

B1 ROAD CLASSIFICATION

Roadway classification is established through the Draft Plan approval process, Municipal Class Environmental Assessment process and the transportation studies. A Transportation Study and Traffic Functional Design Study shall be required by the City in order to help determine the roadway requirements. All new roadways within the City's Urban Service Area shall be fully urbanized.

Table 1: Road Classifications

Category	Drawing No.	R.O.W. (m)	Pavement (m)	Boulevards (m)	TYPE
Residential Locals	MR2	16.0	8.5	5.0/2.5	Single Loaded
	MR3	17.0	8.5	5.0/3.5	Sidewalk on one side
	MR4	18.5	8.5	5.0/5.0	Sidewalks on both sides
	MR4A	18.5	8.5	5.0/5.0	Infill Development
Residential Collectors	MR5	21.5	9.5	6.0/6.0	1-Side Parking
	MR6	23.0	11.0	6.0/6.0	1-Side Parking; shared bike lane
	MR7	24.5	12.5	6.0/6.0	1-Side Parking, bike lanes
Major Collectors	MR8	26.0	14.0	6.0/6.0	Without Central Median
	MR9	27.5	15.5	6.0/6.0	With Central Median
Residential Laneways	MR10	8.5	5.5	1.5/1.5	With Utilities
	MR10A	8.5	5.5	1.5/1.5	Without Utilities
Industrial/Commercial Collectors	MR11	22.0	10.0	6.0/6.0	Shared Bike Route
	MR12	23.5	11.5	6.0/6.0	Centre Left Turn Lane
Non-residential Laneways	MR13	10.5	7.0	1.75/1.75	Non-Residential

B2 GEOMETRIC DESIGN – HORIZONTAL AND VERTICAL

Residential/Industrial Streets

The following table summarizes the geometric design standards for roadways, based on road classification and design speed. Any deviations shall be accepted by the Director of Engineering.

Table 2: Residential/Industrial Streets

Item	Residential Local	Minor Collector	Major Collector/ Industrial
Annual Average Daily Traffic (AADT)	< 2,500	2,501 - 5,000	5,001 - 8,000
Design Speed (km/hr)	40	60	60
Posted Speed (km/hr) - recommended	40	40 - 50	50 - 60
Minimum Stopping Sight Distance (m) (e)	45	65	85
Minimum Pavement Width (face-to-face of curb)	Refer to Table 1		
Minimum Longitudinal Grade (Urban) (c)	0.7%	0.7%	0.7%
Desirable Minimum Sag Curves (K Values)	7	11	20
Minimum Sag Curves (K Values) for Stop Conditions (a)	4	6	10
Desirable Minimum Crest Curves (K values)	5	10	20
Minimum Crest Curves (K Values) (a)	4	7	15
Minimum Centerline Curve Radius (m) of the travel portion of the roadway (no superelevation) (c), (d)	120	150	200
Desired Maximum Grade	6.0%	6.0%	6.0%
Minimum Crossfall	2.0%	2.0%	2.0%

Minimum Lane Widths

	Residential Local	Minor Collector	Major Collector / Industrial
Right Turn Lane (m)	-	3.3	3.3
Left Turn Lane (m)	-	3.3 3.0, if adjacent to a center island	3.3 3.0, if adjacent to a center island

Notes:

- a) *Applicable only if roadway is illuminated.*
- b) *“Saw-toothing” of roads or 0.5% road grades is discouraged and shall only be used under specific circumstances with the acceptance of the Director of Engineering.*
- c) *0.5% road grade may be considered on a limited basis, if required, subject to acceptance by the Director of Engineering. 0.5% may also be considered in retrofit situations, if 0.7% cannot be achieved.*
- d) *For 90° bends, see detailed drawings.*
- e) *Smaller centerline radii may be considered on a site-by-site basis subject to provision of acceptable engineering support information addressing all applicable safe sight line and traffic movement criteria.*

School zones are posted at 40 km/hr.

Vertical Curves

All grade changes for local roads in excess of 1.5% shall be designed with vertical curves. All grade changes for collector (minor/major) roads in excess of 1.0% shall be designed with vertical curves. All intermediate grade points shall be calculated every 10.0 m and shown on the profile along with vertical curve data such as K-value, length and station of tangent intersection (See Table 2). Minimum length of grade changes for 1.5% or less shall be separated by minimum 6.0 m tangents for a local road and 10.0 m for a collector road.

