

Appendix J

Review of Transportation Policies and Road Classification System

City of Vaughan

Review of Transportation Policies, Road Classification System, and Design Standards and Criteria

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Project Number:

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Date:

July, 2011

Revised:

September, 2012

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1. Introduction

The growing congestion and traffic demand within the City of Vaughan require the application of effective transportation policies and standards. This document uses available industry standards and best practices of other municipalities as benchmarks to identify deficiencies in existing transportation policies, road classification system, and design standards and criteria for the City of Vaughan. While suggestions addressing some of these deficiencies have been made within the body of the document, the report concludes with a summary of overall recommendations on transportation policies, road classification systems, design standards and criteria.

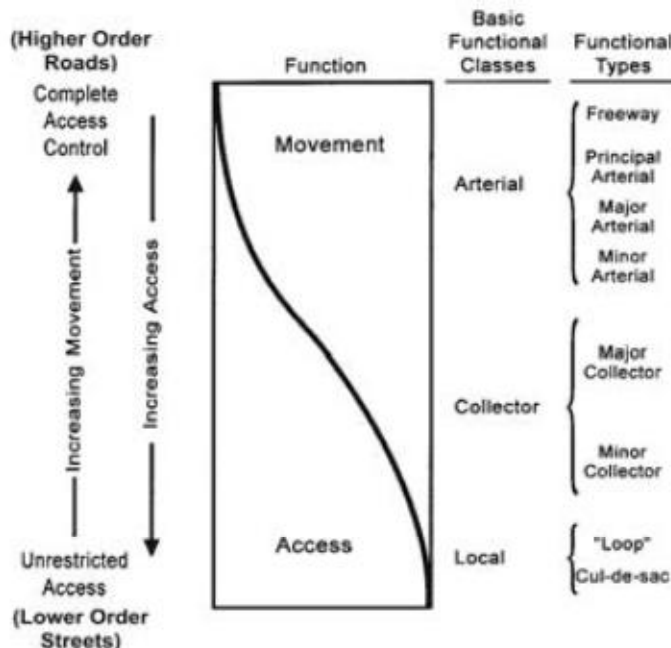
Two main official documents from the City were reviewed including the Official Plan Amendment 600 (OPA 600) and the Design Standards. The OPA 600 was introduced and approved by Regional Council on June 21, 2001 as an improvement and refinement to the original policy and land use framework of OPA 400. It should be noted that there are standard drawings for typical road type cross-sections that were not updated as part of OPA 600. Thus, it was assumed that these typical cross-sections, from pre-OPA 600, are still in place and used by the City of Vaughan.

2. Existing Road System Classification

Road system classification is the first step in any road planning, design or administrative study which requires defining the function that the facility is to serve. The most important functional aspects that need to be defined are degree of mobility and the land access to be provided by the facility. The following are some important characteristics to be considered in roadway classification:

- Service function – service to traffic, access to land or both as illustrated in **Figure 2.1**;
- Traffic Volume: high volume or low volume – high volumes are generally associated with freeways and arterials and low volumes are associated with collectors and local roads
- Traffic Flow – interrupted or uninterrupted - roads primarily serving for traffic movements are expected to have uninterrupted flow and roads to provide full land service have interrupted flow
- Running Speed – generally increase from locals to collectors to arterials to freeways
- Vehicle Type - local roads are generally used predominantly by passenger cars while freeway and arterials are used by commercial vehicles
- Percentage of Total System – relationship between the total length of a given road class and the total length of the whole system in either urban or rural environment
- Connections between different road classes for example arterials can be connected to freeways, arterials or collectors.

Road classification can assist with the land use and transportation planning and co-ordination. It helps in establishing the designated road ROW widths and design standards for access control, road cross-sections, pavement structure, drainage systems, sidewalks, boulevards and street lighting. It also helps in determining traffic operations standards and guidelines for traffic control devices, pavement markings, on-street parking, stopping regulations, speed limits and non-motorized facilities.



Source: TAC, 2009

Figure 2-1 Traffic Mobility and Land Access for Different Road Classes

The City of Vaughan OPA 600 classifies the road system into the following:

- Provincial Highway;
- Arterial Road;
- Collector Road;
- Primary Road; and
- Local Road

The City is responsible for minor arterials, collectors, minor collectors, and local roads. A description of each road class is provided in the following subsections.

2.1 Arterial Roads

The Region of York is responsible for all Major Arterial Roads within the developed areas of Vaughan, while Minor Arterial roads are under the jurisdiction of the City. Categorized as Minor and Major Arterial roads, they function as thoroughfares and carry moderate to high traffic volumes between neighbourhoods. The main difference between the two arterials relate to capacity and speed. Major Arterials carry higher levels of average daily traffic with higher speed limits than Minor Arterials. As defined by the OPA 600, arterials generally connect to provincial highway interchanges; intersect with collector roads and other arterials. Other characteristics are defined as follows:

- Direct access to residential lots are considered only when other feasible alternatives do not exist or where it is required to support planning objectives;
- Connection to local roads are minimized but not prohibited;
- Provisions are recommended for sidewalks on both sides of the road in urban areas;
- Provisions are recommended for bike lanes where required and feasible; and
- Provisions are recommended for HOV lanes where required and feasible.

The City's standards define two types of arterials including 5-lane and 4-lane arterials. A 5-Lane Arterial (Standard Drawing B-1) consists of traffic lanes, turning lanes, mixed car and truck through traffic, limited driveway access (e.g., commercial, high-rise, etc.). ROW width of 35.0 m is required to accommodate the design of a 5-lane arterial. A 4-lane arterial (Standard Drawing B-2) consists of four traffic lanes, mixed car and truck through traffic, bus bays or turning lanes, and limited driveway access. The required ROW for a 4-lane arterial is 30.0 m. It should be noted that the OPA 600 makes no distinction between Major and Minor Arterials. It is recommended that the City makes such distinction since Minor Arterial is under its jurisdiction.

2.2 Collector Roads

Collector roads are intended to provide organization for the local street system within residential areas and provide the main connecting points to the arterial system. These types of roads are designed to be continuous and are expected to carry moderate traffic volumes.

The followings are the general characteristics of Collector Roads as defined in OPA 600:

- ROW width – 26 m (23 m for minor collector roads), to accommodate up to 4 through traffic lanes, and shall be continuous;
- All collectors shall be considered as potential transit routes and shall be able to accommodate conventional (bus-based) transit service;
- Access from abutting properties is permitted and controlled; and
- Abutting residential lots should be arranged so that side yards face the collector road ("flankage"). Direct residential frontage on a collector road is permitted where "flankage" is not feasible. Lot arrangements that result in the rear yards facing onto the collectors shall be discouraged.

It is recommended that transportation forecasting and traffic engineering analyses should be undertaken to identify the expected traffic volumes on the roads in order to identify the requirements for items such as traffic signals, stop signs, turn lanes, and transit stops. ROW widths exceeding the required width as defined in the City's Design Standards may be provided to accommodate operational needs (e.g., turn lanes) if required. Sidewalks should be provided on both sides of the road.

The City's design standards document identifies three classes of collector roads, which are major collector roads, industrial collector roads, and minor collector roads.

2.2.1 Major Collector Roads

The City's Standards require that these roads be designed to have a 26 m ROW width and to accommodate four lanes of traffic or alternatively two traffic lanes and two parking lanes, mixed car and truck through traffic and occasional driveway access (Standard Drawing B-8).

2.2.2 Industrial Collector Road

The City's Standards require that these roads be designed to have a 23 m ROW width. These roads are meant to accommodate two traffic lanes and one parking lane (Standard Drawings B-4, pre OPA-600).

2.2.3 Minor Collector Roads

The City's Standards require that these roads be designed to have a 23 m ROW width. These roads are meant to accommodate two traffic lanes and one parking lane, residential through traffic, and driveway access (Standard Drawings B-10). These roads are also intended to afford organization for the local street system within residential areas and provide the main connecting points to the arterial system. These types of roads are designed to be continuous and are expected to carry moderate traffic volumes.

The characteristics of minor collector roads are as follows:

- ROW width – 23 m, to accommodate a maximum of two through traffic lanes, and shall be continuous;
- Projected Traffic Volumes – less than 500 vehicles per hour in the peak hour and 5,000 vehicles per day;
- All minor collector roads shall be considered as potential transit routes and shall be able to accommodate conventional (bus-based) transit service;
- Access from abutting properties is permitted and controlled; and
- Direct residential frontage on minor collector roads is encouraged. Where direct frontage is not feasible, lots may be arranged so that side yards face the minor collector road ("flankage"). Rear yards of residential lots shall not face onto a minor collector road.
- Retail Commercial development shall provide for on street parking where it is practical and not impede through traffic and surface parking generally limited to the rear of the building(s).
- Active and pedestrian oriented and transit supportive.

2.3 Local Roads

Local roads are intended to provide access to individual properties in residential areas. These roads should be linked to Minor Collectors to provide connections and options for travel within the neighbourhoods without the need to travel on arterial roads. They shall provide connections to schools, shopping, transit stops, parks and other community amenities.

