

## **5.0 BEST PRACTICES RESEARCH**

The issues and opportunities related to the various elements that can affect the design of the cross-sections have been examined through a literature review of best practices in Canada, the United States and elsewhere in the context of a six-lane corridor.

The findings and recommendations based on the best practices research are summarized in the following sections.

### **5.1 LANE WIDTHS**

Reduced lane widths (3.3 metres (11 feet)) are used on roadways with limited rights-of-way to accommodate different elements of the cross-section. Narrower lanes can reduce the pedestrian crossing distance and vehicular traffic speed. Drivers drive more cautiously given the reduced space between vehicles in the adjacent lane. This could also be viewed as a traffic calming measure.

On the other hand, lane widths greater than 12 feet (3.7 metres) can compromise safety. Drivers tend to drive at higher speeds and less cautiously with wider lanes, and speeding is more prevalent along wider lanes. This can lead to more accidents and a less safe environment, especially for pedestrians. In addition, wide curb lanes may encourage drivers to park or stop momentarily on-street where they are not permitted to do so.

The Best Practices review indicates that safety is maximized for lane widths somewhere between 11 feet (3.3 metres) and 12 feet (3.7 metres). Thus, there is little safety benefit to widen the lanes beyond 11 feet (3.3 metres) and that widening beyond 12 feet (3.7 metres) can compromise safety.

Thus, lane widths greater than 3.7 metres are not recommended. Rather, a 3.5 metre wide curb lane is recommended to accommodate buses and heavy vehicles. This can also provide additional space between vehicles and pedestrians, thus further enhancing the walking environment along sidewalks.

In general, reduced lane widths (3.3 metres) are recommended for inner lanes (middle and median lanes), whereas curb lanes should be kept at 3.5 metres wide. However, in industrial areas or other roadways which carry relatively high truck traffic volumes, wider inner lanes (3.5 metres) should be encouraged. It is recognized that a change in design standards will be required in York Region in order to implement this.

### **5.2 PUBLIC TRANSIT**

Public transit is increasingly a major element of a 6 lane corridor. Based on the input obtained from the Visioning Sessions, efficient and convenient transit services accommodated via the provision of exclusive transit lanes or HOV lanes, was noted as a key component of Regional streets.

Plans are in place to implement Bus Rapid Transit (BRT) services along the Yonge Street and Highway 7 corridor. From the literature researched, BRT station spacing

along arterial roadways is typically 1,000 feet (300 metres) or more. Bus lanes are typically 11 to 12 feet (3.3 to 3.7 metres) wide, with shoulders provided along busways where space exists. However, at bus stations, roadways are typically widened to about 50 feet (15 metres) to allow for express bus or skip-stop passing. Safe pedestrian access to and from the stations located along median busways would also include crossings of the arterial. Grade-separated pedestrian crossings should be considered at locations where there are high BRT patron volumes. Left and right turn restrictions are desirable when the turns delay BRT operations. **Figure 5-1** on page 50 illustrates a typical station layout at an arterial street intersection.

For York Region, BRT stations are spaced approximately every 500 metres. Conventional York Region Transit makes use of both the BRT stations where they are available, as well as intermediate stops, resulting in a spacing of about 200 to 250 metres between stops.

