THE DISTRICT OF HOPE

SUBDIVISION AND DEVELOPMENT SERVICING DESIGN CRITERIA MANUAL

SECTION R - ROADS

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R1 GENERAL REQUIREMENTS

The design of roads and highways shall conform to these *engineering* standards and the latest edition of the Geometric Design Guide for Canadian Roads published by:

Transportation Association of Canada (TAC)
2323 St. Laurent Boulevard
Ottawa, Ontario K1G 4K6

R2 HIGHWAY CLASSIFICATION

The appropriate classification shall be consistent with the *Official Community Plan (OCP).*

The Consulting *Engineer* shall confirm the classification with the *Approving Officer* at a pre-design meeting.

R3 HIGHWAY DESIGN REQUIREMENTS

R3.1 Design Speeds

Unless otherwise specified by the *Approving Officer*, the design speed shall be:

Major *Arterials & Arterials*	-	Proposed posted speed + 10 km/h
Major *Collectors*	-	60 km/h
Collectors and below	-	50 km/h

The *Approving Officer* shall confirm the proposed posted speed of any *highway* in the *Municipality*.

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R3.2 Design Gradients

Gradients for highways shall be:

Urban	Maximum	Minimum
Arterial	6%	0.50%
Major Collector	8%	0.50%
Collector	8%	0.50%
Through Local	12%	0.50%
Limited Local	12%	0.50%
Cul-de-sac (downhill)	8%	0.50%
Cul-de-sac (uphill)	10%	0.50%
Lane	12%	0.50%
Rural		
Arterial	8%	n/a
Major Collector	10%	n/a
Collector	10%	n/a
Local	12%	n/a
Cul-de-sac (downhill)	8%	n/a
Cul-de-sac (uphill)	10%	n/a
Lane	12%	n/a

The *Approving Officer* may accept steeper grades for some roads to those stipulated above, if in the *Approving Officer's* opinion it is in the *Municipality's* interest.

R3.3 Cross Slopes and Superelevation

Cross slopes for all *roadways* shall not be less than 2% or more than 4% in the direction indicated on the appropriate Standard Drawing. The crown shall be in the centre of the pavement.

Where extreme topography is involved, limited local roads and lanes may be designed with one-way crossfall to a maximum of 3%, subject to the approval of the *Approving Officer*.

Unless approved by the *Approving Officer*, superelevation for any highway shall not exceed 4%. Superelevation is not required for *collector* or *local roads*. The *Approving Officer* may approve superelevation up to 6% on major *arterials, arterials* and major *collectors*.

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R3.4 Horizontal Curves

Horizontal curves shall be governed by the design speed of the road. Radii shall be derived from the formula:

$$R = \frac{v^2}{127(e+f)}$$

Where: R = radius of circular curve in meters
V = vehicle speed in kilometers per hour
e = roadway superelevation in meters per meter
f = side friction factor

Values for f: 70 km/h = 0.17
60 km/h = 0.18
50 km/h = 0.21
40 km/h = 0.25
30 km/h = 0.31

The following examples are derived from this equation:

Classification	**Design Speed (km/h)**	**Min. Radius (m)**
Local	50 with 2% Crossfall	103
	50 with 2% Superelevation	85
Collector	60 with 2% Crossfall	177
	60 with 2% Superelevation	142
	60 with 4% Superelevation	129

R3.5 Vertical Curves

Vertical curves shall be governed by the design speed of the road. Generally, the numerical value of the length of a vertical curve in meters should not be less than the numerical value of the design speed in km/h.

Vertical curves are required for all changes in grade greater than 1.5%.

(1) Crest Curves: minimum vertical curvature:

Design Speed	Length
20 km/h	1 m/1% change in slope
30km/h	2 m/1% change in slope
40 km/h	4 m/1% change in slope
50 km/h	7 m/1% change in slope
60 km/h	15 m/1% change in slope
70 km/h	22 m/1% change in slope
80 km/h	35 m/1% change in slope

NOTE: When a local road meets another local road at a stop condition and no through condition is contemplated then a 20 km/h design speed is permitted. The 20 km/h design speed is only permitted for the last 10 meters in approaching a stop sign.