Sidewalks shall be installed on at least one side of all local roads, and on both sides of all streets within 300 m of schools.

The street pattern should be planned such that it minimizes through traffic. These roads will accommodate community-oriented transit service, where required. Two types of local roads are identified within the City's design standards including Major Local Roads and Local Road.

2.3.1 Local Roads (Major)

The City's Standards require that major local roads be designed to have 20 m ROW width and 9 m pavement. These roads are designed to accommodate two traffic lanes and one parking lane, residential through traffic, and driveway access. The pavement width is (Standard Drawing B-11)

2.3.2 Local Roads

The City's Standards require that local roads be designed to have a 17.5 m ROW width an 8 m pavement. These roads are designed to accommodate two traffic lanes and one parking lane, residential through traffic, and driveway access. The pavement width is (Standard Drawing B-12)

2.3.3 Local Roads (Cul-de-sac)

The City's Standards require that cul-de-sacs be designed to have an 18.5 m ROW width. These roads should be designed to accommodate two traffic lanes and one parking lane or one travel lane with two parking lanes. (Standard Drawing B-7, pre-OPA 600)

3. Review of Transportation Policies and Guidelines

3.1 ROW Width

The existing ROW requirement for the various road types within the City of Vaughan varies from 8.0 m for a laneway to 35.0 m for a 5 lane arterial. **Table 3.1** summarizes the ROW widths for the various road types.

Table 3.1 ROW Width for Various Types of Roads in the City of Vaughan

Road Type	ROW Width (m)	Pavement Width (m) *	Standard Drawing Number
5-Lane Arterial Road	35.0	19.7	B-1 (pre-OPA 600)
4-Lane Arterial Road	30.0	15.7	B-2 (pre-OPA 600)
Major Collector Road	26.0	14.0	B-8
Industrial Road	23.0	11.5	B-4 (pre-OPA 600)
Minor Collector Road with 3 m Greenway	26.0	11.5	B-9
Minor Collector Road	23.0	11.5	B-10
Major Local Road	20.0	9.0	B-11
Local Road	17.5	8.0	B-12
Local Road	20.0	8.5	B-6 (pre-OPA 600)
Local Road (Cul-de-sac)	18.5	8.5	B-7 (pre-OPA 600)
Buffer Road	15.0	7.0	B-13
Laneway	8.0	6.0	B-14
Lay-by Lane (Minor Collector Road)	23.0	9.75	B-15
Industrial Cul-de-sac	23.0		C-1
Residential Cul-de-sac	18.5		C-2
Residential Cul-de-sac	17.5		C-3

Note: * Includes gutter (measurements are from curb face to curb face)

It should be noted that there are standard drawings for typical road type cross-sections that were not updated as part of OPA 600 revision. Thus, it was assumed that these typical cross-sections, from pre-OPA 600, are still in place and used by the City of Vaughan.

3.2 Speed Limits

Commonly set and enforced by the legislative body of a jurisdiction i.e. the City of Vaughan, the legal speed limit is the maximum allowable speed permitted by-law. Coherently documented speed limit standards are currently nonexistent for the City of Vaughan.

The City may adopt a mix of standards set forth by TAC, the City of Toronto and York Region in determining speed limits for their respective jurisdictions. The standards of legal speed limits set by TAC and other municipalities are compared to that of Vaughan in **Table 5.2**. The speed limits are generally based on the road classification. The higher the classification, the higher the recommended speed limits and vice versa. **Table 3.2** shows the minimum design speed for different road classes as specified in the TAC Geometric Design Guide.

Table 3.2 Minimum Design Speed of Different Road Classes as per TAC Guide

Road Classification	Minimum Design Speed, km/h	Vaughan Existing Design Speed	Recommendation Design Speed
Locals	30-50	50	60 (10 km/hr above the posted speed limit)
Collectors	50-80	50	80 (20 km/hr above the posted speed limit)
Minor Arterial	50-70	60	80 (20 km/hr above the posted speed limit)

The recommended design speed for Vaughan should be 10 km/hr above the typical posted speed limit (50 km/hr) for local road and 20 km/hr above the typical posted speed limit for collectors and minor arterials (60 km/hr) respectively. The City Vaughan can also add to TAC and Toronto's standards by adopting York Region's annual studies and review policy to confirm or adjust speed limits for optimum road safety. This process involves a number of considerations including: on-street measurement of speed, a review of collision, the physical features of the road, and the effect of the transitions of the speed limit from one zone to the next.

3.3 Property Access

Whereas guidelines relating to property access are presently available for the City of Vaughan, they are documented under various topics such as subdivision, road classification, and general transportation policies. The City will be better served by pulling together these guidelines for a succinct explanation of property access standards i.e. Access Management Guidelines similar to those of the Towns of Markham and Oakville.

The existing guidelines, sparsely as they may be, cover relevant aspects of property access standards. Property access to roadways is directly related to road classification. The higher the road classification, the less of property access function it performs. While local roads primarily function to provide access to abutting properties, direct access to arterial roads are only considered in instances where other feasible alternatives are unavailable or where it is required to support planning objectives, including increased access to transit, higher development density and reduced walking distances. Under the jurisdiction of the Ontario Ministry of Transportation, direct access to provincial Highway 400, Highway 427, and the 407 Express Toll Route is prohibited.

3.4 Implementation of Road Improvements

The City of Vaughan currently employs road improvement standards guided by policies outlined in the OPA 600 document. The standards cover several aspects of road improvements including the use of the City's current road upgrading programs and those of York Region and the Ministry of Transportation. It is the City's policy to:

1. Co-ordinate the updating of current road improvement programs and associated transportation/environmental studies relating to these improvements.
2. Implement a ten-year road upgrading program for roads under City jurisdiction to accommodate the forecast travel demands for the next ten-year horizon.
3. Request the Region of York to include in its road improvement program over the next ten 10-20 years the widening of portions of specified Regional roads serving Vaughan with specified ROW for some of them.

4. Request the Ministry of Transportation to complete the improvements for the Provincial road network serving Vaughan and support the planning, corridor protection, and early construction of the Highway 427 extension.
5. Ensure that road system improvements are co-ordinated with block plan approvals so that adequate road system capacity is in place to accommodate projected traffic volumes concurrent with the development of the block.
6. Strongly support early completion of missing links in the arterial network to the extent physically and environmentally feasible.
7. Strongly support elimination of other discontinuities, for example, intersection realignments.

These policy standards address both the overall basis for road improvements, while pointing to specific improvements that are required. They can be improved by clarifying the process by which these road improvements ought to happen. For instance, the City can establish a body made up of a Citizens Advisory Committee and a Technical Advisory Committee that will work together with the City Council. The Citizen Advisory Committee and Technical Advisory Committee can advise and recommend priorities, policies and action, while the City Council as the final decision making authority will be left with prioritizing the road improvements. The committees will together establish road improvement programs that set short-term and long-term road improvement projects based on sound planning and engineering analysis, prioritization of the projects, and clearly identifying the processes by which these improvements ought to happen.

3.5 Surface Transit

Vaughan has exhaustive public transit policies addressing both short and long term standards for transit usage. Outlined in the OPA 600, these standards touch on all aspects of transit usage including roadways to be used for transit services, collaborating with the Region and other agencies to establish transit capacity for at least 15 percent of the current peak hour commuters and a goal of 30 to 40 percent transit modal split for peak hour commuters in the long run. The core of the City's transit policies centres on the promotion of convenient pedestrian access to transit stops and stations. With the recent (September 2010) approval of York Region's new Official Plan, the City's current standards should be brought into conformity with the Region's Policy 7.2.25. That policy states that transit service be provided so that the distance to a transit stop in the Urban Area is within 500 m of 90% of residents, and within 200 m of 50% of residents. The recommended transit mode share targets for the City are 50%, 40% and 30% for the Vaughan Metropolitan Centre, other Urban Intensification Areas and City-wide respectively.

3.6 Sidewalks

The City of Vaughan's Sidewalk Policy was adopted by Council on February 26, 1996. The following guidelines are used to determine the need for sidewalks within a new subdivision:

- Sidewalks are required where they will form a part of a walkway system.
- Sidewalks are required in locations where pedestrian routes connected to local amenities areas such as schools, parks, transit routes, retail areas, etc. as follows:
 - One sidewalk where 40 to 100 units are tributary to the sidewalk route;
 - Two sidewalks where over 100 units are tributary to the sidewalk route;
 - Where only one sidewalk is required, it shall be located on the side of the street that provides the most direct route to the local amenity.
- Sidewalks are required on both sides of collector and arterial roads.
- Sidewalks are required on one side of industrial roads not served by transit.

