



SECTION

“G”

TRANSPORTATION



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G1. GENERAL

This section is intended to provide design and construction information for roadways constructed as part of an urban or rural subdivision development, or the access road connecting such a development to the County road system.

Unless approved otherwise by the Director access to the County road system for a subdivision is to be channeled to a single location. For subdivisions consisting of two (2) lots one common approach is to be used, with three (3) or more lots a connecting service road is to be constructed, with five (5) or more lots the service road is to be paved.

Road classification and designation will be in accordance with the classification system outlined in the Transportation Association of Canada (TAC) Manual – Geometric Design Standards for Canadian Roads and Streets and the Urban Supplement to the Geometric Design Guide for Canadian Roads, and/or Alberta Transportation Highway Geometric Design Guide (HGDG).

Designations of a development as “rural” or “urban”, and individual street classification within the development, are to be based on functional use established by the Engineering Services Department.

The guidelines provided herein represent the minimum requirement under general conditions. The Developer and the Developer’s Consultant are responsible to ensure that the roadway infrastructure is designed and constructed to achieve design life expectations consistent with good design and construction practice. The Developer, through their Consultant, is responsible to confirm whether minimum standards are appropriate for the specific proposed development. For issues not referenced herein, the current TAC, Alberta Environment (AEP) or Alberta Transportation (AT) standards will be used.

G2. DESIGN

G2.1 Survey Control

Developers are responsible for full restoration to Alberta Environment standards of all survey control markers and legal pins removed or disturbed during construction.

G2.2 Traffic Analysis/Traffic Impact Assessments:

The Developer is responsible to carry out a traffic impact assessment when required by the County.

This traffic assessment must include, but is not limited to the following:

1. Volume of daily traffic generated by the development at full development. If the planned development is staged, then the assessment will also include daily traffic volumes at the end of each consecutive development stage.
2. Layout of the internal road system of the proposed development with the accesses clearly marked.
3. Location of the proposed access points.
4. Sight distance assessments at the proposed access points.



5. Full review of the proposed access points using Alberta Transportation Design Guidelines, establishing whether or not intersectional improvements are required.
6. Traffic signal warrant and pedestrian accommodation at major intersections for urban developments.

G2.3 Street Classification:

1. The County is the final arbiter of whether a development is rural or urban, the street classification, and of the requirement for on-street parking.
2. The design standards for a rural road configuration are listed on drawing G-117 in the Appendix.
3. For urban applications the City of Lethbridge design standards are to be incorporated.

G2.4 Vertical Alignment:

1. The minimum grade will be 0.5% along all gutters, 0.7% around curb returns and 0.8% on lanes.
2. A maximum gradient of 4% for a distance of 30 m from the curb return for all roadways connecting to any intersection.

G2.5 Vertical Curves:

1. Vertical curves will be calculated according to TAC Geometric Design Guide.
2. The minimum length of a vertical curve will be 30 m on local roads, and greater than or equal to the design speed in km/h on collector and arterial roads.

G2.6 Horizontal Alignment:

1. The minimum degree of curvature of the centerline of the carriage way is dependent on the road classification and its design speed.
2. All horizontal curves will be designed to meet TAC design guides.

G2.7 Gravel Standard Road Specifications:

Gravel roads require the specific approval of the County. Roads are to be built by a qualified road construction company to the following specifications:

1. Sub-Grade – 1 m of acceptable material (clay/sand) with no organic material i.e. black dirt.
2. Crown – 3.0% +/-0.5%

G2.8 Approaches:

An Access Management Plan is to be developed for each subdivision application.



All rural residential subdivision lots and private properties, accessed by local and collector roadways, will require one approach constructed to the property from the accessing roadway according to the requirements and specifications.

Residential approaches will have a width at property line of 6m and minimum radii of 5m. Industrial approaches will be constructed to the same requirements and specifications as private approaches, with the exception that the width of the approach may be increased to accommodate the type of development.

Road approaches will be located and designed to access the parcel's most desirable building location. These specifications are the minimum standards to be followed. For rural developments, approach locations along through roads will meet minimum site distance requirements as outlined in TAC & HGDG.

The following minimum culvert sizes and minimum specifications for approaches will be used:

Residential Approach Culvert	400 mm diameter
Roadway Cross Culvert	500 mm diameter
Industrial Approach Culvert	600 mm diameter

Culverts will be corrugated steel or concrete reinforced Class III. Depth of cover will meet manufacturer's requirements, with a minimum of 300 mm. Rock rip-rap or sacked concrete rip-rap to be provided at the inlet and outlet of all approach and road culverts.

The Developer will also confirm that culvert sizing is consistent with the stormwater management plan for the development, increasing the size as necessary to meet flow requirements.

1. Industrial Lot Entrances geometric requirements will be followed for:
 1. Light Industry:
 - i. minimum turning radius 12 – 15 m
 - ii. minimum road surface width 11.5 m
 2. Heavy Industry
 - i. minimum turning radius 15 m
 - ii. minimum road surface width 15 m

G3. CONSTRUCTION

G3.1 Clearing and Grubbing

All work will be done within the limits of rights-of-way, permanent and working easements, and will include the complete disposal of all buildings, fences, vegetation and other debris. All work will be in accordance with existing Provincial and County fire and public safety regulations and laws and be done in accordance with the "approved" drawings and specifications.



G3.2 Earthwork

G3.2.1 Topsoil Stripping and Stockpiling:

Topsoil will be stripped to its full depth on all road rights-of-way and excavation areas, and stockpiled for use in final grading and/or landscaping purposes.

G3.2.2 Common Excavation:

All excavations will be done within the limits of the proposed work, to the lines, grades and dimensions as shown on the contract drawings, noted in the contract documents or specifically approved otherwise. Surplus or unsuitable material will be disposed of as determined by the Engineer and approved by the County. Subsoil stripped is to be stockpiled in a topsoil-free area to eliminate the potential for contamination.

G3.2.3 Embankment Construction:

Material will be placed in maximum 300 mm (loose) successive uniform layers, each compacted to a minimum of 98% Standard Proctor Density within 2%+/- of the optimum moisture content, unless stated otherwise. Only "approved" native or imported material will be used.

G3.2.4 Equipment:

All proposed routes for hauling equipment must be approved by the County prior to commencement of the work. Rubber-tired motor scrapers will not be used to haul over improved streets.

G3.2.5 Borrow:

Where sufficient quantity of suitable fill material is not available from excavation on the site, additional fill may be borrowed from other sources. The Developer will be responsible for securing borrow sites, and all associated environmental approvals.

G3.2.6 Reclamation:

All borrow sites will be reclaimed to the satisfaction of the County meeting all the specifications required.

G3.3 Subgrade Construction

G3.3.1 Excavated Areas:

The areas excavated to subgrade elevations will be scarified to a minimum depth of 300 mm below the surface and compacted to a minimum of 100% of Standard Proctor Density at +/- 1% of optimum moisture content. The cut will conform to the lines, grades and dimensions required.

