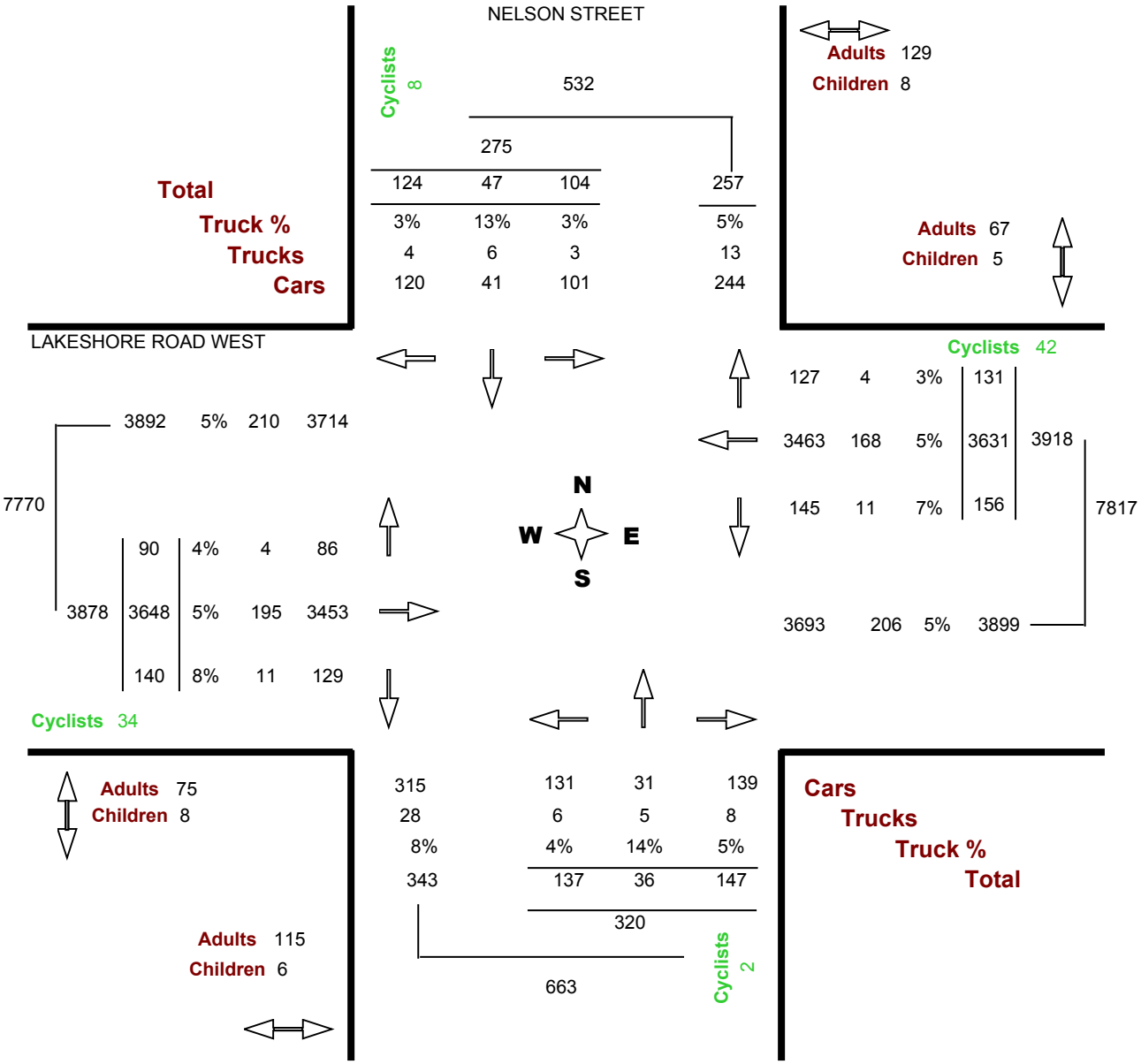
Turning Movements Count - Full Study Report

Location..... LAKESHORE ROAD WEST @ MORDEN ROAD
Municipality..... OAKVILLE
GeoID..... 30080901
Count Date..... Monday, 24 April, 2017