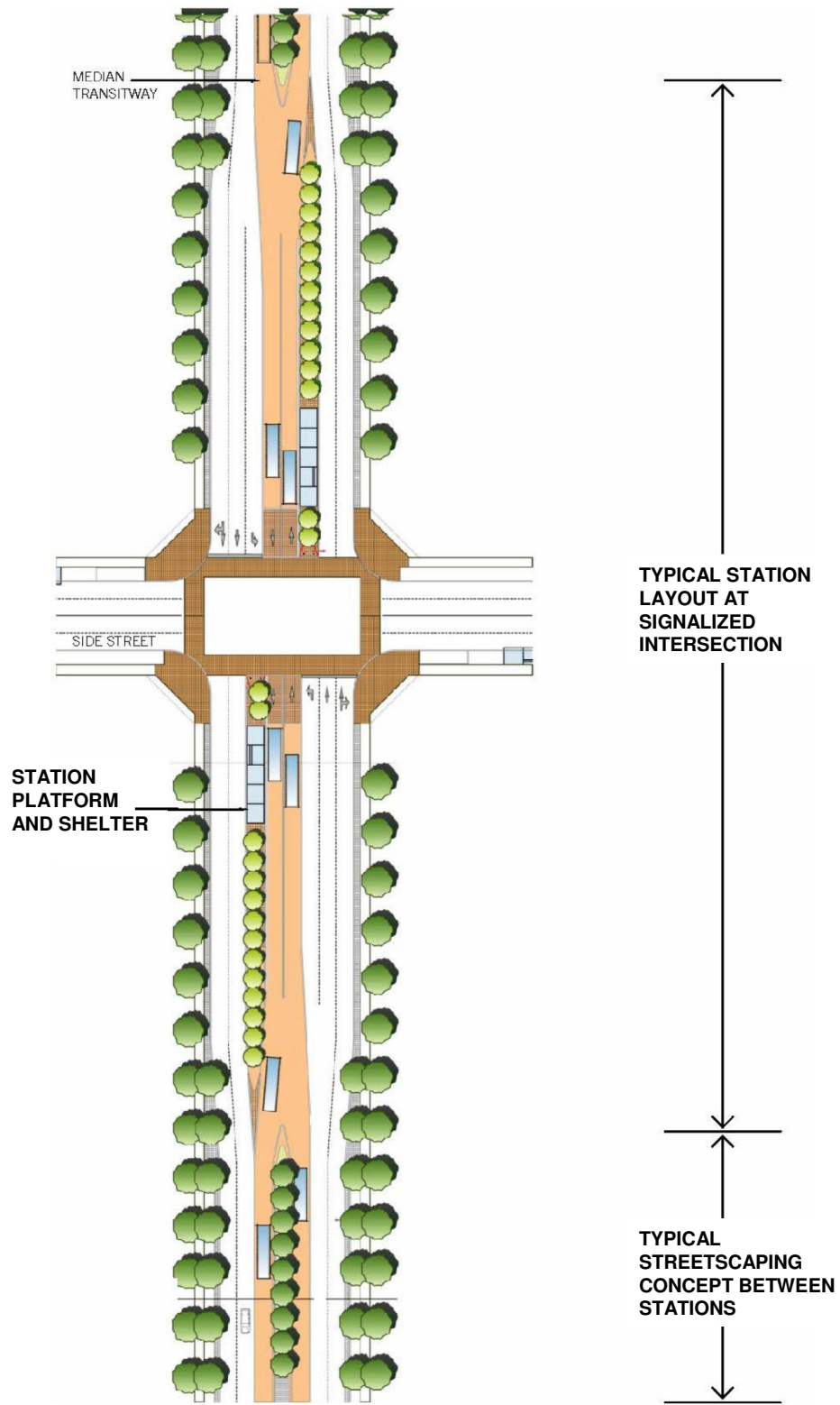
For other 6 lane corridors which do not have BRT services in the short term, improvements in the existing services should also be pursued.

The primary purpose of an HOV lane is to increase the total number of people moving through a corridor. HOV lanes can provide substantial savings in travel time and a reliable and predictable trip for HOV lane users. However, they may not be able to relieve congestion along a particular corridor. Too many or too few vehicles using the HOV lanes should be avoided. Having the curb lanes dedicated exclusively for bus services would have the risk of having too few vehicles. This can lead to frustration by the general road users (non-transit riders), which can result in strong negative public sentiment and even pressure to convert the exclusive lanes to general purpose lanes.

On the other hand, too many vehicles using the HOV lane can result in congestion that in turn degrades the travel time savings and trip time reliability that is intended to make HOV lanes attractive alternatives to driving alone. Thus, it is essential to maintain appropriate vehicle volumes in the HOV lanes. Enforcement is essential to enhance HOV operations and effectiveness. Regular police presence and prosecution is needed to maintain a low violation rate and effective use of the HOV lanes by legitimate users. This would not be implemented within the context of an adopted Regional HOV enforcement strategy.

Providing defined access to and from the bus stop is also important. Sidewalks should be provided to connect bus stops with intersections, or other land uses. Consideration should also be given to safe pedestrian crossings, especially when a bus stop is located at a mid-block location. This can be achieved, for example, by means of a signalized pedestrian crossing. Bus shelters and other amenities should be provided at the bus stops, where appropriate. They can be placed either in front of or behind the sidewalk. Care must also be taken to ensure that these amenities do not pose hazards to pedestrians, nor obstructions for sight lines for vehicular traffic.

