

TOWN OF AJAX
DESIGN CRITERIA

SECTION B
ROADWAYS

B 1.00 CLASSIFICATIONS

B 1.01 STREET CLASSIFICATION

All roadways in new developments shall be classified according to the traffic volume expected and to the intended use of the roadway. For predominantly residential areas, three classifications shall be noted as follows: Local, Minor Collector or Major Collector. For industrial areas, the streets shall be classified Local or Collector dependent upon length of street, traffic volume expected and expected amount of truck traffic. Arterial roadways shall be classified as divided or undivided. The proposed classification of all streets in the development shall be confirmed with the Town of Ajax prior to the commencement of the design.

The following table is presented as a guide to the determination of the street classification.

<u>CRITERIA</u>	<u>LOCAL</u>	<u>COLLECTOR</u>	<u>ARTERIAL</u>
Source Provided	Land Access	Land Access Traffic Movement Transit Routes	Traffic Movement Transit Routes
Length of Trip	Short	Medium	Long
Flow	Interrupted	Interrupted	Through
Interconnections	Local Collector	Local Collector Arterial	Collector Arterial Freeway
Estimated A.A.D.T.	0-1,000	1,000-3,000	Over 3,000

B 1.02 ROADWAY CROSS-SECTIONS

The following table summarizes the roadway cross-sections available and their intended uses.

<u>Type</u>	<u>Uses</u>
<u>Std. No. AS-201</u> 8.5 m Local Road	To be used only as a window street (service road) in a 15 m road allowance when Urban Residential Areas are adjacent to an arterial or collector road.
<u>Std. No. AS-202</u> 8.5 m Local Road	To be used in all Urban Residential Areas where there is to be sidewalk on both sides in a 18.5 m road allowance (Curb and Gutter).
<u>Std. No. AS-203</u> 10.0 m Local Road	To be used in all Urban Residential Areas where a bus route is required or an industrial road in a 20.0 m road allowance (Curb and Gutter).

<u>Type</u>	<u>Uses</u>
<u>Std. No. AS-204</u> 13.0 m Collector Road	To be used in all Urban Residential Areas in a 23 m to 26 m road allowance (Curb and Gutter).
<u>Std. No. AS-205</u> 8.5 m local road in a 17 m road allowance	To be used in residential urban areas where there is sidewalk on one side only.

B 2.00 GEOMETRIC DESIGN ELEMENTS

B 2.01 RESIDENTIAL STREETS – URBAN

<u>GEOMETRIC DETAIL</u>	<u>LOCAL</u>	<u>COLLECTOR</u>
Minimum Right-of-Way Width (metres)	15-20	20-26
Minimum Design Speed	50	10 km/hr over posted speed
Minimum Safe Stopping Sight Distance (metres)	65	85
Minimum Sag Curve K Value	12	15
Minimum Crest Curve K Value	8	10
*Minimum Sag Curve Parameter in Stop Condition K Value	5	5
Minimum Curve Radius (metres)	115	185
Minimum Pavement Width (Face to Face of Curbs in metres)	8.5	10
Minimum Pavement Crossfall (percent)	2	2
Minimum Grade (percent) Note – Gutter grades cannot be less than 0.5%	0.5	0.5
Maximum Grade (percent)	6	6
Intersection Angle (degrees)	70-90	80-90

<u>GEOMETRIC DETAIL</u>	<u>LOCAL</u>	<u>COLLECTOR</u>
Minimum Tangent Length At Intersections (metres)	30	50
Minimum Tangent Length Between Reverse Curves (metres)	10	50
Daylight/Visibility Triangles (metres) Beyond a collector, refer to the TAC Manual	4.5	7.5

Generally, sawtoothing of the vertical alignment will not be permitted. Exceptions will be made at the discretion of the Manager of Engineering.

*Based on comfort criteria. Use in illuminated areas only when stopping sight distance requirements are met.