(2) Sag Curves: minimum length:

Design Speed	Length
20 km/h	2 m/1% change in slope
30km/h	4 m/1% change in slope
40 km/h	7 m/1% change in slope
50 km/h	11 m/1% change in slope
60 km/h	20 m/1% change in slope
70 km/h	25 m/1% change in slope
80 km/h	30 m/1% change in slope

NOTE: When a *local road* meets another *local road* at a stop condition and no through road is contemplated then a 20 km/h design speed is permitted. The 20 km/h design speed is only permitted for the last 10 meters in approaching a stop sign.

R3.6 Mountainous Terrain

"Mountainous terrain" shall be where the predominant slope of the land in the region exceeds 15%.

The *Developer's Engineer* is required to consult with the *Approving Officer* to confirm the use of this Section prior to commencement of design.

Local roads in mountainous terrain may be designed using 30 km/h design speed. These *roads* shall be posted as 30 km/h.

The *Approving Officer* may approve a maximum gradient of 12% over short distances on an arterial road or major collector road where conditions warrant.

R4 INTERSECTIONS

R4.1 Dedications

A minimum 3.0 meter property corner truncation is required at all intersections. The *Developer's Engineer* shall determine whether a greater truncation is required to accommodate all surface and underground works and to maintain a minimum 4 m distance from curb face to property line.

At intersections not at 90°, dedications shall be confirmed with the *Approving Officer*.

R4.2 Curb Returns

Curb return radii shall be as follows:

	Intersection with		
	Local/Frontage	**Collector**	**Arterial**
Lanes	3 m	with 3:1 flare to property corners	
Locals	7 m	9 m	11 m
Industrial Locals	9 m	10 m	11 m
Collectors	9 m	10 m	10 m
Arterials	11 m	10 m	*

* Curb return radii at arterial roads require specific designs taking into account projected volumes, turning movements, truck traffic, whether turning lanes are provided, etc.

The *Approving Officer* may require variations to protect pedestrians and to preclude instances where awkward geometry may otherwise result in vehicles turning into the path of other oncoming vehicles.

Pavement radii at rural road intersections shall be minimum 12 m radius.

Curbs and curb returns for channelized 90° intersections shall conform to TAC. For intersections at angles other than 90°, use WB 17 design vehicle templates for curb return designs.

R4.3 Centreline Crossing/Meeting Grades

Vertical alignment at Intersections - Major *Road*

Major Through Road	**Maximum Grade/Minimum Distance for Major Road Through Road at Intersection With**		
	Arterial	Collector	Local
Arterial	4%/120 m	5%/60 m	6%/30 m
Collector		5%/60 m	6%/30 m
Local			6%/30 m

* Distances are measured from the end of the approach vertical curve (EVC) to the beginning of the departure vertical curve (BCV).

Vertical Alignment at Intersections - Minor *Road*

Minor Road	**Maximum Grade/Minimum Flattened Distance* for Minor Road at Intersection With**		
	Arterial	**Collector**	**Local**
Arterial	2% / 60 m		
Collector	2% / 30 m	2% / 25 m	
Local	2% / 25 m	2% / 20 m	2% / 10 m

* Distances are measured along the minor *road* from the ultimate near curb line of the major *road* to the beginning of the vertical curve (BVC).

Where the predominant slope of the land at the intersection exceeds 12%, the crossfall of the major *road*, through the intersection, may be reduced to zero to assist in achieving the minimum flattened distance along the minor *road*.

R4.4 Spacing and Location

Intersecting roads shall meet as close to 90° as possible. A *collector road* shall not intersect an *arterial road* at an angle of less than 70°.

Crossing sight distance shall be as outlined by TAC.

Intersections on curves should be avoided, especially on the inside of curves. Intersections near the crests of hills should be avoided.

Where T-intersections occur on *collectors*, the minimum spacing between them shall be 80 m as measured between the centrelines of the intersecting streets.

R5 ROAD LENGTHS

R5.1 Cul-de-sacs

The maximum length of permanent dead-end roads shall be:

Type of Development / Road	**Maximum Centreline Length**
Residential	150 m
Industrial, Commercial	110 m
Institutional	110 m
Rural	400 m
*P-loop**	550m

* the entrance leg of a *P-loop* shall not exceed 120 m between the centre line of the intersection street and the centreline of the internal intersection.