G3.3.2 Embankment Areas:

That portion of any fill more than 300 mm below the top of subgrade will be placed in successive horizontal layers not exceeding 300 mm loose depth and compacted to a minimum density of 98% of Standard Proctor within +/- 3% of optimum moisture content. The top 300 mm will be placed in two 150



mm compacted lifts and compacted to a minimum density of 100% of Standard Proctor within +1% to -2% of optimum moisture content.

G3.3.3 Drainage Working Areas:

All work will be carried out by the developer so that excavated areas will drain to catch basins, manholes, or to a natural drainage course during construction.

G3.4 Granular Base Course

G3.4.1 Materials:

Granular materials are to conform to section 3.6 (Granular Base Course) of Alberta Transportation Standard Specifications for Highway Construction.

G3.5 Construction – General:

1. Surface Preparation - The subgrade will be finished to conform to the required section, grade and density prior to the placement of base course material.
2. Placement - The material will be placed on the subgrade or preceding course in a uniform manner to ensure the ultimate planned compacted thickness. Crushed gravel will be mixed and placed in horizontal layers of not more than 150 mm compacted thickness.
3. Water - If the material requires water to attain the specified density, water will be added and the material bladed continually until a uniform mixture is obtained. If the gravel contains an excessive amount of moisture, it is to be scarified and aerated.
4. Compaction - Compaction will be reached by the use of pneumatic tire rollers, vibrating drum packers or other approved types of compaction equipment.
5. Testing and Inspection
 - i) Densities - Field density tests will be carried out for each 2,000 square meters (per layer) of granular base course with a minimum of one test per day of placing operations.
 - ii) Grade - The surface will be such that when tested with a straight edge, the maximum deviation of the surface from the edge of the straight edge will nowhere exceed 13 mm.
 - iii) Appearance - No segregation of rock or fines material will exist in the completed base. The gravel base will be free of all loose or deleterious material.
 - iv) Thickness - Areas suspected of being deficient or excessive in thickness will be cored at the rate of three (3) cores per 1000 square meters.

G3.6 Asphaltic Concrete Pavement

G3.6.1 Pavement Design:

All design parameters, including, but not limited to, traffic count, percentage of types of vehicles, California Bearing Ratio (CBR) are to be provided to the County by the Developer's Consultant.



The pavement structure will be designed to carry the anticipated loadings and traffic capacity for a 20 year life.

Asphalt concrete mix designs will be Marshall mix designs and prepared by a recognized testing laboratory. Mix designs will be forwarded to the County for approval.

No paving will be allowed until the subgrade and base course has been tested, inspected and approved by the County.

Asphalt materials, mixing, spreading and rolling will conform to good construction practice.

Staged construction for any asphalt work is an acceptable method of construction, with the final lift of asphalt placed during the construction season prior to FAC.

Type I Surface Course will be used for all overlays, bottom and top lift, for local, collector and arterial streets. Type II Base Course may be used for bottom lift for local, collector and arterial streets. Type III Base Course may be used for bottom lift of arterial streets.

G3.6.2 Materials:

Asphaltic concrete pavements (surface and base courses) will consist of mineral aggregate, filler and asphaltic binder, and will be laid and compacted to the specified thickness, conforming to the approved lines, grades and typical cross-sections.

1. Mineral Aggregates - When tested by means of laboratory sieve, the combined aggregates in the mix will meet the following gradation:

Sieve Size Passing	Cumulative % by Weight		
	Type I Surface Course	Type II Base Course	Type III Base Course
25,000	-	-	100
20,000 (1")	-	-	85-95
16,000 (3/4")	-	100	77-85
12,500 (1/2")	100	80 - 92	67-80
10,000 (3/8")	83 - 92	70 - 84	59-73
5,000 (No. 4)	55 - 70	50 - 65	40-58
1,250 (No.10)	26 - 45	26 - 45	22-38
630 (No.40)	18 - 38	18 - 38	15-31
315 (No.100)	12 - 30	12 - 30	10-25
160 (No.200)	8 - 20	8 - 20	6-16
80	4 - 10	4 - 10	4-20

A minimum of 70% of the surface course and 60% of the base course material on the 5,000 (No. 4) sieve will have at least two (2) crushed faces.



2. Asphalt will be uniform in character, will not foam when heated to 177° C and will meet the following requirements:

ASTM	Designation	AC - 150/200(A)
D2170	Penetration at 24° C, 100 gm, 5 sec.	150.0
D5	Ductility at 24° C (cm)	100.0
D113	Solubility in carbon tetrachloride (%)	99.5
D2042	Flash Point, Cleveland Open Cup,	205.0
D2171	Thin Film Oven Test Penetration after Test at 24° C, 100 gm, 5 sec. - (% of original)	4.0
	Ductility at 15.6°C, cm. Min	

3. Mineral Filler - If the grading of the mineral aggregates supplied to the plant not meet the required gradation, mineral filler will be added in such quantities as will be required to meet the specifications.

Mineral filler will consist of Portland Cement, Pozzolan, commercially ground stone dust or other mineral dust approved by the County. Mineral filler will have a "Zero" Plasticity Index and will conform to the following gradation requirements:

Sieve Size Passing	Cumulative % by Weight
400 (No. 4)	100
160 (No. 100)	90
63 (No. 200)	70
45 (No. 250)	62

G3.6.3 Composition and Proportioning:

1. Mix Design - A mix design will be based on the Marshall Method and will conform to the following criteria, depending on traffic loading and mix type:

	<u>Type I</u>	<u>Type II</u>	<u>Type III</u>
Marshall Stability (min)	10,000	8500	6700
Flow Value	2 – 3.5	2 – 3.5	2 – 3.5
% Air Voids	3 – 5	3 – 5	3 – 5
% Voids in the Mineral Aggregate	13-15	12.5-14.5	11-13
Asphalt Cement Grade	150/200A	150/200A	150/200A
Voids Filled with Asphalt (%)	65 – 75	65 – 75	65 – 75
Retained Stability % (min)	70	70	70
Theoretical Film Thickness (min)	6.5-6.0	-	-

The mix design will be performed by an accredited testing agency and will be submitted to the County for approval at least one (1) week prior to the commencement of field paving.

A separate and complete mix design will be required for any change in the nature of the source of the material.

2. Tolerances



- i) The amount of bituminous material designated for the job will be within 0.3 percentage points.
- ii) The temperature of asphaltic mixtures will not vary from those specified by more than 9°C.
- iii) Hot plant-mix bituminous surfaces will be placed with sufficient time remaining so that compaction will be completed during daylight hours, when the air temperature is above 2°C and rising, and the road surface is dry.
- iv) Thickness - A minimum compacted thickness of 50 mm of hot mix asphalt concrete will be placed on all streets unless specified otherwise.

Asphalt pavement with excess thickness may be accepted if surface, grade tolerances and textures are met. No additional payment will be made.

In areas suspect to be deficient in asphalt pavement thickness, two cores must be taken from each 1000 m² of applicable mat and the average thickness of the two cores will represent that area.

- v) The complete pavement will have a tightly knit structure and be free from segregation and surface cracking.

