Region of Peel
Working for you

Design Study Report

Dixie Road Lane Reconfiguration

With Bicycle Lanes from Rometown to Lakeshore

IBI

Prepared for Region of Peel
by IBI Group
September 2, 2016

Document Control Page

CLIENT:	Region of Peel
PROJECT NAME:	Dixie Road Lane Reconfiguration Preliminary and Detail Design
REPORT TITLE:	Dixie Road Lane Reconfiguration
IBI REFERENCE:	38948
VERSION:	4
DIGITAL MASTER:	Hamilton J:\38948_DixieRd\10.0 Reports
ORIGINATOR:	Norma Moores
REVIEWER:	
AUTHORIZATION:	
CIRCULATION LIST:	Project Team
HISTORY:	Table of Contents submitted January 28, 2015 Draft Version 2 submitted April 15, 2016 Final Draft Version 3 submitted June 14, 2016 Final Version 4 submitted September 2, 2016

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

List of Exhibits

Executive Summary

The Dixie Road Lane Reconfiguration with Bicycle Lanes Design Study examined the ability to re-stripe Dixie Road from Rometown Drive to Lakeshore Road following a planned resurfacing of the roadway. This section of Dixie Road currently has four travel lanes. The study identified a design for buffered bike lanes, two travel lanes, and centre left-turn lanes that fits within the existing roadway width. This type of lane reconfiguration is also known as a 'road diet'.

The timing of this study anticipated the resurfacing of Dixie Road in 2016 south of the QEW interchange as part of the Hanlan Water Project, as well as the structural remediation and reconstruction of the CNR rail bridge over Dixie Road (Lakeshore Line) in 2017. These projects provide cost-effective opportunities to change the roadway configuration within the existing pavement width. As an outcome of this study, a new signage and pavement marking plan for the reconfigured road with bike lanes has been prepared and incorporated into the Hanlan Water Project contract for resurfacing Dixie Road.

Background

Dixie Road from Rometown to Lakeshore forms a critical link in the transportation network, connecting to existing and planned cycling facilities, major transit hubs, and growing destinations along the waterfront, as illustrated below.

CONNECTS
EXISTING & PLANNED CYCLING NETWORK

SUPPORTS
FUTURE GROWTH AREAS

MAXIMIZES
VALUE OF FUTURE ROAD IMPROVEMENTS

FACILITATES
CONNECTIONS TO TRANSIT & DESTINATIONS

LINKS
MAJOR RECREATIONAL FACILITIES

Support for the implementation of a bikeway on Dixie Road is well-documented in several Regional and City plans:

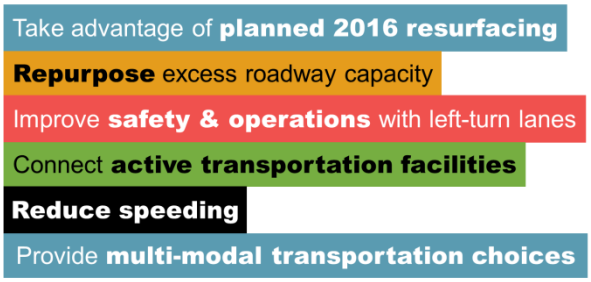
- Region of Peel's Active Transportation Plan (2012) recommends bike lanes on Dixie Road from the QEW to Lakeshore Road

- City of Mississauga Cycling Master Plan (2010) identifies this corridor as a Primary On-Road Route
- Peel Region Road Characterization Study (2013) recognizes the need to accommodate cyclists as well as other road users within Regional corridors.
- Lakeview Local Area Plan (on-going)
- Inspiration Lakeview Master Plan (on-going) core principles to connect the City to the water, improve multi-modal mobility and sustainability
- The Big Move: the Regional Transportation Plan for the Greater Toronto and Hamilton Area (2008) key strategies and priority actions to build communities that are pedestrian, cycling and transit supportive

Other related projects and studies were also considered to understand the impact of a future bikeway on Dixie Road. These projects include:

- Region of Peel's Hanlan Water Project (on-going to 2016): new multi-use trail in the boulevard to be constructed on Dixie Road, from south of Eastgate Parkway to Primate Road (just north of the QEW) in conjunction with the installation of the Hanlan Water Project on Dixie Road.
- Ministry of Transportation, Ontario (MTO) QEW Improvements to Evans Road Study: as part of these improvements, the study proposed to reconfigure the Dixie Road interchange. It includes recommendations to accommodate cyclists on a multi-use trail from Londonderry Drive northerly through the interchange, connecting to the future multi-use trail at Kendall Road.
- City of Mississauga's Lakeshore Road Transportation Review Study (2010): bike lanes are proposed on Lakeshore Road throughout the City over the long-term.

The Feasibility Study evaluated a number of bikeways including a multi-use trail in the boulevard on either side, shared roadway, and bicycle lanes or separated bicycle lanes. It recommended reconfiguring Dixie Road from four travel lanes to two travel lanes with left-turn lanes / painted median, and the addition of bike lanes. This configuration was recommended because it will:

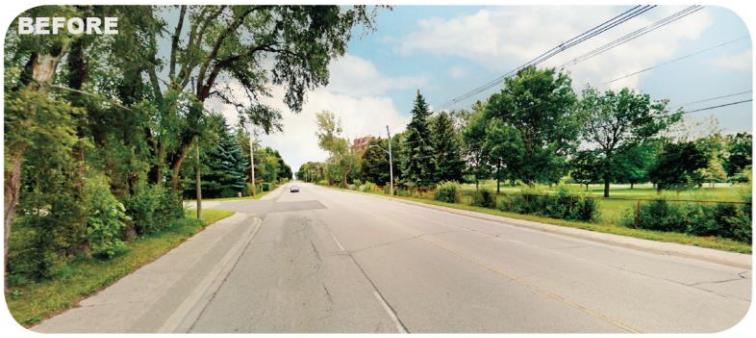


Under the Municipal Class EA process, this project is a Schedule A+ Class EA project. The impacts of these activities are considered minimal, and therefore these types of projects are pre-approved by the Ministry of the Environment. Schedule A+ projects require the Region of Peel to advise the public of the project prior to implementation.

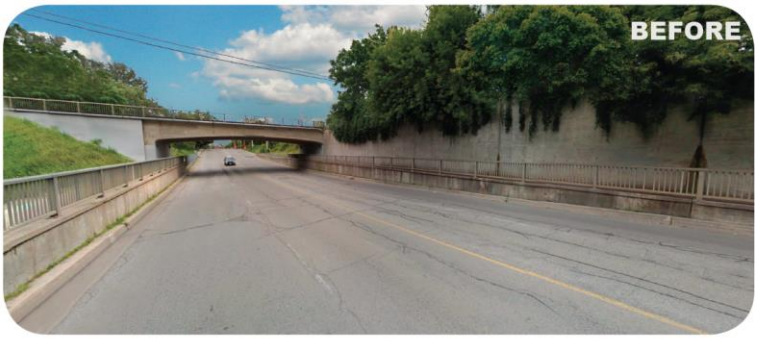
Project Description

The Dixie Road Lane Reconfiguration Detail Design Study determined through a thorough review of the roadway width that a buffered bike lane with two travel lanes and centre turn lane would generally fit within the available road width. The design of the Dixie Road Lane Reconfiguration with Bike Lanes is unique in that it includes the first-ever buffered bike lanes

implemented by the Region of Peel, and incorporates an urban streets approach to improve the safety and comfort of all users of the corridor. Renderings of the buffered bike lane, shown below, were prepared to illustrate to the public and stakeholders what the buffered bike lane and lane reconfiguration could look like.



DIXIE LOOKING SOUTH AT **LARCHVIEW TRAIL**



DIXIE LOOKING SOUTH AT **RAIL UNDERPASS**

DIXIE LOOKING SOUTH AT **ST JAMES AVENUE**

The design criteria for Dixie Road lane reconfiguration incorporates best practices in the design of urban streets:

- The design speed selected is the target speed of 60 km/h
- The travel lane width selected was 3.35 m to have a positive effect on the street's safety without impact traffic operations
- The minimum bike lane width of 1.2 m adjacent a 0.5 m wide gutter was selected, allowing the provision of a 0.5 m wide buffer between the bike lane and travel lane to improve the comfort of people cycling and driving.

The design features of this project that will be used for the first time on a Region of Peel roadway are as follows:

- Bike lane buffer marking throughout the length of the project
- Bike lane conflict zones at Lakeshore Road and the Dixie Outlet Mall South Entrance marked with guidelines, bicycle symbols and green colour
- Two-stage left-turn bike box for the northbound cyclist's left-turn at Rometown Drive

Consultation

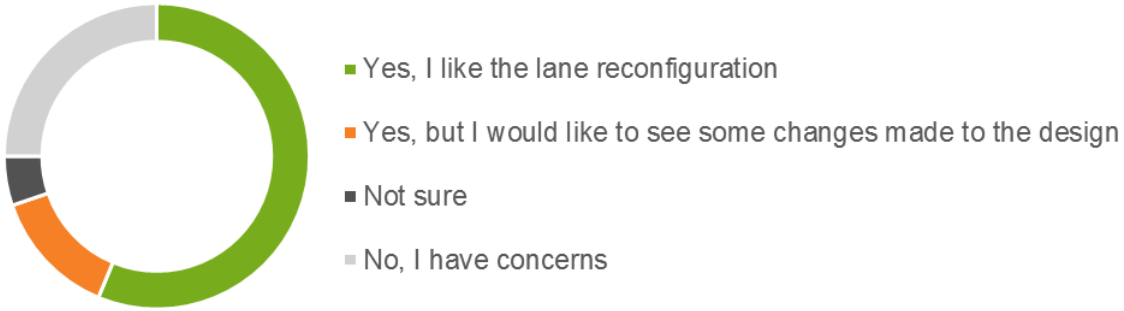
The Region of Peel sought stakeholder and public feedback on their proposed reconfiguration of Dixie Road, Lakeshore Road to Rometown Drive, from four travel lanes to two travel lanes plus turn lanes and buffered bike lanes. The consultation consisted of the following scheduled during various dates in September and October 2015:

- **Meetings with stakeholders** including Mississauga Cycling Advisory Committee, Lakeview Ratepayer's Association, Toronto Golf Club, Lakeview Golf Course, and Orchard Heights Homeowner's Association

- **Events and venues** where project information was on display including 8th Annual Tour de Mississauga, Dixie Outlet Mall, and Fairways Condominium
- **Project web site:** https://www.peelregion.ca/pw/water/hanlan-water/dixie-bikeway.htm
- **Public Information Centre** (October 27, 2015)

The feedback was varied, but largely positive – fifty-four people supported the project, five were unsure, thirteen had suggestions or concerns, and twenty-four were opposed to the project. Common concerns included traffic and congestion now and in the future, and low pedestrian and cyclists volumes not warranting the improvements, as shown below.

Response to project at public venues (54 in total)



Common concerns about the project (43 concerns in total)

Next Steps

The Dixie Road lane reconfiguration will create a “Complete Street” that benefits all users of the corridor as illustrated below. It will be implemented in two phases, through the resurfacing of Dixie Road following Hanlan Water Project construction (Summer 2016), and following the completion of the CNR Structure remediation and reconstruction project (Fall 2017). After the completion of the latter, all signage, symbols for the bike lanes, as well as the green colour at conflict points, will be installed. Following implementation, the Region of Peel will monitor how well Dixie Road services people walking, cycling and driving and modify the design as required to address safety issues.

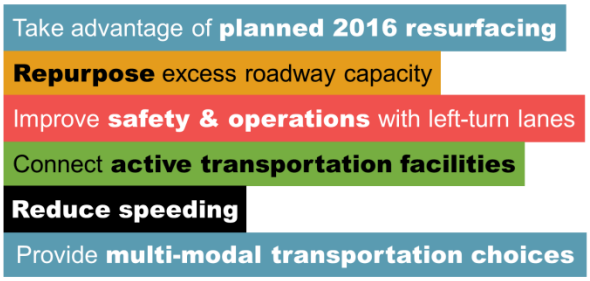
The Region of Peel is working with the Ministry of Transportation, Ontario (MTO) to ensure that the planned improvements to the QEW / Dixie Road interchange will fit with the reconfigured Dixie Road and provide continuous active transportation facilities through the area.

In future years, the Region of Peel will update the Long Range Transportation Plan and the City of Mississauga will complete the Lakeshore Road Transportation Master Plan. These master plans will take into consideration the effects of the reconfiguration and consider longer-term improvements that may be needed.

1 Introduction

The Dixie Road Lane Reconfiguration with Bicycle Lanes Design Study examined the ability to re-stripe Dixie Road from Rometown Road to Lakeshore Road following a planned resurfacing of the roadway. This section of Dixie Road is currently four lanes wide. The study considered if bike lanes, with or without a buffer, two travel lanes and centre left-turn lanes would fit within the existing roadway width. This type of lane reconfiguration is also known as a 'road diet'.

The benefits of the recommended design to area residents and the community include:

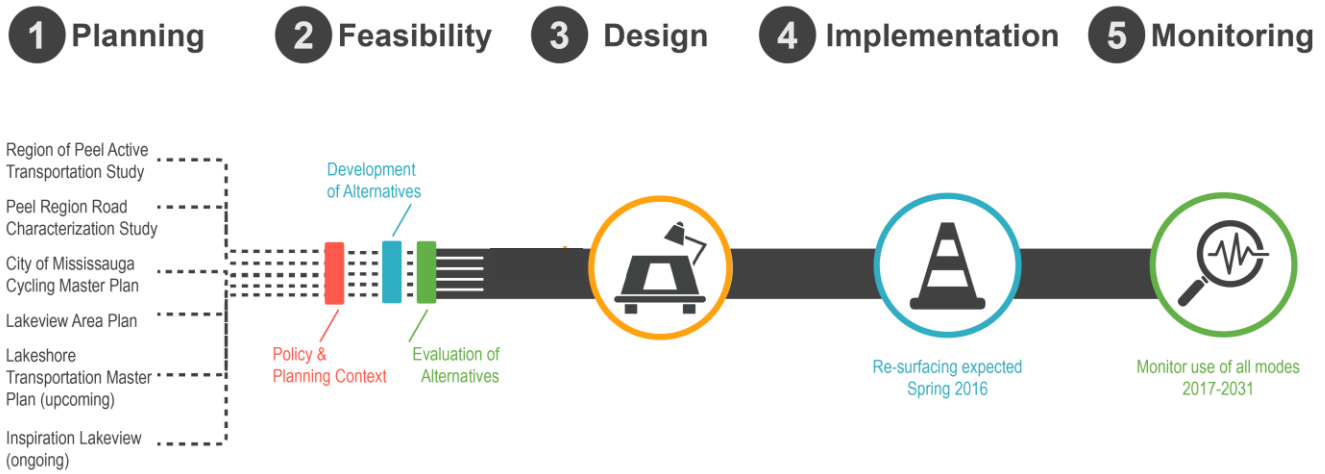


- Improved safety and traffic operations by removing left-turning traffic from the through travel lane
- Easier access at driveways and side streets by providing the left-turn lane
- Reduction in speeding due to fewer travel lanes, and narrower travel lanes
- More comfortable environment for walking with the bike lanes creating a buffer between the sidewalk and the travel lanes
- Improved safety and more comfortable bicycling by providing designated bike lanes
- Increased comfort for a wide range of people who are cycling now or would like to bicycle by providing a buffer between the bicycle lane and travel lane

Timing of this study aligns with the resurfacing of Dixie Road in 2016 south of the QEW interchange as part of the Hanlan Water Project, as well as the structural remediation and reconstruction of the CNR rail bridge over Dixie Road (Lakeshore Line) in 2017. These projects provide cost-effective opportunities to change the roadway configuration within the existing pavement width. A new signage and pavement marking plan can be prepared and incorporated into the Hanlan Water Project contract for resurfacing Dixie Road.

