SECTION “G”

TRANSPORTATION

G1 INTENT

The **County**'s long term roadway network is being developed with consideration to future land use **Development** and forecasted traffic volume. The planned **Development** of the road network has taken into consideration the future growth of residential, recreational, commercial, and industrial land uses.

The **County** has over 2,415 kilometers of developed roadways that range from low volume local roads with gravel surfacing, to paved high volume arterial roads. The **County** follows a road classification system that is based on daily traffic volumes, traffic type, and travel speed. The road classification system also provides access control, intersection spacing, and parking requirements.

This section is intended to provide guidelines to assist the **Developer** in the design of road, sidewalk, and trail improvements that will meet the servicing requirements for commercial, industrial, and residential **Development** within the **County**.

The servicing standards have been developed with goals in mind:

i) To ensure that the **County** is provided with a quality product that will meet an acceptable long term life expectancy while maintaining cost efficiency and practicality so as not to prohibit land **Development**.

ii) To minimize the **Maintenance** requirements associated with roads and subdivisions.

Roadways and subdivision's containing five (5) or more lots in the **Development Areas** within the **County**, shall typically be developed to a rural cross-section with an asphalt surface and roadway ditches to accommodate stormwater and snowmelt runoff.

The guidelines and standards presented in this section should only be considered as minimum requirements. The Geotechnical Investigation must include specific recommendations for pavement structure, based on the site specific conditions and the projected traffic volume. The stronger of the 20 year structure recommended by the Geotechnical Investigation or the structure outlined in each road classification shall be used.

The **Developer** remains fully responsible for the design and construction of **Municipal Improvements** according to accepted engineering practice and standards that

address and meet the specific needs and site conditions of the **Development**. Certain site-specific conditions may warrant more stringent standards are met.

G2 LEVEL OF SERVICE ROADWAYS

The **Developer's engineer** shall be responsible for determining an estimated annual average daily traffic (AADT) generated by the **Development** in order to determine the required cross sectional elements and pavement structure.

Roadway classifications and designations in subdivision **Development areas** shall generally follow the classifications system outlined in the Alberta Transportation Highway Geometric Design Guide, and this document.

G2.1 Residential Access Road: (Refer to Drawing G-01 in Appendix C)

The "residential access road" classification is applicable to internal country residential subdivision roads whose primary purpose is to provide **Property** access. The classification is also applicable to **County** roads that provide access to a limited number of properties, such as properties along a short dead-end road or cul-de-sacs.

G2.2 Local Road: (Refer to Drawing G-02 in Appendix C)

The function of local roads is to provide access to **adjacent** properties carrying traffic from higher order roads to individual land parcels. Local roads are typically low speed and low volume roadways. They connect to other local roadways or collectors.

G2.3 Collector Road: (Refer to Drawings G-03 and G-04 in Appendix C)

A collector road is a low-to-moderate-capacity road which serves to move traffic from local roads to arterial roads.

G2.4 Arterial Road: (Refer to Drawings G-04 and G-05 in Appendix C)

An arterial road is a high-capacity road designed to deliver traffic from collector roads to highways, and between urban centers at the highest level of service possible. As such, many arteries have limited-access and features as they must allow greater flow traffic over longer distances and minimal interruptions. Arterial roads may be 2 or 4 lanes wide, with controlled access.

G3 GENERAL REQUIREMENTS

For each new **Development**, the appropriate roadway classifications and design designation shall be determined during the planning stages in consultation with the **County**.

Where conflicts or inconsistencies with the General Municipal Servicing Standards arise due to adoption of other transportation planning documents, the **Developer** shall be responsible for satisfying the more stringent requirement. Should the need arise that any of the standards cannot be met, a written request outlining the variance is to be forwarded to the **CAO**. The request will be reviewed and a written response will be returned.

For proposed multi-lot residential, confined feeding operations, industrial, or commercial **Development**, the **County** may cost share with the **Developer** for the building of a road within an undeveloped road allowance with approval from **Council**.

The **Developer** shall be responsible for quality control testing related to the roadway construction including but not necessarily limited to sieve analysis, densities, mix design, core sampling, and concrete testing. Quality control shall be performed by an independent party and certified by a professional Engineer licensed to practice in the province of Alberta.

G4 DESIGN CRITERIA

G4.1 Road Right of Ways:

All public roadways will be located within a road right-of-way (ROW) established by statute in the name of the **County**. The developed road rights-of-way shall be adequate width to accommodate the roadway surface and the roadside ditches complete with the required side slopes and back slopes, public **utilities**, pathways, traffic signs etc.