These sidewalk guidelines are similar to those used by other municipalities such as Brampton and Mississauga. The City could however, improve the existing policies to aggressively help address the goal of reducing auto dependency as presented in OPA 600 and reemphasized by 2007 Pedestrian and Bicycle Master Plan and the ongoing TMP. In keeping with this goal and the broader goal of achieving sustainability, the City must continue to encourage active transportation together with the use of public transit by providing sidewalks on both sides of all arterial and collector streets, and streets in intensification areas. Within areas in proximity to schools, parks, transit stops and stations, and other public facilities, sidewalks on both sides of the street may be considered through the Block Plan approval process. Where sidewalks are currently not provided on both sides of the street, sidewalks should be considered during major redevelopment or substantial reconstruction of the right-of-way.

3.7 Pedestrian and Bikeway System

The City of Vaughan's Pedestrian and Bicycle Master Plan and OPA 600 policies cover a number of important issues as they relate to encouraging walking and cycling, such as expanding the pedestrian and cycling network, providing bicycle facilities adjacent to transit system, providing secure bicycle parking at major destination points including transit stops, etc. However, neither document addresses the need to provide bicycle parking in condominiums, as well as parking and shower/changing facilities in office buildings. Bicycle parking should be safely and conveniently located from servicing locations with racks supporting locks for maximum security. The City should consider developing policies that would address these issues in order to help advance the goals envisioned in the Pedestrian and Bicycle Master Plan. The City may also encourage developers of condominiums to implement electric vehicle charging points.

The City may introduce some assistive device for pedestrians with visual impairments, such as accessible pedestrian signals. These signals work in conjunction with the standard pedestrian signals that indicate WALK and DON'T WALK and several types exist. There are audio signals, vibrating or tactile signals or transmitter devices that can send a voice message to hand-held receivers. Information on accessible signals is provided in the TAC publication, *Guidelines for understanding, use and implementation of accessible pedestrian signals* (2008).

The City should adopt an evaluation procedure available in the TAC guidelines, which considers:

- Pedestrian crossing demand, from very light (1-10) to heavy (>51)
- Proximity to alternative crossings, from 100 m to more than 300 m
- Traffic Conditions, which is qualitative measure
- Other factors, including complex traffic signal phasing, intersection geometry, and right turn volumes among others
- Width of crossing, from less than 12 m to more than 24 m

3.8 High Occupancy Vehicle (HOV) Lanes

High Occupancy Vehicle Lanes (HOV) are particularly beneficial to buses and carpooling. It, reduces delays and encourages transit use and discourages single occupancy vehicle users. As previously mentioned, transit responsibilities, including the provision and maintenance of HOV lanes fall under the jurisdiction of York Region with the City's support. The region therefore maintains its own standards for providing HOV lanes. The Rapid Transit and Transit Priority network within the City are generally provided along Regional arterial roadways. While the City support HOV lanes in its OPA 600, it currently lack HOV policy standard. The City should continue to support HOV lanes and where possible work with the Region to adopt standards for minor arterials and/or major collector with 4-lane to 6-lane cross-sections. Standards to consider may include exclusive full time or peak hour HOV lanes, requirement for two or more persons in a vehicle, prohibition of trucks, and allowing bicycles/motorcycles. HOV lanes are widely adopted along multiple minor arterials within the City of Toronto.

3.9 Stop Signs

'Stop' signs are often used to control conflicting traffic movements by allocating ROW at intersections which are not busy enough to warrant traffic signal installation. Standard policies for 'Stop' sign requirements within the City of Vaughan are currently based on those outlined by the Ontario Traffic Manual (OTM) Book 5 which indicates that all-way stop-control should only be considered at the intersection of two relatively equal roadways having similar traffic volume demand and operating characteristics. All-way stop-control may also be considered based on the collision frequency at an intersection.

Neighbouring municipalities such as Toronto and Ajax currently employ 'Stop' sign standards that could be considered by Vaughan to help standardize the application of 'Stop' signs throughout the City. The standards prohibit the use of stop signs on major arterial roads or expressways while recommending rare use on minor arterial roads. At a typical intersection controlled by 'Stop' signs, traffic on the less heavily-travelled approaches is controlled. For example, at a four-legged intersection, traffic on the lower-volume road would be controlled to allow the major traffic stream to proceed unimpeded through the intersection, minimising delay and congestion while improving safety. There are, however, some situations which justify the installation of 'Stop' signs on all approaches. All-way 'Stop' signs are installed at an intersection when a technical warrant is satisfied. Such a warrant takes into consideration speed limits, proximity to other traffic control devices, no of lanes, and motor vehicle and pedestrian traffic volumes on both major and minor roads as well as collision history, among other factors. It is therefore recommended that Vaughan updates its current warrants for the installation of 3 and 4 way stop signs to consider pedestrian exposure and vehicle speeds.

3.10 Turn and Entry Prohibitions at Intersections

Standards for determining turn and entry prohibitions at intersections are currently not available for the City of Vaughan. Standardization may be cumbersome given the subjective nature of this subject matter. The City may establish a new or use existing Transportation Technical Advisory Committee to review individual proposals and make recommendations to the City council for approval. The City can then formulate a policy requiring all proposals to introduce, rescind or modify turn and entry prohibitions to be reviewed by the Technical Advisory Committee and submitted for approval by Council.

3.11 Traffic Control Signals and Pedestrian Crossovers

Traffic control signals are devices positioned at road intersections, pedestrian crossing, and other location to control competing flows of traffic. It is particularly efficient at alternating traffic ROW at the main intersections of arterial roads where certain technical warrants are satisfied. Pedestrian crossovers can also be very beneficial in improving pedestrian safety in the right circumstances. They are most commonly found on minor arterial roads. Although the City of Vaughan does not have set standards for dealing with traffic control signals, City staff has performed traffic signal warrant for certain intersections utilizing York Region's Traffic Control Signal Warrant Policy which is based on the traffic control signal warrants as outlined in Book 12 of the Ontario Traffic Manual. The City can formulate a standard policy requiring analysis and review of all signal proposals by a Technical Advisory Committee and approval by council. The warrant criteria may be based on the Ontario Traffic Manual Standards which requires any one of the following three warrant criteria be satisfied by 100% or at least two warrant criteria by 80%. The first warrant criterion accounts for the total amount of traffic using an intersection, the second warrant criterion accounts for the delay to side road traffic, and the third warrant criterion accounts for the safety performance of an intersection. The City may adopt a policy of approving traffic signals for any roadway intersections as long as the prescribed warrants are met. The City may also look to adopting standards similar to that of the City of Toronto where proposals for the installation of "warranted" traffic signals and pedestrian crossovers are based in part on appropriate minimum distances to adjacent signals and pedestrian crossovers.

3.12 On-Street Parking

Explicit on-street parking standards or policies are lacking for the City of Vaughan except with its application to snowploughing. In an effort to improve snowploughing services and to keep roads clear for emergency vehicles, the City of Vaughan enacted By-Law 1-96 as amended, which prohibits overnight parking of vehicles on any street in the City of Vaughan between the hours of 2:00 a.m. and 6:00 a.m. and in no case can a vehicle be parked on a City of Vaughan's street in excess of three hours between the hours of 6:00 a.m. and 6:00 p.m.

A recent parking review by IBI Group recommended a general reduction of free on-street parking and promoted market-priced public parking as a means to generate capitals to support transportation objectives such as reducing single occupancy vehicle and investing in public transit. The City may adopt standards of other municipalities such as the prohibition of peak period parking or stopping on high volume traffic roads. It will be appropriate for a Technical Advisory Committee to consider individual proposals and make recommendations to the Council for approval.

3.13 Permit Parking

Permit parking entitles permit holding individuals for on-street parking within a specified period of time. Until explicit policies have been developed, the City of Vaughan could adopt reasonable standards employed by other municipalities such as the prohibition of parking on high volume traffic roads such as Minor Arterial and the like. Any proposals to do so should be considered by a Technical Advisory Committee and approved by the Council.

3.14 Heavy Truck Prohibitions

Reasons for heavy truck restrictions on local roads have usually centred on noise, vibration, safety, and strength of pavement structure. In general, the legal standard for heavy truck prohibition is based on the weight carrying capability of the pavement structure of the road. With the advent of the Vaughan Metropolitan Centre (VMC) and development intensification focusing on active transportation, it is appropriate for the City to establish clear standards to minimize heavy truck traffic through the City's future downtown, particularly along Avenue 7 and on local roads. These standards may involve establishment of truck routes coupled with prohibitions. For example, it is a standard practice for the City of Toronto to prohibit heavy trucks on most local and collector roads (except if actually delivering or receiving goods in the immediate vicinity). The City should co-ordinate with the Region regarding any efforts to introduce truck traffic prohibitions that may involve Regional roads.

3.15 Traffic Calming

Traffic calming is the implementation of physical or physiological changes to reduce traffic speeds and to help change driver's behaviour in order to improve safety and "quality of life" within a neighbourhood. Traffic calming installations are generally appropriate for local residential and minor collector roads. The City of Vaughan currently has a procedure in place to conduct/review/develop a neighbourhood traffic calming plan to address traffic calming issues. Outlined in the Neighbourhood Traffic Committee Policy and Procedure document, the procedure uses six standard steps to address traffic calming issues. These standards include: establishing the plan, developing the plan, community meeting, approving the plan, dealing with additional requests and evaluating the plan. Developers are also required to submit a traffic management plan as a condition of Draft Plan approval process. The Plan takes into consideration traffic calming measures and requires Council approval.