Measurement shall be from the centre line of the intersection street with more than one outlet to the beginning of the turn-around or bulb.

The maximum length of a residential *cul-de-sac* may be extended to 230 m provided an emergency access is dedicated and constructed.

Topographic or traffic generation considerations may warrant variations to the maximum length at the discretion of the *Approving Officer*.

R5.2 Future Through Road/Temporary Dead-End

The maximum length of dead-end road that will be extended in the future is 400 m, otherwise alternate access is required.

Temporary dead-end roads longer than 50 m may use hammerhead type turnarounds, or a temporary *cul-de-sac*.

Temporary dead-end turn-arounds shall be within a statutory *right-of-way*.

R6 EMERGENCY ACCESSES

In consultation with the Fire Department, the *Approving Officer* may require the construction of emergency access in urban developments. Any emergency access must be able to support a wheel axle bearing load of nine decimal one (9.1) tonnes.

The travel surface shall be concrete and shall have chainlink fencing on both sides and have swing type bicycle baffles at each end. Variations of the details of the Standard Drawings may be considered by the *Approving Officer*.

Rural emergency accesses or temporary emergency accesses in urban *developments* will require a special design. The travel surface may be of asphalt and fencing may not be a requirement. However, removable vehicular restriction devices must be designed for each end, as required.

Where there is a reasonable expectation that a rural *development* will be urbanized in the near future, an urban standard emergency access will be required.

R7 STRUCTURAL CONSIDERATIONS

R7.1 Cuts and Fills

Cut and fill slopes shall be 2% within 2 m of the proposed curbs.

At the discretion of the *Approving Officer*, cut and fill slopes greater than 2%, to a maximum slope of 2H:1V within the road dedication, may begin at 2 m from back of proposed curbs and project to meet existing slopes. Cut and fill slopes beyond the *highway* dedication limits to a maximum slope of

1.5H:1V may be constructed provided slope erosion or stability are not of concern.

The use of retaining walls to contain *road* cuts and fills is permitted subject to:

(1) the approval of the *Approving Officer*;
(2) the wall being constructed completely on private property; and
(3) geotechnical reports being submitted detailing type of construction, base, backfill, and drainage;
(4) submission of structural drawings of the retaining wall signed and sealed by a Professional *Engineer* for walls over 1.2 m in height.

Encroachment of cuts and fills over existing lots shall be within registered *rights-of-way*.

R7.2 Road Base and Pavement Design

The basic *road* pavement structural design shall be adequate for an expected *road* life of 20 years under the expected traffic conditions for the class of *road*. This shall be determined by the results of soils tests and analysis of the results of Benkelman Beam testing performed on the surface of the road base gravel by a registered Professional *Engineer*.

The *Approving Officer* may require the submission of a geotechnical report to confirm the structural adequacy of any existing or proposed street.

(1) Existing *Road* Upgrading – *road* reconstruction and asphalt overlay design shall be based upon a visual inspection of the pavement, and the performance and analysis of the results of Benkleman Beam tests. If, in the opinion of the Geotechnical *Engineer* or the *Approving Officer*, there is indication of subbase or subgrade weakness test holes shall be excavated or the boring of the road structure shall be performed as required to provide sufficient information for ultimate pavement structure design. An alternate method may be used subject to the approval of the *Approving Officer*.

(2) New *Road* Construction - the design of new *roads* shall be based on an analysis of test holes dug on the proposed *road* site at

representative intervals. An alternate method may be used subject to approval by the *Approving Officer*.

Test holes and samples shall be undertaken by a qualified soils testing company. All reports shall be signed and sealed by a qualified geotechnical *engineer*.

The Benkelman Beam design method shall use the maximum seasonally adjusted design defections (mean plus two standard deviations) per the following:

	Road Base	**Asphalt**
Arterial Roads	1.5 mm	1.0 mm
Collector Roads	2.0 mm	1.2 mm
Local Roads	2.6 mm	1.5 mm

Pavement structure design is to be carried out by a qualified geotechnical engineer. Regardless of the method used for design, the pavement structures shall be at least equal to, or greater than, the minimum pavement structures noted in the applicable standard drawing.