York Region Transit has specific guideline documents that outline their requirements (Technical Guidelines for Transit Facilities, Stops and Accessories, January, 2005 and York Region Transit Drawings and Specifications, November, 2005).



Source: Highway 7 Corridor and Vaughan North-South Public Transit Improvements Final Environmental Assessment (EA) Report, August 2005



**FIGURE 5-1**  
**TYPICAL STATION LAYOUT**  
**AT STREET INTERSECTION**

It is recommended that the Region consider the provision of HOV or transit exclusive lanes along all 6 lane corridors within the context of a comprehensive HOV implementation strategy, which considers the continuity of HOV lanes, as well as a public education campaign and a Regional HOV enforcement strategy. It is also recommended that defined pedestrian access be provided to and from all bus stops and that sidewalks be provided which connect bus stops with intersections and adjacent land uses. Provisions should also be made for pedestrians to safely cross the arterial streets to and from the transit stops. Transit passenger waiting areas (standing areas, shelters and waste pads) should be designed in accordance with the YRT Technical Guidelines for Transit Facilities, Stops and Accessories, January, 2005. **Figure 5-2** on page 52, shows the design layout of a typical transit passenger waiting area.

### **5.3 NEED FOR ACCESS VERSUS CONTROL**

The primary purpose of arterial streets is the movement of traffic (passenger cars, trucks, buses, pedestrians and cyclists). Arterial streets also provide access/egress to abutting land uses, but in a more limited manner as compared to collectors and local streets. Both functions are important, but at times are in conflict with one another.

The literature review indicates that minimizing the number of traffic signals along major arterial roads can reduce the travel times along these roadways. In addition, limiting the number of access points onto the arterial roads can also reduce the conflicting movements and therefore the collision rate. However, without appropriate access, adjacent uses can be significantly impacted (e.g. economic viability, unnecessary circuitous routings, etc.). This can also concentrate traffic at a limited number of access points, thereby indirectly impacting operations of these intersections, and therefore the corridor as a whole. Not only are traffic signals important for vehicular access, but they are also essential for pedestrian crossings. Infrequent signalized intersection spacing can result in pedestrians attempting to cross the roadway at mid-block locations. A delicate balance exists between these different considerations.

According to the Access Guideline for Regional Roads (May, 2004)<sup>1</sup>, regional roads are classified as Types I (Rural), II (Main Street and/or Pedestrian), III (Traffic-Pedestrian), IV (Regional Centre) and V (Traffic). Spacing requirements for major driveways and intersections are provided in the Guideline. The Guideline requires that Regional road Types I and V meet or exceed the spacing requirement of 800 metres which may be reduced to 400 metres if the subject signal maintains the capacity and safety of the corridor, or if the signal does not impact signal progression excessively, to the satisfaction of the Region. Types II and III Regional roads need to meet or exceed a signalized intersection spacing requirement of 300 metres. For all of these types of Regional streets, spacing may be reduced to a minimum of 215 metres if substantiated through the submission of a comprehensive corridor analysis and traffic impact study analyzing all possible alternatives and taking into consideration land use and community factors. It should be noted that according to further clarifications provided by the Region, Type IV roads in Regional Centres, where pedestrian/cycling activities are highest, require the most closely spaced intersections at approximately 200 metres or less, whether signalized or not.

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<sup>1</sup> Access Guideline for Regional Roads, Regional Municipality of York, May, 2004.



**FIGURE 5-2**  
**TYPICAL TRANSIT PASSENGER WAITING AREA**

For unsignalized full moves access, the spacing requirement is 50 metres for Type II Regional roads, and 200 metres for Types I and II Regional roads. The spacing requirement is 200 metres for Type IV and 400 metres for Type V Regional roads, with a median opening permitting 'U'-turns, inbound left turns and right turns (no outbound left turns permitted). For right-in/right-out access, the spacing requirement is 100 metres for Type III Regional roads, and 200 metres for Types IV and V Regional roads.

The Region's Access Guideline recognizes the need for different access management treatments along different types of Regional roads. Higher access control is implemented along Traffic Predominant types of roads (Type V) within an urban setting. However, the Guideline also provides flexibility to reduce spacing, subject to further study.