A review of the City's policy and procedure shows consistency with those of other municipalities across Canada as they relate to existing neighbourhoods. One additional step on the existing procedure would be the prioritization of

traffic calming measures. For example a ranking system could be developed based on a number of criteria such as speed, volume, collisions history, pedestrian and vulnerable road users (i.e., children, senior citizens, and disabled), co-ordination with other road construction projects, and surrounding land uses. It is recommended that as part of the City's standard traffic calming warrants, traffic calming measures such as speed bumps, humps and raised crosswalk should be eliminated on public transit routes similar to the current practice for emergency response routes. City staff requires developers to submit, as part of their traffic impact study, a traffic management plan that takes into consideration traffic calming measures for new development applications.

3.16 Road Maintenance

The City of Vaughan maintains over 640 km of local roads throughout the City, comprising of both hard and gravel surfaces. Major Arterial roads such as Yonge, Bathurst, Dufferin, Keele, Major Mackenzie, Langstaff, etc., are maintained by the Regional Municipality of York. The standard maintenance involve snow ploughing/sanding/salting, road sweeping, road repair, roadside ditch maintenance, and culvert installations. The City has a priority system for all operations with roads and sidewalks being maintained in the following order:

- Primary Roads / Sidewalks – High volume traffic
- Secondary Roads / Sidewalks – Low volume traffic

The city's road maintenance standards do not address such important issues as regravelling, paving, grading and road side mowing. The City may conduct the appropriate technical study and to help set standards for these issues.

Temporary or permanent road closures are usually carried out to allow for road works or to ensure safety at a sporting or social event. The City does not currently have set standards for road closures. Tasks force has usually been set up to investigate proposals for road closures. This practice could be standardized by the City by establishing a Technical Advisory Committee who will be responsible for road closure proposal investigations and making recommendation to the Council for approval or vice versa. This standard may apply to all roadway classifications.

3.17 Transportation Impact Study Guidelines

Although the City of Vaughan continually undertake varying transportation impact study throughout the City, formal standards and guidelines for transportation impact study are lacking. However, the City is currently working on a draft guideline. Industry standard for transportation impact guidelines could be established to ensure uniformity and efficiency in embarking on transportation impact studies. The guidelines may be established in corporation with the policy standards of York Region and other municipalities to outline not only the criteria requiring transportation impact study, but also general standards of factors to be considered for completing the study.

3.18 Site Plan Criteria Guide

In order to ensure a quality development in the City of Vaughan, it is essential that new sites for development meet standards that will ensure adequate utility and service systems, complement existing uses, and promote the health, safety and welfare of the Citizenry. A mechanism needs to be in place to assign a classification to each new road. Similarly, if a change to an existing road classification is sought, a mechanism will be needed to adjudicate this. Changes to new traffic operations policies which are, or may be, dependent on road classification should also have a clear and consistent decision-making mechanism. The City may build on its current review system and develop formal standards as discussed.

4. Design Standards and Criteria

4.1 Design Standards

A review of the existing City of Vaughan's design standards was based on provincial and federal standards such as Ontario Provincial Standards Drawings (OPSD), and the TAC Geometric Design Guide for Canadian Roads. The City of Vaughan's standards were also compared to those of other municipalities for the main purpose of recommending best practices and efficient designs for safety, sustainability and more pedestrian and transit friendly.

4.1.1 Road Cross-Section

After reviewing OPA 600, it was noticed that some of the cross-sections from pre-OPA 600 were not modified. It was assumed in this report that they are still in use by the City.

These standards generally fall within the guidelines of TAC and are comparable to those used by other municipalities. However, the City should consider reducing pavement widths for all road classes to encourage slower and safer driving habits while creating pedestrian-friendly streets, particularly within the urban intensification areas. For instance, while a 3.5 m lane width may be appropriate for transit bus travel lanes, a 3.25 m lane width may be used for all auto lanes.

4.1.1.1 Major Collector Road (Standard Drawing B-8)

In the City of Vaughan standards, these types of roads require a ROW width of 26 m and 14 m pavement width. These roads can accommodate four lanes of traffic or alternatively two traffic lanes and two parking lanes. The standard pavement width of 14 m can accommodate four 3.5 m wide travel lanes within its cross-section.

The TAC Geometric Design Guide for Canadian Roads recommends that for collector roads with design speed of 50 km/hr and design hour volume of more than 450 veh/hr that the lane width be between 3.5 and 3.7 m. The 14 m pavements width requirement for the City of Vaughan meets the TAC minimum requirement. It is further recommended that City considers smaller auto lane widths.

4.1.1.2 Minor Collector Road (Standard Drawings B-9 and B-10)

In the City of Vaughan standards, these types of roads consist of a ROW width of 26.0 m (including a 3.0 m greenway) or a 23.0 m ROW width and an 11.5 m pavement width. These roads can accommodate two traffic lanes and one parking lane.

The lane width requirements in the TAC Design Guide are between 3.5 m and 3.7 m for collector roads with design speed of 50 km/hr. A 2.8 m wide parking lane is recommended on collector roads and a minimum width of 3.5 m where parking is permitted only during off-peak hours. The City of Vaughan pavement requirement exceeds the maximum requirement, and reflects collectors with design speeds of 70 km/h or greater. It should also be noted that wide lane widths may encourage drivers to drive faster than a narrower lane width, which in the case of minor collector roads is not recommended. For this reason, the City should consider revising its standards to reduce the pavement width requirements for minor collector roads to first discourage drivers to drive above the speed limit, and second to keep local collector roads safe for pedestrians with fewer vehicle crashes involving speed.

4.1.1.3 Major Local Road (Standard Drawing B-11)

Major local roads consist of a ROW width of 20.0 m and 9.0 m pavement width. They are designed to accommodate two travel lanes and one parking lane.

The TAC Design Guide recommends a lane width of 3.0 to 3.7 m for local roads for design speeds between 30 to 70 km/h. A 2.4 m wide parking lane is recommended on local roads. The City's standards for major local roads meet the requirements outlined in the TAC Design Guide.

4.1.1.4 Local Road (Standard Drawing B-12)

Local roads consist of a ROW width of 17.5 m and 8.0 m pavement width. They are designed to accommodate two travel lanes and one parking lane.

4.1.1.5 Buffer Road (Standard Drawing B-13)

Buffer roads have ROW width of 15.0 m and 7.0 m pavement. Buffer roads are designed to accommodate two travel lanes with no parking. A 7.0 m pavement width can accommodate two 3.5 m travel lanes.

The 3.5 m wide lanes would meet the minimum TAC Design Guide requirement for most road types.

4.1.1.6 Laneway (Standard Drawing B-14)

Laneways have ROW widths of 8.0 m and 6.0 m of pavement. This pavement width can accommodate two 3.0 m travel lane, which meets TAC Design Guide minimum width recommended for public lanes (alleys) which can be a comparable class.

All the above standards are summarized in **Table 4.2**. The table compares the City of Vaughan's standards to those of TAC and the neighbouring Cities of Brampton and Mississauga. While this serves as a starting point in determining suitable cross-section standards for Vaughan, further investigation of publications by institutions such as AASHTO and practices of other jurisdictions across North America including the Region Waterloo, York Region, New Jersey, Pennsylvania and Washington State were also conducted. Summary lane width recommendations for the City have been provided in the concluding section of this document.

Table 4.1 Comparison of Road Cross-Section Standards for Vaughan and TAC

Road Type	Vaughan Standard			TAC Standard			Mississauga Standard			Brampton Standard		
	ROW Width (m)	Pavement Width (m)*	Lane Width (m)*	ROW Width (m)	Pavement Width (m)	Lane Width (m)	ROW Width (m)	Pavement Width (m)	Lane Width (m)	ROW Width (m)	Pavement Width (m)	Lane Width (m)
Major Collector Road	26.0	14.0	3.5	20.0-24.0	14.0	3.5-3.7	26.0-30.0	14.5-17.0	3.25-3.5	26.0	14.0	3.5
Minor Collector Road	23.0	11.5	4.5 (2.5 for parking)	20.0-24.0	10.0	3.5-3.7	22.0	10.0	3.0-3.5	21.5-25.5	10.0	3.0-3.5 (2.5 for parking)
Major Local Road	20.0	9.0	3.5 (2.0 for parking)	15.0-22.0	8.0	3.0-3.7	20.0	8.0	3.0-3.5	20.0	8.0	3.0
Local Road	17.5	8.0	3.0 (2.0 for parking)	15.0-22.0	8.0	3.0 minimum	18.0-20.0	8.0	3.15-3.20	16.5-20.0	7.5-8.0	3.25
Buffer Road	15.0	7.0	3.5	--	--	3.5 minimum	17.0	8.0	3.0-3.15	18.5	7.5	3.25
Lane Way	8.0	6.0	3.0	--	--	3.0 minimum for public lanes	--	--	--	8.0	6.0	3.0

Note: * Includes gutter (measurements are from curb face to curb face)

4.1.2 Road Geometric Details

4.1.2.1 Industrial Cul-de-Sac (Standard Drawing C-1)

Industrial cul-de-sacs have a 23.0 m ROW width and a 16 m radius. At the curb there shall be a 1.0 m barrier curb between every second driveway around the bulb of the cul-de-sac.