B 2.02 INDUSTRIAL STREETS

<u>GEOMETRIC DETAIL</u>	<u>LOCAL</u>	<u>COLLECTOR</u>
Minimum Right-of-Way Width (metres)	20	20-26
Design Speed (km per hour)	50	60
Minimum Safe Stopping Sight Distance (metres)	65	85
Minimum Sag Curve K Value	12	18
Minimum Crest Curve K Value	10	15
Minimum Curve Radius (m)	115	185
Minimum Pavement Width (Face to Face of Curbs in metres)	10	10
Minimum Pavement Crossfall (percent)	2	2
Minimum Grade (percent) Note – Gutter grades cannot be less than 0.5%	0.5	0.5
Maximum Grade (percent)	6	6
Intersection Angle (degrees)	70-90	80-90

<u>GEOMETRIC DETAIL</u>	<u>LOCAL</u>	<u>COLLECTOR</u>
Intersection Angle (degrees)	70-90	80-90
Minimum Tangent Length At Intersections (metres)	30	60
Minimum Tangent Length Between Reverse Curves (metres)	10	60

B 2.03 ARTERIAL STREETS

Arterial streets will be designed to Region of Durham Design Standards.

B 3.00 DESIGN ELEMENTS

B 3.01 VERTICAL CURVES

All points of grade change in excess of **1.5%** shall be designed with vertical curves as outlined in the current Ministry of Transportation - Ontario publications. The minimum visibility curves to be used are outlined in the geometric details for each roadway classification. The minimum tangent length of any road grade shall be 9 m.

B 3.02 BACKFALL AT INTERSECTING STREETS

At all street intersections the normal crossfall of the major street shall not be interrupted by the crown line of the minor street. A one to two percent backfall shall be provided on the minor street at all street intersections. This backfall shall continue to the end of the curb return radii to facilitate proper drainage of the intersection.

B 3.03 CURB RETURN RADII AT INTERSECTIONS

The curb return radii at street intersections shall conform to the following dimensions:

PAVEMENT WIDTH	PAVEMENT WIDTH	CURB RETURN
<u>Street A</u>	<u>Street B</u>	<u>Radii</u>
8.5 m	8.5 m	8.0 m
8.5 m	10.0 m	10.0 m
10.0 m	8.5 m	10.0 m
10.0 m	13.0 m	12.0 m
13.0 m	10.0 m	12.0 m
13.0 m	13.0 m	12.0 m

Industrial designated streets will be required to have a minimum 15 m radius.

B 3.04 CUL-DE-SACS AND BULBS

Subdivision street pattern designs should avoid the use of cul-de-sacs wherever possible.

Permanent cul-de-sacs shall be constructed in accordance with the details provided in the standard drawings. Minimum gutter grades of 0.5% shall be maintained along the flow line of all

gutters around the cul-de-sacs. All cul-de-sacs, bulbs, and intersections shall be detailed at a scale larger than the road plan. The details shall show gutter, crown, and other grades sufficient to determine that the road will properly drain and shall be used as a basis for layout.

Maximum length of a cul-de-sac shall be 100 metres. Any dead end must terminate in a cul-de-sac. Hammerheads are not permitted.

B 3.05 TEMPORARY TURNING CIRCLES

Temporary turning areas are to be built to the geometric standards of permanent cul-de-sac standards.

B 3.06 EMERGENCY ACCESS

Emergency access entrances are to be avoided wherever possible. Where an emergency access is required to meet the requirements of the local emergency services, its design must meet the requirements of AS-322 and shall be approved of the Manager of Engineering.

B 3.07 LOCATION OF UTILITIES

The location of utilities within the road allowance shall be as per the Town of Ajax Standard Drawings. Utility Coordination Plans shall be submitted to the Manager of Engineering for approval as per Section M of the Design Criteria.

All utility wiring is to be constructed underground. Hydro transformers are to be housed in suitable enclosures and mounted on transformer pads installed at the final surface of ground. Bell Telephone junction and Cable TV boxes may be mounted at the final surface in approved standard enclosures.

B 4.00 PAVEMENT DESIGN

The Town of Ajax is specifying the minimum road structure design using the GBE methodology. Detailed information can be found in the MTO' Pavement Rehabilitation and Design Manual. Essentially, the structural equivalency of the different road materials is equated to granular materials; Granular A having a GBE of 1, HMA has a GBE of 2, and Granular B has a GBE of 0.66. Restated 1 mm of HMA = 2 mm of Granular A= 3 mm of Granular B.