Retaining Walls on Public ROW

The use of retaining walls shall be avoided, wherever possible. Where required, retaining walls shall conform to the following requirements:

- Retaining walls are generally required where 3 : 1 slope cannot be achieved
- Details of retaining walls over 0.90 m shall be submitted and stamped by a Professional Structural Engineer
- Retaining walls over 0.9 m is subject to peer review at Owner’s expense.
- Letter of Credit is required for retaining walls over 0.9 m
- Certification by the Consulting Engineer stating that the retaining wall is designed and constructed to meet the most recent design standards as to granular backfill, structural integrity, materials, tie backs, line and grade is required
- All structural drawings shall be signed and stamped by a Professional Structural Engineer (P. Eng.) for the design and structural stability of the retaining walls
- A 1.5 m high fence shall be required where a retaining wall height exceeds 0.9 m. Details of the fence and its installation on or adjacent to the wall shall be provided on the Engineering Drawings

Minimum Gutter Grades

The minimum gutter grade shall be 0.7%, except for bulbs, turning circles and curb radii where it shall be 1.0%. Where 1.0% cannot be achieved in bulbs or turning circles, catchbasins shall be placed at the direction of the Director of Engineering.

Boulevard Grades

Boulevard grades shall generally be 2.0% and may range from 2.0% to 5.0% for all new roads. For retrofit situations, boulevard grades shall be discussed on a project-by-project basis as accepted by the Director of Engineering.

Cul-de-Sacs

Cul-de-sacs shall be designed in accordance with the Standard Drawings. Minimum grade from the centre of the bulb to the curb shall be 1.0%. Minimum grade around curb, within the bulb, shall be 1.0%.

Curb Radii at Intersections

The following table indicates the minimum curb radii at intersections, unless otherwise required by a Traffic Study for specific situations:

Table 3: Curb Radii at Intersections

Intersecting Streets	Minimum Curb Radius
Laneway* with All roadways	6.0* m
Local Roads with All roadways	7.5 m
Residential Collectors with All roadways	7.5 m
All Others including Commercial/Industrial/Institutional roadways	15.0 m or as per Traffic Study

* Laneways designated as 'Fire Access Routes' shall have a minimum curb radii of 7.0 m

Minimum Sight "Triangle" Requirements

The following table indicates the minimum sight "triangle" requirements, in the form of street line roundings and triangles, for various intersecting roadway situations under ideal conditions. Sight "triangles" shall otherwise be sized according to safe sight distance requirements when conditions dictate.

Table 4: Minimum Rounding/Day-light Triangle Requirements

Road Type	Intersecting Road Type	Minimum Rounding Requirements
Laneways	All	3.0 m
Local	Local, Minor and major Collectors	5.0 m
Minor and Major Collectors	Minor and Major Collectors	10.0 m x 10.0 m (triangle)
Major Collector	Major Collector	15.0 m x 15.0 m (triangle)
All City's Roads/Laneways	Regional Roads	As per the Region

Driveways and Driveway Entrances

Driveway entrances and curb cuts shall be in accordance with the Standard Drawings and Curb Cut By-Law 158-93 or latest version thereof. Driveways shall be indicated on the Plan and Profile drawings, Grading Plans and Composite Utility Plans of Subdivisions. For Site Plans, driveway entrances shall be shown in Site Servicing and Grading Plans.

Driveway slopes shall range from 2.0% and 8.0%.

Residential driveways shall drain towards the street.

Residential driveways shall be straight and perpendicular to the curb and centred opposite the garage door as much as possible.

The location of the residential driveways shall be situated to maximize on-street parking.

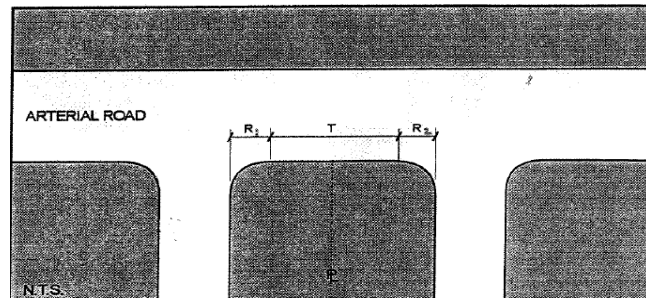
Curb cuts and driveway edges shall be located with a minimum of 1.2 m clearance from all street furniture including light poles, trees, hydro transformers, hydrants, watermain valves and utility pedestals. Deflection of the driveway to accommodate utilities shall not be permitted.