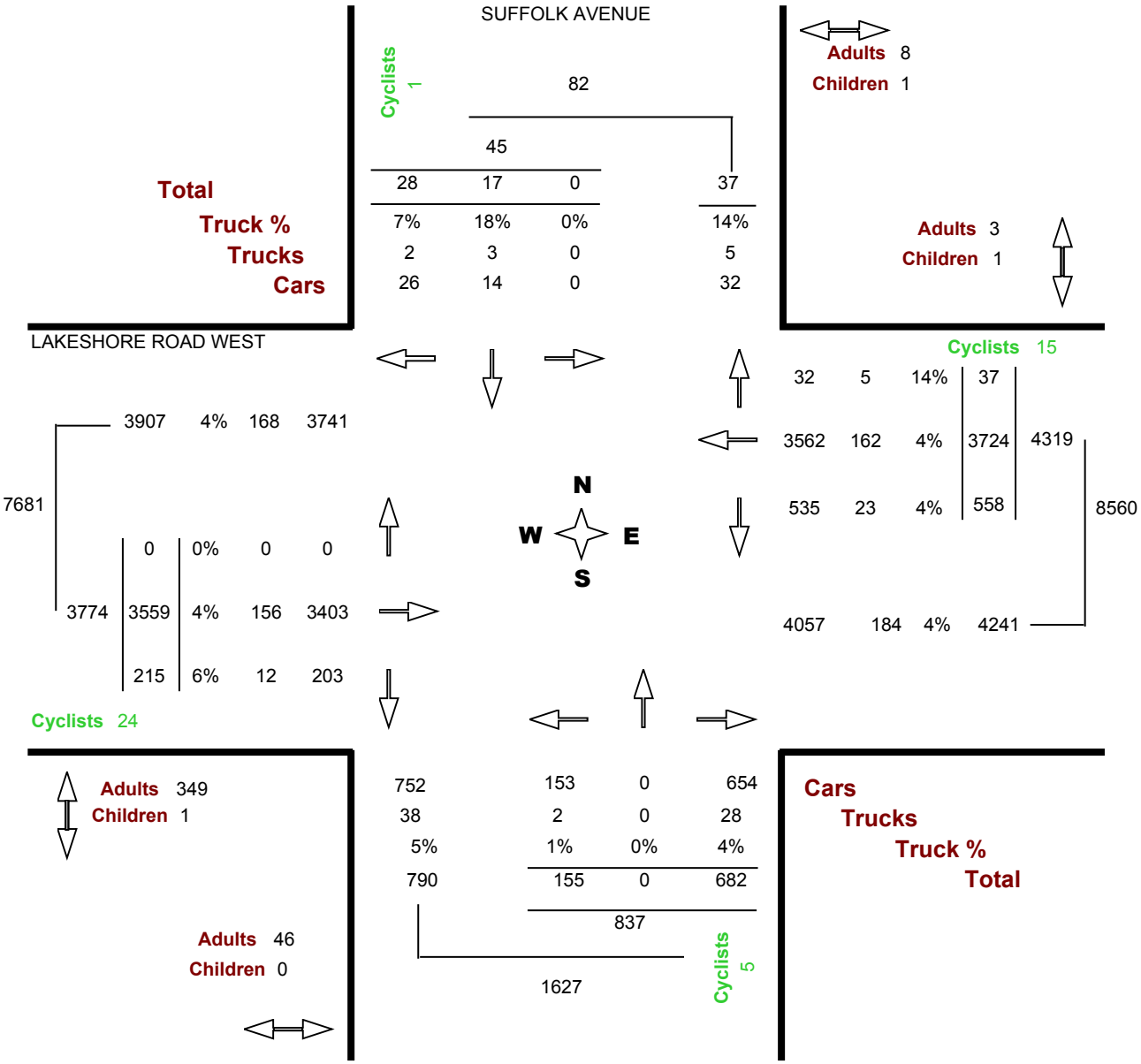
Turning Movements Count - Full Study Report

Location..... LAKESHORE ROAD WEST @ NELSON STREET
Municipality..... OAKVILLE
GeoID..... 30078601
Count Date..... Wednesday, 05 October, 2016



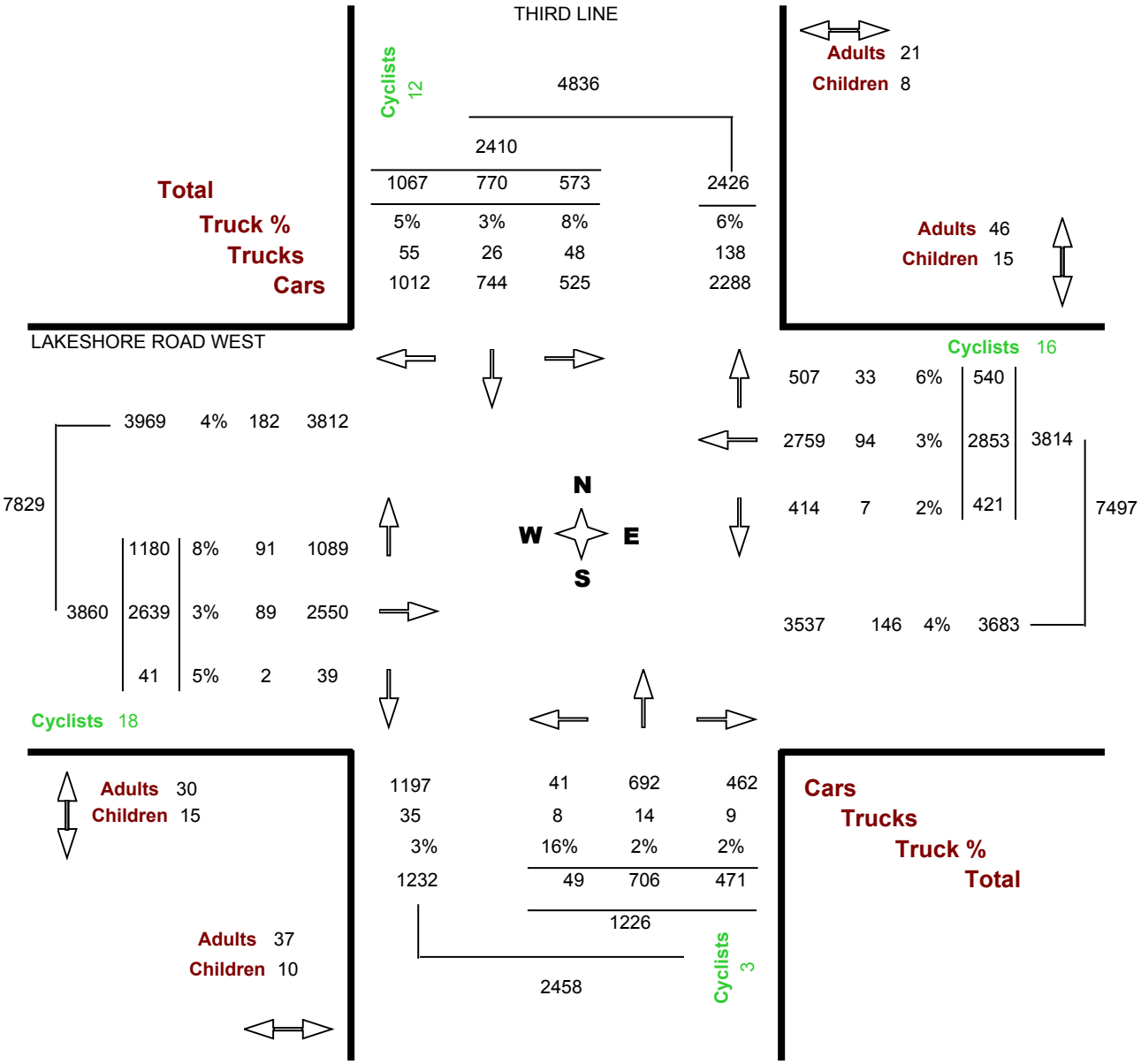
Turning Movements Count - Full Study Report