It is recommended that the Region's access guidelines be revisited within the context of the proposed median implementation. The Region should take into consideration pedestrian crossing requirements to ensure that pedestrians can cross safely at transit stops and other key crossing points. Again, this is in support of initiatives to make transit and walking more attractive alternatives.

#### **5.4 MEDIANS**

The application of a raised median treatment versus two-way left-turn lane (TWLTL) treatment and an undivided roadway can affect traffic operations and safety, as well as economic activities.

Raised medians limit access and therefore reduce the number of conflict points. As a result, the numbers of collisions and collision severity (including pedestrian fatalities) are lower with raised medians than with two-way left turn lanes (TWLTLs), or undivided roadways. For these reasons, raised medians have been found to be a safer treatment than TWLTLs or undivided roadways.

Currently, continuous TWLTL are found in many of the regional streets, even at locations where there are no intersecting streets or driveways, in order to maintain a straight road alignment. However, this results in an excessive amount of pavement. Based on the input obtained from the Visioning Sessions, raised medians were identified as the preferred treatment along any 6 lane corridors, given the safety benefits over the TWLTL treatment and the potential for landscaping. Therefore, environmentally speaking, raised medians are a far more attractive choice than TWLTLs.

Thus, as a general principle, raised medians are recommended as the preferred treatment over two-way left-turn lanes (TWLTLs) and undivided roadways. However, raised medians can potentially affect the businesses along the corridor where direct left turns are not permitted. Reasonable access alternatives (e.g. 'U'-turn median openings) would need to be offered to mitigate the economic impacts to the businesses along the corridor. However, in some cases, TWLTLs may simply need to be maintained.

According to the Region's Guideline, unsignalized access for Regional Centre (Type IV) and Traffic Predominant (Type V) roads are to be at median openings, permitting only 'U'-turns and inbound left turns and prohibiting outbound left turns, unless signalized.

Median openings and/or adjacent signalized intersections would need to be adequately designed to accommodate the increased volumes of left turns and 'U'-turns, so as to ensure that the safety benefits of raised medians would not potentially be offset by higher accident rates elsewhere along the corridor.

It is recommended that raised medians be implemented on 6 lane corridors, where feasible, and within the context of a Regional policy concerning access restrictions as imposed through the introduction of raised medians. Median openings should be provided at strategic locations where left turns from the arterial street and 'U'-turns are permitted to mitigate the effect of controlled access. Left turn storage at median openings would need to be adequately designed so as to accommodate increased left turns and 'U'-turn volumes, as discussed below.

## **5.5 'U'-TURNS**

With the installation of raised medians, direct left turns to and from unsignalized minor streets or driveways are not permitted. Left turns would need to be rerouted to other intersections, or transformed to 'U'-turn/right-turn manoeuvres. The 'U'-turn/right-turn manoeuvres would not substantially increase the travel time as compared to direct left turns from unsignalized minor streets or driveways. Indeed, along moderate or high volume arterial streets, the travel time would be less for the 'U'-turn/right-turn manoeuvre than for the direct left turn from an unsignalized access. The 'U'-turn/right-turn manoeuvre can also reduce conflicts and improve safety.

As noted, raised medians designed with openings to accommodate 'U'-turns at mid-block locations, as well as at signalized intersections, are recommended. However, the operational/design issues should be carefully dealt with in order to accommodate 'U'-turns in a safe and efficient condition. Adequate queuing length would need to be provided at the exclusive left turn lanes at median openings, as well as at signalized intersections where 'U'-turns are permitted. Adequate median widths (at least one car length or 6.0 metres) would also be needed if a crossing or left turning vehicle is to be stopped in the median perpendicular to the through traffic lane. Longer vehicles such as trucks would extend beyond the median and would need to be treated differently. However, it is recognized that even a 6 metre wide median may be difficult to achieve in all cases.

Drivers in the GTA typically lack experience with 'U'-turn provisions. They would need to take some time to adapt to this unfamiliar arrangement before full benefits and operational efficiency can be realized. Lack of awareness may also contribute to further operational issues and potential collisions. Thus, clear signage must be installed at places where 'U'-turns are permitted so as to properly alert drivers.

It is recommended that median openings to accommodate 'U'-turns at mid-block locations and/or at signalized intersections, with adequate storage be provided in the exclusive left turn lane if raised medians are to be implemented. Clear signage would need to be provided at places where 'U'-turns are permitted in order to alert drivers.