The project process is illustrated in Exhibit 1-1. It is consistent with the requirements of the Municipal Class Environmental Assessment process, which enables the planning of municipal infrastructure to be undertaken in accordance with an approved procedure designed to protect the environment. Under the Municipal Class EA process, this project is a Schedule A+ Class EA project. The impacts of these activities are considered minimal, and therefore these types of projects are pre-approved by the Ministry of the Environment. Schedule A+ projects require the Region of Peel to advise the public of the project prior to implementation.

Exhibit 1-1: Dixie Road Lane Reconfiguration with Bike Lanes Project Process



1.1 Design Study Objectives

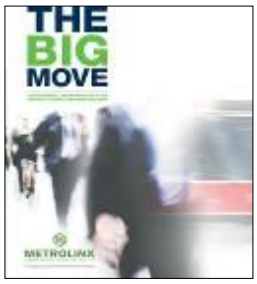
Prior to this design study, the Dixie Road Bikeway Feasibility Study was completed recommending bike lanes retrofitted to the existing roadway by reconfiguring the travel lanes with the resurfacing in 2016. It also recommended that the Region of Peel undertake the following in order to study and plan for the reconfiguration:

- Consult with Region of Peel and City of Mississauga staff to address any outstanding technical issues associated with the recommended strategy
- Consult with area Councillors and stakeholders to garner Council and community support for the potential changes to Dixie Road
- Undertake a traffic analysis to determine turn lane requirements
- Prepare preliminary design plans to determine the lane reconfiguration and bike lane treatments throughout the corridor
- Prepare a design plan to illustrate how the reconfiguration would fit with future improvements planned by the Ministry of Transportation (MTO) at QEW and Dixie Road
- Prepare detail design drawings and a schedule of quantities for the pavement markings and signage to be incorporated into the contract for the resurfacing of Dixie Road as part of the Hanlan Water Project
- Although the resurfacing of Dixie Road is part of the Hanlan Water Project, it was recommended that the Region of Peel consider the reconfiguration as a Schedule A+ Municipal Road Project under the MCEA. Public notice prior to construction is required for Schedule A+ projects.

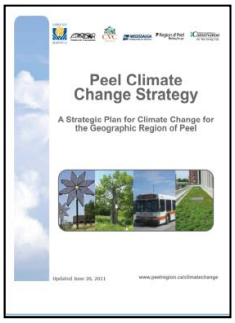
1.2 Benefits of the Dixie Road Lane Reconfiguration

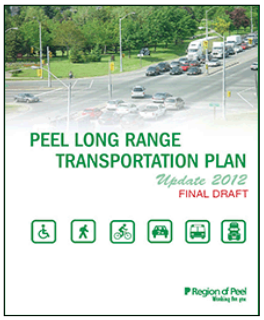
The Region of Peel supports a multi-modal transportation system. Enabling active transportation (walking and cycling) is supported by a number of Provincial, Regional and City policies:

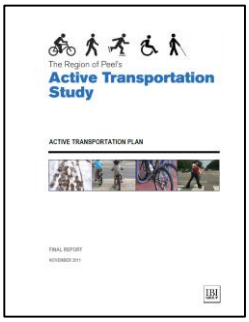
- Provincial Legislation—Places to Grow Plan; Provincial Policy Statement; Metrolinx Big Move Plan; and Ontario Cycling Strategy



- Regional Plans—Regional Official Plan; Peel Healthy Index; Peel Climate Change Action Plan; Long Range Transportation Plan and Peel Active Transportation



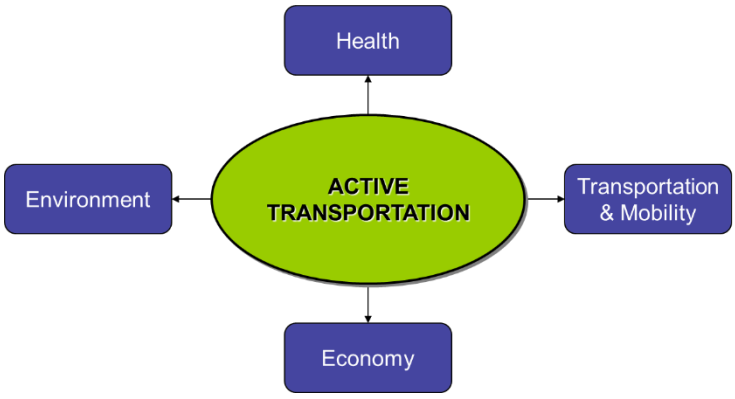




- Mississauga Plans—Mississauga Strategic Plan, Mississauga Official Plan and Mississauga Cycling Master Plan

Active transportation addresses a number of broader community challenges:

- **Economy**—On average it costs $8,000 to $11,000 per year to own and operate a car. A bicycle costs about $150, and walking is virtually free!
- **Transportation & Mobility**—In Ontario congestion costs are estimated to be $6.4B annually



- **Health**—The prevalence of diabetes among Peel's adults is projected to increase from current 1 in 10, to 1 in 6 by 2025.
- **Environment**—Transportation emits 28% of the total geographic greenhouse gas (GHG) emissions in the Region of Peel.

As illustrated in Exhibit 1-2, this section of Dixie Road is part of a larger network of existing and planned cycling facilities. It supports a number of regional and local initiatives, including:

- The bike lanes will connect to existing cycling facilities: Queensway multi-use trail, Stanfield Road bike lanes, Ogden signed bike route, and the Lake Ontario Waterfront Trail
- The bike lanes will connect to proposed cycling facilities: MTO QEW/Dixie Interchange improvements that include a multi-use trail, Dixie Road multi-use trail from Primate Road to Eastgate Parkway, North Service Road multi-use trail, and South City trail
- The project supports the future growth area of Inspiration Lakeview
- The project maximizes future road improvements: QEW / Dixie Road interchange improvements, and Lakeshore Road Transportation Study
- The project facilitates access by multiple transportation modes to destinations and transition connections: Dixie Outlet Mall, BRT Station at Dixie and Eastgate Parkway, Dixie GO Station, Long Branch GO Station and TTC Loop, and proposed Regional Express Rail service
- The project links major recreational facilities: future Lakeview Waterfront Connection and the Lake Ontario Waterfront Trail

The Dixie Road lane reconfiguration with bicycle lanes is a critical link that connects existing and planned active transportation facilities, major transit hubs, & growing destinations along the waterfront.

Exhibit 1-2: Dixie Road Project Context

Dixie Road (Rometown to Lakeshore) forms a **critical link in the transportation network**, connecting to existing and planned **cycling facilities**, major **transit hubs**, and growing destinations along **the waterfront**.

CONNECTS
EXISTING & PLANNED CYCLING NETWORK

SUPPORTS
FUTURE GROWTH AREAS

MAXIMIZES
VALUE OF FUTURE ROAD IMPROVEMENTS

FACILITATES
CONNECTIONS TO TRANSIT & DESTINATIONS

LINKS
MAJOR RECREATIONAL FACILITIES

The Dixie Road lane reconfiguration will create a “Complete Street” that benefits all users of the corridor as illustrated in Exhibit 1-3.

Exhibit 1-3: Complete Streets Benefit All Road Users

1.3 Project Team

The Region of Peel retained IBI Group to carry out the Design Study in order to meet the Hanlan Water Project timelines and provide expertise in bikeway design. This will be the first bike lanes on a Regional road when implemented.

The Design Study was carried out by a core team from the Region of Peel and IBI Group, along with supporting staff from the Region of Peel and City of Mississauga, as follows.

CORE TEAM

Region of Peel:

- Margie Chung and Arthur Lo, Project Managers
- Bill Turner, Project Manager South, Hanlan Water Project

IBI Group:

- Norma Moores, Project Manager
- Scott Johnston, Traffic Analysis

PROJECT TEAM

Region of Peel

- Wayne Chan, Sustainable Transportation
- Scott Durdle, Ambassador, Hanlan Water Project
- Sandra Almeida, Public Health – Built Environment
- Sean Carrick, Traffic Development & Permits
- Eric Chan, Transportation System Planning
- Gino Dela Cruz, Infrastructure Programming & Studies
- Chris King, Traffic Operations
- Natalie Kou, Sustainable Transportation
- Natalie Lapos, Public Health – Built Environment
- Troy Leyburne, Water Capital
- Lorenzo Mele, Public Health
- Bob Nieuwenhuysen, Roads Design and Construction
- Azeem Parvez, Traffic Signals & Street Lighting
- Kyle Van Boxmeer, Traffic Operations

City of Mississauga:

- Steve Barrett, Transportation Asset Management
- Leslie Green, Transportation Projects
- Jacqueline Hunter, Active Transportation

2 Background

Support for the implementation of a bikeway on Dixie Road is well-documented in several Regional and City plans. In early 2012, the Region of Peel approved its Active Transportation Plan which recommends bike lanes on Dixie Road from the QEW to Lakeshore Road. The City of Mississauga Cycling Master Plan (2010) identifies this corridor as a Primary On-Road Route. The Peel Region Road Character Study (2013) further recognizes the need to accommodate cyclists as well as other road users within Regional corridors. The Road Character Study classifies this section as a Suburban Connector, which calls for either an off-street multi-use trail or on-road bike lanes to accommodate cyclists.

Other related projects and studies were also considered to understand the impact of a future bikeway on Dixie Road. These projects include:

- Region of Peel's Hanlan Water Project (on-going to 2016): new multi-use trail in the boulevard to be constructed on Dixie Road, from south of Eastgate Parkway to Primate Road (just north of the QEW) in conjunction with the installation of the Hanlan Water Project on Dixie Road.
- Ministry of Transportation, Ontario (MTO) QEW Improvements to Evans Road Study: as part of these improvements, the study proposed to reconfigure the Dixie Road interchange. It includes recommendations to accommodate cyclists on a multi-use trail from Londonderry Drive northerly through the interchange, connecting to the future multi-use trail at Kendall Road. The construction work on the Dixie Road interchange is expected to commence in 2018.
- City of Mississauga's Lakeshore Road Transportation Review Study (2010): bike lanes are proposed on Lakeshore Road throughout the City over the long-term. Near Dixie Road, the proposed bike lane requires widening on both sides of the street.
- Region of Peel's Strategic Goods Movement Network Study (2013): This study identifies a hierarchical truck route network through Peel Region. The study recognizes the important role of goods movement to the Regional and Provincial economies. South of the QEW, Dixie Road is not identified as part of the truck route network.

2.1 Dixie Road Bikeway Feasibility Study

The Region of Peel initiated the Dixie Road Bikeway Feasibility Study in October 2013. The purpose of the study was to identify feasible strategies to implement bikeways along 1.6 km of Dixie Road from just south of the QEW to Lakeshore Road. Providing a bikeway on Dixie Road is supported in:

- Region of Peel's Active Transportation Plan (2012)
- City of Mississauga Cycling Master Plan (2010)
- Peel Region Road Characterization Study (2013)
- Lakeview Local Area Plan (on-going)
- Inspiration Lakeview Master Plan (on-going) core principles to connect the City to the water, improve multi-modal mobility and sustainability

- The Big Move: the Regional Transportation Plan for the Greater Toronto and Hamilton Area (2008) key strategies and priority actions to build communities that are pedestrian, cycling and transit supportive

The Feasibility Study evaluated a number of bikeways including:

- A **multi-use trail** in the boulevard on either side of the road is not feasible due to the narrow right-of-way and narrow boulevard. Property would have to be purchased on either side, and hydro poles would have to be relocated if located on the west side. A wider boulevard would impact the trees and vegetation that are part of this City-designated Scenic Route. At the GO Transit Lakeshore West railway underpass (200 m long), there is insufficient width to develop a two-way trail on one side under the structure at sidewalk level.
- **Shared roadway**, including bike route signs or shared-lane pavement markings ("sharrows"), is inappropriate based on the speed and volume of traffic on Dixie Road, according to guidance in OTM Book 18.
- Adding **bike lanes or separated bike lanes** to the existing four-lane roadway with sidewalks will not fit within the existing 20 m right-of-way. The existing sidewalks would have to be reconstructed, the hydro poles on the west side would have to be relocated and additional right-of-way width would need to be purchased. A wider road would impact the trees and vegetation that are part of this City-designated Scenic Route.

The Feasibility Study recommended reconfiguring Dixie Road from four travel lanes to two travel lanes with left-turn lanes / painted median, and the addition of bike lanes. This configuration was recommended because:

- Improved safety for all road users
- Discouragement of speeding
- Low cost solution
- Improved comfort for cyclists
- Pedestrians buffered from traffic
- Existing right-of-way maintained

2.2 Hanlan Water Project

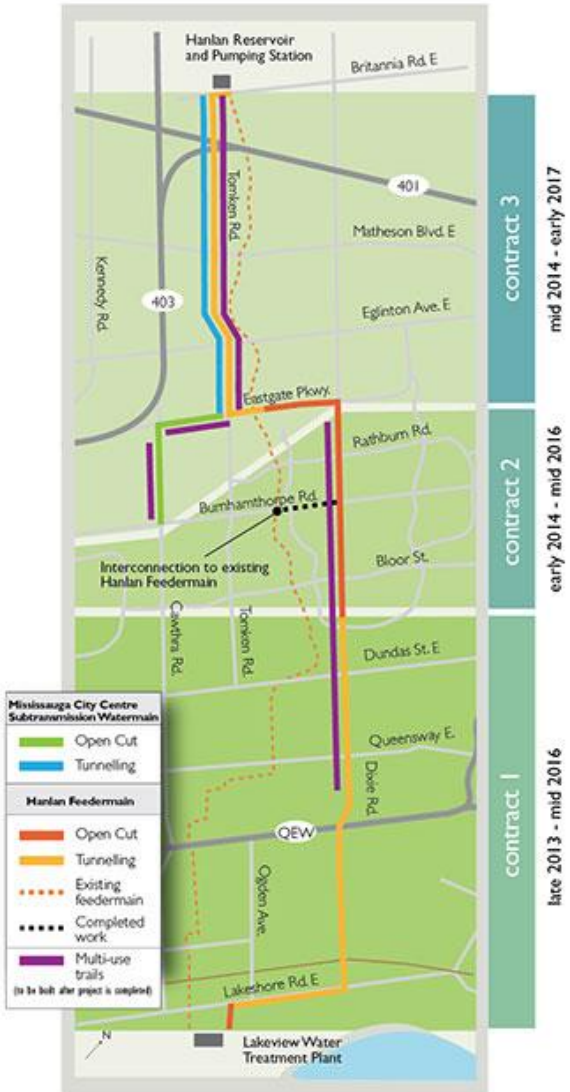
The Hanlan Water Project, illustrated in Exhibit 2-1, is the largest and most extensive watermain initiative the Region of Peel has ever designed and constructed. It includes the installation of a 2400-mm diameter Hanlan Feedermain and a 1500-mm Mississauga City Centre Subtransmission Watermain. The feedermain will run approximately 14.5 km from the Lakeview Water Treatment Plant on Lake Ontario to the Hanlan Reservoir and Pumping Station at Tomken Road and Britannia Road East. The subtransmission main will run approximately six kilometres from the Hanlan Reservoir and Pumping Station to the intersection of Cawthra Road and Burnhamthorpe Road. Work also includes local distribution works, road improvements and wastewater collection improvements along the route. Walking and cycling facilities are also being implemented along the Hanlan Water Project route in conjunction with the City of Mississauga Cycling Master Plan and the Peel Active Transportation Plan.