Water boxes shall have a minimum 0.3 m clearance from the driveway edge.

Industrial/Commercial/Institutional driveways shall be graded to ensure that the site drainage is self-contained.

Minimum distance of driveway from an intersection shall be 15.0 m measured from the tangent curb line of the adjacent road intersection and no portion of driveway shall be located within a sight triangle. For retrofit situations, minimum distance of driveway from an intersection shall be checked with City's Traffic Operations staff.

Driveway Spacing: consecutive driveways shall maintain a minimum tangent (T) length between the curb radii (R1 and R2). In general, minimum tangent length varies from 1.0 m to 6.0 m depending on the curb radii. For a standard radii of 9.0 m, tangent length (T) must be 6.0 m or greater. For a standard radii of 15.0 m, tangent length (T) must be 1.0 m or greater.



Driveway Alignment: if there are two driveways opposite and in close proximity to each other, every effort shall be made to align the proposed driveway to the existing or other proposed driveways.

Angle of Intersection: driveways shall intersect with the City's roads as close to 90 degrees as possible.

Radius Encroachment: the curb returns of a proposed driveway shall not encroach/pass the adjacent property line. An imaginary extension of a property line to the curb may be necessary to determine an appropriate limit for the curb returns.

B3 PAVEMENT DESIGN (ROADWAYS AND LANEWAYS)

A Geotechnical investigation shall be conducted by a licensed Geotechnical Engineering firm. Copies of the soil analysis, along with proposed road designs, shall be submitted to the Director of Engineering. (See Section I)

Minimum thicknesses of asphalt and granular materials are outlined in the following table that may be increased on a situational basis on the recommendations of a qualified Geotechnical Engineer. Thickness is measured in a compacted state.

Table 5: Minimum Pavement Thicknesses

Category	Surface Course Asphalt	Base Course Asphalt	Granular 'A' or 20 mm CRLS* Base	50 mm CRLS* Sub-base**
Residential	40 mm HL3	75 mm HL8 (1 lift)	150 mm	300mm
Collector and Industrial	50 mm HL3	100 mm HL8 (2 lifts)	150 mm	450 mm

* **CRLS** means crusher run limestone.

** Granular 'B' materials, if specified in place of 50 mm CRLS, will require Geotechnical Report specifying Granular 'B' depth.

In all cases:

- Asphalt job mix designs, approved by the Owner's Geotechnical Engineer, shall be submitted to the Director of Engineering a minimum of fourteen (14) working days prior to the commencement of paving for review
- Full pavement structural strength shall be achieved at the base asphalt stage

B4 CURBS AND GUTTERS

- All new streets shall have poured concrete curb and gutter construction
- Curbs and gutters shall be designed and constructed to the most recent City Standards and Ontario Provincial Standards
- Curb depressions are required at each intersection or pedestrian road crossing and at all driveway locations. The width and location of all driveway curb depressions shall conform to the City's Curb-cut By-Law 158-93 (Single Driveway = maximum 3.7 m, Double Driveway = maximum 6.0 m; slopes included, Triple Driveway maximum = maximum 7.0 m, Mutual Driveway = maximum 6.0 m)
- A minimum sub-base of 150 mm of granular material compacted to 98.0% Standard Proctor Density and extending 300 mm beyond back of curb shall be required as a base for all types of curb installations
- A two-stage curb shall be used on residential streets with driveway entrances and rear lanes
- A single-stage curb and gutter may be used along section of roads without driveway entrances, adjacent to parks or school sites, or in industrial Subdivisions

- Roll curbs shall be used for lanes and may be used for site plan developments in low speed applications. The use of roll curb for any other application shall be accepted by the Director of Engineering
- Barrier curb at islands/center medians may be used for parking lot areas and where the use of reverse grades is prevalent
- A 150 mm diameter perforated single wall corrugated (rigid) HDPE subdrain coupled with geotextile sock shall be installed continuously under all curb and gutter
- Concrete shall be a minimum of 32.0 MPA @ 28 days with 5.0% to 8.0% plastic air content. Maximum slump shall be 50.0 mm and maximum water-cementing ratio (W/CM) shall be 0.45. All concrete shall follow the requirements of OPSS.MUNI 1350 and CSA A23.1 Exposure Class C-2

B5 SIDEWALKS

Location

Sidewalks shall be constructed as shown on the City's Road Cross-section Standards. The location and extent of sidewalks shall be finalized with the City prior to commencing detailed engineering design. In particular, a sidewalk location plan shall be prepared and submitted for City's acceptance prior to pre-sales of homes and posted in the sales office accordingly.