## **5.6 PEDESTRIANS**

In order to encourage alternative means of travel, such as transit and walking, a safe pedestrian crossing and access environment is essential. Signalized intersections provide relatively safe pedestrian crossing locations. In order to accommodate older pedestrians and pedestrians with disabilities, ideally signal timing plans should assume a lower walking speed (e.g. 1 metre per second or lower). However, with 6 lane cross-section, along with ancillary lanes, it could be very challenging to provide for sufficient pedestrian time to cross the major arterial street, while maintaining an acceptable level of service for the arterial. To mitigate the situation, signal operations which allow pedestrians to cross only half of the arterial street at a time are recommended at intersections where side street/driveway traffic volumes are relatively low. As such, pedestrian refuge areas in the medians and pedestrian actuation buttons within the median should be provided.

Travel time increases as signal density increases. However, infrequent signalized intersection spacing can result in pedestrians crossing the roadway at mid-block locations. The issue of marked versus unmarked crosswalks is often a controversial one. A study found that for multi-lane roads with traffic volumes greater than 12,000 vehicles per day, a higher pedestrian collision rate occurred at marked crosswalks, as compared to unmarked crosswalks. Thus, if marked crosswalks are to be provided, complementary safety enhancements are highly recommended at marked crosswalk locations (e.g. pedestrian signals).

However, marked or unmarked crosswalks at mid-block locations may not be able to address the problems of inadequate gaps in traffic and high traffic speeds typically found along major arterial streets. Pedestrian signals can provide a relatively safe and protected location for crossing, but signal warrants for pedestrian crossings at mid-block location often cannot be met because of the unfriendly pedestrian crossing environment that deters pedestrians from crossing at that mid-block location. Thus, the basic signal warrant requirement should be reconsidered when the community has raised the issue related to the need for pedestrian crossing signals.

In order to ensure a pedestrian friendly and walkable environment along the 6 lane corridors, sidewalks should be provided along both sides of major arterial streets. It is recognized however that the local municipalities, not the Region, are responsible for the installation of sidewalks along Regional roads. Efforts should be made in consultation with local municipalities to harmonize location and design to ensure consistency in form and function. As such, the cooperation of the local municipalities is required to ensure that sidewalks are installed along both sides of Regional roads, particularly within the urbanized parts of the Region, and selectively in the rural parts of the Region (e.g. where a hamlet exists, etc.).

Sidewalks along arterial streets should have a minimum width of 1.5 metres. Wider sidewalks should be considered in areas of higher pedestrian activity (1.8 metres, 2.4 metres, or wider). Street furnishings can further enhance the pedestrian environment, but should not obstruct the pedestrians using the sidewalk.

It is recommended that the Region continue the use of lower walking speeds (1 m/s) when designing signal timing plans to accommodate older pedestrians particularly at locations where seniors tend to cross (e.g. near a seniors' housing or recreational

complex). Signal operations which allow pedestrians to cross only half of the arterial street at a time at intersections where side street/driveway traffic volumes are relatively low should also be considered. Pedestrian refuge areas in the medians and pedestrian actuation buttons within the median should be provided in this case. Basic pedestrian signal warrants should be reconsidered when the community has raised an issue related to the need for pedestrian crossing signals.

Marked crosswalks should only be installed where adequate protection is provided. Conversely, the Region may wish to consider small breaks in raised planters to allow pedestrians to cross at their own risk at uncontrolled mid-block locations, as some other municipalities have done.

As noted, sidewalks should be provided along both sides of the streets, with a minimum width of 1.5 metres and wider in areas of higher pedestrian demands.

## **5.7 FRONTAGE STREETS**

Frontage streets can be an effective access control technique in reducing the frequency of access points onto the arterial streets and for separating high speed through traffic from local traffic that requires access to land uses along the street. However, frontage streets must be carefully designed to avoid conflicts and delays at the intersecting streets. The outer separation should be at least 46 metres (150 feet) between the arterial road and the frontage street at the intersecting street. Narrower frontage roads are acceptable where traffic on the frontage street is very light and where the frontage street operates one way only. Mid-block slip ramps would be needed between the arterial street and the frontage road. A basic 61 metre (200 feet) right-of-way is needed. However, York Region currently designates a maximum right-of-way of 45 metres for the six lane corridor, with most rights-of-way being only 36 metres. Thus, frontage road concepts are not applicable in the 6 lane corridor, based on the parameters outlined above.