Construction began in 2011 and is scheduled to be completed by early 2017. On Dixie Road, the installation is by tunnelling – digging two shafts and using specialized equipment to excavate beneath the surface of the road to install the pipe. Improvements being implemented as part of

the Hanlan Water Project for Dixie Road from Lakeshore Road to Rometown Road include the following:

- Replacing and improving the aging local distribution watermain and sanitary sewer along Dixie Road, Cormack Crescent and Larchview Trail by open-cut construction
- Replacing water services and sanitary services to the property line
- Resurfacing Dixie Road from Lakeshore Road East to Rometown Drive
- Replacing various sections of sidewalk on Dixie Road including: east side from Larchview Drive to Toronto Golf Club; west side between Dixie Outlet Mall and Toronto Golf Club, and from south of CNR Structure to Lakeshore Road
- QEW Improvements at Dixie Road

Exhibit 2-1: Region of Peel's Hanlan Water Project



2.3 Dixie Road CNR Structures

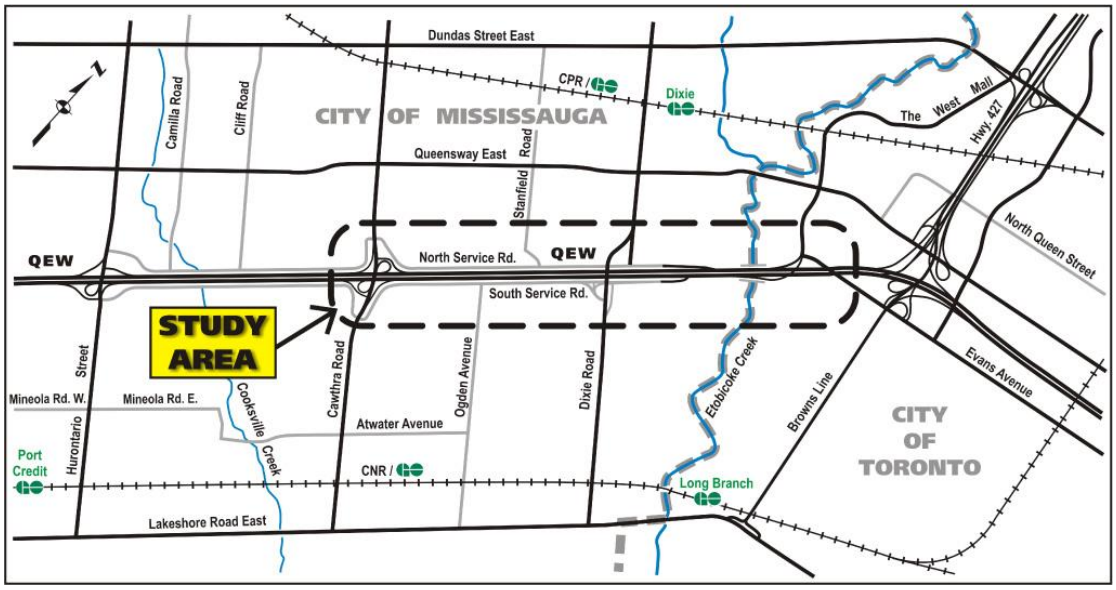
Region of Peel is undertaking the remediation and reconstruction of the CNR Structures (the railway is owned by Metrolinx) over Dixie Road located just north of Orchard Hill Road. The work consists of reconstructing the sidewalk on both sides and roadway for 360 m and rehabilitation of the retaining walls. Construction will commence in Spring 2017 following completion of the Hanlan Water Project construction on Dixie Road.

It was recommended that the handrail adjacent the sidewalk be increased to accommodate cyclists should they choose to ride on the sidewalk through the underpass to avoid the steeper grades on the road. In addition, the profile of the handrail was recommended to be as narrow as possible to provide more effective width along the sidewalk for pedestrians.

2.4 QEW Improvements at Dixie Road

The Ministry of Transportation, Ontario (MTO) completed a Preliminary Design and Class Environmental Assessment Study to examine rehabilitation and improvement needs for the Queen Elizabeth Way (QEW) from Evans Avenue to Cawthra Road. The study limits extend approximately 3.5 km through the City of Mississauga (Region of Peel) and the City of Toronto, as shown in Exhibit 2-2.

Exhibit 2-2: Study Area for MTO's Queen Elizabeth Way (QEW) from Evans Avenue to Cawthra Road (From http://qewdixieea.ca/study-documents/)



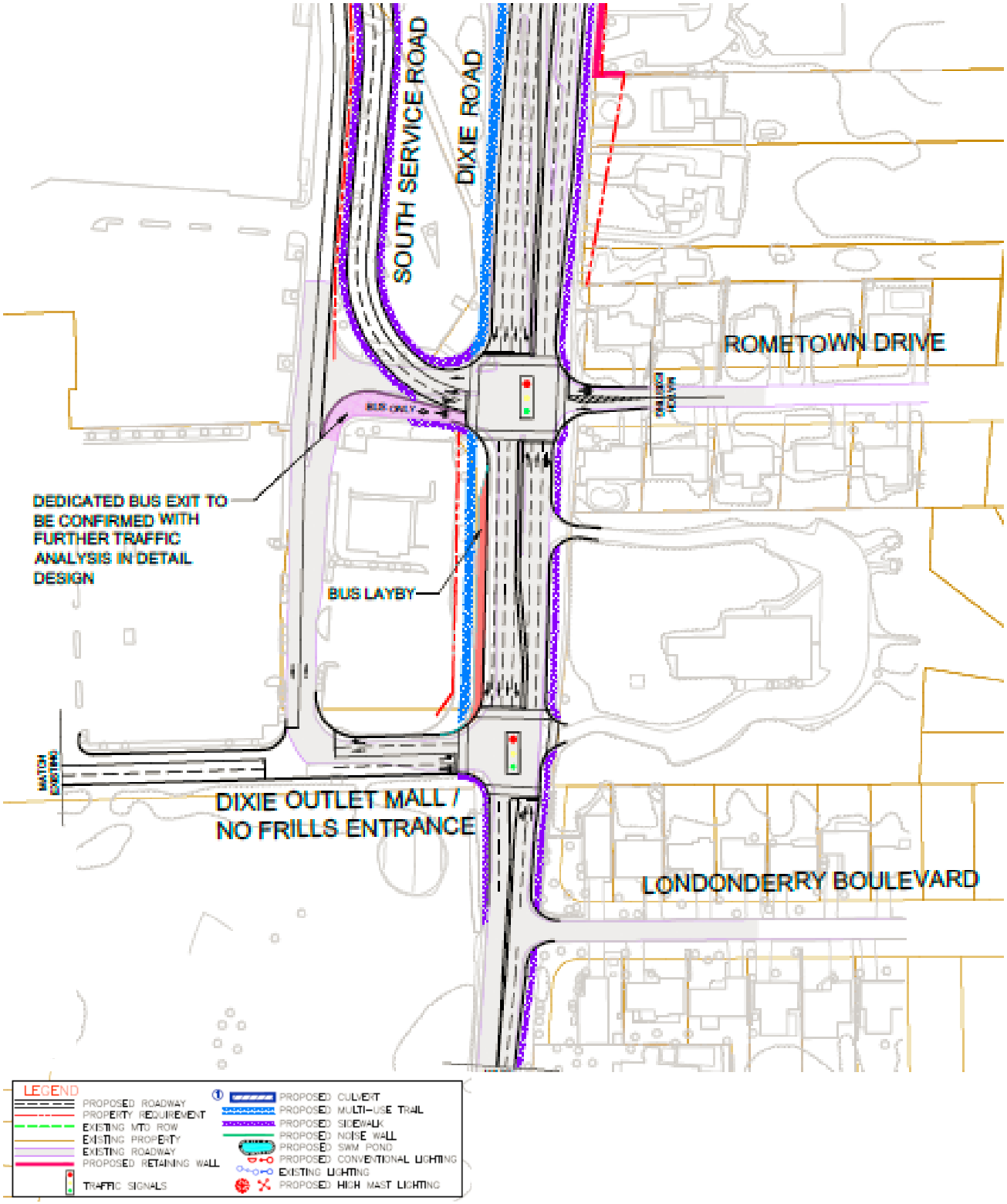
The study was initiated to identify and recommend a plan to address transportation improvements including structural rehabilitation and replacement needs, and safety and operational needs. The preferred plan consists of a number of improvements including the following that affect Dixie Road south of the QEW:

- Replace the existing partial interchange at Dixie Road with a full interchange, and replace the Dixie Road bridge
- Realign the South Service Road west of Dixie Road so that it intersections Dixie Road across from Rometown Road

- Relocate the Dixie Outlet Mall / No Frills main entrance at Dixie Road to the existing secondary/No Frills access and reconfigured as a full-move, signalized intersection
- Accommodate the Peel Region's request to extend their multi-use trail along Dixie Road from south of Primate Road southerly through the study limits to the newly relocated Dixie Outlet Mall south entrance.

An excerpt of the preferred plan showing the reconfiguration of Dixie Road and South Service near Rometown Road and Dixie Outlet Mall entrance is provided in Exhibit 2-3.

Exhibit 2-3: Excerpt from the Preferred Plan from the Transportation Environmental Study Report – Queen Elizabeth Way (QEW) from Evans Avenue to Cawthra Road, Exhibit ES-2g (January 2016)



3 Consultation

The Region of Peel sought stakeholder and public feedback on their proposed reconfiguration of Dixie Road, Lakeshore Road to Rometown Drive, from four travel lanes to two travel lanes plus turn lanes and buffered bike lanes. The consultation consisted of a number of stakeholder meetings, opportunities to present the project at public events / venues and a Public Information Centre. The consultation and feedback are summarized below. Detailed comments received are provided in Appendix A.

3.1 Stakeholder Meetings

Region of Peel and IBI Group staff met with stakeholders to present the proposed lane reconfiguration, discuss their concerns and answer any questions they may have. Below is a summary of each of the meetings.

- **Mississauga Cycling Advisory Committee**, September 8, 2015—Ten members were present at a regular MCAC meeting. A brief presentation was made to the committee followed by a question and answer period. Members of the committee were generally in support of the project and recommended receiving the presentation (subsequently approved by Council September 16, 2015).
- **Lakeview Ratepayer's Association**, September 15, 2015—Approximately six to eight members were present (people joined the meeting while in progress). A handout was provided and presented to the group followed by a discussion. Individuals were interested in enhancements that would add to the streetscape, such as planters in the bike lane buffer or median. A couple of members support providing the buffered bike lanes and felt they were a reasonable option to implement at this time with the resurfacing noting that they would add to livability of the community. A couple of members expressed concern about the traffic forecasts and suggested that additional traffic analysis be presented in light of the QEW changes proposed by MTO and potential Inspiration Lakeview development (the results of the project traffic analysis were not available until after this meeting).
- **Toronto Golf Club,** October 6, 2015—The Chief Operating Officer from the golf club attended this meeting. A handout and plan of the proposed reconfiguration was provided and the project reviewed. They were supportive of providing the left-turn lane at their main entrance and requested that a short left-turn lane be provided at their service entrance used by employees and for deliveries.
- **Lakeview Golf Course**, October 6, 2015—Three management staff from the golf course attended this meeting. A handout and plan of the proposed reconfiguration was provided and the project reviewed. They were supportive of providing the left-turn lane at their entrance. They expressed concerns over errant golf balls that may be hit over the high fence along Dixie Road; this is an on-going concern for them. They questioned how right-turns from the travel lane would work with the bike lane and were informed of the need for turning motorists to yield to cyclists travelling through on the bike lane. They also recognized that some people may use the centre turn lane / median to turn left from their driveway onto Dixie Road but thought others may not know that this manoeuvre is possible.

  Staff from both golf courses saw the bike lane providing space for motorist to encroach on the roadway providing better sightlines to turn onto Dixie Road.

- **Orchard Heights Homeowner's Association**, October 8, 2015—Two members of the organization attended; a handout and plan of the proposed reconfiguration was provided and the project reviewed. Concerns centred on the traffic analysis. With MTO's proposed reconfiguration of the QEW / Dixie Road interchange, they were concerned that new traffic would be attracted to the area further increasing congestion, noise and speeding. They mentioned that they have had long-standing concerns about traffic associated with the South Service Road and QEW. It was noted that implementing the reconfiguration in advance of the MTO work may help curtail increases in traffic due to the interchange improvements.

3.2 Public Events / Venues

Region of Peel staff provided information about the project at the following three venues or events:

Project display at Dixie Outlet Mall

- **8th Annual Tour de Mississauga**, September 20, 2015—Over 3,700 people participated in this non-competitive bicycle ride in the City of Mississauga with routes from 15 km to 120 km long (a wide variety of cyclists attend). Region of Peel staff were present at a booth for the Walk n' Roll program and included a display about the project. People were encouraged to leave comments on sticky notes and post them to a board. Four-five people wrote comments. Thirty-six comments supported the project; one was unsure; eight people provided comments to consider such as green paint, planters, etc.
- **Dixie Outlet Mall**, October 21, 2015—Staff from Region of Peel set up a table with a display in the mall. Ten people wrote comments and all supported the project.
- **Fairways Condominium**, October 22, 2015—A staff person from Region of Peel set up a table with a display in the lobby of the Fairways Condominium. More than 30 people stopped by the table to find out about the project and could leave written comments. People generally appreciated that the experience of pedestrians and cyclists would be improved with the reconfiguration. Most residents mentioned that they either walk or drive around the neighbourhood. A few people said they regularly bike and see that the project would make Dixie much safer for them. There was concern that speeding would continue. Many residents mentioned that they have had long-standing concerns about the driveway and want a traffic signal installed so they can turn onto Dixie. Sixteen people wrote comments. Six of these were about needing a traffic signal at the driveway on Dixie; three had concerns about the project; four did not support the project; three supported it; and three included suggestions such as improving the sidewalks, adding a crosswalk and better winter maintenance.