All local roads shall have sidewalk on one side (minimum), collectors on both sides unless otherwise accepted by the Director of Engineering. Cul-de-sacs and window streets (roads adjacent and parallel to a regional road or City's local/collector road), in general, do not require a sidewalk unless there is a walkway connection from the cul-de-sac.

Generally sidewalks shall be located on the North and East side of the roadways.

In determining which side to locate a single sidewalk, factors influencing pedestrian destinations such as locations of existing and proposed parks, schools, malls and transit routes shall also be considered.

Sidewalks shall be constructed on both sides of the roadways surrounding schools, parks, ICI and medium/high density residential areas.

Specification

- Concrete sidewalks shall be a minimum of 125 mm thick and 175 mm thick across driveways
- Standard width of a sidewalk is 1.5 m. For high density areas, sidewalk width may be in the range of 2.0 m to 3.0 m as per the accepted plans, e.g. sidewalk width shall be increased to 2.4 m when adjacent to a curb, on collector roadways, schools, bus stops, high pedestrian areas and major collectors or arterials roadways as directed by the Director of Engineering
- Concrete shall be a minimum of 32.0 MPA @ 28 days with 5.0% to 8.0% plastic air content. Maximum slump shall be 100.0 mm and maximum water-cementing ratio (W/CM) shall be 0.45. Concrete shall meet the requirements of OPSS.MUNI 1350 and CSA A23.1 Exposure Class C-2
- Concrete sidewalks that cross commercial and industrial use driveways shall be minimum 200 mm thick
- Sidewalks shall be constructed with a minimum 2.0% cross-fall towards curb. Maximum grades across sidewalks shall be 4.0%; in some circumstances, maximum grades may be 5.0% with the acceptance of the Director of Engineering
- No special bedding requirements are normally necessary where sidewalks are constructed upon earth which has been properly consolidated to 98.0% Standard Proctor Density and has a bearing capacity of at least 75.0 KPA, unless otherwise recommended by a qualified Geotechnical Engineer

- A 6.0 mm plastic underlay sheeting shall be placed on the ground prior to placing concrete
- Sidewalks shall not be constructed on organic soils
- Where fill is required to bring the sidewalk to accepted grade, the fill shall be OPSS- Granular 'A' material compacted to a minimum of 98.0% Standard Proctor Density
- Sidewalks that intersect with a street, cross walk or traffic intersection shall be ramped for accessibility including dropped curb, a clearance slope of 5.0% and maximum of 8.0% and directional lines all in accordance with MR 20, or latest version

B6 TRANSIT CONCRETE PADS AND PLATFORMS

Transit pad and platform locations shall be accepted by the Director of Engineering and the Region of York Transit. The pads shall be shown on all Engineering Drawings, including CUP.

Concrete shall be a minimum of 32.0 MPA @ 28 days with 5.0% to 8.0% plastic air content. Maximum slump shall be 100.0 mm and maximum water-cementing ratio (W/CM) shall be 0.45. Concrete shall meet the requirements of OPSS.MUNI 1350 and CSA A23.1 Exposure Class C-2.

B7 WALKWAYS

Location of walkways, where required, shall be determined by the City's Planning and Urban Design Department and shall be shown on all Engineering Drawing. Longitudinal grade of walkway shall be 5.0% maximum and cross falls shall range from 2.0% to 4.0%.

Wherever the longitudinal grade of the walkway is greater than 6.0%, special provisions shall be made to produce a non-slip surface (course broom finish). Longitudinal grades shall not exceed 8.0%.