R7.3 Paving Materials

The standard paving material in the *Municipality* is hot-mixed, machine laid, asphaltic concrete, and shall conform to appropriate standards and specifications of the *Municipality*.

Gravel, surface-treated, or flush-coated *roads* are not acceptable for new *highway* construction.

R7.4 Paving Procedure

The paving of all streets shall be done in two lifts in thicknesses as designated by the applicable Standard and Specifications, and in conformance with the Construction Specifications.

The first lift shall be laid on an approved road base. The second and final lift may be laid just prior to the end of the one-year maintenance period or when 90% of house construction in the *development* is complete, at the direction of the *Approving Officer*.

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R8 CROSS-SECTIONS

R8.1 Standards

Refer to standard drawings for appropriate cross-section.

The *Approving Officer* shall determine which cross-section is appropriate for each *development*. Where the *highway* passes through more than one *zone*, the *zone* having the most impact on the roadway will dictate the appropriate standard.

Standard off-sets for utilities and other services are shown on the Standard Drawings.

When existing utilities do not conform to the standard off-sets, or will not permit the use of a standard cross-section, an alternative design is required. The *Developer's Engineer* shall confirm the alternative design with the *Approving Officer*. The *Developer* shall provide further dedication if required.

R9 DRIVEWAYS

Driveways shall conform to the Access Driveway Permit Bylaw.

Each lot created by *development* must have sufficient *road* frontage to accommodate the construction of a standard driveway access.

(1) Rural Driveways

Design of driveway culverts shall conform to Section D – Drainage. The minimum length of culvert shall be 6 meters.

(2) Urban Driveways

The minimum width for driveway let downs, where required, is 6.0 meters for residential crossings and 9.0 meters for commercial and industrial crossings.

Where a corner lot adjoins roads of different classifications, the driveway shall be constructed to access the *road* of the lower classification.

Normally only one access is permitted to each lot, however a secondary access may be approved at the discretion of the *Approving Officer*.

No driveway shall be constructed within 1.5 m of a street light or fire hydrant.

The maximum grade beginning at the property line for a single-family residential driveway onto a *local road* shall be 15%, except that the *Approving Officer* may approve driveway grades to a maximum of 20% in unusual circumstances . The maximum grade, beginning at the property line for any driveway onto *collector* and *arterial roads*, shall be 10%. All driveway accesses shall be designed to permit the appropriate vehicular access without "bottoming-out" or "hanging-up."

Driveway accesses shall be restricted to a minimum ten (10.0) meters from the nearest edge of the driveway letdown to the property line adjacent to the intersection with an *arterial road*, and no closer than six (6.0) meters from any intersection as measured from the property line. A note is to be added to the design drawings indicating the access location restriction.

R9.1 Boulevards

All *boulevards* shall be finished with a minimum of 100 mm topsoil and seeding or sod. Seed mix shall be as specified by the *Approving Officer*.

R10 SIGNS

All street signs and traffic advisory signs required for each project will be installed by the *Municipality* at expense to the *Developer*.

Street signs shall comply to the latest edition of Uniform Traffic Control Devices for Canada.

Street signs are to be shown on the Road Design Drawings.

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R11 POSTAL SERVICE

The placement and construction of pads for post boxes shall conform to the standards set out in the latest edition of Canada Post Corporation's publication entitled, "Planning for Postal Service".

The location shall be approved by the *Approving Officer*. *The Developer's Engineer* shall consult with Canada Post's local delivery planner.

R12 CURBS, *SIDEWALKS* AND *WALKWAYS*

R12.1 Curbs and Gutters

All full urban *roads* shall be complete with concrete curbs and gutters on both sides of the *road*.

All commercial and residential *roads* eleven (11.0) meters and wider shall have barrier curbs.

Residential *roads*, of less than eleven (11.0) meters in width, shall have rollover curbs, except when fronting schools, parks or multi-family developments, in which case barrier curbs are required.

Where major flood path routing (as defined in Section D - Drainage) dictates, the *engineer* may propose barrier style curbs on residential roads less than eleven (11.0) meters in width, provided that predetermined driveway accesses are incorporated into the design.