Location..... LAKESHORE ROAD WEST @ SUFFOLK AVENUE
Municipality..... OAKVILLE
GeoID..... 30080701
Count Date..... Thursday, 01 October, 2015



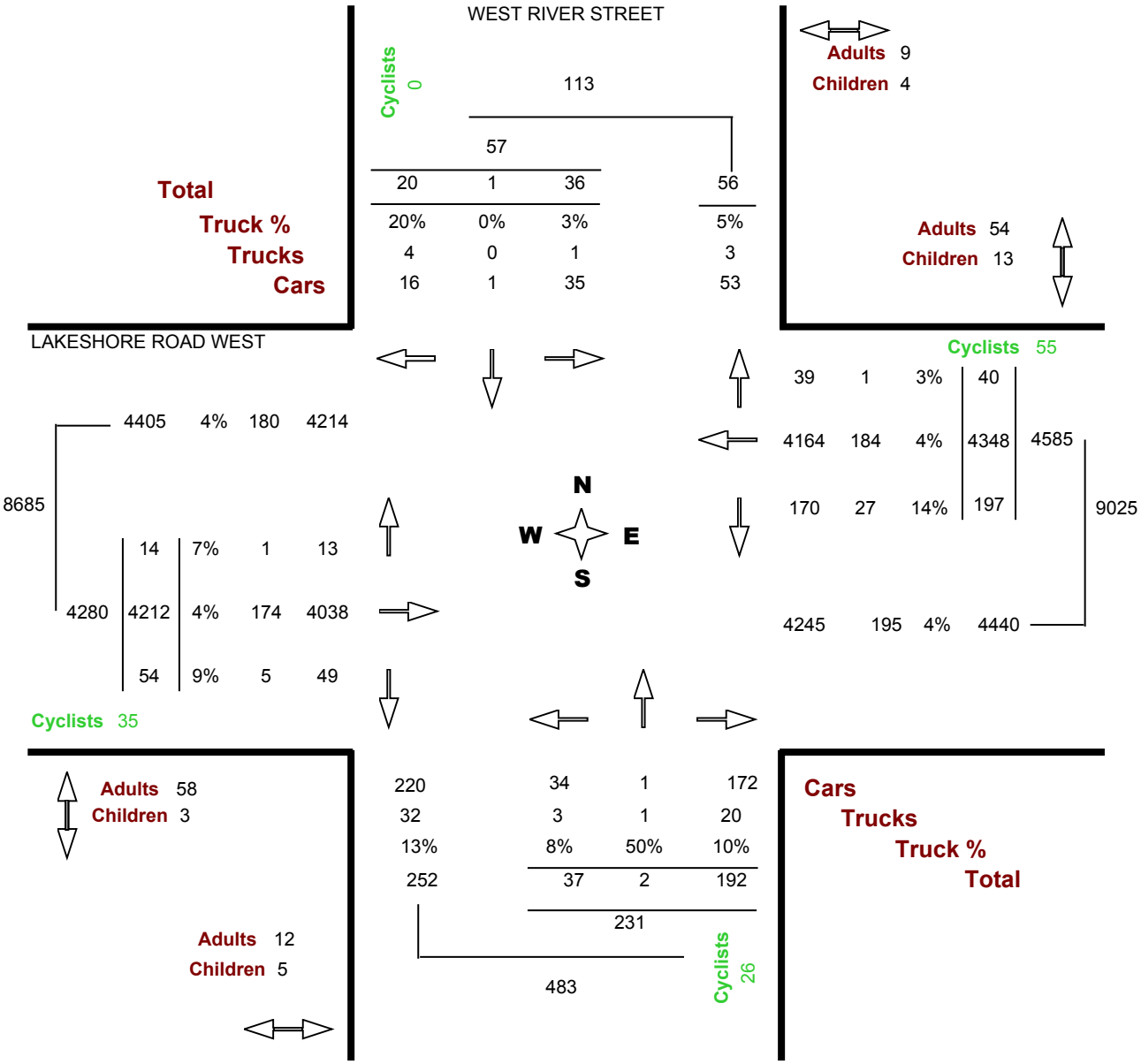
Turning Movements Count - Full Study Report

Location..... LAKESHORE ROAD WEST @ THIRD LINE
Municipality..... OAKVILLE
GeoID..... 30079101
Count Date..... Wednesday, 07 September, 2016