3.3 Public Information Centre

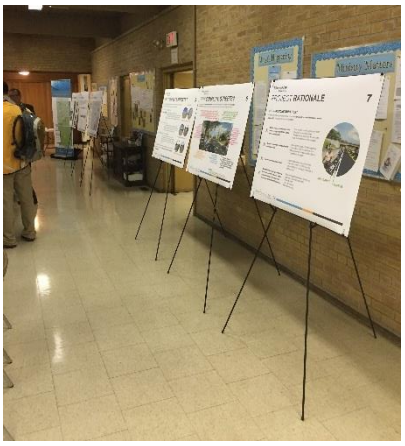
A Public Information Centre (PIC) was held on October 27, 2015 at St. Luke's Church, 1513 Dixie Road located at the north end of the project from 6 PM to 9 PM. Boards with

information on the project and a plan illustrating the design were on display. City, Region and IBI Group staff were on hand to review the information and discuss the project. A presentation was made at 6:30 PM followed by a question and answer period.

People were notified of the PIC through as follows:

- A notice of the PIC was placed in The Mississauga News on October 15, 2015
- Notices were delivered by Canada Post to the residents and business in the area bounded by the QEW, Ogden Avenue, Halliday Avenue and Etobicoke Creek on the week of October 19, 2015
- Notices (approximately 800) were hand-delivered to households and businesses fronting Dixie Road plus in the area bounded by Halliday Avenue, Ogden Avenue, Lake Ontario, and Dixie Road on October 14, 2015. A notice was not left at two condominiums (Fairways Condominium, and Lakeview Promenade), one business (Plaster Form Inc.) and a church (St. Luke's Church). A display was set up at Fairway Condominium prior to the PIC, and the PIC was held at St. Luke's Church.

Thirty-three people signed in at the PIC. Sixteen comment forms and 15 emails were received. Six people supported the project; two supported it but suggested design changes; four people were unsure; and 19 did not support it.



Some of the boards on display at the PIC

Presentation during the PIC

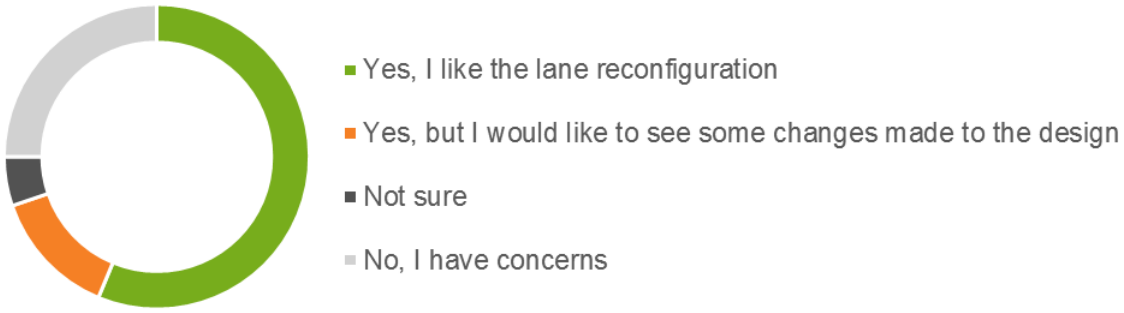
Plan illustrating the proposed lane reconfiguration

3.4 Summary of Feedback

All comments received have been documented, reviewed, and analyzed in terms of supporting the project, not supporting the project, or concerns. A two-page Summary of Consultation and four-page Frequently Asked Questions were available on the project web site following the consultation to respond to concerns.

Exhibit 3-1 illustrates the responses to the project of those who provided comments at each of the four venues, and by e-mail. The feedback was varied, but largely positive – fifty-four people supported the project, five were unsure, thirteen had suggestions or concerns, and twenty-four were opposed to the project. Six people commented about a traffic signal required to address safety at the Fairways condominium entrance.

Exhibit 3-1: Response to project at public venues (54 in total)



Of those who were concerned about the project, the following concerns (of 43 in total) were the most frequently identified (see Exhibit 3-2).

Exhibit 3-2: Common concerns about the project (43 concerns in total)

3.5 Project Website

A project website was established to provide information about the project: https://www.peelregion.ca/pw/water/hanlan-water/dixie-bikeway.htm. After the Public Information Centre, the display boards and presentation were uploaded onto the website. On December 18th, 2015, a Frequently Asked Questions page and consultation summary were also added to address common feedback received.

4 Traffic Analysis

The FHWA Road Diet Informational Guide advises that roadways with an Average Daily Traffic volume (ADT) of 20,000 vehicles per day (vpd) or less may be good candidates for four-to-three lane reductions. Some road diets have been implemented on roadways carry more than 20,000 vpd. Additional analysis is recommended to determine feasibility.

Dixie Road south of Rometown Drive carried approximately 12,500 vpd in 2015. With the reconfiguration of the QEW and Dixie Road interchange, MTO traffic forecasts for 2031 are equivalent to approximately 16,000 vpd. It is anticipated that Dixie Road could reach 20,000 vpd once Inspiration Lakeview is fully built-out but only if current mode share, i.e. the percent of trips by car, transit, cycling and walking, remains unchanged. With improvements to regional, rapid and local transit and to the walking and cycling networks in this area of Mississauga, mode share is expected to shift such that this daily volume will not be reached.

IBI Group undertook a more detailed traffic analysis for Dixie Road to understand how well traffic operates on Dixie Road now and in the future, and the lane configuration required at intersections to accommodate the traffic. The results are summarized below. A copy of the Dixie Road Lane Reconfiguration Traffic Analysis in provided in Appendix B.

The traffic analysis considered both the AM and PM peak hours; the PM peak hour carries more traffic so it is the focus of the results presented below.

4.1 Existing and Future Traffic Operations

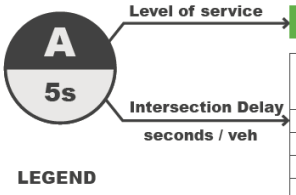
The traffic analysis reviewed the impact of the lane reconfiguration on existing (year 2015) traffic volumes. Results are shown in Exhibit 4-1. All intersections in the study area operate well, with no additional delay with the lane reconfiguration compared to existing conditions.

Two future scenarios for the year 2031 were reviewed that could affect the volume of traffic on Dixie Road. Both incorporated MTO's planned improvements to the QEW / Dixie Road interchange.

- Scenario 1—Background growth in traffic assumes an annual growth rate of 1.3% equivalent to a 23% increase in traffic from .2015 to 2031. This is considered a relatively high rate of growth in traffic compared to similar areas in the Greater Toronto Area. However, it aligns with the rate of growth in traffic assumed by the MTO in preparing their improvement plans for QEW at Dixie Road.
- Scenario 2—Assumes an aggressive annual growth rate of 2.8%, reflecting conditions if Inspiration Lakeview redevelopment was completed by 2031.

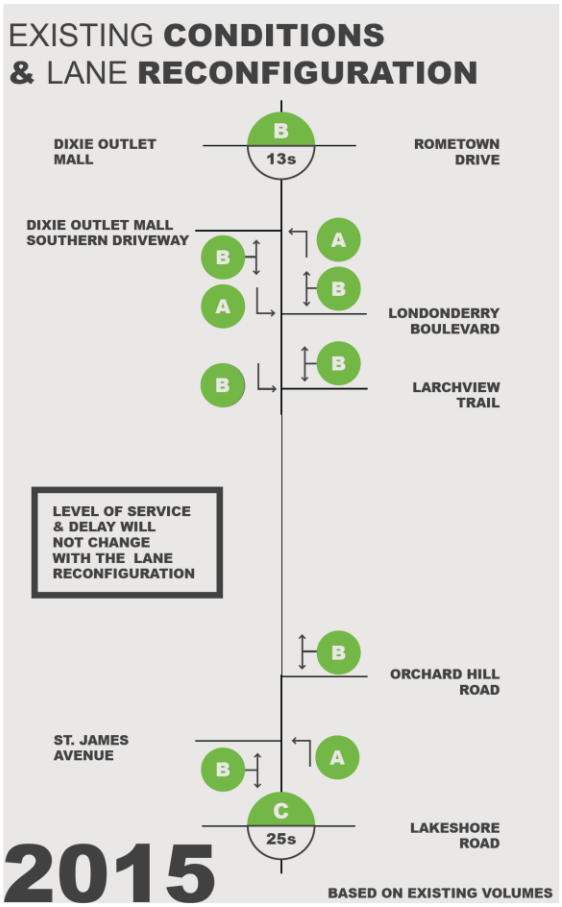
With Scenario 1 traffic forecasts, there will be an increase in delay at some intersections but they will still operate well. With Scenario 2, some additional delay will be experienced during the peak hours with longer waits to turn onto Dixie Road from some of the side streets. The additional delays may not be realized since the traffic forecasts are based on the current mode share, i.e. the percent of trips by car, transit, cycling and walking. With improvements to regional, rapid and local transit and to the walking and cycling networks in this area of Mississauga, mode share is expected to shift such that the traffic forecasts will likely be lower than forecast, and thus the delays less than estimated.

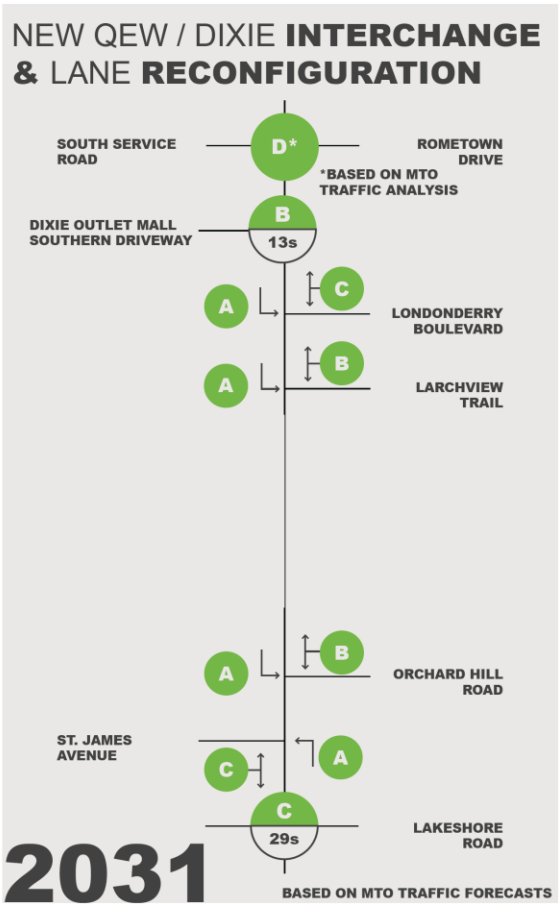
Exhibit 4-1: Results of the Traffic Operational Analysis

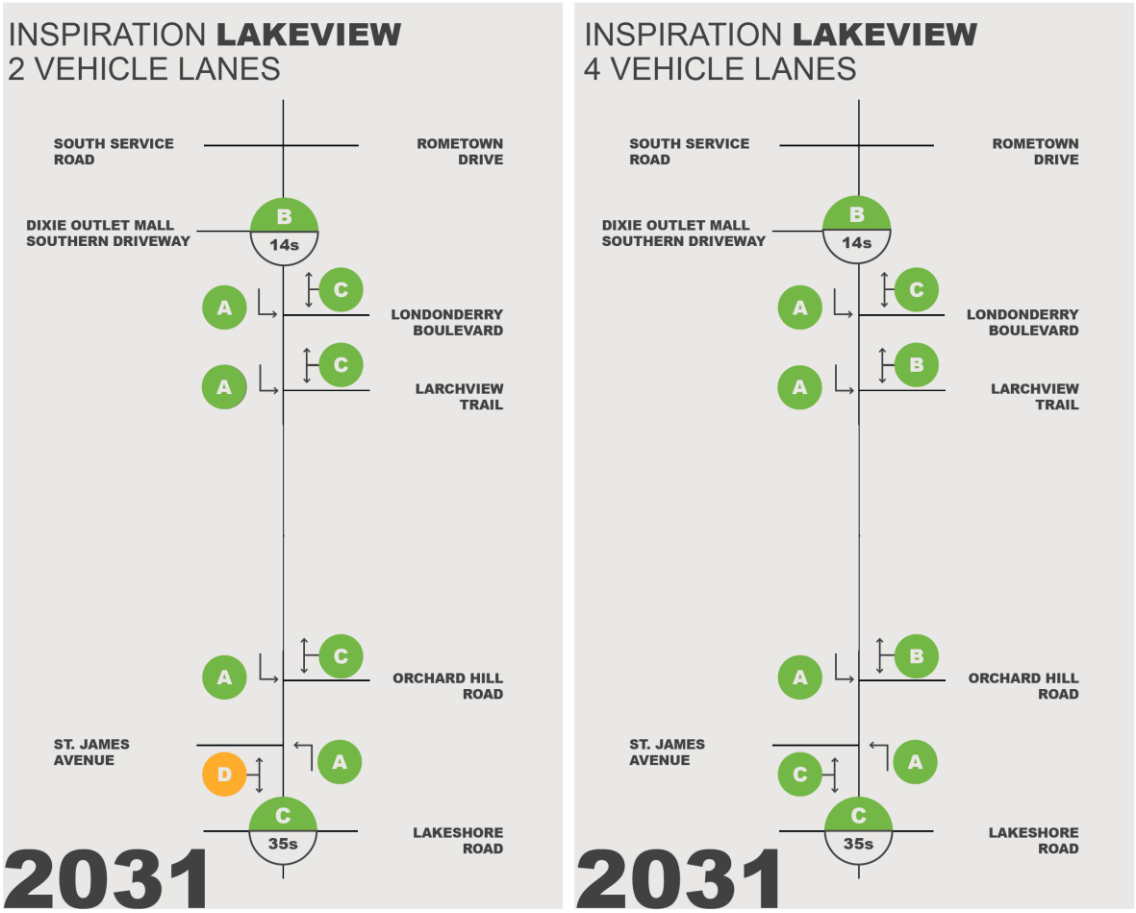


Level of Service	Delay - Signalized Intersection (seconds / PCU)	Delay - Unsignalized Intersection (seconds / PCU)
A	≤10	≤10
B	>10 to ≤20	>10 to ≤15
C	>20 to ≤35	>15 to ≤25
D	>35 to ≤55	>25 to ≤35
E	>55 to ≤80	>55 to ≤50
F	>80	>50

ALL RESULTS SHOWN REFER TO THE AFTERNOON PEAK HOUR







Overall, the traffic analysis determined that the proposed lane reconfiguration works within acceptable levels of service in both scenarios. However, it did anticipate that in the aggressive growth scenario (Scenario 2), delays would be longer at some unsignalized intersections. Signal warrant reviews were performed at these locations but were not found to be justified based on projected traffic volumes and delays. With the implementation of the Dixie Road reconfiguration, the Region of Peel would continue to monitor intersections along Dixie Road, and regularly evaluate the need for improvements at intersections.