However, non-continuous frontage streets are becoming more frequent in York Region. These frontage streets turn back into the subdivision rather than intersecting directly with the arterial street. The two streets are separated by landscaping or low fences. This concept is preferred over the traditional reverse frontage concept and should be continued to be applied in new residential subdivisions abutting arterial streets.

Reverse frontage development is not recommended along the 6 lane corridor, since the disadvantages of reverse frontage development can significantly outweigh the advantages. The major drawback is the inhospitable walking environment for pedestrians, with no “eyes on the street”, particularly those walking along the street in the evening. Secondly, the streetscape is typically unattractive (i.e. largely noise barriers, fences). However, reverse frontage development is predominant within the older subdivisions. This cannot be changed.

York Region should continue to discourage any new reverse frontage development adjacent to Regional streets. Rather, the Region should continue to promote the use of the frontage street concept (tied back into the subdivision) with any new subdivisions adjacent to Regional arterial streets.

## **5.8 CYCLISTS**

Bicycle lanes are often included in pedestrian-oriented streetscape designs because they provide a viable alternative to the automobile. When designed properly, bicycle lanes can add a more “human” element to the streetscape by inviting people out of their automobiles.

In the design of bicycle facilities it is important to consider the types of people who will use the facilities. Trip type is typically categorized as either recreational, or utilitarian, as is typically the case for those cycling on York Regional streets. Trip type is correlated with skill level, and utilitarian users are often more skilled than recreational users. Adults are typically the main users of bicycle infrastructure within arterial corridors. Children typically do not use bicycle infrastructure along major arterials because of perceived safety concerns by their parents and because they have not yet acquired sufficient skills and experience to cycle on busy streets.

The curb lanes of some major arterial streets are designed to be sufficiently wide for shared vehicular and bicycle traffic. However, delineated bikeways are thought to provide safer conditions for cyclists and motorists. They also encourage bicycle use by broadening the range of ages and skill levels of those who are more comfortable cycling in bike lanes on arterial streets rather than sharing the same lane with motor vehicle traffic. Bike lanes or paved shoulders on rural cross-section roads are particularly important on streets that typically have higher operating speed limits, such as the major arterial streets in York Region.

Based on the operating envelope of a typical cyclist, the minimum bicycle lane width for streets with low to moderate traffic conditions is 1.5 metres in addition to the width of the gutter. If on-street parking is also provided, the preferred minimum widths are increased to between 1.8 and 2.0 metres for the bike lane and between 2.2 and 2.4 metres for the adjacent curb side parking stall. The design of the bikeway must also take into consideration the roadway speed, since higher traffic speed limits require wider bike lanes, or paved shoulders on rural road cross-sections.

The most common collision that occurs between an on-road cyclist and motorist at an intersection is between a right turning motorist and a cyclist who is approaching the intersection. These incidents can be minimized by changing the pavement markings of the bikeway from a solid line to a broken line. The change in pavement marking alerts motorists to watch for cyclists when changing lanes. In the case of an exclusive right turn lane, it is recommended that the change from a solid line to a broken line occur at a minimum of 15 metres approaching the start of the right turn lane. Besides appropriate pavement markings on exclusive bike lanes, signage should also be used to alert motorists to the presence of cyclists.

It is recommended that exclusive bike lanes of 1.5 metres in width be provided on urban cross-section streets, with appropriate signage and pavement markings along the land use categories that currently exhibit or in the future are expected to have cyclists. Clearly, however, bicycle lanes need to provide for a logical continuous network, rather than discrete segments, as identified in the York Region Pedestrian and Cycling Master Plan Study (PCMP).

## **5.9 PARKING**

On-street parking is viewed often as being essential by landowners in an urban commercial/mixed use setting, where buildings front the street. These business owners rely on capturing a proportion of their business from traffic passing by their door. The ability to stop and park in front of the establishment is viewed as being important to capturing this customer base. In York Region, only limited segments of Regional streets would fall into this category.

In addition to this need for parking, on-street parking can provide a buffer between vehicular traffic and pedestrians. It can also reduce the speed of through traffic, thus enhancing the safety and comfort of pedestrians. However, the parking manoeuvres can impede through traffic flow and create conflicts along the roadway. In addition, parked vehicles can also result in less visibility between motorists and pedestrians who attempt to cross the street.