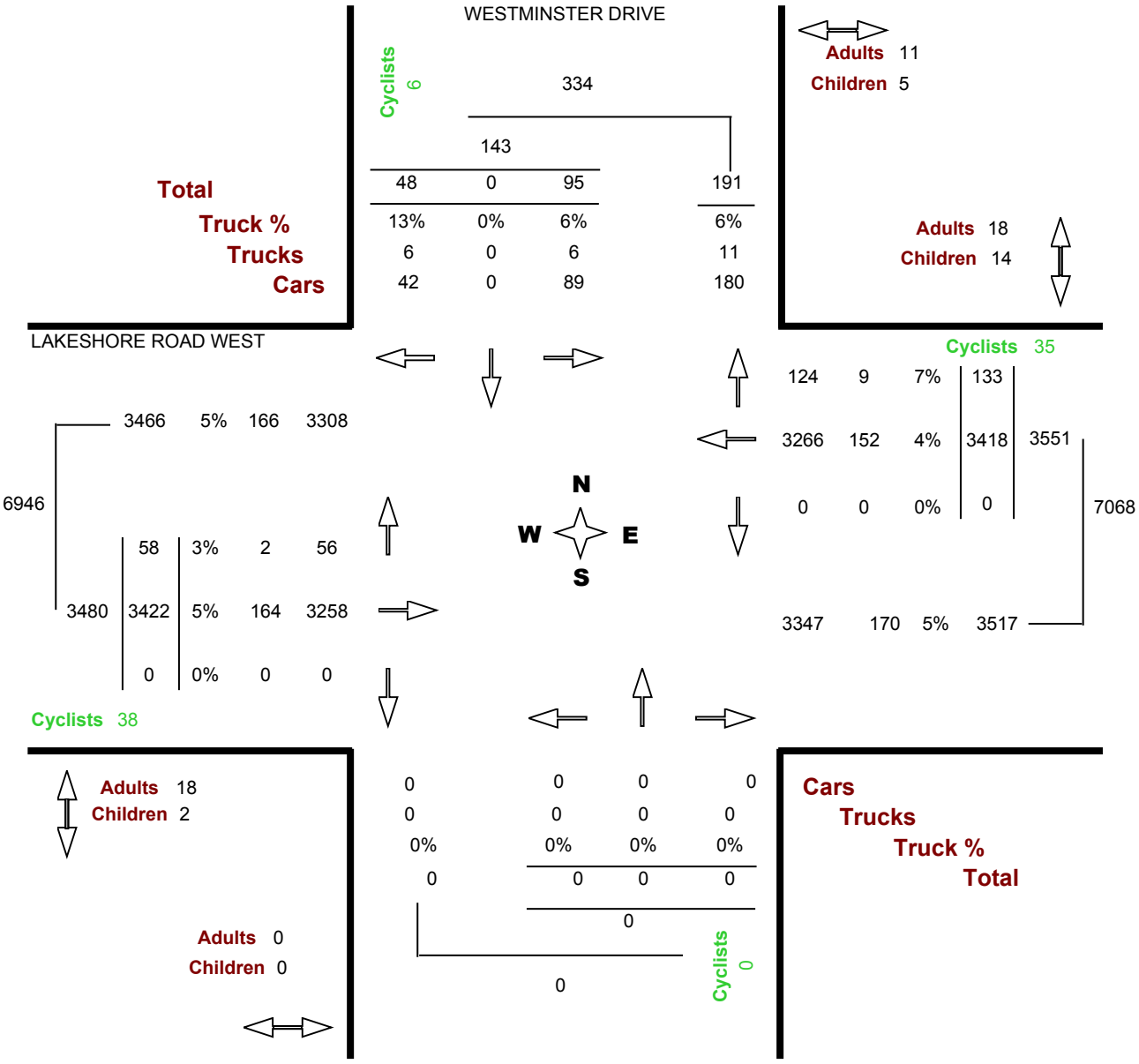
Turning Movements Count - Full Study Report

Location..... LAKESHORE ROAD WEST @ WEST RIVER STREET
Municipality..... OAKVILLE
GeoID..... 30078301
Count Date..... Tuesday, 04 October, 2016



Turning Movements Count - Full Study Report

Location..... LAKESHORE ROAD WEST @ WESTMINSTER DRIVE
Municipality..... OAKVILLE
GeoID..... 30079301
Count Date..... Monday, 13 June, 2011



Automatic Traffic Recorder (ATR) data received by the Town of Oakville. The summary below includes 2021 and 2031 projected data based on future growth rates.

ATR Counts - Average Daily Traffic (ADT)

Section	2016	2021	2031
West River Street and Bronte Road	15,946	16,759	16,759
Bronte Road and Jones Street	10,787	11,337	11,337
East Street and Solingate Drive	12,760	13,746	12,432
Windsor Gate and Third Line	14,136	15,228	13,772
Third Line and Belvedere Drive	11,292	12,165	11,002
West Lynn Road and Westdale Road	13,199	14,219	12,859
Fourth Line and Whittington Place	13,320	14,349	12,977
Morden Road and Shorewood Place	12,663	13,642	12,337
Holyrood Avenue and Dorval Drive	13,703	14,762	13,351
Average	**13,314**	**14,248**	**13,206**

Traffic Movement Counts (TMC's) received from the Town of Oakville. Cycling number were taken from the TMC's.

Cycle Counts (from traffic movement counts) - Average Daily

Intersection	Total	2016				Total	2021 (3% growth)				Total	2031 (5% Growth)			
		NB	SB	EB	WB		NB	SB	EB	WB		NB	SB	EB	WB
Mississaga Street	130	1	1	70	58	151	1	1	81	67	192	1	1	104	86
West River Street / Triller Place	85	26	0	4	55	99	30	0	5	64	126	38	0	6	81
Bronte Road	101	14	8	39	40	117	16	9	45	46	149	21	12	58	59
Jones Street	48	2	2	26	18	56	2	2	30	21	71	3	3	38	27
Nelson Street	86	2	8	34	42	100	2	9	39	49	127	3	12	50	62
East Street	58	9	1	19	29	67	10	1	22	34	86	13	1	28	43
Third Line	49	3	12	18	16	57	3	14	21	19	72	4	18	27	24
Westminster	79	0	6	38	35	92	0	7	44	41	117	0	9	56	52
Fourth Line	62	1	13	33	15	72	1	15	38	17	92	1	19	49	22
Suffolk Avenue	45	5	1	24	15	52	6	1	28	17	67	7	1	36	22
Morden Road	18	0	0	10	8	21	0	0	12	9	27	0	0	15	12
Dorval Drive	36	0	2	18	16	42	0	2	21	19	53	0	3	27	24
Total	**797**	**63**	**54**	**333**	**347**	**924**	**73**	**63**	**386**	**402**	**1,179**	**93**	**80**	**493**	**513**

Sections	Total	NB	SB	EB	WB	Total	NB	SB	EB	WB	Total	NB	SB	EB	WB
Mississaga Street to Jones Street	364	43	11	139	171	422	50	13	161	198	539	64	16	206	253
Jones Street to Dorval Drive	433	20	43	194	176	502	23	50	225	204	641	30	64	287	260

Strava Data taken from the Town of Oakville's Active Transportation trends map on Town's website