The traffic analysis was undertaken assuming current levels of transit usage, walking, and cycling. In the future, these levels are expected to increase in relation to driving. GO Transit has plans to improve service on the GO rail network through the Regional Express Rail program, including on the Lakeshore West Line. The City of Mississauga will also be commencing a Transportation Master Plan for Lakeshore Road, which includes looking into opportunities for improved transit and conditions for walking and cycling. Providing safer facilities for walking and cycling would strengthen the “first mile” and “last mile” connections to transit systems.

4.2 Impact on Cycling

4.2.1 Bicycle Level of Service

Although the concept of analysing traffic using level of service measures is well-established, some municipalities are now starting to develop level of service (LOS) tools that evaluate conditions for other road users. Segments of Dixie Road were reviewed using a bicycle level of service tool to provide some comparison to the traffic results.

The cycling experience is affected by many complex factors, such as pavement quality, topography, aesthetics, etc. Some argue that the stress of traffic overwhelms most other factors in deterring or encouraging cycling[1]. Motor vehicle traffic volumes and speeds figure prominently in most bicycle LOS frameworks developed to date.

A Mineta Transportation Institute (MTI) report presents a cycling level of traffic stress (LTS) measurement, a methodology adopted by the City of Ottawa in their multi-modal level of service guidelines. The MTI report presents two objectives for developing this tool:

1. Identify a user-oriented cycling network of streets and paths that do not exceed people's tolerance for traffic stress
2. Identify barriers to low stress connectivity such as freeways, railways and creeks, arterial streets without safe crossings for the lower-stress side streets, and breaks in the neighbourhood street network typically caused by the use of arterials for local access

The City of Ottawa has adapted the LTS tool to allow for comparison with other modes by mapping LTS to level of service A-F as shown in Exhibit 4-2.

Exhibit 4-2: Qualitative Descriptions for Each Cycling Level of Traffic Stress (LTS) Score and Corresponding LOS

From City of Ottawa Multi-Modal Level of Service (MMLOS) Guidelines, October 2015 - adapted from MTI Report no. 11-19

LTS	DESCRIPTION	CATEGORY OF CYCLIST	CITY OF OTTAWA LOS
LTS 1	Presenting little traffic stress and demanding little attention from cyclists, and attractive enough for a relaxing bike ride. Suitable for almost all cyclists, including children trained to safely cross intersections. On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a slow traffic stream with no more than one lane per direction, or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where cyclists ride alongside a parking lane, they have ample operating space outside the zone into which car doors are opened. Intersections are easy to approach and cross.	All ages and skill levels – both children and adults	A
LTS 2	On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a well-confined traffic stream with adequate clearance from a parking lane, or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where a bike lane lies between a through lane and a right turn lane, it is configured to give cyclists unambiguous priority where cars cross the bike lane and to keep car speed in the	Most cyclists	B

[1] Mekuria, M. C., Furth, P. G., & Nixon, H. (2012). Low-Stress Bicycling and Network Connectivity. Report prepared for the Mineta Transportation Institute [MTI].

LTS	DESCRIPTION	CATEGORY OF CYCLIST	CITY OF OTTAWA LOS
	right-turn lane comparable to bicycling speeds. Crossings are not difficult for most adults.		
LTS 3	More traffic stress than LTS 2, yet markedly less than the stress of integrating with multilane traffic, and therefore welcome to many people currently riding bikes in American cities. Offering cyclists either an exclusive riding zone (lane) next to moderate-speed traffic or shared lanes on streets that are not multilane and have moderately low speed. Crossings may be longer or across higher-speed roads than allowed by LTS 2, but are still considered acceptably safe to most adult pedestrians.	Most experienced adult cyclists	C, D based on facility characteristics
LTS 4	A level of stress beyond LTS3.	Very confident cyclists only	E, F based on facility characteristics

Since the LOS methodology is related to the type of cyclists that will be comfortable on certain roads and facilities, it provides support and justification for infrastructure improvements that may attract new riders.

The LTS method is unique in that it does not rely on traffic volumes. Instead, the number of lanes is used as a proxy since the authors assumed motor vehicle traffic volumes would not be widely available for all road segments. By basing LTS on the number of lanes, this also means that LTS does not vary by time of day.

The City of Ottawa methodology was applied to the Dixie Road corridor without and with the buffered bike lanes. Calculation sheets are provided in Appendix C. The results of the analysis are provided in Exhibit 4-3. The overall route BLOS without buffered bike lanes is F, and with buffered bike lanes is C. If a two-stage, left-turn bike box was provided at the Lakeshore intersection, the intersection BLOS would be A; if the segment speed lowers to 50 km/h or less, the segment BLOS would be A; and the overall route BLOS would be A.

Exhibit 4-3: Bicycle Level of Service Results Without and With Buffered Bike Lanes

LOCATION	WITHOUT BUFFERED BIKE LANES	WITH BUFFERED BIKE LANES
Dixie Road segment from Rometown to Lakeshore	E	C
Signalized intersection at Rometown (south approach)	F	A
Signalized intersection at Lakeshore (north approach)	D	C
Overall Route Score	**F**	**C**

4.2.2 Effects of Implementing Cycling Facilities – Other Municipalities

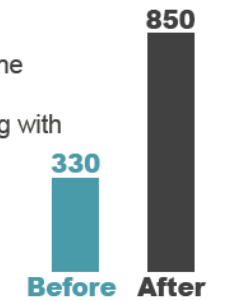
Experiences in other municipalities after the implementation of cycling projects showed increases in the number of cyclists and other measures of the street's performance, as illustrated in Exhibit 4-4.

Exhibit 4-4: Measured Effects of Implementing Cycling Facilities in Other Municipalities

Hamilton, Ontario

Bikeway: two-way bike lane implemented on one-way Hunter Street (1.5 km long with a 0.5 km gap)

Bike trips more than doubled after installation



Peterborough, Ontario

Bikeways: 20 km of bike lanes

Cyclists and women who ride bicycles prefer roads with bike lanes

102% more cyclists ride on streets after bike lanes installed

28% more women are cycling on streets after bike lanes are installed

New Orleans, Louisiana

Bikeway: 5 km of bike lanes on St. Claude Avenue

133% increase in the average daily number of woman riders

More people and more women riding bicycles after bike lanes installed

57% increase in the overall daily number of cyclists

Seattle, Washington

Bikeway: Stone Way carrying 13,000 vehicles a day and 50 km/h speed limit repaved from 4 travel lanes to 2 with two-way left-turn lane and bike lanes (2 km long)

Speed declines, peak hour capacity maintained and bicycle volumes go up:

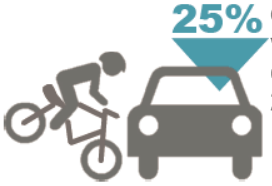
- Motorists **exceeding speed limit** by more than 15 km/h **dropped by 75%** after installation
- Traffic volume dropped by only 6% so **corridor can still carry same amount of traffic** as before
- **Bicycle traffic increased by 35%**
- Bicycles represent 15% of the traffic during the peak traffic period

Stone Way N, Seattle

Edmonton, Alberta

Bikeways: 65 km of bikeways on streets

Bikeways improve safety



25% decrease in motor-vehicle – bicycle collisions from 2009 to 2013

4.3 Collision History

Region of Peel reviewed the reported collisions on Dixie Road for the period from January 1, 2009 to December 31, 2013 from Londonderry Boulevard to Lakeshore Road. Below is a summary by location.

- Dixie Road at Lakeshore Road—34 reported collisions: Over 85.3% of the collisions involved only property damage and 14.7% represented non- fatal injury. None of the collisions reported resulted in fatal injuries. The predominant impact type at the intersection were rear-end collisions representing (35.3%), followed by sideswipe collisions. There was one reported pedestrian / motor vehicle collision.
- Dixie Road at Saint James Avenue—8 reported collisions: Over 87.5% of the collisions involved only property damage and 12.5% represented non- fatal injury.

None of the collisions reported resulted in fatal injuries. The predominant impact type at the intersection were rear-end and angle collisions each representing (37.5%), followed by one single motor vehicle collision.

- Dixie Road at Londonderry Boulevard—5 reported collisions: Over 80.0% of the collisions involved only property damage and 20.0% represented non- fatal injury. None of the collisions reported resulted in fatal injuries. The predominant impact type at the intersection were rear-end collisions representing (60.0%), followed by one single motor vehicle collision and sideswipe.
- Dixie Road at Larchview Trail—4 reported collisions. All of the collisions involved only property damage. The predominant impact type at the intersection were rear-end collisions representing (50.0%), followed by one single motor vehicle collision and approaching.
- The following locations on Dixie Road had one reported collision each: Orchard Hill Road, Saint James Avenue, and between Larchview Trail and a private condominium access

There are no reported cyclist / motor vehicle collisions on Dixie Road from Londonderry Boulevard to Lakeshore Road. The majority of the collisions occurred under ideal driving conditions which is daylight, dry road surface and clear environmental conditions.

The collision rate on Dixie Road for the period reviewed is approximately 1.5 collisions per million vehicle kilometers. This is more than twice the average historical rate of 0.7 collision/Mvkm for Region of Peel roads. The addition of left-turn lanes and a centre two-way left-turn lane on Dixie Road will reduce the potential for rear-end, angle and side-swipe collisions with left-turning vehicles. Based on the FHWA Crash Modification Factors Clearinghouse (www.cmfclearinghouse.org), reducing a roadway from 4 to 3 lanes is expected to reduce all collisions by 37%.

4.4 Speed Study

The posted speed limit on Dixie Road is 60 km/h north of the GO Rail Underpass and 50 km/h on the south side to Lakeshore Road. The 85th percentile operating speed is around 70km/h.

Traffic calming by design is an objective of the lane reconfiguration. Four lanes to two plus turn lane reconfigurations such as this one have been found to improve safety by reducing the differential in speeds between motorists. On four-lane roads, drivers frequently slow or change lanes due to slower turning or stopped vehicles, particularly those stopped in a travel lane to turn left. The provision of the turn lanes reduces the speed differentials between vehicles, reducing weaving in and out of lanes. Studies show a 19 to 47% reduction in overall crashes. Average speeds have been found to decrease by 5 to 8 km/h, and various studies show a decrease in the number of high-end speeders, that is those travelling more than 20 km/h over the speed limit. The severity of crashes decreases too because of the lower speeds at which crashes may occur.

The posted speed limit on Dixie Road was analyzed to determine if changes should be made during the reconfiguration project. Worksheets are provided in Appendix D.

Two methods of analysis were undertaken:

- Transportation Association of Canada's Automated Speed Limit Guidelines – This methodology assess the risk associated with various geometric elements of the roadway including horizontal and vertical alignment, lane width, roadside hazards, pedestrian and cyclist exposure, presence of on-street parking, and number and type of traffic control at intersections and driveways. Based on this methodology, the speed limit of 60 km/h was recommended.

- Northwestern Speed Zoning Technique – This methodology considers speed data, road parameters, and collision rate. The recommended speed limit is 60 km/h.

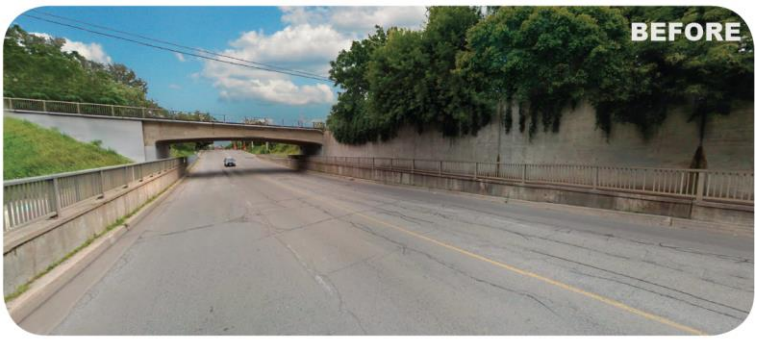
Changes to the current posted speeds are not recommended.

5 Design

The Dixie Road Bikeway Feasibility Study recommended implementing bike lanes by examining the typical width of the roadway from selected field measurements. A more thorough review of the roadway width based on a survey to determine the width of the bike lanes and the potential to include a buffer between the bike lane and the adjacent travel lane was required. Based on the engineering drawings provided from the Region of Peel through the Hanlan Water Project, it was determined that a buffered bike lane with two travel lanes and centre turn lane would generally fit within the available road width.

The design of the Dixie Road Lane Reconfiguration with Bike Lanes is unique in that it includes the first-ever buffered bike lanes implemented by the Region of Peel, and incorporates an urban streets approach to improve the safety and comfort of all users of the corridor. Renderings of the buffered bike lane, shown in Exhibit 5-1, were prepared to illustrate to the public and stakeholders what the buffered bike lane and lane reconfiguration could look like.

Exhibit 5-1: Illustrations of Dixie Road before and after the Lane Reconfiguration



DIXIE LOOKING SOUTH AT **RAIL UNDERPASS**

DIXIE LOOKING SOUTH AT **ST JAMES AVENUE**

IBI Group prepared the preliminary design for the reconfiguration of Dixie Road. It was reviewed by the project team, refined and then presented to stakeholders and the public. IBI Group then prepared Detail Design Drawings from the preliminary design and modified to reflect comments arising from the consultation and further project team review. The detail design drawings are provided in Appendix E.

5.1 Design Criteria and References

The preliminary design of the Dixie Road lane reconfiguration with buffered bike lanes was based on the design criteria listed in Exhibit 5-2. The design criteria are based on a number of North America design guidelines and incorporate best practices in the design of urban streets regarding design or target speed, lane widths and bike lane and buffer widths. These are described in the following sections.