Minimum right-of-way would be determined by class of roadway.

It is the **Developer**'s responsibility to assess the traffic impacts associated with a proposed land **Development**. This assessment must include a projection of the average annual daily traffic (AADT) over a 20-year design life for the internal subdivision roads as well as any **adjacent** provincial highways or municipal roadways.

All off-site road improvements required as a result of land **Development** must be identified in the design stage by the **Developer**.

It is the responsibility of the **Developer** to obtain any necessary additional road right-of-way width necessary to accommodate proposed road improvements.

If the road improvements are covered by an off-site levy the **Developer** will be assessed and charged the applicable rates.

If the improvement is not covered under an existing levy bylaw the **Developer** will be responsible for the offsite improvements under terms of a **Development** Agreement.

The **County** will require a design life of 20 years for all future road classifications.

G4.2 Cul-De-Sacs: (Refer to Drawing G-06 in Appendix C)

Cul-de-sacs should be graded to drain towards the intersection unless a PUL is provided to allow drainage to escape.

The minimum cul-de-sac bulb radius for residential areas is 18 m measured to the face of curb or shoulder. Industrial radius for bulbs is minimum 24 m.

G4.3 Dead-end Roads:

All dead-end roads in multi-lot residential subdivisions with five or more lots shall be provided with a paved cul-de-sac or turnaround area consistent with the requirements of these Servicing Standards.

G4.4 Emergency Access Routes: (Refer to Drawing G-07 in Appendix C)

When the primary access route at a buildings principal entrance measured from the center line of the primary access road to the closest point of the access route exceeds 120 m but is less than 200 m and/or the total number of residences exceeds 100 m, an emergency access route is required to be provided. (National Fire Protection Association (NFPA) 1141)

The minimum width of the emergency access route is 6m and must be designed to support a load of 38,556 kg and will be required to meet the requirements set out in the Alberta Building Code, Article 3.2.5.6.

The intent of an emergency access route is to provide a secondary entrance/egress to a building site, complex, **Development**, or subdivision.

The emergency access route is to be supplied by the **Developer** at the **Developer**'s expense.

The emergency access route is to be installed as remote from the primary access as possible or practical and is to be connected to a thoroughfare.

The emergency access route will be made available for emergency services vehicles/personnel only and restricted from **Unauthorized Use** by way of approved bollards (break-away style) or approved access gate.

"No-parking" signs shall be posted 20 m apart and 2.3 m above surrounding grade.

G4.5 Second Public Access:

A second public access is required when the distance from the centre line of the primary access road to the closest point of the access route at a building's principal entrance exceeds 200 m and/or the total number of households exceeds 100 (National Fire Protection Association (NFPA) 1141).

It shall be designed to the same standard of the adjoining road, a minimum 7.3 m wide.

The second public access is to be installed in the early stages of the **Development** or in conjunction with the primary access.

The second public access provides an additional route into and out of building sites, complexes, **Development**s, or subdivisions. These roads are to remain accessible to all, be maintained, and remain unobstructed.

These roads shall be provided by the **Developer** for every building or **Development** constructed or moved into, full or partial, within the **County**. This would apply to public and private roads.

The second public access is to be installed as remote from the primary access as possible or practical.

The second public access shall be connected to a primary road.

G4.6 Approaches: (Refer to Drawings G-08, G-09, and G-13 in Appendix C)

Unless approved otherwise by the **CAO**, access to the **County** road system for a subdivision is to be channeled to a single location. For subdivisions consisting of three (3) or more contiguous lots, a connecting service road is to be constructed. With five (5) or more lots, the service road is to be paved.

An approach links a private parcel of land to a **County** road. Before constructing an approach, residents must obtain **County** approval. Approval will only be granted where the requested location is considered practical and safe by the **County**.

If approved, the approach must be constructed to the **County** specifications and must receive final approval from the **County** upon completion. Any access approach not approved by the **County** will be removed at the expense of the registered landowner.

Approaches must meet the requirements of **County** Policy 13-15 – Approaches Construction Guidelines, and amendments thereto. This policy provides additional guidance on the number of approaches allowed.

Approaches shall be situated such that they do not access directly onto a roadway with an estimated Average Annual Daily Traffic (AADT) of greater than 4000.

Approaches shall have a minimum clearance of 1.5 metres from any surface feature such as hydrants, power poles, and curb cocks.