		Time					
Description		**12 to 4:59 am**	**5 to 9:59 am**	**10 am to 2:59 pm**	**3 to 7:59 pm**	**8-11:59 pm**	**Total**
Mississaga to Midblock	All	0	2597	2604	1583	141	**6925**
	Commuters	5	350	410	298	42	**1105**
Midblock to Triller Pl	All	0	2516	2502	1530	149	**6697**
	Commuters	6	351	403	310	45	**1115**
Triller Pl to Midblock	All	0	2527	2503	1523	144	**6697**
	Commuters	5	348	384	311	45	**1093**
Midblock to Bronte	All	0	2695	2799	1673	160	**7327**
	Commuters	6	402	454	334	50	**1246**
Bronte to Jones	All	0	2614	2565	1470	148	**6797**
	Commuters	6	364	419	306	42	**1137**
Jones to Nelson	All	0	2442	2406	1356	151	**6355**
	Commuters	6	341	392	228	45	**1012**
Nelson to East	All	0	2434	2432	1335	140	**6341**
	Commuters	7	363	410	241	45	**1066**
East St to Livno	All	0	2392	2354	1347	138	**6231**
	Commuters	7	364	379	238	44	**1032**
Livno + 5m	All	0	2260	2217	1364	137	**5978**
	Commuters	7	371	407	252	43	**1080**
Livno +5m to Solignate Dr	All	0	2280	2192	1333	144	**5949**
	Commuters	7	341	378	239	41	**1006**
Solignate to Windsor Gate	All	0	2306	2229	1338	134	**6007**
	Commuters	7	320	368	234	43	**972**
Windsor Gate to 3rd Line	All	0	2521	2373	1425	136	**6455**
	Commuters	6	351	373	248	44	**1022**
Third Line to Belvedere Dr	All	0	2364	2285	1321	124	**6094**

	Commuters	6	323	343	222	40	**934**
Belvedere Dr to Hamlet Common	All	0	2332	2324	1484	141	**6281**
	Commuters	0	342	358	255	41	**996**
Hamlet Common to Coronation Park Driveway	All	0	2321	2358	1473	145	**6297**
	Commuters	0	349	374	254	39	**1016**
Coronation to Westminster Drive	All	0	2429	2450	1565	147	**6591**
	Commuters	0	352	365	264	39	**1020**
Westminster Drive to Coronation	All	0	2406	2405	1517	154	**6482**
	Commuters	0	354	380	263	44	**1041**
Coronation to Coronation	All	0	2408	2415	1514	154	**6491**
	Commuters	0	357	397	272	40	**1066**
Coronation to Woodhaven Park Dr	All	0	2412	2397	1523	141	**6473**
	Commuters	0	348	387	266	39	**1040**
Woodhaven Park Dr to Sandwell Drive	All	0	2587	2605	1646	146	**6984**
	Commuters	0	394	408	285	37	**1124**
Woodhaven Park Dr to Sandwell Drive Waterfront Trail	All	0	2104	1765	971	92	**4932**
	Commuters	0	395	435	288	44	**1162**
Sandwell Drive to Willowridge Ct Waterfront Trail	All	0	2202	1807	1026	100	**5135**
	Commuters	6	403	413	283	40	**1145**
Sandwell to Wolfdale Ave	All	0	2593	2583	1599	147	**6922**
	Commuters	6	391	425	272	39	**1133**
Wolfdale Ave to Willowridge Ct	All	0	2430	2408	1516	140	**6494**
	Commuters	6	369	391	271	39	**1076**
Willowridge Ct to Westdale Rd	All	0	2517	2538	1631	154	**6840**
	Commuters	5	386	424	279	40	**1134**
Willowridge Ct to Spring Garden Rd Waterfront Trail	All	0	2159	1794	982	98	**5033**
	Commuters	1	82	78	64	4	**229**

Wilder Dr to W Lynn Rd	All	0	2598	2612	1647	163	**7020**
	Commuters	5	385	419	296	38	**1143**
W Lynn Road to Westdale Road	All	0	2429	2475	1576	152	**6632**
	Commuters	6	355	389	272	35	**1057**
Spring Garden Road to Westdale Road Waterfront Trail	All	0	2164	1835	1024	114	**5137**
	Commuters	2	40	42	43	1	**128**
Westdale Road to Fourth Line	All	0	2048	1742	938	102	**4830**
	Commuters	6	14	20	18	2	**60**
Fourth Line to Whittington Pl	All	0	2543	2571	1572	155	**6841**
	Commuters	6	385	395	248	36	**1070**
Fourth Line to Birch Hill Ln Waterfront Trail	All	0	1202	1845	1156	120	**4323**
	Commuters	0	10	13	10	0	**33**
Whittington Pl to Suffolk Ave	All	0	2492	2509	1584	152	**6737**
	Commuters	6	360	394	258	39	**1057**
Suffolk Ave to Birch Hill Lane	All	0	2540	2443	1569	143	**6695**
	Commuters	6	343	369	258	39	**1015**
Birch Hill Lane to Morden Road Waterfront Trail	All	0	1533	1993	1290	131	**4947**
	Commuters	2	65	101	80	12	**260**
Birch Hill Lane to Paliser Ct	All	0	2577	2477	1594	147	**6795**
	Commuters	6	397	441	297	43	**1184**
Paliser Court to midblock	All	0	2587	2559	1667	157	**6970**
	Commuters	6	384	410	284	41	**1125**
Midblock to Morden Road	All	0	2601	2549	1675	153	**6978**
	Commuters	6	390	407	280	40	**1123**
Morden Road to Shorewood Pl	All	0	2460	2474	1589	141	**6664**
	Commuters	6	357	399	270	32	**1064**
Morden Road to Shorewood Pl Waterfront Trail	All	0	1565	2102	1352	133	**5152**
	Commuters	2	108	121	110	10	**351**

Tavistock Square to Holyrood Ave	All	0	2529	2435	1583	134	**6681**
	Commuters	6	341	362	259	31	**999**
Shorewood Pl to Holyrood Ave Waterfront Trail	All	0	1536	1937	1327	127	**4927**
	Commuters	1	102	116	103	9	**331**
Holyrood Ave to Dorval Drive	All	0	2679	2571	1623	143	**7016**
	Commuters	6	352	387	264	35	**1044**
Holyrood Ave to Dorval Drive Waterfront Trail	All	0	1279	2018	1322	127	**4746**
	Commuters	0	19	36	21	1	**77**