The design commonly used for cul-de-sacs according to the TAC Design Guide is a circular pavement symmetrical about the centreline of a roadway. For a radius that is less than 14.0 m, the turnaround area is bordered by mountable curbs to permit manoeuvring of an occasional oversize vehicle.

The 16 m radius required by the City meets the TAC Design Guide recommendations.

4.1.2.2 Residential Cul-de-Sac (Standard Drawings C-2 and C-3)

Residential cul-de-sacs have ROW widths of 18.5 m and 17.5 m and a 13.0 m radius. At the curb there shall be a 1.0 m barrier curb between every second driveway around the bulb of the cul-de-sac.

The City's requirements meet the TAC Design Guide recommendations, as the driveways can serve as mountable curbs to allow oversize vehicles to turn around.

4.1.2.3 Horizontal Curve

Depending on intended design speed and other factors appropriate design of a horizontal curve is necessary to provide a transition between two tangents and allow a vehicles to negotiate a turn at a gradual rate rather than a sharp cut. The City of Vaughan Design Criteria requires horizontal control data to be shown on plan and profile drawings. The minimum radii outlined in design standard per road type are as follow:

- R = 65.0 m Major, Local, or Local Roads
- R = 115.0 m Minor Collector or Industrial Roads
- R = 220.0 m Major Collector Roads

Added to these minimum standards are the design requirement that boulevard widths be maintained throughout the curve and application of 20 m minimum straight ROW beyond curve.

While radii standards set by road functional class are appropriate, the City may add to these by drawing on the TAC Design Guide to expand horizontal alignment design standards taking into consideration all the appropriate factors such as speed, traffic volume, topography and utility locations.

TAC standards and Vaughan standards are compared and summarized in **Table 4.3**.

4.1.2.4 Angle Bend

The angle bend design standard by the City achieves comparable objective to that of Mississauga and of Brampton. The two Cities' design standards are similar, recommending that angle bends provide an outer radius greater than the lane width to allow vehicles to manoeuvre safely without encroaching on the opposite oncoming car(s) when performing the turn. The angle bend design by the City of Vaughan, on the other hand, recommends that the inner lane be deflected to allow manoeuvring vehicles appropriate room without encroachment from opposing oncoming vehicle at the turn. The designs are different but achieve the objective of providing manoeuvrability.

Table 4.2 Comparison of Road Geometry (Horizontal Alignment) Standards for Vaughan and TAC Guide

Types of Roads	Vaughan Standard		TAC Standard				Comments
	ROW Width (m)	Horizontal Radius (m)	ROW Width (m)	Minimum Horizontal Radius (m)	Minimum Design Speed	Minimum Tangent Length at the Intersection	
Industrial Cul-de-sac	23.0	16.0		16.0			Meets TAC standard
Residential Cul-de-sac	18.5	13.0					
Major Local Road	20.0	65.0	15.0-22.0	70.0	50.0	N/A	Does not meet the minimum requirement
Local Road	17.5	65.0	15.0-22.0	70.0	50.0	N/A	Does not meet the minimum requirement
Major Collector Roads	23.0	220.0	20.0-24.0	225.0 (AADT 8000-13000) 320.0 (AADT 13000-17000)	60.0-70.0	50.0	Does not meet the minimum requirement
Minor Collector	23.0	115.0	20.0-24.0	190.0	60.0	30.0	Does not meet the minimum requirement

4.1.3 Intersection Details

Standard design criteria for intersection details are currently provided for 7 types of intersections including: Basic, Tapered, Intermediate 'T' Collectors, Intermediate 'T' Arterials, Intermediate 'X', Major 'T' and Major 'X' intersections. Other subcategories of intersections are based on the intersecting road types. They include local to local, local to industrial, industrial to industrial, collector to collector, and local to major collector. Design criteria including sight triangles and curb radii are provided for each one of these subcategories. A review of the available standard criteria indicates that the City of Vaughan is applying comparable criteria as those of other municipalities across Canada. Areas of improvement may include the incorporation of bicycle and pedestrian design standards with the intersection design. Close attention should be paid to visibility / sight triangles, curb radii, and curb ramps. Summary recommendations for the City have been provided in the concluding section of this document.

4.1.4 Median Details

A review of the practices of other jurisdictions across North America and publications by AASHTO and others have been used as a basis for recommending median standards for the City of Vaughan. Understanding the medians provide refuge for pedestrians at intersections with wide crossing distances, median widths are recommended to be a minimum of 1.2 m with a desirable width of 1.8 m. The minimum width to accommodate left-turn lanes should be 3.5 m. Further details are provided under conclusion and recommendation section.

4.1.5 Sidewalks and Walkways

4.1.5.1 Sidewalk and Ramp (Standard Drawing E-1)

The sidewalk width requirement in the City of Vaughan is 1.5 m as shown in Standard Drawing E-1.

In the TAC Design Guide the typical minimum clear sidewalk width is 1.5 m. However, where sidewalks are placed directly against the curb, the sidewalk width is normally increased by 0.5 m. In the areas of hospital and nursing homes the minimum sidewalk width should be increased to 2.0 m to accommodate wheelchairs. In addition, the sidewalk width in commercial areas is typically 2.4 m or more to accommodate higher pedestrian volumes. Sidewalks adjacent to a bus bay should have sufficient width to accommodate waiting passengers and pedestrians walking by. A minimum sidewalk width of 3.0 m is typical.

The City of Vaughan's standard drawing E-1 only shows a sidewalk width of 1.5 m. The City should consider revising its standard to include different sidewalks width requirements based on pedestrian volumes and the land use in different areas such as high order transit hubs, intensification corridors, high density residential areas and commercial/entertainment areas. The City should further investigate site specific sidewalk design details for each of these areas. Other measures to consider in improving pedestrian safety include consistent and visible crosswalk markings, change in materials (e.g., brick or concrete with colour contrast to asphalt), refuge islands sidewalk extension, and raised crosswalks/intersection.

4.1.6 Curb and Gutter

The City of Vaughan has recently replaced its 1999 curb and gutter standards with the Ontario Provincial Standards Drawings (OPSD) (600.0700). The new standard, adopted in 2006, requires a two-stage construction of concrete barrier curb with standard gutter. Although the standards for curb and gutter are aligned with provincial standards and other municipalities across Ontario, the City may go into detail and specify curb and gutter standards for various road facilities and pedestrian facilities. Other standard drawings to consider may include all the OPSD 600 series.

4.1.7 Traffic Control

Traffic control involves the use of road measures to manage traffic, to direct and inform drivers and pedestrians alike about any upcoming situation on the roadways and/or sidewalks. It ensures the safety of emergency response team, construction workers and the general public. The City uses the installation of street signs, dead end barricades, construction traffic barricades, and project signs as means of traffic control. Similar to several municipalities across Canada, the standard design details of these traffic control measures used by the City of Vaughan are generally based on signs specified in the Manual of Uniform Traffic Control Devices in Ontario (MUTCD).

4.2 Design Criteria - Geometric Standards

Road design criteria outlined in the City of Vaughan Design Standard are presented in **Table 4.4**.

Table 4.3 Road Design Criteria

	Road Design Geometric Features				Industrial	Minor Collector	Local
Design Speed (km/h)	90	80	70	60	50	50	50
Min. Stopping Sight Dis (m)	170	140	110	85	65	65	65
Min. Horizontal Curve Radius (m)	340	250	220	125	115	115	65-115
K-Crest min. (m)	55	35	22	15	7	7	7
K-Sag min.(m)	20	20	15	10	6	6	6
Headlight ctrl.	40	30	25	20	11	11	11
Min. C/L Grade	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Max. C/L Grade	5	5	5	5	5	5	5

The design standard criteria presented in **Table 4.4** are current and comparable to those of other municipalities such as Mississauga. The City could however improve the criteria by being more specific with regard to each road classification and corresponding required criteria. For example, minor arterial, major collector, minor collector, and collector can all be individually defined as opposed to the available categories.

5. Conclusions and Recommendations

This review has shown that while the City's transportation policies, road classification system, and design standards and criteria generally conform to those of federal, provincial, municipal and other industry standards, certain aspects require improvements. A significant deficiency in the City's standards relate to non-motorized transportation, particularly cycling. Although, the City's OPA 600 addresses policies relating to active transportation, those policies are not adequately reflected in the design standards and criteria. The City may bring all standards to par by adopting the recommended standards outlined in Federal, Provincial and Regional guidelines. The City may also draw further on the best practices of other municipalities. The following presents a summary of recommendations and conclusions categorized into:

- Road System Classifications and Rights-of-Way;
- Policies and Guidelines; and
- Design Standards and Criteria.