All materials used in the construction of the Town of Ajax Roads must meet or exceed the OPSS requirements, or the Town of Ajax Special Provisions, whatever is specified.

The Developer shall engage a qualified Soils Consulting Engineer to design a suitable pavement structure. Soil sampling shall be carried out in the presence of the Soils Consultant at intervals not exceeding 60 m along the centreline of the subdivision road, to a minimum depth of 1.5 m below the proposed road grade. If an existing road is to be reconstructed as part of the development, the borehole should extend a minimum of 0.5 m into native sub-grade.

The composition and design thickness of the pavement section shall be determined from:

- (a) Sub-grade soil classification with gradation analyses including hydrometer testing of material with more than 10% passing the 75 µm sieve.
- (b) Sub-grade soil frost susceptibility.

- (c) Sub-grade soil drainage.
- (d) Traffic Volumes including the percentage of trucks based on a 20 year life cycle.

Pavement structure design may be undertaken using either empirical or mechanistic methodologies.

Copies of all test results and proposed road designs and supporting calculations shall be submitted with the engineering drawings. Pavement design not meeting the minimum standards, as indicated above for the particular road classification, will not be acceptable.

The **minimum** pavement design for all **local residential** roads in new subdivisions shall be 40 mm of HL3, 50 mm of HL8, 150 mm of Granular A and additional approved granular product (Granular A or Granular B) so as to create a minimum Granular Base Equivalency (GBE) of 530. All urban road cross-sections shall have sub-drains located lower than the lowest elevation of granular material in the road base.

The **minimum** pavement design for **collector roads** shall be 40 mm of HL3, 100 mm of HL8, 150 mm of Granular A and additional approved granular product so as to create a minimum Granular Base Equivalency (GBE) of 730. All urban road cross-sections shall have sub-drains located lower than the lowest elevation of granular material in the road base.

The **minimum** pavement design for **arterial roads** shall be 40 mm of HL3, 100 mm of HL8, 150 mm of Granular A and additional approved granular product so as to create a minimum Granular Base Equivalency (GBE) of 830. All urban road cross-sections shall have sub-drains located lower than the lowest elevation of granular material in the road base.

Copies of all test results and proposed road designs shall be submitted with the engineering drawings. In no case will a pavement design less than the minimum Town of Ajax Standard as shown on the Standard Drawing for the particular road classification be considered acceptable.

The Consulting Engineer shall be responsible for approving the source of supply and quality of all materials supplied by the Developer and his Contractors. Testing and approval of all granular materials at the designated pits and subsequent in-situ verification tests shall be performed by the Consulting Engineer and shall be presented to the Town.

Prior to the placement of concrete and the asphalt pavement, the Consulting Engineer must submit to the Manager of Engineering for approval the concrete and asphalt pavement mix designs for all mixes.

Lift thicknesses are to be between 40 to 80 mm and dependent on road cross-section, if 2 lifts are required, they are to be placed in equal depths.

Material Requirements

The source of supply and quality of all materials and supplies is subject to the approval of the Town and by the Consulting Engineer. The Consulting Engineer shall perform testing and approval of all granular materials at the designated pits and subsequent in-situ verification tests.

All granular materials shall meet the Town of Ajax and OPS specifications. The Consulting Engineer shall submit physical testing results to the Town for approval of each source.

Prior to the placement of asphalt pavement, the Engineer must submit the asphalt pavement mix

designs to the Manager of Engineering for approval. The mix design shall be reviewed and approved by a Geotechnical Engineer. The asphalt mix design shall meet the appropriate OPS specification.

B 5.00 CONCRETE CURB AND GUTTER

Concrete curb and gutter conforming to the Ontario Provincial Standard Drawings 600.040 or 600.070 shall be used on all new roadways.

Adjustment and final setting of catchbasins frames shall be completed by pouring concrete, or using adjustable concrete riser units, immediately prior to the placement of the top lift of asphalt. Riser units shall be parged on the outside of the catchbasins only. Catchbasins shall be initially set to base asphalt elevation. Temporary asphalt curb shall be placed at catchbasins until they are raised to final grade just prior to top asphalt.