On-street parking can be allowed along some arterial streets in the off-peak periods. This can provide some convenient parking spaces in front of the businesses, while minimizing the impacts on through traffic, since the volumes are lower during off-peak periods. If off-peak parking is to be provided along the arterial street, clear signage and pavement markings, as well as strict enforcement of parking restrictions, are needed.

Bulbout designs (i.e. parking in bays) can improve the safety of pedestrians crossing the street. However, these effectively reduce the throughput of the arterial street as compared to the outer travel lane being used for parking during non-peak periods only.

It is recommended that the Region consider off-peak on-street parking in urban mixed use areas where the parking would benefit the proposed users. Parking in bays in urban mixed use settings should only be considered when 6 lanes of road capacity are not required during peak periods, and where the parking is seen as being of benefit to the adjacent uses.

## **5.10 URBAN DESIGN**

Streetscape elements are essential in contributing to the overall impression of the corridor whether driving, on-foot, cycling through the corridor, or observing it from an adjacent building. Median and boulevard treatments contribute to that impression.

Median surface treatments rely on a combination of hard and soft landscape applications using concrete, unit pavers and landscape plant materials. Splash strips are usually constructed of concrete, with stamped concrete patterns or unit pavers on concrete. However, the use of splash strip unit pavers laid down on granular sub-base is not recommended due to ongoing maintenance and replacement problems.

The boulevard is usually treated with a combination of sod, trees and concrete pedestrian walkways. Urban design improvements to the boulevards should include the addition of shrubs, native grasses, groundcovers and hard surface splash strips, where applicable. If enough right-of-way is available, sidewalks should allow for a meandering path instead of straight alignment, in certain applications (e.g. in residential areas).

Sculptural features related to design themes, corporate imaging, or honouring important public figures/events can be placed at strategic positions within the median. The boulevard can be used for a variety of public art display including display banners, urban sculptural forms and artistic/architectural lighting standards and civic sculptures.

Boulevards also accommodate features such as garbage receptacles, seating, transit shelters, information kiosks, bicycle racks, signage, fire hydrants, various utility boxes, newspaper stands and landscape plantings. Excluding utility related street furniture, the location of many of these features is more flexible and can occur at roadway intersections where pedestrian traffic is heavier, as well as at appropriate interval locations (i.e. mid-point crossings), or along the pedestrian walkway system.

Lighting and signage within the median serves the dual practical purposes of area illumination and information way finding. It can also be used to emphasize community/corporate identity, artistic accomplishments and urban design themes. Boulevard lighting should assist with creating public spaces that are well lit, safe and aesthetically pleasing. Roadway lighting, pedestrian scale walkway lighting and special area lighting should be consistent and in harmony with other urban design elements along the six lane street corridors.

## **5.11 LANDSCAPE DESIGN PLANTING PRINCIPLES**

Opportunities exist to enhance the urban forest and to improve the aesthetics through the use of landscape plant materials along boulevards and medians. However, conditions along the street typically do not provide a good environment for maintaining healthy landscape plants. Thus, the mortality rate of trees along major roadways, especially those within the median area, is relatively high. Special design considerations, care, and protective treatments, and maintenance should be considered when planting along medians.

Due to limited growth space, salt levels, poor soil drainage, compaction and insufficient water, it is difficult to properly sustain landscape plant materials within narrow medians. Thus, median widths between 4.5 and 6.0 metres are needed for the sustainability of plant materials in medians. To better ensure the survival and ongoing health of plant materials within the medians, protective measures are also recommended. A hard surface splash strip can protect the plants against the effects of road salt and oil based pollutants. Installation of low planter retaining walls with a minimum height of 200 to 500 mm can provide further protection. When utility lines are present within the median area, only shrubs and groundcover plantings or hard features (e.g. flag poles, art work, etc.) are recommended in order to minimize conflicts between service requirements and plant materials.

For boulevard tree planting, a minimum tree trunk caliper size of between 50 and 100 mm is recommended. Double row tree plantings along the boulevard help to improve visual aesthetics of the immediate street area. These can also assist with pollution abatement, with increased filtering capabilities as well as improve pedestrian shade walking conditions during hot weather. However, given the limited rights-of-way, double row tree planting is difficult to achieve. Thus, double row tree planting is recommended only within a right-of-way of 40 metres or wider. Consideration should be given to providing minimum soil volumes to ensure that tree performance standards are met.