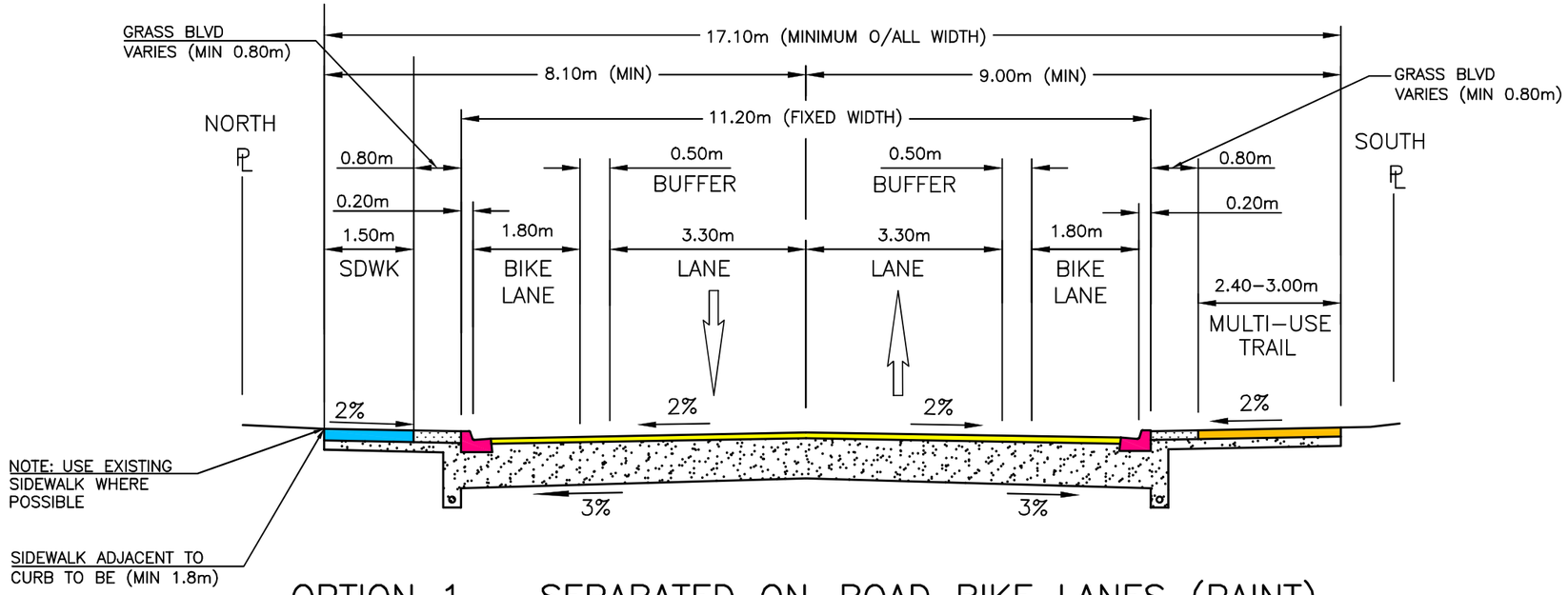
Appendix P

Cycling Reassessment (2019)

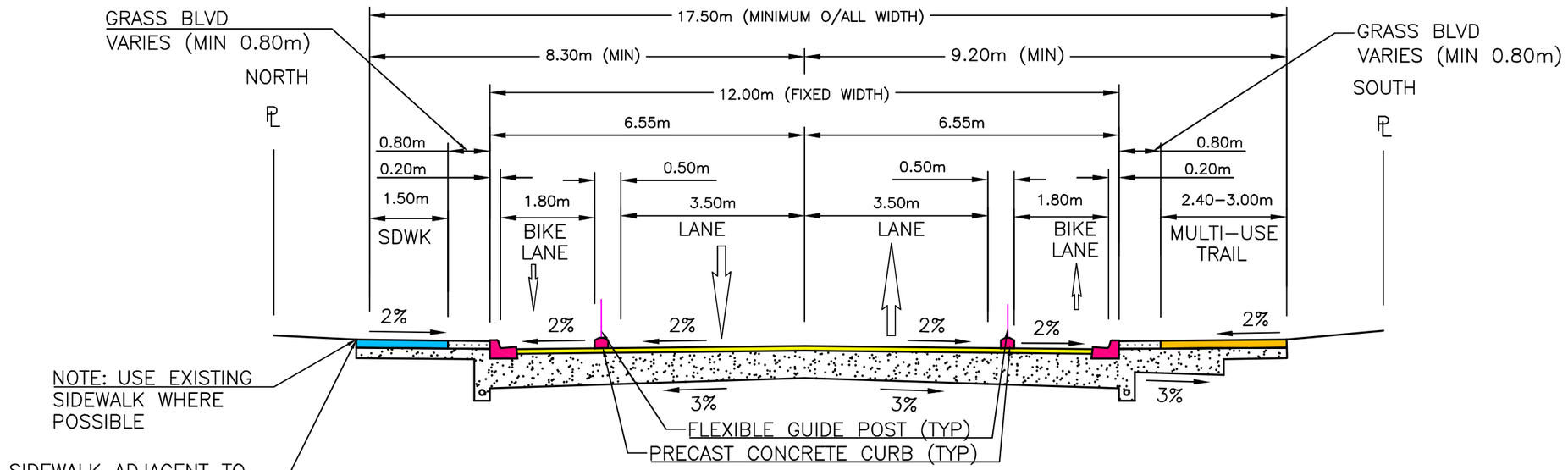
Table 3.2 - Protected Bike Lane Feasibility Assessment - Lakeshore Road West from East Street to Dorval Drive