Driveway depressions shall be formed in the curb according to the details and locations as shown on the Town of Ajax Standard Drawings. If the driveway depression should be improperly located, then that section of the depressed curb which is improperly located shall be broken out and shall be replaced with a normal curb and gutter section. **The concrete capping of a depressed curb shall not be permitted.** The new driveway depression at this location can be formed by cutting the back of the curb with a curb cutting machine providing the existing section is free from cracks and other defects, otherwise the curb is to be replaced. For multiple units, commercial and other entrances, the existing curb and gutter shall be completely removed and replaced with a steel reinforced depressed curb section as per Town of Ajax Standard AS-342.

B 6.00 SIDEWALKS

The location requirements for sidewalks in new subdivisions shall be identified on a Traffic Management Plan to be submitted to the Town for approval prior to Draft Plan Approval.

In general, sidewalks are required on both sides of all arterial and collector roadways and on one side of local streets unless warranted on both sides. For local roadways, the locations of schools, parks, churches, commercial establishments, the length of street and traffic volume expected, and the number of dwelling units serviced will be some of the criteria used in determining whether sidewalks are required on both sides of the street.

The sidewalk shall conform in details and dimensions to the current Ontario Provincial Standard Drawings and shall be installed at locations as shown on the typical road cross-sections. The standard width of sidewalk for local streets is 1.5 m arterial and collector roads which are a minimum 1.8 m.

The sidewalks shall be increased in thickness at all driveway locations as shown on the Ontario Provincial Standard Drawings. In cases where the sidewalk has been constructed prior to the establishment of an entrance the existing sidewalk shall be removed and shall be replaced with a thickened sidewalk section.

At street intersections the curb and the sidewalk shall be depressed to meet the roadway elevations as shown on the Ontario Provincial Standard Drawings

When a sidewalk is constructed adjacent to a curb and gutter, a keyway shall be provided along the back of the curb to support the sidewalk. An expansion joint shall be provided to separate the back of the curb from the face of the sidewalk.

B 7.00 DRIVEWAYS

The subdivider, or his assign, is responsible for the grading and paving of the entire length of all driveways from garage to curb to Town of Ajax Standards.

B 7.01 MINIMUM DRIVEWAY DESIGN

The minimum consolidated depth requirements for the granular base and asphalt in driveways shall be as detailed on the Town of Ajax Standard Drawings AS-341 and AS-342.

The minimum consolidated depth requirements for driveways shall be as follows:

- a) **SINGLE FAMILY RESIDENTIAL**
HL3 asphalt – 50 mm (if driveways are to be paved in two lifts, the top lift shall be a minimum of 25 mm in thickness)
Granular base – 150 mm of Granular ‘A’ GBE of 250

- b) **COMMERCIAL, LIGHT INDUSTRIAL AND APARTMENTS**
Asphalt - 40 mm HL3 surface course
 - 50 mm HL8 base course
Granular base 150 mm of Granular ‘A’ plus additional granular material to create a GBE of 480

- c) **HEAVY INDUSTRIAL DRIVEWAYS**
Asphalt - 40 mm HL3 surface course
 - 75 mm HL8 base course
Granular Base - 150 mm of Granular ‘A’ plus additional granular material to create a GBE of 580

B 7.02 DRIVEWAY GRADES

The maximum permissible design grade is 6%. The minimum grade for any driveway shall be 2%. This maximum grade is not recommended and should be employed only in exceptional cases where physical conditions prohibit the use of lesser grade. The maximum permissible as constructed grade for any driveway shall be 8% to allow for a construction tolerance similar to the foundation control tolerance.

The driveway width shall not exceed the width of the external walls of the garage. The specified grades for driveways shall be directed away from the houses. The use of reverse driveways is not permitted. For industrial and commercial sites requiring site plan approval, a break in grade for driveways shall occur at the street line, providing positive drainage from property line to the roadway while keeping all flows from these properties contained within the property itself.