B8 LANEWAYS

- Length of laneways shall not exceed 90 m in length for townhouses (with detached garages) and shall not exceed 120 m in length for singles (with detached garages)
- 90 degree bends shall not be allowed in laneways
- No municipal services, except for local storm sewers, shall be allowed, unless otherwise accepted by the Director of Engineering
- Laneways shall intersect with public roads
- If a laneway intersects a laneway, one of the laneway shall be wider (10.0 m)

B9 BIKE LANES

- Refer to Bicycle Facility Selection Guide for details
- Bike routes shall be provided as per the latest "Cycling, Pathways and Trails Master Plan" or as directed by the Director of Engineering
- Lane width for a shared bike route shall be 4.5 m
- Lane width for a dedicated bike lane, along curb lane, shall be 1.5 m
- Lane width for a dedicated bike lane, adjacent to a parking bay, shall be 1.8 m

B10 MULTI USE PATHWAYS (MUP)

- MUP shall be provided as per the latest “Cycling, Pathways and Trails Master Plan” or as directed by the Director of Engineering
- Standard MUP width shall be 3.0 m unless otherwise accepted by the Director of Engineering
- MUP shall be concrete
- Concrete shall be a minimum of 32.0 MPA @ 28 days with 5.0% to 8.0% plastic air content and not be less than 325 kg/m³ of cement. Maximum slump shall be 50.0 mm and maximum water-cementing ratio (W/CM) shall be 0.45
- MUP shall be constructed with a minimum 2.0% cross-fall towards curb. Maximum grades across MUP shall be 4.0%; in some circumstances, maximum grades may be 5.0% with the acceptance of the Director of Engineering
- Where fill is required to bring the MUP to accepted grade, the fill shall be OPSS- Granular 'A' material compacted to a minimum of 98.0% Standard Proctor Density

B11 TEMPORARY TURNING CIRCLES

Temporary turning circles are required where a road will be continued for future phasing of development, but currently dead ends. Temporary turning circles shall be designed in a manner that will minimize future pavement removal, i.e. reverse grade on pavement beyond standard pavement width. Land easements shall be dedicated to the City to facilitate installation of temporary turning circles.

- Requirements
- Right-of-way radius - as dictated by temporary grading requirements
 - Curb radius: - 14.0 m (residential)
- 16.0 m (commercial/industrial/institutional)

Permanent sidewalk shall terminate short of the temporary turning circle with a temporary asphalt ramp connecting the sidewalk to the bulb.

Permanent Stage 1 of two stage curb and gutter shall, in general, be installed through the temporary bulb and the permanent position of roadway paved with normal crown elevation and crossfall.

B12 FIRE ACCESS & FIRE LOT

To ensure access for Fire Department vehicles under all conditions, two access roads, independent of one another shall be provided.

Every seventh lot is a fire lot and every other block in Townhouse is a fire lot.

B13 STREET NAME AND TRAFFIC SIGNS

The proposed location of signs to be installed shall be included on the Composite Utility Plans (CUP) and Pavement Marking and Signage Plans (PMSP).

Street Name Signs and Mounting of Street Signs

Street name signs shall be placed at every intersection and shall be double sided. These signs shall be placed in the locations and shall be as per the Standard Drawings.

Temporary street name signs, accepted by the Director of Engineering, shall be erected at intersections upon completion of rough grading of the roadways at base asphalt. These signs shall be double-sided and maintained in legible condition until such time as the permanent street name signs are in place.

The mounting of street signs shall be in accordance with the Standard Drawings. Single Post Mount shall be used on all roads, except of mast mounted street signs at signalized intersection.

Traffic Signals

Traffic signal handwells, power service pedestals and conduit shall be designed in accordance with the Standard Drawings. Traffic signal power service pedestals are also to be indicated on the electrical drawing and the Composite Utility Plan.

Traffic Control Signs

All regulatory signs shall be constructed in accordance with the following specifications, as described in the "Ontario Traffic Manual" (OTM).

Sign Faces

All facing shall be OTM standard reflective sheeting unless otherwise specified.

Colours

OTM standard

Lettering

OTM standard

Sign Blanks

- Ra-1 stop blank (60 cm x 60 cm) 1.63 mm thick 5052H34, 1200S alodine aluminum
- Ra-101 stop blank (75 cm x 75 cm) 2.06 mm thick 5053H34, 1200S alodine aluminum
- Ra-101, stop blank (90 cm x 90 cm) 2.06 mm thick 5052H34, 1200S alodine aluminum
- Rb-1, maximum speed (60 cm x 90 cm) 2.06 mm thick 5052H34, 1200S alodine aluminum
- Rb-51, 52, 53, parking restriction, 1.63 mm thick utility grade aluminum, mill baked white enamel both sides
- All other sign blanks shall be mini spangle galvanized 1.60 mm steel
- All sign blanks shall have appropriate radius corner (40 mm)
- All sign blanks shall have 15 mm x 10 mm slotted holes to accept metric or imperial mounting