G3.6.4 Construction Methods:

- 1. Weather Limitations - Mixture will not be placed:
 - i) When air temperature is 2°C or cooler, except in specific situations where, in the opinion of the County, conditions warrant the risk involved.

- 2. Base Preparation - The prepared base will be dry and clean of all loose or foreign materials.

Where tack coat or primecoat is applied, it will be thoroughly cured prior to placing the mixture.

Where existing pavements are to be overlaid, a leveling course of hot mix asphaltic concrete will be required prior to placing the surface course.

- 3. Transportation of Mixture - The mixture will be transported in vehicles equipped with protective covers and clean, tight, smooth-sided boxes. The inside surface of the box may be lubricated with a light coating of soap or detergent solution; petroleum derivatives will not be permitted.

Any accumulation of asphaltic material which has collected in the box will be thoroughly cleaned before loading with hot mix.

Trucks will be maintained perfectly clean of mud or any substance which could contaminate the working area.



G3.6.5 Testing and Inspection:

The following tests will be carried out for **each 1000 tonnes of asphalt pavement**, to a minimum of two sets of tests during each placing shift:

1. Sieve Analysis (ASTM C136 & C117)
2. Bulk Specific Gravity (ASTM D2726)
3. Bitumen Content (ASTM D2172)
4. % Voids in the Mineral Aggregate (VMA) (ASTM D2726)
5. Air Voids (ASTM D3203)
6. Core Densities (1 per 1000 m²)

G4. PRIME COATS AND TACK COATS

"**Prime coats**" will be the application of bituminous material to subgrade or previously prepared gravel base course, prior to placing bituminous surfacing material.

"**Tack Coats**" will be the application of bituminous material to a previously constructed paving surface, of any type, in preparation for placing bituminous surfacing materials, and against curb gutter faces, manholes, valves and other appurtenances in the area to be paved.

G4.1 Prime Coat:

The asphalt types may vary from M.C. 30, from SS-1 to SS-2 or an emulsified asphalt primer, to suit the conditions of the base. The rate of application may vary from 1.01 to 1.50 liters/square metre. The material temperature at application will fall within the following limits:

Medium Curing Asphalt:

M.C. 30 - (50 - 70°C)

Emulsified Asphalt:

S.S. 1 - (24 - 54°C)

S.S. 2 - (24 - 54°C)

Emulsified Asphalt Primer - (15 - 50°C)

The Contractor will choose between SEP.1, SEP.2, or SS1 for application through August 31st each season, and will choose between MC-30, SEP-1, SEP-2 or SS1 after August 31st each season.

G4.2 Tack Coat (Over Asphalt Base):

The asphalt for the tack coat may vary from SS-1, from R.C. 30 to R.C. 70, depending on conditions to suit the base. The rate of application will be 0.25 to 0.90 liter/square metre. Temperatures of application will fall within the following limits:

Rapid Curing Asphalt's:

SS-1 - (24 - 54 °C)

R.C. 30 - (50 - 70°C) (after August 31st)

R.C. 70 - (75 - 98°C) (after August 31st)

R.C. 250 - (100 - 110°C)



G5. SEAL COATS AND FOG COATS

"Seal coats" will consist of a surface treatment composed of a single application of bituminous material on an existing bituminous surface immediately followed by covering with aggregate.

When a seal coat is applied without cover then it will be referred to as a "Fog Coat", a light application of slow-setting asphalt emulsion diluted with water. The emulsion will be diluted with an equal amount of water and sprayed at the rate of 0.45 to 0.70 liter/square metre in order to renew old asphalt surfaces.

G5.1 Application:

Seal coats will be applied during daylight hours when the shade temperature is 10°C or higher. No bituminous material will be applied when the roadway surface is damp or wet, or when weather conditions are such that the bitumen will become chilled before the cover aggregate can be spread and rolled. Work will not be started without consent of the County and will be promptly terminated in the event of unfavorable road or weather conditions.

1. Sweeping - All dust, dirt and foreign matter will be carefully swept from the surface of the pavement, for the full width to be seal-coated, immediately prior to the application of the binder.
2. Asphaltic Binder - The selected bituminous material will be uniformly applied on the properly prepared surfaces at a rate specified by the County and within the following ranges:
 - i) Fog Coat - 0.23 to 0.70 liters/square meter, with a distributor having special fog nozzles for the purpose of applying a light spray.
 - ii) Sand Seal - .50 to 1.4 liters/square meter.
 - iii) Chip Seal - .90 to 1.8 liters/square meter.
 - iv) Graded aggregate seal - 1.2 to 2.5 kg/m²

G5.2 Materials:

1. Bituminous Material:

The liquid asphalt used for seal coating will be rapid curing or emulsified asphalt; the actual grade and type will be determined to suit the surface condition and will be approved by the County.

Temperatures of applications will fall within the following ranges:

Rapid Curing Asphalt's:

R.C. 30 - (50 - 70°C)
R.C. 70 - (75 - 90°C)
R.C. 250 - (100 - 110°C)

Emulsified Asphalt:

CRS-2
R.S. 1k - (15 - 50°C)
R.S. 2k - (15 - 50°C)
H.F - 150S
HF-250S

2. Mineral Aggregate



- i) Chip Seal - Chip seal aggregate will be free from soft shale, organic or other deleterious matter and a minimum of 75% fracture on 2 sides and 100% fracture on one face +5000 material.
- ii) When tested by means of laboratory sieves, it will meet the following gradation:

Sieve Size Passing	Cumulative % by Weight
12500	100
10000	85-100
5000	0-10
80	0-0.3

- iii) The maximum amount of moisture content in the chips will be 1% for an R.C.asphalt and 3% for an R.S. asphalt.
- iv) Sand Seal - When tested by means of laboratory sieves, it will meet the following gradation:

Sieve Size Passing	Cumulative % by Weight
5,000	100
315	0-15
80	Less than 2

- v) The maximum amount of moisture content in the sand will be 2% for an R.C. asphalt and 5% for an R.S. asphalt.
- vi) Graded Aggregate Seal Coat - when tested by means of laboratory sieves, it will meet the following grade:

Sieve Size Passing	Cumulative % by Weight
12,500 mm	100
10,000 mm	70 - 93
5,000 mm	30 - 60
1,250 mm	9 - 28
315 mm	0 - 15
160 mm	0 - 11
80 mm	0 - 8

and a minimum of 60% fracture on 2 sides for material retained on the 5000 sieves.

- vii) Application of Mineral Aggregates - The application of bituminous material will not proceed until a supply of aggregate is immediately available sufficient to allow covering of the entire bitumen area in less than five (5) minutes. The bitumen area will be promptly covered with specified mineral aggregate at a rate of 5.5 to 11.0 kg/m² for sand, from 8.0 to 16.0 kg/m² for chips, and from 20 kg/m² to 30 kg/m² for graded aggregate.

Special care must be taken in the spreading of mineral aggregates in order that the uniformity of cover will be secured. If, in the opinion of the Engineer, uniform distribution of the aggregate is not being obtained, the



cover aggregate will be alternately drag broomed and rolled until it is uniformly bonded over the full width of the application.