5.1 Road Classification and Rights of Way (ROW)

The City's road classification system is overly complex and somewhat confusing. There are inconsistencies between the City's road classification system as defined in OPA 600 and the City's cross-section Design Standards. For instance, the OPA 600 identifies primary road classification while the standard drawing document does not. The design standard on the other hand provides an industrial road classification and different categories of collector and local roads while the OPA 600 makes no mention of any of them. These discrepancies need to be reconciled along with simplifying the road classification system. The primary road and industrial road categories could be discarded, while the remaining classification including arterial and collector and their respective subcategories are clearly defined with matching standard drawings.

5.1.1 Road Classification and Rights of Way (ROW)

It is recommended that the City road classification system be simplified to include four basic types: Minor Arterials; Major Collectors; Minor Collectors; and Local Roads. Typical mid-block cross-sections were developed to assist in determining appropriate rights-of-way for each roadway type. The sections are illustrated in the figures that follow. In the case of Minor Arterial, the right-of-way width of 36 m was adopted, since most of these roads are candidates for future assumption by the Region of York, and 36 m is the Region's standard. For Major and Minor Collectors, the rights-of-way provide for on-street bike lanes, as needed. These cross-sections are typical for mid-block conditions and therefore represent a minimum for each roadway type. The specific allocation of elements within the right-of-way can be tailored to the specific environment, depending on the composition of traffic to be accommodated and the need for wider sidewalks and boulevards.

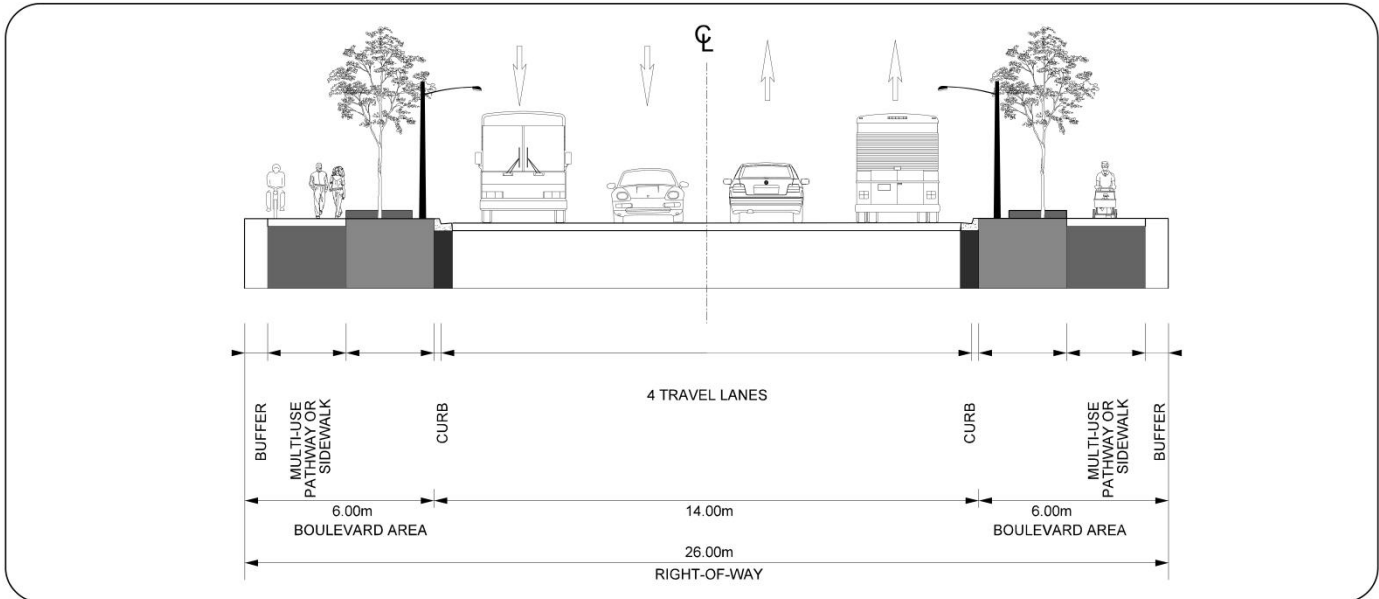
Minor Arterial Roads

With the exception of McNaughton Road, all Minor Arterial Roads are rural and aligned with the Regional Road grid system. As noted above, it is recommended that a ROW of 36 m be adopted to provide for their possible assumption by the Region. Any roadway improvements within the right-of-way would likely assume the characteristics of a Major Collector, albeit with wider boulevards.

Major Collector Roads:

Figure 5-1 shows a typical mid-block cross-section for a Major Collector.

Figure 5-1 Typical Cross-Section – Major Collector Road



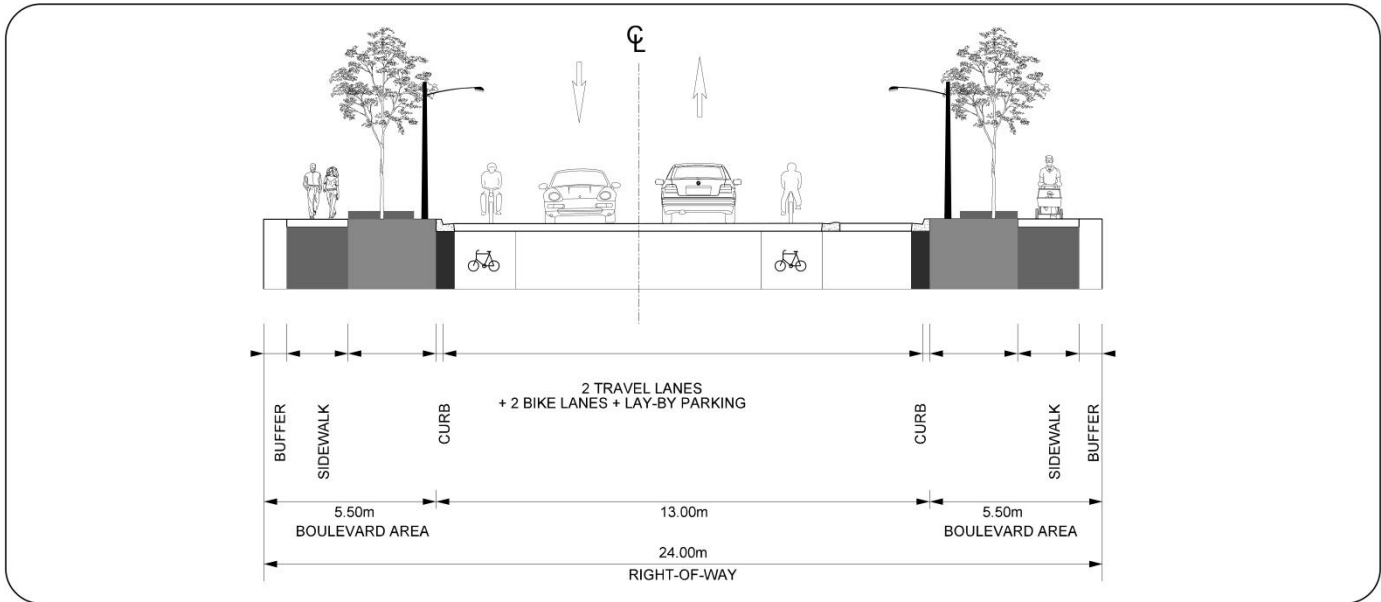
**TYPICAL CROSS-SECTION
MAJOR COLLECTOR ROAD**

- Notes:
1. Major Collector Roads shall have a minimum ROW width of 26 m
 2. Boulevards on both sides of the pavement area shall be a minimum of 6.0 m and will include a grass verge, street trees and a minimum 1.5 m sidewalk on both sides or 3.0 m multi-use pathway(s);
 3. Transit service and related facilities will be accommodated on Major Collector Roads

Minor Collector Roads:

Figure 5-2 shows a typical mid-block cross-section for a Minor Collector.