Factors	Criteria	Option 1: Separated On-Road Bike Lanes (Paint) Sidewalk Northside (1.5m) MUT Southside (2.40m - 3.0m) Road Lane Width (3.30m)	Option 2: Separated On-Road Bike Lanes (Fixed Curb/Delineator) Sidewalk Northside (1.5m) MUT Southside (2.40m - 3.0m) Road Lane Width (3.50m)	Option 3: Dual Multi-Use Trails/ No On-Road Bike Lanes MUT Northside (2.40m - 3.0m) MUT Southside (2.40m - 3.0m) Road Lane Width (3.50m)	Option 4: Separated Two-Way Cycle Track (One side) Sidewalk Northside (1.5m) MUT Southside (2.40m - 3.0m) Road Lane Width (3.50m)
Plans and Policies	Compatibility with Livable Oakville policies and alignment with the Active Transportation Master Plan (ATMP)	Compatible with Livable Oakville Policies Directly aligned with the ATMP	Compatible with Livable Oakville Policies Directly aligned with the ATMP	Somewhat Compatible with Livable Oakville Policies Not aligned with the ATMP	Somewhat Compatible with Livable Oakville Policies Not aligned with the ATMP
Roadway and Right-of-Way (ROW) Requirements	Minimum Overall Width of the ROW cross section to accommodate the cycling infrastructure based on design criteria	17.1m (Minimum Overall Width)	17.5m (Minimum Overall Width)	14.4m (Minimum Overall Width)	17.7m (Minimum Overall Width)
Road Entrances and Ease of Ingress and Egress	Number of accesses and driveways Ease of ingress and egress	Frequent accesses and driveways are accommodated without compromising cycle facility Minimal disruption to driveway ingress and egress	Frequent accesses and driveways are accommodated without compromising cycle facility Minor disruption to driveway ingress and egress	Frequent accesses and driveways are accommodated without compromising cycle facility Minor disruption to driveway ingress and egress	Frequent accesses and driveways are accommodated without compromising cycle facility Moderate disruption to driveway ingress and egress on one side of roadway
Property Impacts	Potential impacts to existing properties adjacent to the roadway	Minimum cross section is less than Minor Arterial prescribed 26m ROW Minimal to no impact potential impact to properties where 26m ROW is not met	Minimum cross section is less than Minor Arterial prescribed 26m ROW Minimal to no impact potential impact to properties where 26m ROW is not met (slightly greater impact than Option 1)	Minimum cross section is less than Minor Arterial prescribed 26m ROW Least potential impact to properties with introduction of two MUT where 26 m ROW is not met	Minimum cross section is less than Minor Arterial prescribed 26m ROW Minor potential impact to properties (One Side) where 26m ROW is not met
Aesthetics / Scenic Corridor	Added visual clutter to the roadway Disruption to the scenic corridor viewshed	Minimal added visual clutter to the roadway Minimal disruption to the scenic corridor viewshed	Significant added visual clutter to the roadway Moderate disruption to the scenic corridor viewshed	Minor added visual clutter to the roadway Minor disruption to the scenic corridor viewshed	Moderate added visual clutter to the roadway Moderate disruption to the scenic corridor viewshed
Tree Impacts / Utility Conflicts	Potential impact to roadside trees and conflict with above-ground roadside utilities	Minimal impact to trees or utility conflicts from on-road cycle facility Minor impact to trees or utility conflicts from MUT and sidewalk	Minimal impact to trees or utility conflicts from on-road cycle facility Moderate impact to trees or utility conflicts from MUT and sidewalk	Potential minor impact to trees and utility conflicts from two off-road MUT (2.40 - 3.0m)	Minimal impact to trees or utility conflicts from on-road cycle facility Moderate impact to trees or utility conflicts from MUT and sidewalk
Bicycle Traffic Operations Safety / Accessibility	Separation between motorized vehicles and cyclists. Routing and connectivity of bicycle traffic	A painted buffer provides a spatial separation between vehicles and cyclists reducing conflict potential and allows for cyclist passing Preferred by commuter cyclists No barier to passing MUT preferred by recreational cyclists At accesses, drivers are more aware of cyclists on the roadway.	A curb provides a physical separation between vehicles and cyclists reducing the conflict potential more than Option 1. Preferred by commuter cyclists Fixed barier inhibits passing MUT preferred by recreational cyclists At accesses, drivers are more aware of cyclists on the roadway.	In-boulevard MUT provides physical separation between vehicles and cyclists reducing conflict potential more than Options 1 or 2 Not preferred by commuter cyclists MUT preferred by recreational cyclists At accesses, mix of recreational and commuter cyclists presents greater potential for conflicts between vehicles and cyclists	The two-way cycle-track provides a physical separation between vehicles and cyclists reducing conflict potential more than Option 1 Preferred by commuter cyclists No barier to passing MUT preferred by recreational cyclists At accesses, contraflow of cycling traffic presents greater potential for conflicts between vehicles and cyclists
Vehicular Traffic Operations Safety	Potential adverse effect to traffic operations	Conflict zone at intersection from right turning vehicles. Conflict zone in advance of intersections with dedicated vehicular right turn lane are provided as vehicles must merge into the right lane crossing through the bike lane Travel lanes 3.3m At accesses, drivers are more aware of cyclists on the roadway. Buffer provides level of comfort for cyclists and drivers	Conflict zone at intersections from right turning vehicles. Conflict zone in advance of intersections with dedicated vehicular right turn lane are provided as vehicles must merge into the right lane crossing through the bike lane. Travel lanes 3.5m At accesses, drivers are more aware of cyclists on the roadway. Curb provides level of comfort for cyclists and drivers	Conflict zone at intersection from right turning vehicles. Travel lanes 3.5m At accesses, drivers are less aware of cyclists on the MUT. Curb provides level of comfort for cyclists and drivers	Conflict zones at intersections from right turning vehicles. Separated from vehicle traffic on roadway. Travel lanes 3.5m At accesses, drivers are less likely to be aware of cyclists Curb provides level of comfort for cyclists and drivers Curb provides level of comfort for cyclists and pedestrians
Capital and Maintenance Costs	Capital cost of the proposed improvements and costs of maintaining the facility, including winter maintenance	Moderate construction costs. Maintenance (snow removal) of facility to be completed as part of roadway snow removal. Additional painting of the buffer resulting in marginal increase in maintenance costs.	Capital costs will be higher with the additional curb and wider lanes and bike lanes Maintenance (snow removal) of facility will have be plowed separately, increasing maintenance costs.	Moderate construction costs, marginally less than Option 2. MUT will be asphalt reducing capital cost vs concrete sidewalk, but will be wider, requiring more material Maintenance (snow removal) of MUT will be marginally higher than Option 1	Capital costs will be higher with the additional curb and wider lanes and bike lanes Maintenance (snow removal) of facility will have be plowed separately, increasing maintenance costs.
		Most Preferred	**Somewhat Preferred**	**Somewhat Preferred**	**Neutral**
	Overall Evaluation				