Longitudinal laps may be from 150 to 250 mm in width, but there will be no overlap at the end junction of the applications. In order to prevent lapping at transverse junctions, building paper or metal sheets will be spread over the treated surface for sufficient distance back from the joint, on cover aggregate, so that sprayers are operating at full force upon reaching the surface to which application is to be made. The bitumen application will be stopped or shut-off on paper or metal sheets. Any paper used for covering joints will be removed and destroyed.

- viii) Rolling - Immediately after the mineral aggregate has been applied, the road surface will be rolled sufficiently so that the maximum amount of cover aggregate will be "keyed".

Rollers of a weight that crushes the mineral aggregate will not be used. The Developer may use steel wheel, pneumatic-tired or vibratory rollers. The minimum number of five (5) complete coverings by the rollers will be carried out within thirty (30) minutes of the application of the bituminous material. The speed of the rollers will be such that the suction of the tire will not lift the aggregate from the sealed surface, or eight (8) kilometers/hour, whichever is less.

- ix) Traffic - No traffic will be permitted on the sealed roadway until after the rolling has been completed and the bituminous material has set to a degree satisfactory to the County. In no case will traffic be permitted on the sealed roadway until at least twenty-four (24) hours after the application of the bituminous material.

G6. RE-CYCLED ASPHALT

G6.1 Surface Recycling:

Surface recycling is a rehabilitation process in which an asphalt pavement surface is heated in place, scarified, re-mixed, re-laid and rolled.

The Developer will submit a design for review and approval.

G6.2 Cold Mix Re-cycling:

Cold-Mix recycling is a process in which reclaimed asphalt pavement materials and/or reclaimed aggregate materials are combined with new asphalt and/or recycling agents to produce a cold-mix base mixture.

The Developer will submit a design for review and approval.

G6.3 Hot Mix Recycling:

Reclaimed asphalt pavement materials and/or aggregate materials are combined with new asphalt and/or recycling agents, and/or new aggregate as necessary, to produce a hot-mix paving mixture.

The Developer will submit a design for review and approval.



G6.4 Asphaltic Dust Abatement:

Asphaltic dust abatement consist of mixture of crushed aggregate and liquid emulsified asphalt that is road mixed, spread and placed upon the previously prepared surface, compacted and finished as specified herein.

1. Materials:

- i) Aggregate - crushed aggregate will be applied in accordance with the following:
 - granular materials will consist of crushed gravel, meeting the accompanying specifications:
 - a) All materials supplied will comply fully with these specifications - the Developer will submit for approval by the Director the source of all aggregates and a representative sieve analysis test result for each type of aggregate to be incorporated into the work.
 - b) Gradation requirements - the crushed aggregate will be composed of sound, hard and durable particles of sand, gravel and rock, and will be free from elongated particles, injurious quantities of flaky particles, soft shales, organic matter, clay lumps and other foreign matter.
 - c) When tested by means of Standard Laboratory screens, the aggregate of the type provided for and as shown on the plans will respectively meet the specified gradation requirements as shown below:

Sieve Size (µm)	% Passing
20,000	100
10,000	35-77
5,000	15-55
1,250	0-30
80	0-12

- d) A tolerance of three percent in the amount passing the maximum size screen will be permitted, providing 100% of all oversize material passes a screen having openings no greater than 5 mm larger than the specified maximum size, and will have a minimum two face fracture of 40% for material greater than 5000 µm.
- e) The crushed gravel, as produced or processed, will be tested in accordance with the latest editions of the following standard methods: Sampling Stone, Slag, Gravel Sand and Stone Block for use as Highway Materials AASHTO T2. Sieve Analysis of Fine and Coarse Aggregates (1) AASHTO T27, any amount of material finer than 0.075 mm sieve in Aggregate (1) AASHTO T11. Determining the liquid limit in soils AASHTO T89. Determining the plastic limit and plasticity index of soils (1) AASHTO T90. Method of determining percentage of fractured particles in coarse aggregate ASTM D5821. Classification of soils for engineering purposes (for definition of coefficient of uniformity, cu) ASTM D2487.



- f) In all test methods used as reference in this specification, metric sieves as specified in Canadian Government Specification Board specification 9-GP-2M will be substituted for any other specified wire cloth sieves in accordance with the following table:

California Transportation

Test Method No. Calif.205

Sieves in accordance Metric Sieves in AASHTO Designation:

M92 & accordance with: ASTM Designation: E11 CGSB

Spec. 8-GP-2M (US Standard Series)

Opening and Designation

125 mm	5"	125,000
75 mm	3"	80,000
63 mm	2 ½"	63,000
50 mm	2"	50,000
37.5 mm	1 ½"	40,000
25.0 mm	1"	25,000
19.0 mm	¾"	20,000
16.0 mm	5/8"	16,000
12.5 mm	½"	12,500
9.5 mm	3/8"	10,000
4.75 mm	#4	5,000
2.36 mm	#8	2,500
2.37 mm	#10	2,000
1.70 mm	#12	1,600
1.71 mm	#16	1,250
0.850 mm	#20	800
0.600 mm	#30	630
0.425 mm	#40	400
0.300 mm	#50	315
0.150 mm	#100	160
0.075 mm	#200	80
0.045 mm	#325	45

2. Crush - aggregate will conform to Aggregate of the above specifications.



G7. ROAD GRAVELLING

Upon the County approval of the roadway construction, the Developer will supply and place the first lift of gravel in accordance with the specified gradation and rate of application. No gravelling will be permitted on the finished subgrade until the subgrade has been tested, inspected and approved.

The stockpile source of gravel will be approved by the County. The size and gradation will conform to the recommended standards outline below:

Sieve Size (um)	% Passing
20,000	100
10,000	35-77
5,000	15-55
1,250	0-30
80	0-12

Material must have a minimum of 40% two face fracture

G7.1 Surfacing Gravel:

Surfacing gravel will be applied to the completed road bed surface at the rates as outlined below. These application rates may be increased or otherwise varied by the Engineer as required to suit the roadbed conditions.

The following chart has been developed to assist in the design of first course gravel surfacing quantities:

SUBGRADE WIDTH (m)	SPREAD RATE (m ³ /km)
7.0	350
8.0	400
9.0	450
10.0	500
11.0	550
12.0	600
13.0	650
14.0	700
15.0	750
16.0	800
17.0	850
18.0	900

The spread rates provided apply to general application only for gravel roadways. The condition of the subgrade may affect the actual gravel requirements. Gravel requirements beneath asphalt pavement will vary with the design of the structure.

All entrances to lots will be graveled at a rate of 8 cubic metres per entrance, as measured from the shoulder of the road to the lot property line.



G8. CONCRETE AND REINFORCED CONCRETE

G8.1 Description:

This specification covers the manufacture and placing of concrete, reinforced concrete and related work for the construction of curbs, gutters, sidewalks, catch basins, duct lines, sewers and other ancillary structures associated with roadway construction; but not including bridges.