Figure 5-2 Typical Cross-Section – Minor Collector (With Bike Lanes)



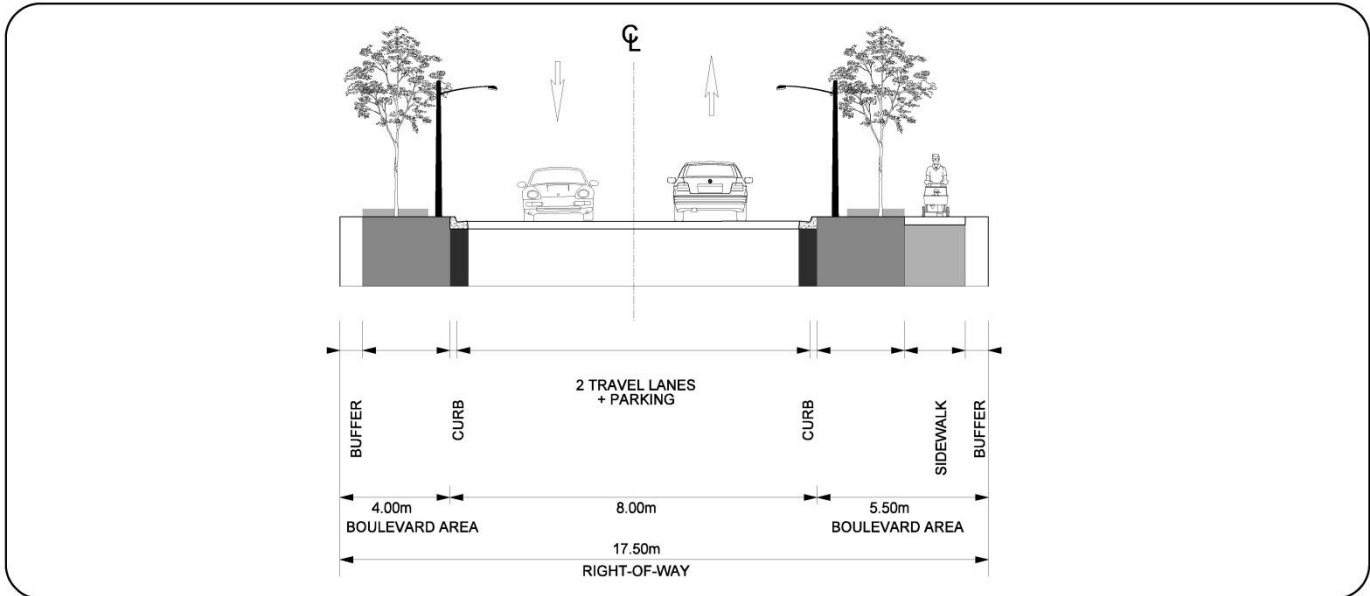
AECOM TYPICAL CROSS-SECTION MINOR COLLECTOR (WITH BIKE LANES)

- Notes:
1. Minor Collector Roads shall have a minimum ROW of 24.0 m
 2. Provision will be made for parking on at least one side of the road
 3. The road surface is typically 10.5 m including a 1.5 m bike lane on each side, as needed, and additional 2.5 m lay-by parking
 4. Boulevards on both sides of the pavement area shall be a minimum of 5.5 m, and will include a grass verge with street trees and a minimum 1.5 m sidewalk on both sides
 5. Transit service and related facilities may be located on any Minor Collector Road
 6. The lane widths of a Minor Collector will be decreased to 3.25 m where there is no need to accommodate buses or heavy trucks
 7. Lay-by parking is typically 2.5 m, or double row of trees where lay-by is not feasible

Local Roads:

Figure 5-3 shows the recommended mid-block cross-section for local roads.

Figure 5-3 Typical Cross-Section – Local Road



AECOM TYPICAL CROSS-SECTION LOCAL ROAD

- Notes:
- 8. Local Roads shall have a minimum ROW width of 17.5 m;
 - 9. Parking will be accommodated on at least one side of the road
 - 10. Boulevards with sidewalks shall be a minimum of 5.5 m and will accommodate a grass verge with street trees. Boulevards without sidewalks shall be a minimum of 4.0 m.
 - 11. Local Buffer Roads or Local Roads with a single lane in each direction of travel may be designed with a 15.0 m ROW, and a reduced boulevard abutting the stormwater management feature, open space, parkland or an environmental feature.

5.1.2 Pedestrian and Cycling Needs

To support greater emphasis on Active Transportation, the TMP review ensured that the recommended ROW provided sufficient space for the needs of pedestrians and cyclists, particularly in intensification areas.

Bicycle Lanes:

On-street bicycle lanes may be a desirable addition on all but local and high-speed roads. A minimum bike lane width of 1.5 m is recommended for minor collector roads, consistent with the recommendation of the 2007 City of Vaughan Pedestrian and Bicycle Master Plan. Bike lanes should be delineated from the motor vehicle travel lanes and parking lanes with solid white lines.

Sidewalks:

It is recommended that the City consider sidewalk width requirements based on expected pedestrian volumes and the nature of adjacent land uses. For example, at higher order transit hubs, along intensification corridors, or in high density residential areas and commercial/entertainment areas, wider sidewalks will be desirable. The City should

further investigate site specific sidewalk design details for each of these areas and consider measures to improve pedestrian safety including the provision of consistent and visible crosswalk markings, change in materials (e.g., brick or concrete with colour contrast to asphalt), refuge islands, sidewalk extension, and raised crosswalks/intersection. The sidewalks should be located as far as practical from the travelled way and usually close to the ROW limits. A minimum width of 1.5 m sidewalk is recommended, but widths up to 3 m may be appropriate, depending on the area and availability of ROW.

Medians:

Medians can provide refuge for pedestrians at intersections with wide crossing distances. Median widths are recommended to be a minimum of 1.2 m with a desirable width of 1.8 m. High-contrast detectable warning surfaces are recommended to be installed within the channel for visually impaired people. The minimum width to accommodate left-turn lanes should be 3.5 m. Thus, the recommended centre median width is 5 m (face of curb to face of curb) inclusive of landscaping area and 0.75 buffer strips. In addition, the median or the median nose adjacent to a turn lane should extend to the crosswalk. Medians can end prior to the crosswalk for a continuous pedestrian crossing or can extend through the crosswalk if a channel at street grade or a ramp is provided through the median. In the latter case, median noses extending through the crosswalk provide a refuge area for pedestrians.

5.1.3 Reduced Geometric Design Standards for Intensification Areas

Lane Widths:

Lane widths for intensification areas are recommended based on roadway type, transit requirement, bicycle facilities, desired operating speed and context area. Narrower lanes are generally recommended to avoid excessive pavement width, reduce pedestrian crossing distance and act as a traffic calming measure. Sources considered in recommending narrower lane widths include York Region's "Towards Great Regional Streets – A Path to Improvement", Region of Waterloo's Context Sensitive Regional Transportation Corridor Design Guidelines, City of Mississauga's Standard Drawing No. 2211.120, New Jersey's and Pennsylvania's Smart Transportation Guidebook, Washington State's DOT, TAC, AASHTO Green Book and NCHRP Report 612 on Urban Roadside Treatments. The recommended lane widths for City of Vaughan roadways within intensification areas are as follows:

Lane Type	Minimum Width (M)	Range
Curb Lane	3.5	3.5 – 4.0
Through Lane	3.0	3.0 – 3.5
Centre Lane	3.5	3.5 – 4.8
On-street Parking Lane - Local Road	2.0	2.0 – 2.5
On-street Parking - Collector Road	2.2	2.2 – 2.7
Bike Lane	1.2	1.2 – 1.8
Shared Use Lane (including bicycle facility)	3.0	3.0 – 4.25

Intersections Geometrics:

A review of the available standard criteria indicates that the City of Vaughan is applying comparable criteria as those of other municipalities across Canada. However, areas of improvement may include the incorporation of bicycle and pedestrian design standards with intersection designs. Close attention should be paid to Visibility / Sight Triangles, Curb Radii, and Curb Ramps.

Visibility / Sight Triangles: It is critical that pedestrians on the corner have a good view of a travel lanes and that motorists in the travel lanes can easily see waiting pedestrians. Based on review of several sources such as TAC, City of Portland's Pedestrian Design Guide, San Diego's Street Design Manual, Metrolinx's Draft Mobility Hub

Guidelines, the AASHTO Green Book and Institute of Transportation Engineers (ITE) documents, it is recommended that no obstructions (on-street parking, big signs, etc.) to pedestrian visibility (and their line of sight) particularly that of young children and those in wheelchairs be present within 9.0 m of an intersection or 4.5 m of a driveway.

Curb Radii: In general, a smaller curb radius is recommended for pedestrian benefits. A tight curb radius provides more pedestrian area at the corner, allows more flexibility in the placement of curb ramps, results in a shorter crosswalk, and requires vehicles to slow more as they turn the corner. Curb radii should be co-ordinated with crosswalk distances or special designs should be used to make crosswalks efficient for pedestrians. The following table presents recommendations for optimum curb radii based on a review of AASHTO Green Book, City of Portland's Pedestrian Design Guide and the practices of other municipalities.

Type	Recommended	Current Vaughan
Residential Local to Residential Local	6.0 m	10
Residential Local to Minor Collector	6.0 – 7.5* m	10
Minor Collector to Minor Collector	7.5 – 9.0** m	12
Minor Collector to Major Collector	7.5 – 9.0** m	-
Local to Major Collector	7.5 – 9.0** m	12
Intersections with High Volume of Trucks (in excess of 5%) and/or Bus Turns (more than twice per hour)	10.0 – 12.0 m	-

Notes: * The recommended width is 7.5 m or greater with a substantial volume of turning trucks and / or buses and encroachment into the opposing lane is unacceptable.
** The recommended width is 9.0 m or greater with a substantial volume of turning trucks and / or buses and encroachment into the opposing lane is unacceptable.