The transition between barrier and rollover curbs shall be done through a minimum distance of two (2.0) meters and preferably through wheelchair let-downs.

The support structure for the road(s) shall be constructed to zero decimal three (0.3) meters beyond the back of the curb in order to provide support for the curb.

R12.2 Wheelchair Ramps

Wheelchair ramps are required at all corners of all intersections and on the straight sides of through *roads* opposite an intersecting *road*.

R12.3 Sidewalks

Sidewalks may be required as noted in the cross-sections for the applicable *road* classifications. At the discretion of the *Approving Officer* the *Developer* may be required to provide cash-in-lieu of sidewalks to provide the *Municipality* with the funds to construct the sidewalks in the future.

A *sidewalk* is required on any urban *road* that provides a pedestrian link to a school, community centre, walkway, park, etc. These *sidewalks* will be identified in the *Preliminary Approval*.

The *Approving Officer* may require that the width of *sidewalks* along *collector*, major *collector*, or *arterial roads* be greater than one decimal five (1.5) meters, or that the *sidewalk* is separated from the curb by a *boulevard* strip.

For *cul-de-sacs*, a *sidewalk* will be required on one side of the access *road* to the bulb portion. Where a pedestrian generating access route (i.e. a *walkway* or emergency access) is proposed off the bulb portion, the *sidewalk* is to be extended around and connected to that facility.

The grade of the *sidewalk(s)* shall match the grade of the *road* where possible and in any event be consistent with the grade of the *road*.

All *sidewalks* adjacent to rollover style curbs shall be a minimum 140 mm thick with a minimum of 100 mm of crushed base gravel and 200 mm of subbase gravel. Subbase gravel shall be thicker where in the geotechnical *engineer's* opinion the minimum thickness is not adequate to support vehicular loadings. All *sidewalks* adjacent to barrier style curbs shall be a minimum 100 mm thick with a minimum of 100 mm of crushed base gravel. The *sidewalk* base and subbase gravels shall be constructed to zero decimal three (0.3) meters beyond the *sidewalk*.

R12.4 Walkways

Walkways with an overall grade of 8% or less shall have a uniform gradient. Where the gradient exceeds 12%, a stairway, in accordance with

the appropriate requirement of the National Building Code, shall be provided.

Walkways with an overall grade exceeding 8%, but less than 12%, shall use a ramp and step combination as approved by the *Approving Officer*.

Walkway lighting shall be at the discretion of the *Approving Officer*. In general, *walkways* shall have ornamental street lighting at:

(i) the entrance and exit;
(ii) all changes in direction greater than 30° along its length; and
(iii) every 50 m.

Walkways shall be appropriately signed for the disabled.

Urban *walkways* that will not be used for vehicular access shall be a minimum of 100 mm thick concrete over a minimum of 100 mm thick crushed base gravel, with chainlink fencing on both sides and bicycle baffles at both ends. Rural *walkways* may be asphalt. Fencing and bicycle baffles will be at the discretion of the *Approving Officer*.

Walkways that will provide access for vehicles shall be designed by an *Engineer*, but in no case shall the concrete and gravel thicknesses be less than those required for *sidewalks* adjacent to rollover curbs.

The *walkway* base and subbase gravels shall be constructed zero decimal three (0.3) meters beyond the *walkway*.

R12.5 Handrails

All handrails shall be constructed and installed in accordance with Standard Drawings. Handrails shall be required for *walkways* and/or *sidewalks* where grades are determined to warrant such installations or where steps are provided due to grades in excess of twelve percent (12.0%).

Handrails will be required along the top of major storm sewer inlets and outfalls where the height exceeds 1.2 m, along *walkways* and/or *sidewalks* where steep or excessive side-slopes may be encountered, or in any location as deemed necessary by the *Approving Officer* where, in his opinion, the safety of pedestrian traffic or the protection of the public so requires.

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R13 CYCLE PATHS

R13.1 Cycle Paths

At the discretion of the *Approving Officer*, the *Owner* may be required by the *Municipality* as a condition of *Subdivision* or *Development* to construct cycle paths at locations and to standards determined by the *Municipal* Planning Department.