G8.2 Materials:

1. Portland Cement:

Portland Cement will conform to the CSA Standard Specifications for Portland Cement (CSA A23.1), and will be of the following types:

- i) Normal Type G0
- ii) High Early Strength Type HE
- iii) Sulfate Resistant Type MS, HS
- iv) Heat of Hydration Type MH, LH

2. Concrete Aggregates:

Concrete aggregates will conform to the CSA Standard Specifications for Concrete Aggregates (A 23.1).

3. Air Entraining Agent:

Air entraining agents will conform to ASTM Standard Specification C260.

4. Calcium Chloride:

Calcium Chloride will conform to ASTM Standard Specification D098.

5. Water:

Water used in mixing concrete will be clean and free from injurious amounts of oils, acids, alkalis, organic materials or other deleterious substances.

6. Metal Reinforcement:

Reinforcing bars will be deformed bars in accordance with CSA Standard Specification G30.12.

7. Cold Drawn Wire:

Cold drawn wire or welded wire fabric for concrete reinforcement will conform to the requirements CSA Standard Specification G30.5.

8. Curing Compound:

Resin base impervious curing compound will conform to ASTM Standard Specification compound will conform to ASTM Standard Specification C309 Type ID - Type B. The curing compound will contain white fugitive dye.

9. Sealing Solution:



Sealing compound will be mixture of fifty percent (50%) Kerosene or Varsol and fifty percent (50%) boiled Linseed Oil or approved alternate.

10. Retarding Admixtures:

Retarding admixtures will conform to ASTM Standard Specification C494.

G8.3 Composition and Proportioning:

The design of the structure is based upon the assumption that concrete will develop the specified compressive or flexural strength at twenty-eight (28) days and a seven (7) day test resulting in approximately seventy percent (70%) of the 28-day strength.

1. Storage:

Cement and aggregate will be stored in such a manner as to prevent deterioration or intrusion of foreign matter; any material that has deteriorated or that has been damaged will not be used for concrete.

2. Batching Materials:

- i) Cement - Cement will be measured by weight and will be weighed on a scale separate from those used for other materials.
- ii) Aggregate - Aggregate will be measured by weight. Batch weights will be based upon dry materials and will be required weights of dry material plus the total weight of moisture (both absorbed and surface) contained in the aggregate.
- iii) Water - Water will be measured by volume or by weight. The device for the measurement of the water will be readily adjustable and, under all operation conditions, will have an accuracy within one percent (1%) of the quantity of water required for the batch. The device will be so arranged that the measurement will not be affected by variable pressures in the water supply line. Measuring tanks will be equipped with outside taps and valves to provide for checking their calibration, unless other means are provided for readily determining the amount of water in the tank.
- iv) Admixtures - Powdered admixtures will be measured by weight and paste, or liquid admixtures by weight or volume, within a limit of accuracy of three percent (3%) of the required weight. All air entraining agents, or other admixtures, will be introduced to the mix at the batching plant during the initial batching cycle. No admixtures will be added at the job site.



G8.4 Concrete Classes:

Unless otherwise specified, all concrete used in roadway construction will be one of the following classes:

Class	Min. 28 Day Compressive Strength (MPa)	Slump (mm)	Entrained Air Limites (%)	Max. Agg. Size (mm)
A- Exposed pavement	30	60+/-10	5.5-8	28
B- Pavement base or unexposed use	30	60+/-20	5.5-8	28
C- Exposed road associated works	30	60+/-20	5.5 Up	28
D- General Unexposed use	25	60+/-20	5.5-8	28
E- Filler	10	80+/-20	5.5-7	28

No subscript will be used when Normal Portland Cement is required.

A subscript **30** attached to any of the above classes will indicate that High Early Cement is specified.

A subscript **50** attached to any of the above classes will indicate that Sulfate Resistant cement is specified.

Any concrete placed after September 30 will not be accepted unless its specified 28-day minimum compressive strength is attained in 7 days.

G8.5 Equipment:

All equipment used for batching, mixing and hauling concrete will conform to ASTM Standard Specification C 94.

1. Hauling:
 - i) Delivery Time - When hauling equipment is used, concrete will be delivered to the site and discharged into the work within one and one-half (1 1/2) hours after introduction of the mixing water to the cement and aggregate.
 - ii) Rotating Drum Type Haulers - All concrete will be hauled using drum-type haulers capable of agitating or mixing the concrete within speed tolerances as specified by the equipment manufacturer. Haulers will not be overloaded.

G8.6 Forms:

Forms, either of steel or wood, will conform to the shape, lines and dimensions of the concrete as called for on the Plans. Lumber used in forms for exposed surfaces will be dressed to a uniform thickness and will be free from loose knots or other defects. Joints in forms will be horizontal or vertical. For unexposed surfaces and rough work, undressed lumber will be used. Lumber once used in forms will have nails withdrawn and surfaces in contact with the concrete are to be thoroughly cleaned before being used again.

1. Design:

Forms will be substantial and sufficiently tight to prevent leakage. They will be properly braced or tied together so as to maintain position and shape. If



adequate foundation for shores cannot be secured, trussed supports will be provided.

2. Workmanship:

Bolts and rods will be used for internal ties. They will be so arranged that when the forms are removed, no metal will be within 25 mm of any surface. Wire ties will be permitted only on light work. They will not be used through surfaces where discoloration would be objectionable. Forms will be set to line and grade, and so constructed and fastened as to produce true lines. Special care will be used to prevent bulging.

3. Oiling:

The inside of forms will be coated with non-sustaining mineral oil or other approved material, or thoroughly wetted (except in freezing weather). Where oil is used, it will be applied before the reinforcement is placed.

4. Removal:

Forms will not be disturbed until the concrete has adequately hardened. Shoring will not be removed until the member has acquired sufficient strength to safely support its weight and the load upon it.

5. Concrete Backfill

In the case of sidewalks, monolithic curbs, gutters and walks, the Contractor will backfill with 15 Mpa concrete between pavement and walk edges as soon as possible after the removal of forms. The backfill will be left 60 mm low to allow for bituminous asphaltic infill, as approved by the County.

G8.7 Placing Concrete:

1. Handling:

Concrete will be handled from the mixer to the place of final deposit as rapidly as practicable, by methods that will prevent the separation or loss of the ingredients. It will be deposited in the forms as nearly as practicable in its final position to avoid rehandling.

The sequence of concrete placement will be arranged so that concrete which has partially hardened will not be subjected to injurious vibration.

2. Free Fall:

The vertical height of free fall of concrete will not exceed 1 m. For falls greater than 1 m, chutes or tremies will be used.

3. Compaction:

During placement, concrete will be sufficiently tamped and vibrated with suitable equipment to secure close bond with the reinforcement, eliminate entrapped air voids, and ensure a homogeneous structure with adequate consolidation. Particular care will be given to placing and tamping along the faces of the forms to ensure a dense smooth surface.