B 7.03 DRIVEWAY DEPRESSIONS

The width and location of the depressions in the curb and gutter for single family residential driveways shall be as detailed in the Town of Ajax Standard Drawings.

The width and location of the driveway depressions for apartment, commercial and industrial driveways shall be detailed on the engineering drawings. These driveways shall be designed to accommodate the anticipated vehicular traffic without causing undue interference with the traffic flow on the street. The minimum width of any driveway depression for commercial, apartment, or industrial driveways shall be a minimum 15.5 m. All apartment, commercial, and industrial driveways shall be provided with barrier curbs constructed to blend into the roadway curb and gutter.

The minimum and maximum widths of driveway depressions for a single width driveway are as per the Town of Ajax Zoning Bylaw.

Roadway curb & gutter shall be continuous across the entire width of any entrance.

B 7.04 DRIVEWAY APPROACHES WITH OPEN DITCHES

The Developer is responsible for the grading, gravelling, and paving of all driveways from the edge of the pavement of the roadway to the property line. The minimum consolidated depth requirements for the granular base in driveways over open ditches shall be 250mm of Granular 'A'.

The minimum length of each C.S.P. driveway culvert shall be 9.0 metres (for a single width entrance) and the minimum diameter shall be 400 mm. The maintenance and repair of such culverts shall remain the responsibility of the Developer until such time as the Town has assumed the works.

The construction of driveway headwalls at each end of the driveway culvert will not be permitted.

B 8.00 BOULEVARDS

All boulevard areas are to be graded between 2% and 5%. In order to minimize construction problems for the other utility companies, the grade of the boulevard shall be constant from the back of the curb to the municipal right-of-way. Terracing or embankments within the road allowance on new subdivision streets shall not be permitted.

All debris and construction materials shall be removed from the boulevard area upon completion of the initial stage of road construction and the boulevards shall be maintained in a clear state until the roadway section is completed.

Clean, weed free, topsoil shall be placed on all boulevard areas prior to sodding. The minimum depth of topsoil required shall be such that the combined thickness of the topsoil and sod is at least 150 mm. Number 1 nursery sod shall be used for all boulevard areas. All boulevards shall be sodded to the right-of-way limit.

B 9.00 STAGING OF CONSTRUCTION

The construction of all roads in new subdivisions shall be staged in order that the completion of the roadway coincides with the completion of the development of the surrounding lands. The initial stage of construction shall provide a roadway of proper granular base and base asphalt with first stage curb for building construction, traffic movement, and land access. Dust control measures shall be maintained during all phases/stages of construction. All roadway catchbasins shall be protected as to prevent the accumulation of deleterious materials. Roads shall be

periodically cleaned and maintained by the developer in such a way that no debris shall accumulate on the road. Please refer to the current Town of Ajax Bylaw 69-2002, as amended from time to time.

The second stage of roadway construction shall complete the roadway to the final design cross section.

B 9.01 RESIDENTIAL AND LOCAL COLLECTOR ROADWAYS

For residential and local collector roadways, the initial stage of construction shall consist of:

- (a) the grading to the full cross sectional width as shown on the Town of Ajax Standard Drawing
- (b) the complete granular base
- (c) the first stage of curb and gutter
- (d) the base course of asphalt

The second stage of road construction shall comprise the following:

- (a) the installation of the second stage curb and gutter and sidewalk
- (b) the grading, topsoiling, and sodding of all boulevards
- (c) the grading, gravelling, curbing, and paving of all driveways
- (d) the completion of the surface courses of asphalt
- (e) the final adjustment to grade of all utilities
- (f) all other work necessary to complete the roadway to the final design cross section including boulevard tree plantings

The top surface course of asphalt shall not be placed in any area until ALL the following conditions are met:

- (a) A minimum period of one (1) year has expired from the completion of the initial stage of construction.
- (b) 85% of the dwellings with frontage or flankage on the street are completed to the fine grading and topsoil stage.
- (c) All undeveloped blocks and lots are graded in accordance with the approved Lot Grading Plan.
- (d) All service connections for multiple family, commercial, institutional, or other blocks are installed.
- (e) Approval is obtained from the Town.