Exhibit 5-2: Design Criteria for Dixie Road Lane Reconfiguration with Buffered Bike Lanes

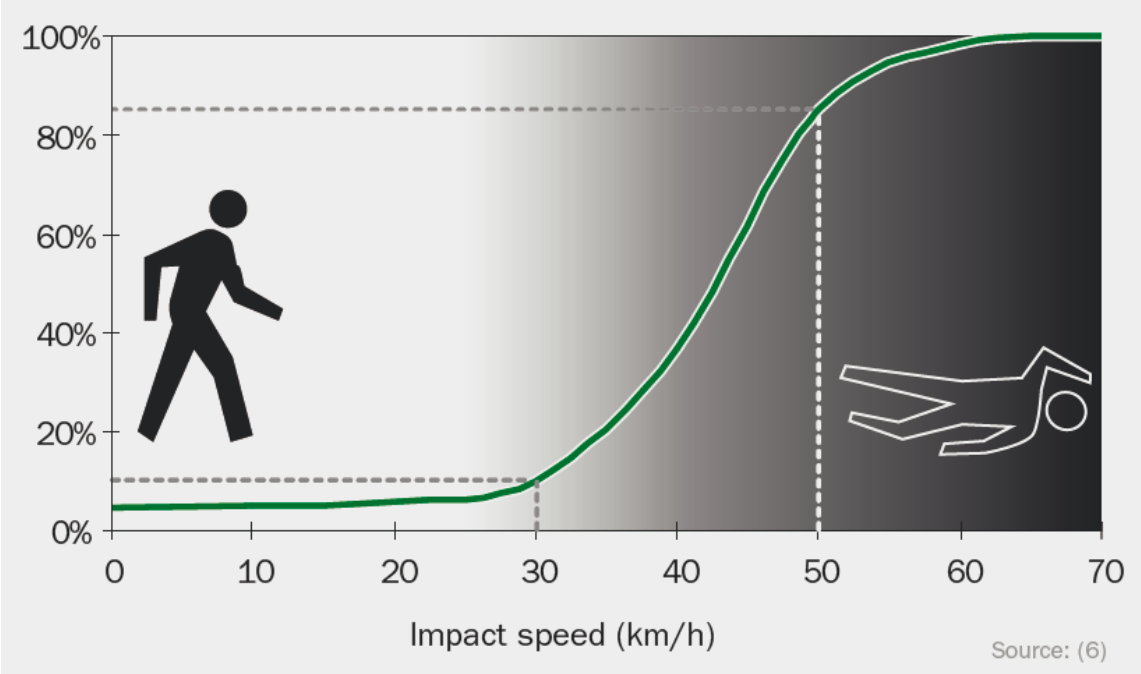
ELEMENT		CRITERIA	REFERENCE
Design / target speed		60 km/h (equivalent to posted speed north of the CNR Structure)	NACTO Urban Streets Design Guide, 2013
General purpose travel lane width		Minimum 3.35 m	NACTO Urban Streets Design Guide, 2013
Left-turn lane:	Width	• Minimum 3.0 m • Preferred 0.25 m less than adjacent through lane	NACTO Urban Streets Design Guide, 2013
	Length	• Minimum 15 m • Preferred storage length as recommended by the traffic analysis (deceleration occurs over the taper)	TAC Geometric Design Guide for Canadian Roads, 1999
	Tape ratio	• 1:15	TAC Geometric Design Guide for Canadian Roads, 1999
Centre, two-way, left-turn lane width		• Minimum 3.0 m • Preferred 3.5 m	FHWA Safety Program Road Diet Informational Guide, November 2014 TAC Geometric Design Guide for Canadian Roads, 1999
Bike lane:	Width (not including gutter)	• Minimum 1.2 m • Preferred 1.5 m • 2.0 m adjacent retaining wall at CNR structure	NCHRP Recommended Bicycle Lane Widths for Various Roadway Characteristics, 2014 OTM Book 18 Cycling Facilities TAC Geometric Design Guide for Canadian Roads, 1999
	Buffer width:	• Minimum 0.5 m	

5.1.1 Target Speed

Conventional road design requires selecting a “design speed” typically higher than the posted speed to allow for a greater margin of safety. However, this practice has resulted in operating speeds equivalent to the design speed, frequently exceeding the posted speed. On urban streets, motorists’ speed is an important factor for the safety of all users, in particular more

vulnerable pedestrians and cyclists who are likely to be injured or killed if involved in a collision with a motorist, as illustrated by the risk of fatality in Exhibit 5-3. “Higher design speeds often mandate larger curb radii, wider travel lane widths, on-street parking restrictions, guardrails, and clear zones. Lower design speeds reduce observed speeding behavior, providing a safer place for people to walk, park, and drive.” (NACTO, Urban Streets Design Guide, pg. 141).

Exhibit 5-3: Probability of Fatal Injury for a Pedestrian Colliding with a Vehicle



From **Speed management: A Road Safety Manual for Decision-Makers and Practitioners**, Geneva, Global Road Safety Partnership, 2008

The NACTO Urban Streets Design Guide recommends designing streets using target speed, the speed intended for drivers to go, rather than operating or design speed. The design criteria for urban street elements can be based on the target speed. Higher design speeds can be used for limited access freeways and highways, but are inappropriate on urban streets, including urban arterials. As noted in NACTO, “bring the design speed in line with the target speed by implementing measures to reduce and stabilize operating speeds.”

On Dixie Road, the posted speed limit is 60 km/h north of the CNR structure and 50 km/h south of the CNR structure to Lakeshore Road. The 85th percentile operating speed (typically used to assess posted speed with 85 percent of the traffic traveling at this speed or less) is around 70km/h. The design speed for the reconfiguration of Dixie Road was set to a target speed of 60 km/h. This provides some flexibility in terms of the width of travel lanes and the design of auxiliary turn lanes (length and tapers).

5.1.2 Travel Lane Width

Conventional wisdom in road design suggested that wider travel lanes were more desirable since they are more forgiving for drivers, and therefore, safer. However, this assumption has been questioned heavily in urban areas where speeding is a major concern, both from a vehicular safety perspective but also for pedestrian and cyclist safety should they be involved in a crash with a vehicle.

Recent research (since 2005) was reviewed and summarized (refer to Exhibit 4 3). The research projects identified are generally large scale studies presented in peer-reviewed journals such as the Journal of the Transportation Research Board.

Exhibit 4 3: Summary of Research on Safety & Operational Impacts of Lane Widths

STUDY	SUMMARY OF RESEARCH
Relationship of Lane Width to Safety for Urban and Suburban Arterials (2007) Potts, I., Harwood, D. & Richard, K. *Transportation Research Record: Journal of the Transportation Research Board* 2023 (2007): 63-82	» Study was conducted using data collected in Minnesota (primarily in the Minneapolis-St. Paul metropolitan area) & Michigan (primarily in Oakland County) along both urban and suburban arterials » Five arterial types of roadways were identified: two-lane undivided arterials, three-lane arterials including a centre two-way left-turn lane (TWLTL), four-lane undivided arterials, four-lane divided arterials and five-lane arterials including a centre TWLTL **Findings for Segment (Midblock) Lane Widths** "Analysis of geometric design, traffic volume, and accident data collected in NCHRP Project 17-26 has found that, with limited exceptions, **there is no consistent, statistically significant relationship between lane width and safety for midblock sections of urban and suburban arterials**. There is **no indication that the use of 3.0- or 3.3-m, rather than 3.6-m lanes**, for arterial midblock segments **leads to increases in accident frequency**." A few exceptions were noted: » Data for one of the states showed increasing crash rates for lane widths of 3.0m or less on four-lane undivided arterials [not corroborated by the other state's data] » Data for one of the states showed increasing crash rates for lane widths of 2.7m or less on four-lane divided arterials [not corroborated by the other state's data] » The authors thus suggest that these widths in the specific conditions "should be used cautiously unless local experience indicates otherwise" (p. 22) **Findings for Lane Widths on Intersection Approaches** "Analysis of geometric design, traffic volume, and accident data collected in NCHRP Project 17-26 has found that, with limited exceptions, **there is no consistent, statistically significant relationship between lane width and safety for approaches to intersections on urban and suburban arterials**. There is **no indication that the use of 3.0- or 3.3-m, rather than 3.6-m lanes**, for arterial midblock segments **leads to increases in accident frequency**." One exception was noted: » Data for one of the states showed increasing crash rates for approaches to 4-way stop-controlled intersections with lane widths of 3.0m [not corroborated by the other state's data]
Relationship of Lane Width to Saturation Flow Rate on Urban and Suburban Signalized Intersection Approaches (2007)	» Study was conducted on data from 25 intersection approaches located in nine cities and five states » The data excluded locations with curb parking, bus stop activity, substantial driveway interference, or heavy pedestrian or bicycle activity » The data was limited to queue lengths between 8 and 11 vehicles "Research indicates that **saturation flow rate varies with lane width.** Average saturation flow rate was in the range of 1,736 to 1,752 passenger cars per hour per

STUDY	SUMMARY OF RESEARCH
Potts, I., Ringert, J., Bauer, K., Zegeer J., Harwood, D., Gilmore, D. *Transportation Research Record: Journal of the Transportation Research Board* 2027 (2007): 44-51.	lane (pc/h/ln) for 2.9-m lanes, 1,815 pc/h/lm to1,830 pc/h/ln for 3.3- to 3.6-m lanes, and 1,898 to 1,913 pc/h/ln for lane widths of 4.0 m or greater" Note that no data is provided for lane widths of 3.0m, and that flow rate did not change for lanes between 3.3- to 3.6-m.
Optimizing Lane Widths to Achieve a Balance of Safety, Operations, and User Needs (2015) Isebrands, H., Newsome, T., & Sullivan, F. Institute of Transportation Engineers. ITE Journal (2015) 85:3.	» Article largely summarizes the experiences of several states in implementing narrower lane widths, including Charlotte & Florida, ultimately concluding that "in jurisdictions that are optimizing their street space, 11-ft. [3.35 m] lanes are emerging as the new normal, with 10-ft [3.05 m] and 12-ft [3.65 m] lanes being implemented under justified circumstances." (p. 42) » The theme of differentiating between new construction and retrofit standards is emphasized: "Many of Charlotte's street projects are modifications to existing streets, frequently in constrained environments. This often involves re-allocating space between the curblines by converting 4 lane streets to 2-3 lane streets with bike lanes, or by narrowing existing travel lanes to provide space for bikes. In these cases, some lane widths might be narrower than for new streets (and some might be wider). These streets frequently incorporate 10-ft [3.05 m] lanes." (p. 39)

Overall, these results do not preclude the use of narrow lanes. From a safety perspective, the use of narrower lanes does not represent a greater risk to users. Operationally, narrower lanes may reduce the saturation flow rate by up to 150-200 pc/h/ln. However, in urban settings, saturation flow rates are likely to be impacted more severely by other factors such as friction from on-street parking, queuing from turn lanes, downstream congestion or high percentages of heavy vehicles. As a result, the potential upside of narrower travel lanes (more space for cycling and pedestrian facilities, lower speeds) warrants the consideration of narrow lanes.

The NACTO Urban Streets Design Guide recognizes that the "width allocated to lanes for motorists, buses, trucks, bikes, and parked cars is a sensitive and crucial aspect of street design. Lane widths should be considered within the assemblage of a given street delineating space to serve all needs, including travel lanes, safety islands, bike lanes, and sidewalks. Each lane width discussion should be informed by an understanding of the goals for traffic calming as well as making adequate space for larger vehicles, such as trucks and buses." The NACTO Urban Streets Design Guide recommends lane widths of 3 m in urban areas since they have a positive impact on a street's safety without impacting traffic operations. For designated truck or transit routes, one travel lane of 3.35 m may be used in each direction.

The travel lane widths on Dixie Road currently range from 3.33 m wide to 3.6 m wide. Currently City of Mississauga operates transit buses on Dixie Road from the Dixie Outlet Mall northerly. Dixie Road is not a goods movement route for truck traffic, although trucks are permitted to use Dixie Road for local deliveries. City of Mississauga indicated that they may operate transit on this section of Dixie Road in the future, in particular to connect future development on and south of Lakeshore Road to transit services and destinations to the north, and to provide access to the nearby Long Branch GO Station. Therefore, the lane width selected for the design of the reconfiguration of Dixie Road is 3.35 m for general purpose travel lanes, and 3.0 m for auxiliary (left and right-turn) lanes.

The FHWA Road Diet Informational Guide (November 2014) recommends two-way left-turn lane widths from 3.0 to 4.8 m; Geometric Design Guide for Canadian Roads (1999) recommends a width of 3.5 m for design speeds of 60 km/h or less. City of Toronto has adopted a minimum width of 2.7 m, a target width of 3.0 m and a maximum width of 3.2 m. The design criterion selected for Dixie Road is a minimum of 3.0 m; 3.5 m preferred. It was designed to a width of 3.3 to 3.35 m.

5.1.3 Bike Lane and Buffer Width

The US National Cooperative Highway Research Program (NCHRP) completed a major research project in 2014 entitled Recommended Bicycle Lane Widths for Various Roadway Characteristics. Perhaps one of the most interesting findings of the research was the limited impact of bicycle lane width on cyclist positioning:

> This research investigated bicycle lanes ranging in width from 3.5 to 6 ft [1.1 to 1.8 m]. In general, **there was no practical difference in bicyclist positioning when operating within the bicycle lanes of these varying widths**…Similarly, when adjacent to a vertical curb (without a gutter), there was no practical difference in bicyclist positioning when operating within bicycle lanes of 4 ft [1.2 m] as compared to 5 ft. [1.5 m]…Therefore, in terms of accommodating bicyclists within a bicycle lane, **there does not appear to be a distinct advantage of providing a wider bicycle lane compared to a narrower bicycle lane, at least when considering bicycle lane widths between 3.5 and 6.0 ft. [1.1 to 1.8 m]**. Widening or narrowing the bicycle lane does not necessarily move bicyclists away from the door zone of parked vehicles, nor does it practically effect the spread of bicyclist lateral positions within the bicycle lane. (p.54-55).

The research findings promote the effectiveness of buffers (over adding width to the bike lane) as a means of shifting cyclists away from the door zone adjacent to parked cars or to provide additional comfort from vehicles in the travel way. One notable exception to the findings of this study, however, would be where the volume of cyclists is heavy enough to warrant wider cycling lanes that allow for passing within the bike lane. A discussion of cyclist volumes was not raised in this research, likely because in most major North American cities this issue is just now beginning to emerge as a design parameter as the number of cyclists grows over time.

In addition to examining the width of bike lanes, the study considered the width of travel lanes adjacent to bike lanes:

> During the field data collection, **few passing vehicles were observed encroaching into the bicycle lanes for most of the study scenarios, even from the narrowest 10-ft [3.05 m] travel lane.** Similarly, few passing vehicles encroached into adjacent travel lanes to the left, especially when encroachment involved crossing the centerline of the roadway. Thus, based on these field observations, travel lanes between 10 and 12 ft [3.05 and 3.65 m] in width were found to be appropriate when adjacent to a bicycle lane. This is consistent with previous research (Potts et al., 2006) that indicates the use of travel lanes narrower than 12 ft [3.65 m] on urban and suburban arterials does not necessarily increase expected crash frequencies and that geometric design policies should provide flexibility for use of lane widths narrower than 12 ft. [3.65 m] (p. 55-56).

Ultimately, the project provides design guidance regarding bike lane width on corridors:

> …for streets where on-street parking is prohibited, the analysis results from this research indicate that **the minimum bike lane width should be 4 ft. [1.2 m], measured from the face of curb or vertical surface to the center of the bike lane line, for roadway widths of 32 ft. [9.75 m] or greater (measured curb to**

> **curb) and may be appropriate for roadway widths as narrow as 28 ft. [8.5 m] For roadways with higher volumes or higher truck percentages, a bike lane width of 5 ft. [1.5 m] is desirable.** (p. 58)

It should be noted that for the above study, truck volume less than 10% was considered low, while truck percentages 16 to 20% were considered high. Dixie Road carries about 5% trucks.

For Dixie Road, a minimum bike lane width of 1.2 m was selected adjacent a 0.5 m wide buffer. Where additional roadway width was available, a bike lane width of 1.5 m was preferred; and additional width beyond this was added to the bike lane buffer. Note that these widths do not include the gutter width. These are compatible to those recommended in the Ontario Traffic Manual Book 18 Cycling Facilities of 1.8 m preferred and 1.5 m minimum including gutter.