- i) Vibrators and Screeds - Vibrations will be of sufficient duration to thoroughly compact the concrete, but the duration will not be long enough to cause segregation. Vibrators will not be used for moving concrete.
- ii) Initial Set - After the initial set of the concrete, the forms or concrete structure will not be jarred and no strain will be placed on the ends of projecting reinforcement.

4. Machine Placement:

Submit specifications of the proposed concrete slipform/extrusion equipment to the County for review prior to use.

The approved slipform/extrusion machine will be so designed as to place, spread, consolidate, screed and finish the concrete in one complete pass in such a manner that the minimum of hand finishing will be necessary to provide a dense and homogeneous concrete section. The machine will shape, vibrate and/or extrude the concrete for the full width and depth of the concrete section being placed. The operation of the machine will be continuous until a section or scheduled pour is completed. The interval between successive loading of the concrete hopper will not exceed 30 minutes. If the operations are delayed, or if the section is to be continued later, the machine will be emptied and a joint constructed as outlined herein. A similar joint will be constructed at the beginning of the extruded section. Excess concrete that has passed through the machine will not be re-used.

G8.8 Reinforcing

Lane crossings and commercial crossings will be reinforced. Dowels will be provided where concrete swales meet sidewalks, where concrete sidewalks are poured separately from the curb and gutter or when the pouring of concrete is suspended by more than 30 minutes. Dowelled joints will contain one 10M reinforcing bar for every 300 mm of width of the structure, and the bars will extend a minimum of 600 mm into both sides of the joint.

Where necessary, additional reinforcing steel will be installed as directed by the County, at no additional cost to the County.

G8.9 Finishing:

Working of the surface in the finishing operations will be the minimum necessary to produce the specified finish. The finished surface will have a fine granular or sandy texture without exposed aggregate or entrapped air holes.

1. Surface Water:

If there is evidence of excess water on the concrete surface, finishing will be delayed until the excess water has evaporated to the satisfaction of the County.

2. Brush Finish:

A nylon bristle brush of an approved type will be required. Surface grooves made by the broom will not be more than 3 mm deep. Before brushing, all surplus water will be removed from the brush.



3. Burlap Finish:

A burlap finish will be formed by dragging longitudinally in the direction of concrete placement a multiple ply burlap drag equal in length to the width of the slab and having at least 1m in contact with the concrete. The dragging will be carefully done so as to produce a finished granular or sandy texture without disfiguring marks.

4. Mortar Finish:

Where approved by the County, mortar consisting of cement and fine sand, mixed in the proportions used in the concrete, may be applied to extruded concrete to fill irregularities in the surface. This mortar will not be applied after the concrete has attained its initial set, and at no time will excess mortar be applied to cover the concrete surface.

G8.10 Curing:

Exposed concrete surfaces will be protected by using a resin base impervious membrane, unless otherwise specified.

1. Resin Base Impervious Membrane Curing:

The curing compound will be applied under pressure, with a spray nozzle, in such a manner as to cover the entire surface thoroughly and completely with a uniform film at a rate that will depend on the roughness of the surface of the concrete, but in no case will be less than 0.25 liters/m² of concrete surface.

2. Moist Curing:

If specified in Special Conditions, moist curing will be carried out according to the following requirements:

- i) After the concrete has set sufficiently, the exposed surfaces of the concrete will be kept continuously moist using wet burlap or polyethylene film in contact with the concrete for at least seven (7) consecutive days after placing, when normal or sulfate resistant Portland Cements are used, and for at least three (3) consecutive days when High Early Strength Cement is used.

G8.11 Surface Sealing:

Two applications of an approved sealing solution will be sprayed on all exposed concrete. The concrete will be dry and swept clean when the solution is applied. The first application will be made within seven (7) days after placing the concrete. The second will be made immediately after the first has been absorbed and regains its dry appearance. The first application will give a coverage of not more than 9 m²/liter. The second application will give a coverage of not more than 12 m²/liter.

G8.12 Joints:

Contraction, construction and longitudinal joints will be constructed where required as shown on the Plans, or as specified.

1. Stress Relieving Joints:



Where specified, stress relieving joints will be constructed either by sawing or by installation of polyethylene separators.

- i) Sawn Joints - Sawn joints will be cut as late as possible following concrete finishing, without permitting cracking to develop in the concrete slab. The time at which such saw cutting is to be undertaken will be determined by the Contractor. The contractor will be wholly responsible for all concrete defects arising from the cutting operation.
- ii) Polyethylene Formed Joints - As an alternative to sawing, stress relieving joints may be formed by equipment capable of inserting polyethylene film into the fresh concrete in a straight line and to the depth specified.

2. Contraction Joints:

- i) Contraction joints will be formed to fully control cracking. Surface joints will not exceed 12 mm in depth.
- ii) Sawn Contraction Joints - Where specified, sawn joints will be cut in such a manner that the edges are smooth and no aggregate is removed from the surface of the concrete.
- iii) Formed Contraction Joints - Formed contraction joints will be constructed with plates penetrating the concrete to specified depth. The joint edges will be finished with a 6 mm radius in both edges when the plates are removed.
- iv) Tooled Joints - Joints in extruded concrete will be formed to depth specified and finished to a 6 mm radius on both edges. The construction method will be at the option of the Contractor, but will be subject to approval by the County. The construction method used will not affect the line and grade of the extruded section.
- v) Surface Joints - A surface or dummy joint will be constructed to the depth specified and finished to a 6 mm radius on both edges.
- vi) Construction Joints - Construction joints will be constructed with a formed Keyway or "Vee" as shown on the drawings. Edges will be finished to a 6 mm radius. This joint is to be formed at a 10 mm depth.
- vii) Expansion Joints - When required, expansion joints will be shown on the Plans or detailed in Special Conditions.

G8.13 Construction:

- 1. Subgrade - The subgrade elevation will be the bottom of the concrete section to be placed, that has been compacted to the specified density for a minimum depth of 150 mm below the finished grade within 25 mm of the proposed subgrade elevation. No more than 25 mm of cushion material will be placed on the subgrade.
- 2. Forming - Curbs with a radius less than 40m will be constructed with flexible forms, well staked and braced to the established line and grade.
- 3. Placing Concrete - Concrete will be placed only after the sub-base and forming have been inspected and approved by the County. The concrete will be deposited in a manner to prevent segregation and as close to the final point of deposit as possible. The interval between placing successive batches will not exceed 50 minutes. If a section is to be continued at a later date, a construction



joint will be made with three 10 mm diameter reinforcing rods (equally spaced in the sidewalk, and in the curb and gutter sections) extending a minimum of one-half (1/2) metre into both the existing and future pour. Vibration will be done by pencil vibrators and/or a vibrating screen, and will be of sufficient duration only to prevent honeycombing.