Posts

- All posts shall be per Standard Drawings. Metal pole bases, if used, are not to be anchored in concrete
- Existing street light posts may be used where appropriate
- U channels can be used for No Parking, Speed Limit signs, etc.
- Stop signs and street names shall be installed on 75 mm diameter galvanized steel posts

Size

- 60 cm x 60 cm stop signs shall be installed at intersections where the travelled portion of the road allowance is less than 11.0 m
- 75 cm x 75 cm stop signs shall be installed at intersections where the travelled portion of the road allowance is 11.0 m or greater

Location

All traffic signs shall be shown on PMSPs and CUPs and installed according to:

- Highway Traffic Act
- Markham By-laws and Standards
- Ontario Traffic Manual, or as accepted by the Director of Engineering

B14 PAVEMENT MARKINGS

Durable pavement markings (Cold Plastic) shall be provided for all permanent stop bars, stop lines, crosswalks, turning arrows, and other traffic control measures as required. Painted pavement markings are required for lane separations, road centerline, turning lanes, bike lanes, island markings, railway crossings, school zones, speed bumps, and other traffic control measures as required.

Pavement markings and signages shall be shown on Pavement Marking and Signage Plans and Composite Utility Plans and shall be in accordance with the latest OPSS requirements.

All road markings shall be maintained by the Owner at no cost to the City until the Assumption of the Subdivision.

All temporary pavement markings shall be provided using Water Base or Organic Solvent Latex paint (dependent on the time of year) and maintained by the Owner following installation of base course asphalt.

For removal of pavement markings, no-abrasive road blasting shall be used.

Paint Specification for Line Painting

All pavement markings shall be reflective unless otherwise specified.

Water based latex paint shall be homogeneous and shall be well ground to a uniform smooth consistency. It shall be free from skin, dirt and other foreign particles, and shall be capable of being sprayed at the temperature intended for application. These products shall conform to all applicable sections and sub-sections of OPSS 1712, OTM Book 11. Water based paint to be applied between May 1 and October 15 of each calander year.

Organic solvent based paint (Oil Base) shall be homogeneous and shall be well ground to a uniform smooth consistency. It shall be free from skin, dirt, and other foreign particles, and shall be capable of being sprayed at the temperature intended for application. These products shall conform to all applicable sections and sub-sections of OPSS 1712, OTM Book 11. Organic solvent based paint can be applied between October 16 and April 30 should applications be required.

Durable pavement markings (Cold Plastic) shall be a two-component cold-curing material applied by either spray or extrusion process. These products shall conform to all applicable sections and sub-sections of OPSS 1712, OTM Book 11.

Traffic Paint Reflective Glass Beads shall conform to OPSS Standard 1750-1 and its sub-sections. The pavement markings shall be retroreflective white or yellow, and shall be readily visible as white or yellow when viewed at night.

All products and materials used on the City's roads shall be on the Ministry of Transportation approved list and shall conform to the latest specifications within OPSS and OTM Books 7 & 11.

B15 TRAFFIC CALMING MEASURES

Traffic calming measures may be required as part of the original design of roadways where traffic calming issues are anticipated and in accordance with an accepted Traffic Impact Study. Further, the Owner shall be responsible to implement traffic calming measures up until Assumption of Subdivision, should unanticipated requirements arise after a development becomes occupied.

Markham traffic calming implementation requirements shall be followed according to the "Guidelines for Neighbourhood Traffic Improvement Projects" – September 22, 1998.

For the design and application of traffic calming measures, the "Canadian Guide to Neighbourhood Traffic Calming" – by the Transportation Association of Canada, December 1998, shall be followed.

B16 ROUNDABOUTS (TRAFFIC CIRCLES)

Roundabouts are generally permitted, subject to suitability in a given situation as addressed by an accepted Traffic Impact Study. City's criteria for roundabouts shall be added to Engineering Standards as they are developed.

B17 PARKING

On-street parking is generally established through the Draft Plan approval process and will be agreed upon prior to submission of Engineering Drawings.

B18 TRAFFIC SIGNAL DESIGN AND INSTALLATION STANDARDS

Refer to Annex 4 for details.

B19 BICYCLE DESIGN CRITERIA

Refer to the following City's guidelines:

- Bicycle Facility Selection Guide (January 2012)
- Bicycle Facility Design: Guideline Toolbox for Intersections (May 2012)