An exception to the bike lane widths noted above is adjacent the retaining wall under the CPR structure. The Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads, Chapter 3.4 Bikeways recommends an offset of 0.6 m to fixed objects such as retaining walls (pg. 3.4.6.3). Thus the bikeway width is increased to 2.0 m where possible with a 0.5 m buffer through the CNR structure.

5.2 Pedestrian Crossings

Pedestrian crossings of Dixie Road are currently provided at the signalized intersections at Lakeshore Road and Rometown Drive. With the future reconfiguration of the QEW / Dixie Road interchange, a new traffic signal will be installed at the Dixie Outlet Mall south entrance. There are the only locations were pedestrians are provided the right-of-way over traffic to cross Dixie Road during the appropriate “walk” signal phase. Rometown Drive and the Dixie Outlet Mall south entrance are 130 m apart, Lakeshore is 1.5 km to the south.

The lane reconfiguration provides a painted median in some locations along Dixie Road. The locations of destinations that would attract pedestrian crossings of Dixie Road, and the potential of adding a raised pedestrian refuge island to assist pedestrians in crossing the road one direction of traffic at a time were reviewed:

- Residents living in the Orchard Heights neighbourhood on the east side of Dixie Road will can use the traffic signals at Rometown Drive and future signals at the Dixie Outlet Mall south entrance to access the mall on the west side.
- Residents living in the Fairways Condominium do not need to cross Dixie Road to access the mall. If their destination was in the Orchard Heights neighbourhood, they can use the traffic signals at Rometown Drive and future signals at the Dixie Outlet Mall south entrance to cross Dixie Road
- Residents living in the neighbourhoods east and west of Dixie Road just north of Lakeshore Road would have to travel a maximum of 250 m south on Dixie to use the traffic signals at Lakeshore Road to cross the road. South of the Metrolinx Railway Underpass to Lakeshore Road, the centre turn lane is used for left-turns into side streets and driveways on both sides of the road. No location was found to add a median refuge island that would not block access to the side streets or driveways.

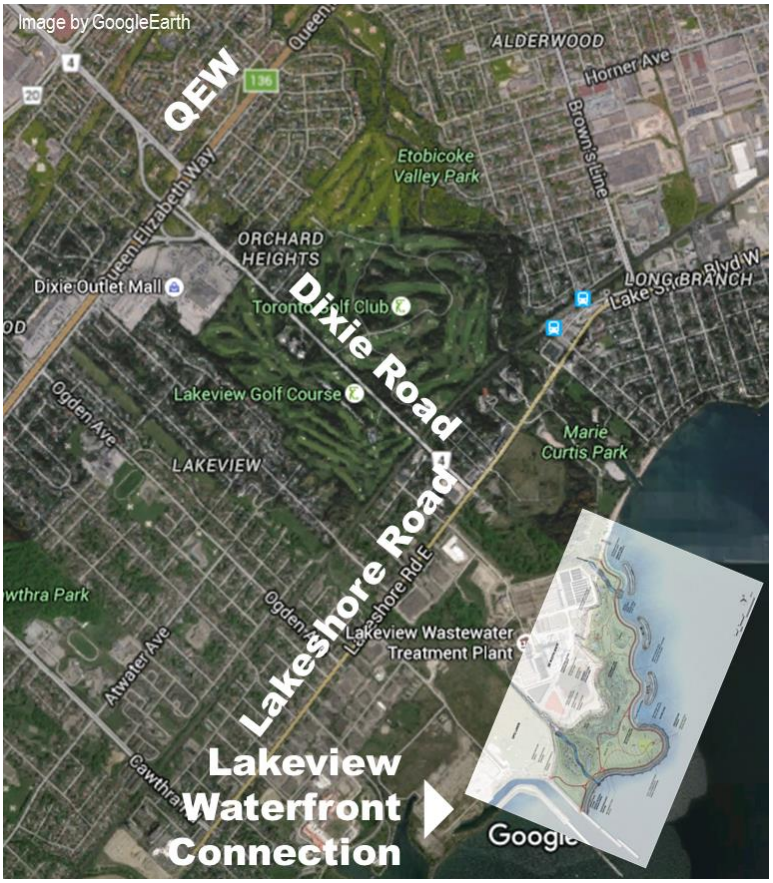
No new pedestrian crossings or pedestrian refuge islands are recommended as part of the lane reconfiguration project.

5.3 Lakeview Waterfront Connection Truck Traffic

The Lakeview Waterfront Connection Project (LWC Project) aims to create a new natural waterfront park in the Lakeview neighbourhood (Inspiration Lakeview) to enhance degraded

aquatic and terrestrial wildlife habitat and provide public access to the waterfront in an area that currently does not provide such opportunities. The LWC Project Environmental Assessment (EA) was undertaken by Credit Valley Conservation (CVC) and the Region of Peel (co-proponents), with the support of Toronto and Region Conservation Authority (TRCA) and the City of Mississauga. It was approved in May 2015, and amended and approved in January 2016. The Planning for the LWC Project is supported by recent City of Mississauga planning initiatives and spearheaded by active public support, which identify a strong desire for greater public access to the eastern Mississauga waterfront. The concept plan and location in relation to Dixie Road along with the preferred construction access route are illustrated in **Exhibit 5-4**.

Exhibit 5-4: Lakeview Waterfront Connection Concept, Location and Preferred Construction Access Route



Location of Lakeview Waterfront Connection in relation to Dixie Road

Preferred Construction Access Route
(EA Amendment, November 27, 2015)

The LWC Project EA estimated the number of trucks as follows (April 2014, page 6-25):

> A 7 to 10 year construction period is anticipated for the placement of fill so the access route would be in place for 7 to 10 years to complete the LWC Project (although it could be longer depending on construction timelines). The construction planning team anticipates a maximum of 250 truck deliveries per day with a more typical volume being 200 trucks per day.

The LWC Project EA assessed the impact of the construction truck traffic as follows (April 2014, page 7-19):

> The traffic analysis conducted for the LWC Project indicates that baseline traffic conditions at most intersections is congested. Traffic generated by construction of the LWC Project will result in an increase in traffic of 0.5% to 3.5% at various intersections during peak periods which will have a negligible impact on existing traffic conditions in the Project and Regional Study Areas.

Various access routes were evaluated. The preferred construction route approved by the Ministry of the Environment and Climate Change runs along the eastern boundary of the Ontario Power Generation (OPG) lands, where the Lakeview Power Generating Station once stood, on Lakeshore Road about 200 m west of Dixie Road.

Trucks would use various routes to travel to / from the construction route, including Dixie Road, ultimately arriving on Lakeshore Road at the construction access west of Dixie. The traffic analysis presented traffic volume diagrams for the AM and PM peak traffic hours. The traffic volume diagrams illustrate about 30 trucks an hour using Dixie Road north of Lakeshore Road.

At Lakeshore Road, the LWC Project construction trucks will be turning left from eastbound on Lakeshore Road to northbound on Dixie Road, and turning right from southbound on Dixie Road to westbound on Lakeshore Road. Currently about 5% of the traffic on Dixie Road are trucks (Dixie Road Bikeway Feasibility Study, IBI Group, September, 2015). An additional 250 trucks a day represents an increase in the percent of trucks to almost 7% (not all trucks will use Dixie Road so this estimate is not likely to be realized).

There is little information available in terms of a threshold at which trucks become of a greater concern to cyclists. Design guides that support narrower lane widths for urban streets than conventionally used suggest that truck volumes can be considered “heavy” when the volume is above 10% and thus need to be more explicitly considered in the design of streets.

Trucks are accounted for in the design of the Dixie Road lane reconfiguration as follows:

- Large vehicles are accommodated by the 3.35 m wide travel lane width adjacent the 0.5 m wide buffer for the bike lane.
- The southbound bike lane buffered is continued to the stop bar at the Lakeshore Road and a “right-turning vehicles yield to cyclists” sign is installed.
- Guidelines and green colour through the Dixie Road / Lakeshore Road intersection guide cyclists to / from the Waterfront Trail connection and alert motorists of potential conflicts in the intersection.
- A guideline is used for the right-turn from westbound on Lakeshore Road to Dixie Road to guide motorists into the travel lane instead of following the curb into the bike lane.

5.4 Description of Key Design Features

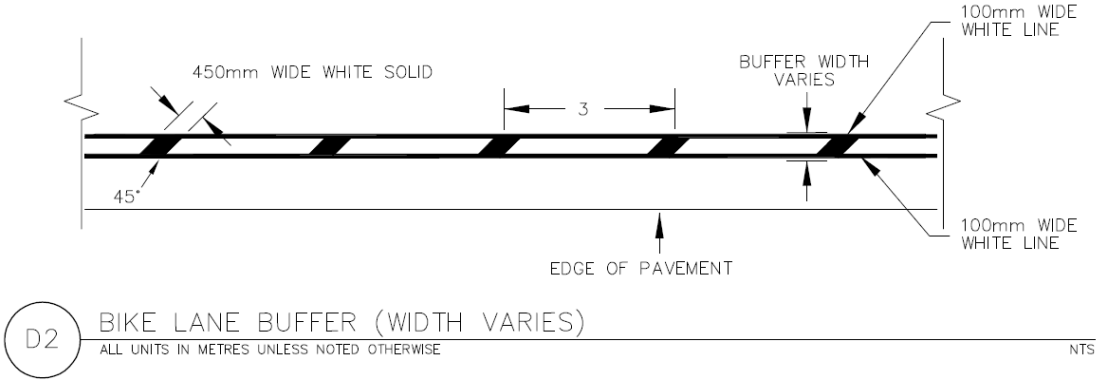
The design features of the Dixie Road lane reconfiguration with buffered bike lanes that will be used for the first time on a Region of Peel roadway are described in the following sections. Reference is made to Ontario Traffic Manual Book 18 Cycling Facilities, December 2013 (OTM Book 18).

5.4.1 Bike Lane Buffer Marking

The buffer between the bike lane and the travel lane is marked as follows and illustrated in Exhibit 5-5:

- 100 mm wide, white longitudinal lane line adjacent the bike lane
- 100 mm wide, white longitudinal lane line adjacent the travel lane. OTM Book 18 notes that “this line can be 100 to 200 mm wide”; 100 mm was selected for greater visibility given the 85th percentile operating speed of 70 km/h, and the posted speed of 50 to 60 km/h.
- 450 mm wide white diagonal hatch lines spaced 3 m centre to centre. OTM Book 18 notes that “the spacing between the diagonal lines is typically in the range of 3 to 12 metres and is generally a function of vehicular speed. On roadways with faster moving motor vehicles, the lines may be spaced farther apart; on roadways with slower moving motor vehicles, the hatched lines should occur more frequently.” It provides no further guidance. A spacing of 3 m was selected as appropriate based on Ontario Traffic Manual 11 Markings and Delineation (March 2000) recommendation of 3 to 6 m for diagonal marking of non-freeway gore areas.

Exhibit 5-5: Bike Lane Buffer Pavement Marking Detail



5.4.2 Buffered Bike Lane Treatment at Driveways and Approaching Intersections

At lower volume driveways the buffered bike lane pavement marking continues through the driveway, just as travel lane lines would continue through the driveways. At higher volume driveways, such as the two golf courses, and unsignalized side street intersections, the bike lane buffer is terminated just as travel lane lines are terminated.

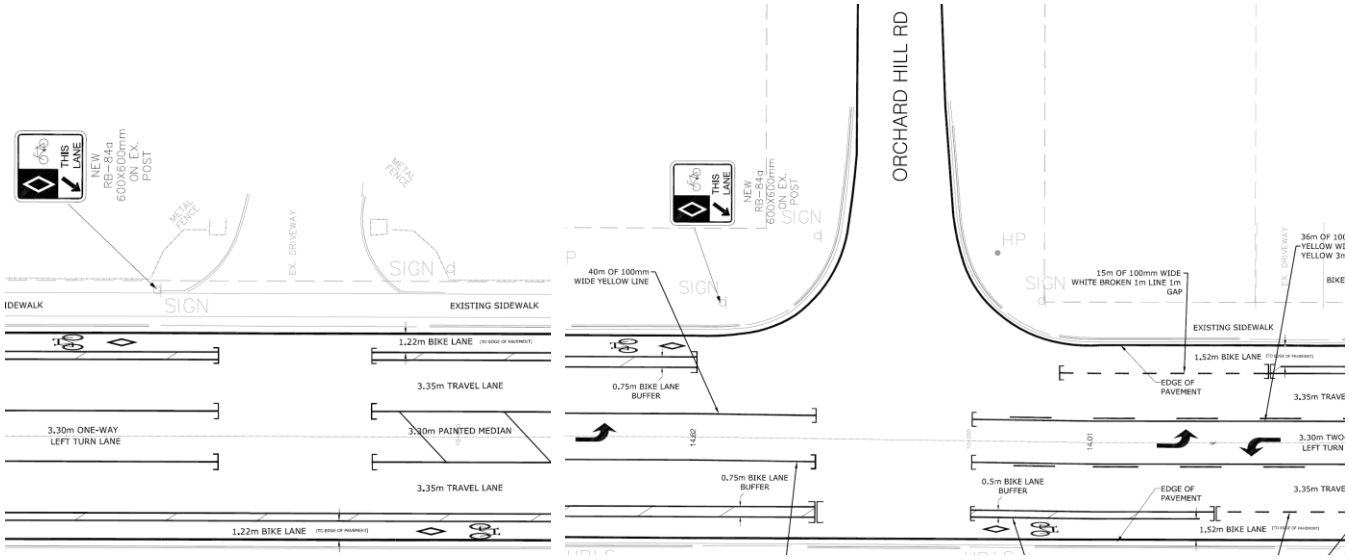
Approaching unsignalized side street intersections, the bike lane buffer is discontinued and a dashed white bicycle lane line (1 m line, 1 m dash) is provided extending from the line which defines the boundary between the buffer and the travel lane, as recommended in OTM Book 18. The dashed bike lane line terminates at the beginning of the corner curb radius; the buffer pavement marking commences on the far side of the intersection at the end of the corner curb radius. A typical side street intersection is illustrated in Exhibit 5-6.

There is no guidance on T-intersection treatments for the buffer in OTM Book 18. At T-intersections, the buffer is discontinued on the far side from the side street indicating that cyclists can enter the bike lane from the side street. This detail is not carried through at driveways; the buffer is continuous.

Exhibit 5-6: Typical Buffered Bike Lane Pavement Markings at Higher Volume Driveways and Unsignalized Side Street Intersections

Higher Volume Driveway

Unsignalized Side Street Intersection



5.4.3 Bike Lane Conflict Zones

OTM Book 18 presents two types of pavement markings for cycling facilities through intersection to guide the travel path of cyclists and indicate to motorists where to expect cyclists to be crossing through the intersection: guide lines and crossrides:

- Guide lines are 100 mm wide white dashed lines (0.5 m line, 0.5 m dashed) applied within intersections. OTM Book 18 notes that “such markings may help to guide cyclists between facilities on either side of the intersection. They also highlight conflict areas where cyclists and motor vehicles will cross paths so that each user group is more aware of the other.” Their application is typical for bike lanes, buffered bike lanes, separated bike lanes and cycle tracks that are adjacent travel lanes and remain within the roadway at intersections.
- Crossrides are made up of two longitudinal lines of what are called “elephant’s feet” – 200 mm to 400 mm white squares spaced 200 to 400 mm. Crossrides or elephant’s feet are applied to intersections where the crossing is offset in the boulevard (behind the curb) similar to crosswalks. Their application is typical for separated bike lane and cycle tracks that “bend out” at the intersection farther from the roadway curb or for boulevard multi-use paths behind the curb. OTM Book 18 says, “elephant’s feet markings are reserved for crossrides at intersections. They should not be used through the central portion of intersections themselves.