Curb Ramps: Curb ramps should facilitate wheelchair, bicycle, and pedestrian street crossings at intersections as recommended by TAC, City of Portland's Pedestrian Design Guide, San Diego's Street Design Manual, Metrolinx's Draft Mobility Hub Guidelines the AASHTO Green Book and the Institute of Transportation Engineers (ITE). It is recommended that the designer consult these sources for best practices. The TAC Geometric Design Guide includes drawings that show the details of curb ramps. As per this Guide, curb ramps require a minimum width of 1.5 m with a maximum grade of 6%. According to the Americans with Disabilities (ADA) Act requirements and Portland's Pedestrian Design Guide, the maximum ramp slope in the right-of-way is 1:12 with a cross-slope of no more than 1:50 (2%) and landing areas both at the top and the bottom. As noted in the TAC Geometric Design Guide, sidewalk ramps and curb cuts have the disadvantage of making the curb line difficult to detect for people who are visually impaired. With detectable warnings, effective uniform texturing or similar treatment an appropriate definition of the ramped area can be achieved. The textured surface also assists in providing a non-skid surface for persons in wheelchairs.

5.2 General Policies and Guidelines

The following summarizes the general recommendation to improve policies and guidelines. Note that the above sections provide specific recommendations (and cover other topics as well).

- **REDUCED ROADWAY ROW:**
The City may reduce ROW standards by 3 m if bicycle lanes or paths are not required.
- **DESIGN SPEED LIMIT:**
The City should adopt a mix of standards set forth by TAC, the City of Toronto and York Region in determining design speed limits for their respective jurisdictions. The recommended design speed for Vaughan should be 10 km/hr above the typical posted speed limit (50 km/hr) for local road and 20 km/hr above the typical posted speed limit for collectors and minor arterials (60 km/hr) respectively.

- **PROPERTY ACCESS:**
The City should develop an access management guidelines document similar to those currently in use in the Towns of Markham and Oakville.
- **ROAD IMPROVEMENTS:**
The City's policies and standards address the overall basis for road improvements, while pointing to specific improvements that are required. They can be supported by clarifying the process by which these road improvements ought to happen. For instance, the City could establish a body made up of a Citizens Advisory Committee and a Technical Advisory Committee that will work together with the City Council to identify and prioritize road improvements.
- **SURFACE TRANSIT:**
The City's transit policies are generally adequate, but should be broadened and reinforced to include all new secondary plan areas within the City limits.
- **SIDEWALKS:**
Installation of sidewalks on both sides of the road where possible, would be beneficial to achieving the City's goal of auto dependency reduction.
- **PEDESTRIAN AND BIKE SYSTEM:**
The City should provide bicycle parking in condominiums as well as parking/changing facilities in major office buildings. The City may introduce some assistive device for the pedestrians with visual impairments like accessible pedestrian signals.
- **HIGH OCCUPANCY VEHICLE (HOV) LANES:**
The City should adopt HOV lane standards for minor arterials. Standards to consider may include exclusive full time or peak hour HOV lanes, requirement for two or more persons in a vehicle, prohibition of trucks, and allowing bicycles/motorcycles.
- **STOP SIGNS:**
The City should update its current warrants for the installation of 3 and 4 way stop signs to consider pedestrian exposure and vehicle speeds.
- **ON-STREET PARKING:**
The City may adopt standards of other municipalities such as the prohibition of peak period parking or stopping on high volume traffic roads. It would be appropriate for a Technical Advisory Committee to consider individual proposals and make recommendations to Council for approval.
- **HEAVY TRUCK Prohibitions:**
The City should establish clear standards to minimize heavy truck traffic on local roads. These standards may involve establishment of truck routes coupled with prohibitions.
- **TRAFFIC CALMING:**
It is recommended that as part of the City's standard traffic calming warrants, traffic calming measures such as speed bumps, humps and raised crosswalk should be eliminated on public transit similar to the current practice for emergency response routes.
- **ROAD MAINTENANCE:**
The City should set standards for maintenance issues such as re-gravelling, paving, grading and side mowing.

- **TRANSPORTATION IMPACT STUDIES:**

Industry standard for transportation impact guidelines should be established to ensure uniformity and efficiency in embarking on transportation impact studies. The guidelines may be established in corporation with the policy standards of York Region and other municipalities to outline not only the criteria requiring transportation impact study but general standards of factors to be considered for completing the study.

- **TRAFFIC OPERATIONS AT SCHOOLS:**

The City should conduct traffic operations studies at school to observe and assess the traffic and safety conditions at Elementary and High Schools for the Catholic and Public School Boards located in the City and recommend improvements. The study should review general site requirements, parking options, bus operations, student drop-off and pick-up zones, signage, pedestrian and bicycle access, driveways, turn lanes and traffic related issues.

5.3 Design Standards and Criteria

The following suggestions are recommended after reviewing the City's standard drawings:

- Development of new Standard Cross-Section Drawings with bike lanes;
- Reduce pavement width in the Standard Drawing for Minor Collector Road;
- Include a minimum boulevard width for collector and local roads;
- Revise minimum sidewalk width to accommodate all users, including persons in wheelchairs;
- Reduce auto lane widths for all classes of road where possible

While radii standards set by road functional class are appropriate, the City may add to these by drawing on the TAC Design Guide to expand horizontal alignment design standards taking into consideration all the appropriate factors such as traffic speeds, traffic volumes, topography and utility locations.

A review of the available standard design criteria for intersections indicates that the City of Vaughan is applying comparable criteria to those of other municipalities across Canada. Areas of improvement may include the incorporation of bicycle and pedestrian design standards with intersection designs.

Although the standards for curb and gutter are aligned with Provincial standards and other municipalities across Ontario, the City may wish to provide further detail and specify curb and gutter standards for various road facilities and pedestrian facilities. Other standard drawings to consider may include all the OPSD 600 series.

Finally, there is the need to develop design standards to cater to the evolving urban intensification areas and promote active transportation within Vaughan. Borrowing from the Context Sensitive Regional Transportation Corridor Design Guidelines prepared for the Region of Waterloo in March 2010, the following design criteria should be considered for all urban intensification areas

- Limit the number and width of travel lanes without compromising safety and capacity requirements to help reduce the amount of auto travel lane surface, widths of crosswalks, and to dedicate as much ROW as possible for boulevard elements.
- Promote pedestrian safety by considering the smallest curb radius at intersections to allow the shortest crosswalk for pedestrians and slowest turning movement for vehicles.

- Consider introducing curb extensions at mid-blocks and intersections to promote comfort and safety for pedestrians crossing the street
- Consider an appropriate sight triangle to mitigate the risk of potential traffic and pedestrian conflicts by considering road widths and design speed.

5.4 References

List of references used in this document include:

- *Geometric Design Guide for Canadian Roads*, Transportation Association of Canada (TAC), 1999 and Update 2002
- *Guidelines for Understanding, Use and Implementation of Accessible Pedestrian Signals*, Transportation Association of Canada (TAC), 2008
- *Manual of Uniform Traffic Control Device (MUTCD) 4th Edition*, Transportation Association of Canada, 2002
- *Ontario Provincial Standard Drawings (OPSD)*, Ministry of Transportation Ontario
- *Ontario Traffic Manual Books 5 and 12*, Ministry of Transportation Ontario, 2007
- Region of York Roadway Geometric Design Criteria
- *Transportation Fact Book*, Region of York, 2007
- Region of Peel Roadway Geometric Design Criteria
- Region of Durham Roadway Geometric Design Criteria
- *Arterial Road Classification Review*, Region of Durham, 2007
- *Arterial Corridor Guidelines*, Region of Durham, 2007
- Signal Warrants Guidelines, Town of Ajax
- City of Ottawa Transportation Master Plan 2008 (Update)
- Town of Oakville Roadway Geometric Design Criteria
- *Official Plan Amendment 600*, City of Vaughan, 2000
- City of Vaughan Policy Tables
- City of Vaughan Roadway Geometric Design Criteria – Engineering Department
- *Pedestrian and Bicycle Master Plan*, City of Vaughan, 2007
- City of Brampton Roadway Geometric Design Guidelines, 2008 – 2009
- City of Mississauga Roadway Geometric Design Guidelines, 2002
- *Transportation Master Plan “Downtown21 – Conceptual Master Plan and Directions”*, City of Mississauga, 2009
- City of Toronto Roadway Geometric Design Guidelines
- *Road Classification System*, Toronto Services, City of Toronto, 2008
- *Context Sensitive Regional Transportation Corridor Design Guidelines*, Region of Waterloo, 2010
- City of Ottawa Pedestrian Plan, Draft January 2009
- Draft Mobility Hub Guidelines for Greater Toronto and Hamilton Area, Metrolinx, 2011
- Smart Transportation Guidebook - New Jersey DOT, 2008
- Guidelines for Street Corners - Portland Pedestrian Design Guide, 1998
- ITE Proposed Recommended Practice - Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities, 2006
- Smart Transportation Guidebook – Planning and Designing Highways and Street that Support Sustainable and Liveable Communities (New Jersey DOT and Pennsylvania DOT, March 2008)