4. Finishing - Working the surface during finishing will be the minimum amount necessary to produce the specified finish, with no exposed aggregate or entrapped air. The brush finish will be done with an approved nylon bristle brush lengthwise along the curb and gutter, and transversely across the sidewalk. There is to be no excess water on the concrete surface.
5. Joints - Contraction, construction and longitudinal joints will be constructed where required as shown on the plans, or as specified. Generally, transverse contraction joints will be formed every 3 m. Transverse surface joints will be formed every 3 m alternating with the contraction joint.
6. Cold Weather Concrete:
 - i) Concrete Strength - After September 30th, all concrete will attain the specified strength in seven (7) days.
 - ii) Base Condition - No concrete will be placed on frozen sub-grade or sub-base.
 - iii) Concrete Temperature - When the ambient temperature is less than 5°C, concrete delivered to the site will have a temperature not less than 15°C. For concrete placed when the ambient temperature is expected to fall below 2°C, the Contractor will completely cover the concrete and forms, maintaining an adequate air cushion between the concrete and cover, using straw, insulation or other approved insulating material. If a temperature of 18°C cannot be maintained for 72 hours after placing using insulation, then concreting will cease.
7. Hot Weather Concrete:
 - i) Hot weather will be considered to be an air temperature in the shade of 23°C or above.
 - ii) The concrete temperature at the time of placing in hot weather will not exceed 30°C. In the event that this limit is exceeded, the concrete operations will be suspended until the constituent materials of the concrete are cooled.
 - iii) Retarding admixtures will be approved by the County prior to use in the concrete.
8. Testing and Inspections
 - i) Slump, air content and compressive strength tests will be made on the concrete for each 150 cubic meters placed for each class of concrete, with at least one test for each day of placing concrete.
 - ii) Sampling and testing will be performed in accordance with the following:
 - Compression Test Specimens: Standard method of "Making and Curing Concrete Test Specimens in the Field" in accordance with CSA 23.2-3C.



- Compression Test: Standard Method of "Test for Compressive Strength of Cylindrical Concrete Specimens" in accordance with CSA 23.2-9C.
- Air Content: Standard Method of "Test for Air Content of Freshly Mixed Concrete by the Pressure Method" in accordance with CSA 23.2-4C.
- Slump: Standard Method of "Test of Slump of Portland Cement Concrete" in accordance with CSA 23.2-5C.
- Sampling Fresh Concrete: Standard Method of "Sampling Fresh Concrete" in accordance with CSA 23.2-1C.

G9. ASPHALT PATHWAYS

The asphalt materials, mixing, spreading and compaction will conform to the County of Lethbridge Standards and Specifications, as outlined under this Section, for all of the work required.

G10. BOULEVARD GRASSING

The work will include the placing of topsoil, seeding, watering and at least two successive cuttings of all grassed areas indicated on the plans or as called for under the contract documents.

G10.1 Materials:

All materials used in these specifications are subject to inspection testing and approval by the County.

1. Topsoil - Topsoil will be of a natural, fertile agricultural soil of the "A" horizon layer, capable of sustaining plant growth. It will be free of subsoil, clay lumps, stones, live plants or any other extraneous matter, organic or inorganic, which may be detrimental to the lawn. Topsoil will contain no toxic materials and the pH will be 6.0 - 7.5.
2. Seed Mixture - The seed mixture will be No. 1 lawn seed mixture and will consist of:

Kentucky Blue Grass	- 50% by weight
Creeping Red Fescue (<i>Festuca Rubra</i>)	- 40% by weight
Red Top	- 10% by weight

The mixture will comply with Federal and Provincial seed laws, and have a minimum germination of 75% and a minimum purity of 97%. Bags of seed mixture will be clearly tagged, showing the name of the supplier and the contents.

3. Sod - Sod will be No. 1 nursery-grown sod, consisting of a uniform mixture of:

Kentucky Blue Grass	- 60% by weight
Creeping Red Fescue (<i>Festuca Rubra</i>)	- 40% by weight.

Sod will be:



- i) a minimum of eighteen (18) months old.
 - ii) free of noxious weeds.
 - iii) minimum 20-25 mm in thickness.
 - iv) healthy with a thick growth.
 - v) sufficiently moist to prevent burning at the edges,
 - vi) first cut.
4. Fertilizer - Fertilizer will conform to the following:
- i) Root Fertilizer:
 - granular water soluble fertilizer 10-6-4 Super phosphate
 - granular water soluble fertilizer 5-20-10 or equivalent
 - ii) Supplementary Fertilizer:
 - organic fertilizer 14-7-6
 - even 35%
5. Peat Moss - Peat moss will be mixed with topsoil and meet the following specifications:
- i) have a pH value of 5.0 - 7.0,
 - ii) have a water holding capacity of 1100% by weight,
 - iii) be free of toxic material, live plants, live roots or seeds,
 - iv) be delivered in a pulverized condition.

G10.2 Construction

The contractor will be responsible for the control of weed growth until the final acceptance of the contract.

1. Subsoil Preparation - All rocks larger than 50 mm in diameter, roots and other foreign matter will be removed. The subsoil will be mechanically loosened to a depth of not less than 50 mm immediately prior to placing the topsoil.
2. Topsoil Placement - The topsoil will be uniformly spread on the prepared areas to a minimum compacted depth of 150 mm, measured after the area is readied with the soil seed equipment. If organic material is required to meet the organic material specification for topsoil, peat moss in pulverized condition will be added in the field and mixed with cultivation equipment. The area will then be disked, harrowed and floated thoroughly to a depth of 75 mm, leaving the soil in a good viable condition and true to grade.
3. Fertilizing - After the topsoil has been properly prepared, a uniform application of granular water soluble root fertilizer will be placed at the rate of 5 kg/100 square meters using a mechanical spreader. The fertilizer will be thoroughly and evenly mixed with the soil to a maximum depth of 75 mm. Approximately six (6) weeks after germination, supplementary application of an organic



fertilizer, such as 10-6-4 or equivalent, will be applied at a rate of 5 kg/100 square meters.

4. Seeding - Grass seed will be sown at a rate of 2.5 kg/100 square meters by one or more of the following methods:
 - i) Hand application with a cyclone type seeder capable of distributing seed in two directions in equal amounts. Hand application will require a 6 mm top dressing or mulch of pulverized peat moss.
 - ii) Mechanical application with a calibrated grass seeder complete with compaction roller
 - iii) Hydro-seeding by applying an approved turf-fiber at a rate of 0.135 kg of dry matter/square metre.
5. Watering - To avoid washing, the area will receive light watering with a fine spray to a penetration of not less than 25 mm, after the seeding operations are completed. In areas where seed fails to germinate for whatever reason, the Contractor will re cultivate and re-seed until germination occurs.
6. Repairs and Maintenance - At the time of the supplementary fertilizing, the following repairs will be carried out by the Contractor:
 - i) Top Dressing - repair ruts, unevenness and erosion problems
 - ii) Over-seeding - dried out areas will be cultivated and re-seeded.
 - iii) Weed Spraying - an application of an approved weed killer will be applied one (1) week after the fertilizer has been applied.

The first and second grass cutting will be done by the Contractor when the grass is approximately 100 mm in height. Cut height will be 50 mm.