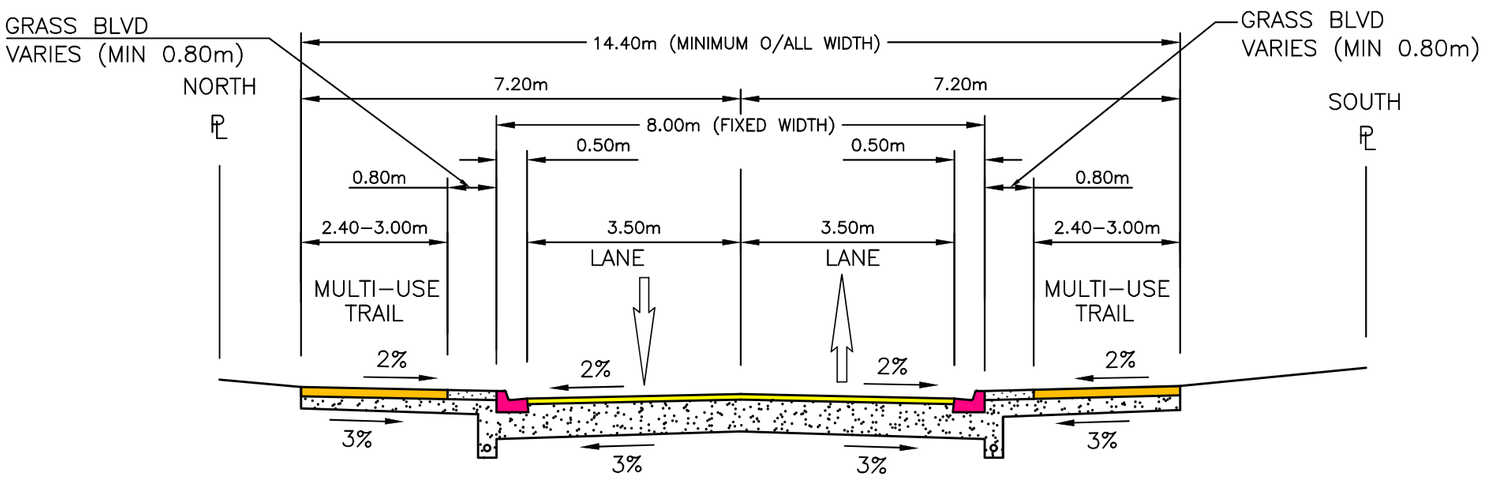
Legend:	
Most Preferred	
Somewhat Preferred	
Neutral	
Less Preferred	
Least Preferred	



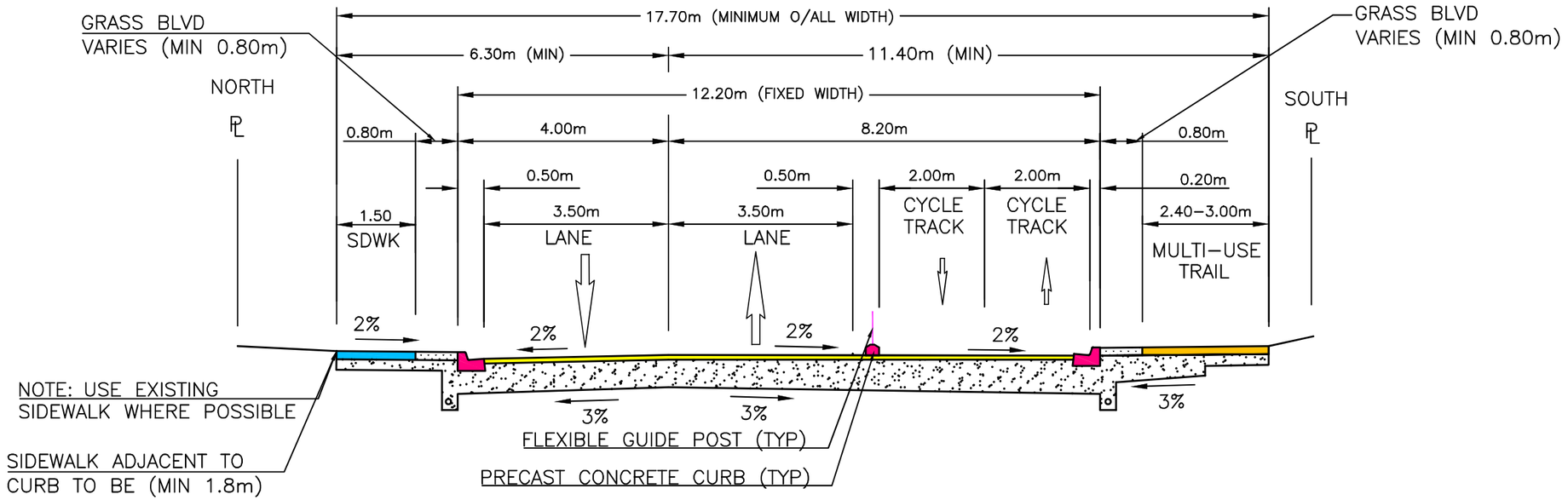
OPTION 1 – SEPARATED ON–ROAD BIKE LANES (PAINT)



OPTION 2 – SEPARATED ON–ROAD BIKE LANES (FIXED CURB/DELINEATOR)



OPTION 3 – DUAL MULTI–USE TRAILS; NO ON–ROAD BIKE LANES



OPTION 4 – SEPARATED TWO–WAY CYCLE TRACK (ONE SIDE)