In summary, it is recommended that a minimum 4.5 to 6 metre wide landscaped median be provided within the 36 metre rights-of-way, in order to ensure sustainability of plant materials. Protective measures such as hard surface splash strip should also be provided along the medians. Ideally adequate soil volumes of 30 m<sup>3</sup> per tree should be provided where trees are proposed. However where spatial area is constrained 16 m<sup>3</sup> is acceptable. Double row tree plantings should also be considered along boulevards with wider rights-of-way, or where partnership tree planting at or beyond the right-of-way limit can be negotiated.

## **5.12 BARRIER AESTHETIC TREATMENTS**

Traffic barriers have been used for many years as an effective way to prevent vehicles from leaving the roadway. However, many of the barrier systems currently in place are not very aesthetically pleasing, having been designed primarily for function. Aesthetic barrier design is becoming increasingly important to street design. It has been shown to have community benefits to those travelling along the corridor in a vehicle, as well as to those residing in the area. Yet, safety factors should not be ignored. The National Cooperative Highway Research Program (NCHRP) Report 350 and the CalTrans guidelines are two appropriate reference guides for the selection of barriers and surface treatments.

One of the ways to improve aesthetics is to change the overall geometry of the barrier. Stone masonry design and deep cobblestone design are examples of a non-standard barrier design that have been crash tested and have been found to meet the NCHRP Report 350 requirements. A more cost-effective approach is to place a new surface treatment on a proven barrier profile. Dry stacked rock design and rock cobble design are examples of a proven barrier design with aesthetic surface treatments that have been crash tested and found to meet the NCHRP Report 350 requirements.

The use of an aesthetic barrier in place of standard design is much preferred, but safety implications need to be given due consideration to ensure that safety is not jeopardized.

## **5.13 DESIGN SPEEDS**

Drivers tend to drive at a speed which is perceived to be appropriate based on the geometric characteristics of the street, as well as the traffic and road conditions permit, regardless of the posted speed limit. Since design speeds affect many geometric design elements of an arterial street, they have a significant effect on the speed at which drivers choose to drive.

Literature review indicates that the definition of design speed has been changed from the expected uniform speed on the road for the faster group of the drivers, to the running speed of a large proportion of drivers, with consideration to the context. Design speed should be carefully chosen with full recognition of the context of the project. For example, the design speed of an urban arterial street with significant pedestrian activities should be lower than that for a rural arterial street. Lower design speeds can lead to designs that are less intrusive and perceived to be safer for pedestrians and cyclists. This would create a more friendly environment to pedestrians and cyclists, and enhance

their walking/cycling experience on the street. In addition, the use of lower design speed would result in a shorter taper length for turn lanes, such that a reasonable length of an aesthetically pleasant median with plantings can be provided in the mid-block locations.

The design guidelines need to be examined within this context, taking into consideration operations, safety and related factors.

#### **5.14 EXAMPLES OF SIX LANE CROSS-SECTIONS IN OTHER MUNICIPALITIES IN THE GTA**

Examples of other six lane cross-sections in some municipalities in the GTA (City of Toronto, City of Mississauga, and City of Brampton) are shown in **Figures 5-3 to 5-5** on pages 62 to 64.

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Yonge Street, near Sheppard Avenue (City of Toronto)



Don Mills Road (City of Toronto)



**FIGURE 5-3**  
**EXAMPLES OF**  
**SIX LANE CROSS-SECTIONS**  
**IN THE GTA (PART I)**

Markham Road, South of Finch Avenue (City of Toronto)



University Avenue (City of Toronto)



Ellesmere Road, near McCowan Road (City of Toronto)



**FIGURE 5-4**  
**EXAMPLES OF**  
**SIX LANE CROSS-SECTIONS**  
**IN THE GTA (PART II)**

Dixie Road (City of Mississauga)



*Near Bloor Street*



*Near Eglinton Avenue*

Hurontario Street, near Highway 403 (City of Mississauga)



Hurontario Street, near Highway 407 (City of Brampton)



**FIGURE 5-5  
EXAMPLES OF  
SIX LANE CROSS-SECTIONS  
IN THE GTA (PART III)**