B 9.02 MAJOR COLLECTOR, INDUSTRIAL COLLECTOR, AND ARTERIAL ROADWAYS

For these roadways, the initial stage of construction shall consist of:

- (a) all work necessary to complete the roadway to the final design cross section, with the exception of the surface asphalt
- (b) the boulevard sodding
- (c) the driveway approach paving
- (d) the full curb and gutter, and sidewalk

The second stage of construction shall comprise the following:

- (a) the surface asphalt
- (b) the final adjustment to grade of all utilities in the surface asphalt
- (c) all other work necessary to complete the roadway to the final design cross section including boulevard tree plantings

The top surface course of asphalt shall not be placed in any area until ALL the following conditions are met:

- a) A minimum period of one (1) year has expired from the completion of the initial stage of construction.
- b) All undeveloped blocks and lots are graded in accordance with the approved Lot Grading Plan.
- c) All service connections for multiple family, commercial, institutional or other blocks are installed.
- d) Approval is obtained from the Town.

B 10.00 CONSTRUCTION REQUIREMENTS

B 10.01 CLEARING AND GRUBBING AND AREA ROUGH GRADING

The road allowance shall be cleared of all trees, shrubs, and boulders not to be included in final landscaping and of all other obstructions for such widths as are required for the proper installation of roads, services, and other works. Rough grading shall be done to bring the travelled portion of the road to the necessary grade and in conformity with the cross section shown on the drawings. An approved tree inventory and preservation plan must be in place prior to any clearing and grubbing operations.

Rough grading of all lots and easements must be performed prior to the placement of granular materials in the roadways. The sub-grade for all roads shall be properly shaped and compacted to 95% Standard Proctor Density prior to any application of granular base course materials.

In all cases, topsoil shall be stripped for the complete width of the road allowance and stock piled at locations approved by the Consulting Engineer.

All sediment and erosion control measures as outlined on the Sediment and Erosion Control Plan must be in place and functioning before any clearing, grubbing or earth work operations start. Refer to Section L for Sediment and Erosion Control.

For any excess fill removed to a disposal site classified as "swamp, ravine, floodplain, or lake", the Developer must receive prior written permission from the local Conservation Authority.

B 10.02 SUB-GRADE

The sub-grade for all roads shall be properly shaped and compacted to 95% Standard Proctor Maximum Dry Density (SPMDD) prior to any application of granular base course materials. The finished sub-grade shall be proof rolled in the presence of the soils consultant and certified as being acceptable. The soils consultant shall provide a certificate indicating that the subgrade has been inspected and is suitable for the placement of the granular materials.

B 10.03 GRANULAR BASE

The granular base for all roads shall be properly shaped and compacted to 100% Standard Proctor Maximum Dry Density (SPMDD) prior to any application of hot mix asphalt. The finished granular base shall be proof rolled in the presence of the soils consultant and certified as being acceptable. The soils consultant shall provide a certificate indicating that the subgrade has been inspected and is suitable for the placement of the hot mix asphalt.

B 10.04 ROAD SUB-DRAINS

Due to the impervious soils predominant in the Town, 100 mm diameter perforated filter cloth wrapped plastic corrugated sub-drains will be required to run continuous along both sides of all roads with curb and gutter, and connected to the storm sewer system. The sub-drain will be installed at an elevation lower than the granular base course of the proposed road (See AS-221).

B 10.05 SNOW CLEARING

Snow clearing operations will be carried out by the Town once occupancies have occurred, if so requested by the Developer in writing, and the roads are kept in a condition acceptable to the Town.

B 10.06 OTHER REQUIREMENTS

Whenever it is necessary to cut through an existing Town road, the Developer's contractor will be responsible for obtaining a Road Occupancy Permit and properly compacting the backfill material and restoring the surface pavement to its original conditions immediately upon completion of backfilling operations.

Before making detours, permission is required from the Town's Planning and Development Department. Where the road is not part of the Town road system, approval from the appropriate road authority will also be necessary. In all cases, the Fire and Police Departments, School Boards, Ambulance Service, Town of Ajax Operations Department, and Durham Transit must be notified by the Developer or his contractor.

All work will be done in accordance with ordinances and by-laws of the Town of Ajax.