7. Sodding - Sodding will be done on all areas where slopes are two horizontal to one vertical or greater, and staked. Sod may be substituted for grass seeding on all other areas.
 - i) Sod Laying - The sod will be closely butted together and laid evenly, in staggered rows, with all newly-laid sod matched to the existing grade of other landscaped or cultivated areas as specified. The sod will be top dressed and rolled with a medium weight roller (90-120 kg) to a smooth and even surface.
 - ii) Watering - After placement, the sod will be continuously watered for one (1) week or until significant root growth has occurred.
 - iii) Fertilizing - Approximately four (4) weeks after placement, and following the initial cutting, an organic fertilizer will be applied at the rate of 5 kg/100 square meters.
8. Growing Season:
 - i) Grass Planting - Grass seed will not be planted before May 15 or after October 15.



- ii) Sod Laying - Sod will not be laid before May 15 or after September 1. Sod laying on slopes 3:1 or steeper will not be done when the temperature is above 23°C.
- iii) Tree Planting - Within one (1) year after the issuance of a Construction Completion Certification for paved roads, the developer will sod and plant boulevard trees on all roads. Deciduous trees must be placed in a uniform lineal manner. The developer will be responsible for full maintenance and tree replacement for one (1) calendar year after installation.

G11. TRAFFIC CONTROL DEVICES

A traffic control device is a sign, signal, marking, barrier or other device, placed upon, over or adjacent to a roadway, that is intended to regulate, warn, or guide the road user. All such traffic control devices will be installed in accordance with the "Uniform Traffic Control Devices for Canada" manual, latest revision thereof, distributed by the Roads & Transportation Association of Canada, and with the new "Alberta Highway Signing Policy Manual", latest revision thereof.

All traffic control devices must be authorized and approved by the County prior to placement. No traffic control device, nor its support, will bear any commercial advertising.

It is the intent that these devices be kept serviceable year-round for the safe movement of traffic in both daylight and darkness.

G11.1 Traffic Signs:

Signs inform road users of traffic regulations, warn of roadway characteristics and road hazards, and provide information necessary for route selection. Simplicity in design, care in placement and a standard of maintenance are essential. Signs are to be used only when necessary and justified. All sign materials will conform to the Canadian Standards Association (CSA) specifications.

All traffic control signing erected within County and subdivision road allowances will be according to the latest edition of the manual "Uniform Traffic Control Devices for Canada". All sign posts will be located horizontally 3 meters from the shoulder of the adjacent road and the bottom of the sign will be 1.5 meters above the shoulder elevation of the road. Stop signs and yield signs will be positioned in line with the near property line of the intersecting road allowance.

1. Materials:

- i) Signs - Signs made of treated ferrous and non-ferrous metal and waterproof resin bonded plywood are suitable for use in permanent signs (certain wood fibrous materials, when properly fabricated, are also acceptable). Wooden boards may be used for large signs and for temporary and seasonal signs.
- ii) Sign Panels - Information signs will be constructed with high intensity reflective panels. Regulatory and Hazard signs will be constructed with high intensity grade reflective panels.
- iii) Sign Posts - Where applicable, it is encouraged that all signs be placed on existing supports used for other purposes, such as traffic signals or street lights. If sign posts are required, they will be made of galvanized metal



(schedule 40), 60 mm in diameter, 3.65 m in length and a quick fix breakaway coupling installed 50 mm from ground level.

- iv) Fasteners - Stainless steel fasteners will be used to attach signs to their supports.

2. Installation & Maintenance:

Signs are to be placed with the posts vertical and the signs level. The bottom of the sign must be a minimum of 2.0 meters above the level of the nearest travel lane or existing grades. Signs are to be positioned with best possible road visibility in mind. All signs will be kept clean, in proper position and legible. Damaged signs are to be repaired or replaced as soon as possible. No vegetation, construction materials snow or other items or materials are to be allowed to obscure any sign.

G11.2 Pavement Markings:

Pavement markings are traffic control devices placed on carriageway surfaces to delineate and clarify traffic and pedestrian movement by regulating, warning and conveying information to individuals without diverting attention from the roadway.

Traffic marking materials will be either industrial traffic marking paint or thermoplastic material, as dictated by the County.

Pavement markings will conform to the following:

1. Colour - Yellow (solid) lines must be used to delineate the separation of opposing traffic flows. White lines delineate the separation of traffic flows in the same direction - all lateral pavement markings are to be white in colour.
2. Pattern - Broken longitudinal lines are to indicate that lane changing is permitted and solid longitudinal lines indicate that lane changing is not permitted. Lateral pavement marking may be parallel or "zebra" lines, and are to be used to indicate the limits of the driver's right-of-way concerning stopping, pedestrian crosswalks, no parking areas and similar requirements.

Refer to the "Uniform Traffic Control Devices for Canada" manual for pavement marking details.

G11.3 Temporary Signage:

Temporary signage and devices will be located as to provide motorist and pedestrians with adequate warning of construction or unusual conditions. A plan showing signage location, spacing and types will be submitted to the County for approval a minimum of 72 hours prior to disruption. Refer to "Uniform Traffic Control Devices for Canada" manual Section D.

G12. STREET LIGHTING

All street lighting layout, and location of the buried and the overhead lines, will be approved by the County. The location, type and frequency of street lights will be such as to provide the minimum lighting levels in conformance with the Roads and Transportation Association of Canada guidelines.



Illuminating Engineering Society (IES) lighting standards are acceptable within local road areas only. Arterial/Collector roads will be to Roads and Transportation Association of Canada guidelines.

Wherever possible, street light cables will be installed underground. Cables crossing all roadways or driveways will be placed in direct-burial type rigid plastic pipe using one pipe per individual cable unless noted otherwise.

Corrosive resistant street light poles complete with fixtures and concrete pedestals only will be used unless approved otherwise.

Street lights will be so located as to not interfere with proposed driveways, lanes and motorist's lines of vision, and will be located in line with the extension of common property lines wherever possible.

G13. VEHICULAR BARRIERS

All materials are to conform to the standards and specifications contained in Section G of this Manual, unless otherwise approved by the County in writing.

Vehicular barriers must be constructed at the following locations:

1. across the end of a walkway that terminates in a lane;
2. across the end of a lane cul-de-sac that abuts a roadway;
3. along a lane that parallels an adjacent roadway;
4. near permanent bodies of water;
5. at areas showing a large difference in grade separation;
6. bridge abutments;
7. retaining walls; or
8. as a longitudinal divider on narrow medians.

While vehicular barriers are designed to reduce the hazard of errant vehicles leaving the road surface, they themselves must also be considered as hazards. Installation is warranted only where the severity of an accident is greater than the hazard presented by with the traffic barrier. Their purpose is to shield those hazards that cannot be eliminated.

G14. BACKFILLING UTILITY TRENCHES ON COUNTY RIGHT-OF-WAY

All ditches, trenches and cuts on County rights-of-way (adjacent to roadway) will be done with a minimal amount of disturbance. The backfill must be with an approved material placed in uniform lifts not exceeding 300 mm of loose depths, to a density of not less than 96% of the maximum density of a Standard Proctor. No excavation will be closed until compaction has been approved by the County.