OTM Book 18 describes the pavement marking treatment options at intersections and conflict zones increasing order of visibility as follows:

- No treatment
- Bike stencils or chevrons at 1.5 m to 10 m spacing (with optional directional arrows to clarify cyclists’ trajectories)
- Sharrows at 1.5 m to 15 m spacing
- Dashed guide lines (with optional bike stencils or chevrons but not sharrows)
- Green surface treatment
- Dashed guide lines (with optional bike stencils or chevrons but not sharrows) and green surface treatment.

Conflict zones are marked with guide lines, bike stencils and green colour at two locations on Dixie Road:

- Lakeshore Road
- Dixie Outlet Mall South Entrance

Detailed descriptions of the designs at these two conflict zones are provided in Sections 5.4.6 and 5.4.7. Other locations for the application of green colour were discussed. However, the locations were limited to where there is a higher potential for conflicts between motorists and cyclists than at conventional intersections and driveways in order to emphasize the need for caution on the part of motorists and cyclists.

5.4.4 Two-stage Left-turn Bike Boxes

OTM Book 18 describes a two-stage left turn queue box as follows: “a designated area within the signalized intersection that allows cyclists to safely wait while making a two-stage left turn movement.” A two-stage left turn, also known as a “pedestrian left”, is made by cyclists proceeding straight through on a green light at an intersection, waiting in the two-stage left-turn bike box. When the traffic signal turns from red to green on the street they just crossed, they can proceed straight through the intersection completing their “two-stage” left turn.

A two-stage left turn bike box will be located in front of the stop bar of the cross street. It also must be located so that it does not block through cyclists, crosswalk or motorists traveling through the intersection on the first stage where the turn is initiated. It can block motorists travelling through the intersection on the second stage or cross street, giving the cyclists a “head-start” to cross since these motorists will be facing a red traffic signal. OTM Book 18 describes the possible locations and pavement marking as follows:

- Aligned with a parking lane or be downstream of an exclusive right-turn lane, to the right of the through lanes from the street where the turn is initiated.
- Mark with a white rectangular or square box using 100 mm wide solid lines surrounding a turn arrow pointing in the direction in which cyclists will leave the intersection, plus a bicycle symbol oriented according to the direction from which they entered. …Green surface treatment is required to enhance the visibility of the two-stage.

OTM Book 18 also notes that “given that cyclists in the queue box may obstruct the right-turn movement from the cross street, designers should consider restricting this right turn on red.”

A two-stage, left-turn bike box are provided for the northbound cyclist’s left-turn at Rometown Drive, described in detail in a Section 5.4.8

5.4.5 Separators in the Buffer

Separators such as flexible posts, rubber or concrete barriers, or planters can be installed in a bike lane buffer in order to provide physical separation between the bike lane and travel lane, or prevent motorists from stopping or parking in the bike lane.

The Region of Peel does not look after planters (City responsibility) and the buffer is not wide enough generally to fit planters. Barriers or posts in the buffer would make it more difficult to sweep and clear snow / ice in the bike lane. Since there is no parking on Dixie Road, motorists stopping and parking in the bike lane will not likely be a problem, often the reason a barrier is installed. In the future, if use of the bike lane goes up, motorists speeds come down, and new maintenance practices and costs can be accommodated, Region of Peel may consider installing flexible posts in the buffer.

5.4.6 Lakeshore Road Intersection

The intersection of Dixie Road at Lakeshore Road, a T-intersection, includes the following design features:

- Conflict zone pavement markings, as described in Section 5.4.3, connect north and south through the intersection between the buffered bike lanes and the Waterfront Trail on the south side of Lakeshore Road.
- Broken bike lane line and sharrow pavement markings at the northeast corner. The bike lane line is on a radius to guide westbound motorists on Lakeshore Road turning right on Dixie Road into the travel lane and not the bike lane. The sharrow guides cyclists travelling northbound from the Waterfront Trail on the south side of the intersection, providing guidance between where the conflict zone markings end and the buffered bike lane begins.
- Southbound on Dixie Road, it is anticipated that most cyclists will travel through the intersection to gain access to the Waterfront Trail instead of turning left or right onto Lakeshore Road. There is also truck traffic generated by the Lakeview Waterfront Connection project anticipated to turn right, in conflict with the through cyclists. To address this, the buffered bike lane extends to the stop bar at the intersection and an RB-37 Turning Vehicles Yield to Bicycles custom sign is installed.

5.4.7 Dixie Outlet Mall South Entrance Options

A number of alternative treatments for the southbound lanes between Rometown Drive and Dixie Outlet Mall south entrance were identified. The section between Rometown and Londonderry requires transitioning from four through lanes and one northbound left-turn lane into two through lanes and one centre two-way left-turn lane. In addition to the lane transition, driveway access to the Dixie Outlet Mall must be maintained. The right turning vehicles volumes are low (about 10veh/hr). Mississauga Transit buses currently turn right into this entrance to access the bus terminal on the mall site. The constrained width at this location limits design options that can be implemented through pavement markings following resurfacing of Dixie Road.

The lane width dimensions are pavement widths and do not include the gutter. The gutter width on the centre median is 0.5 m wide so the adjacent southbound travel lane that is 3.25 m wide has an effective width of 3.75 m. The gutter adjacent to the 1.2 m wide southbound, bike lane is 0.3 to 0.4 m wide so the effective width of the bike lane is 1.5 to 1.6 m.

Five options were developed for this location (see Appendix F):

- Option 1 – Two southbound, through travel lanes merge to one. A southbound bike lane is provided approaching the driveway. The conflict zone across the driveway is marked with bike lane guidelines, bicycle symbols and green colour. The buffered bike lane begins south of the driveway. A right-turn lane at the driveway is not provided; the merging through travel lane plus bike lane at the driveway is 3.85 m wide.
- Option 2 – The southbound, right travel lane becomes a right-turn only lane for the driveway. A southbound bike lane is provided for 50 m departing the Rometown Drive intersection and is dropped 30 m in advance of the driveway where the right-turn lane narrows to 3.0 m. The right-turn only lane is marked as a “mixing zone” over that 30 m where cyclists weave to the left side of the lane, and right-turning cars weave to the right. “Sharrow” pavement markings are placed through the driveway, and the buffered bike lane begins after the driveway.

- Option 3 – The southbound, right travel lane becomes a right-turn only lane for the driveway. A multi-use trail is provided on the west side of Dixie Road as an alternative to an on-road bikeway approaching and across the driveway. A transition to the on-road bike lane occurs after the driveway crossing. The driveway is marked as a "mixed crossride"; the bicycle symbol and arrow are southbound only in the crossride. The multi-use trail replaces the existing sidewalk. It is curb-faced and only 2.5 m wide (a 3.0 m width with an offset of 0.6 m to the curb face is preferred for shared use by pedestrians and cyclists) and would replace the existing sidewalk. Since this is a temporary multi-use trail until the MTO reconstructs Dixie Road in a few years, the trail is narrow to avoid moving light and hydro poles behind the sidewalk.
- Option 4 – The southbound, right travel lane becomes a right-turn only lane for the driveway. A southbound bike lane is provided for 50 m departing the Rometown Drive intersection and is dropped 30 m in advance of the driveway where the right-turn only lane narrows to 3.0 m. With the bike lane dropped, the wide right-turn lane is marked with sharrows adjacent the curb with a Turning Vehicles Yield to Bicycles sign. The conflict zone across the driveway is marked with bike lane guidelines, bicycle symbols and green colour. The buffered bike lane begins south of the driveway.
- Option 5 – The southbound, right travel lane becomes a right-turn only lane for the driveway. Sharrows are placed on the right side of this 4.6 m wide lane. The lane is generally too wide for centre sharrows, although it narrows to less than 4.0 m wide for just 15 m before the driveway. The conflict zone across the driveway is marked with bike lane guidelines, bicycle symbols and green colour. The buffered bike lane begins south of the driveway. This option includes a Turning Vehicles Yield to Bicycles sign, but it could also be marked with a mixing zone, as shown in Option 2 with sharrows merging across the wide lane to the left side of the right-turn arrows.

Each option was reviewed against several criteria including the continuity of the cycling facility, the right-turn configuration, potential conflicts, comfort for a variety of cyclists, and ease of implementation. A summary table is provided in Appendix F. Conflict diagrams were prepared for each option including the potential area over which conflicts could occur (see Appendix F).

The recommended alternative is Option 4. The bike lane for 50 m, shared right-turn lane with sharrows adjacent the curb for 30 m, Turning Vehicles Yield to Bicycles Cyclists sign and marking of the driveway conflict zone reduce the workload on cyclists while accommodating the low volume of right-turning traffic including the Mississauga Transit buses. This makes the treatment more compatible compared to the other options with the more comfortable buffered bike lanes to the south. Specifically, option 4 is preferred namely for the following reasons:

- The southbound bike lane provides designated space that is more comfortable for people with a wider range of cycling skills than marked, shared lanes. The Dixie Road Bikeway Feasibility Study (IBI Group, September 2015) documented that a "shared roadway is inappropriate based on the speed and volume of traffic on Dixie Road. Operating speeds are 70 km/hr. Even if the operating speeds were at the posted speed limit of 50 km/h, traffic volumes would have to be 3,000 vpd or less to accommodate cyclists sharing the road with motorists." Dixie Road currently carries 12,500 vpd.
- The low-volume of right-turn motorists and Mississauga Transit buses are accommodated in a right-turn only lane
- The Turning Vehicles Yield to Bicycles Cyclists sign, and marking of the driveway conflict zone provide clear guidance to right-turning motorists.

- With the designated lane for cyclists, the southbound through motorists in the right travel lane can focus on merging into the left travel lane instead of being concerned with sharing the lane with cyclists.
- With the low volume of right-turning vehicles, signing Turning Vehicles Yield to Bicycles Cyclists should operate well. It allows cyclists to remain near the curb over a short distance of about 30 m; they do not have to weave across a travel lane in a mixing zone and then change their path of travel back to the right across the driveway to gain access to the buffered bike lane.
- Low-cost (pavement markings and signs only), interim solution until the MTO reconstructs this section of Dixie Road

5.4.8 Rometown Drive Intersection

The northern limits of the bike lanes on Dixie Road are at the signalized intersection of Rometown Drive. The traffic signals allows cyclists to access the Dixie Outlet Mall, and residents in the Orchard Heights neighbourhoods to access the bike lanes. A two-stage, left-turn bike box is provided, as described in Section 5.4.4, on the northeast corner to allow northbound cyclists to cross Dixie Road and access the Mall.

5.5 Compatibility with MTO's Future Work

The Region of Peel is working with the Ministry of Transportation, Ontario (MTO) to ensure that the planned improvements to the QEW / Dixie Road interchange will fit with the reconfigured Dixie Road and provide continuous active transportation facilities through the area. The Dixie Outlet Mall South Entrance will be signalized and become the main entrance; the South Service Road will connect to Dixie Road at Rometown Drive. The buffered bike lanes from the new traffic signal northerly will be replaced by a multi-use trail on the west side of Dixie Road northerly through the interchange. The traffic signal allows northbound cyclists in the buffered bike lane on the east side of the road to cross Dixie Road to the multi-use trail on the west side.

Region of Peel will work with the MTO on their detail design project in 2016 to meet the active transportation and motor vehicle lane requirements without requiring additional property or utility relocations beyond what MTO has identified through QEW Improvements (Evans Avenue to Cawthra Road) Dixie EA.

6 Next Steps

The Dixie Road lane reconfiguration with bike lanes will be implemented in two phases, through the resurfacing of Dixie Road following Hanlan Water Project construction (Summer 2016), and following the completion of the CNR Structure remediation and reconstruction project (Fall 2017).

Following the resurfacing planned by the Hanlan Water Project, the pavement will be re-striped to delineate the new lane configurations, and buffered bicycle lanes. This work is expected to be completed in Summer 2016. However, the signage and symbols on the bike lanes, and green paint, will not be implemented at this time.

The CNR Structure remediation and reconstruction project, planned to be undertaken from Spring to Fall of 2017, will close the bike lanes in the work area through the construction period. After the completion of this project, all signage, symbols for the bike lanes, as well as the green colour at conflict points, will be installed.

The phased implementation of this project is preferred since it will reconfigure the lanes and provide buffered space for bicycles prior to the CNR structural remediation project, but it avoids opening the facility in full in anticipation of further construction within the project limits, and also minimizes throwaway costs.

Following implementation, the Region of Peel will monitor how well Dixie Road services people walking, cycling and driving and modify the design as required to address safety issues.

In future years, the Region of Peel will update the Long Range Transportation Plan and the City of Mississauga will complete the Lakeshore Road Transportation Master Plan. These master plans will take into consideration the effects of the reconfiguration and consider longer-term improvements that may be needed.

Beyond 2031, the Region of Peel may undertake a network study of needs and options if required to address transportation issues that may develop along Dixie Road.

6.1 Monitoring

The Region of Peel will be monitoring the operation of Dixie Road after the implementation of the bike lanes using a variety of methods:

- Automatic bike lane counters will be installed in the bike lanes to measure the number of people using them over sustained periods of time. These counters provide counts in hourly intervals, and therefore can reveal information about usage depending on time of day and in different weather conditions.
- There is also the opportunity to augment the bike lane counters with the temporary installation of Miovision cameras, which would provide footage showing how users are adapting to the road, such as in terms of the level of sidewalk cycling and the function of centre turn lanes.
- The Region's traffic count program will continue to establish counts of pedestrians, bicycles, and motor vehicles at intersections, providing information about overall traffic volumes on the corridor compared to the expected growth over time.
- The need for traffic signals will continue to be reviewed at some accesses along the corridor, such as at the Fairways condominium.
- The MTO's Travel Time Study, to be conducted in 2016 and in future years, could also provide insight relating to the traffic conditions on Dixie Road.

The monitoring strategy for the Dixie Road reconfiguration project establishes measurable indicators that enable the corridor to be evaluated against the project's goals, and the expected growth in usage over time. The strategy will provide data to inform opportunities to improve traffic operations, in a manner that addresses the needs of all road users. If traffic operations become congested or crashes increase, the Region of Peel will commence a comprehensive transportation study to corridor and network-wide improvements.

Appendix A – Comments Received

Appendix B – Traffic Analysis Report

Appendix C – Bicycle Level of Service Analysis

Appendix D – Speed Studies

Appendix E – Design Drawings

Appendix F – Design Options at Dixie Outlet Mall South Entrance