Approaches shall not be situated on a curb return.

For corner lots, the approaches should access the road with a lesser traffic volume wherever possible. Wherever possible, approaches should not be located within 40 m of an intersection with the exception of multi-lot subdivisions.

All approaches shall typically have the same structure as the adjoining roadway and will have an 8.6 m width.

Industrial approach widths are subject to review for specific vehicle movements anticipated with the **Development**.

All residential subdivision **Development** shall require the **Developer** to construct access to each lot off the required access road.

The following unobstructed sight distance requirement must be obtained for any approach:

- 180 m for a gravel roadway
- 200 m for a paved roadway

Access roads or approaches entering a **County** road shall be set back a minimum of 40 m from any intersection or railway right-of-way.

A minimum spacing of 40 m is required between individual approaches.

All existing approaches will be inspected at the time of subdivision, and will be required to meet the standard prior to endorsement.

G4.7 Intersections: (Refer to Drawing G-08 in Appendix C)

Intersections shall be designed at 90° wherever possible.

The minimum angle of intersection for two roadways shall be 75° unless otherwise approved by the **CAO**.

Intersection design shall incorporate accepted sight distances based on the roadway classification and good engineering practice minimum of 300 m.

The grades at intersections for all roadway classifications shall not exceed 2% for a minimum distance of 30 m, measured from the shoulder edge of the receiving road.

Flares at intersecting roadways shall have the following minimum radius from shoulder to shoulder:

- Residential access 10 m
- Residential collector and local 15 m
- Industrial local and collector 15 m

Minimum intersection spacing shall be 60 m measured from centreline to centreline.

Intersectional treatments shall be designed based on estimated 20-year traffic volumes. All necessary widening of existing right-of-ways shall be provided by the **Developer**. Sight distance shall be minimum 300 m in both directions.

G4.7 Roadway Surface Finishes:

The **County** presently approves three types of roadway surface finishes:

- Gravel surface,
- Asphaltic concrete (hot mix asphalt) pavement surface (A.C.P.), and
- Chip seal, cape seal, microsurface.

Irrespective of the roadway surface finish approved by the **County** for a specific **Development**, good roadway industry construction practices and techniques shall be employed at all times. Furthermore, roadway subgrade and base construction shall be undertaken with the view that an asphaltic concrete pavement will ultimately be placed as the surface finish for the roadway.

Should a gravelled surface be approved, even for an interim period, the surface gravel shall be a minimum compacted layer of 50 mm depth of 20 mm crushed gravel. All approaches shall be similarly treated.

Designation 4, Class 20 (Modified)
For gravel surfacing
% Fracture by Weight (2 faces) 60 +
Plastic Index 0-8

Metric Sieve (CGSB – GP – 2M) µm	% Passing
100%	100%
35 – 75%	35 – 75%
15 – 50%	15 – 50%
0 – 25%	0 – 25%
2 – 10%	2 – 10%

G4.8 Road Graveling (Rural Roads):

The roadway gravelling application rate shall be determined by the **CAO** based on the roadway use and soil conditions.

All rural residential driveways shall be gravelled at a minimum rate of 8 cubic metres per approach, from the roadway shoulder to the **Property** line.

Gradation of surface gravel shall be approved by the **CAO** or designate.

G4.9 Pavement Structure:

The pavement structures indicated on the cross sections are intended as minimum standards only. Roadway subgrade and pavement structures shall be based on results of a geotechnical investigation.

A report shall be submitted specifying the required structure and all design factors including design, traffic loading, and the pavement design life.

It is the **Developer**'s responsibility to design the roadways to meet or exceed these standards in accordance with good engineering practices and specific site conditions (min 120 mil pavement ACP).

Paved roadways shall be designed in accordance with the Asphalt Institute method of pavement design using minimum design loadings of 8165 kg (18,000 lbs) axle loads for local streets and 10,886 kg (24,000 lbs) axle loads for collector streets. All industrial/commercial roads shall be designed using a minimum design loading of 10,886 kg (24,000 lbs) axle loads. The design parameters such as traffic count, percentage of trucks, measure, or estimated Resilient Modulus (MR or California Bearing Ratio (CBR) etc., are to be outlined to the **CAO**. The **CAO** reserves the right to request the **Developer** to engage a geotechnical engineering agency to carry out MR or CBR tests on the subgrade prior to having to confirm adequacy of design.

G4.10 Pipeline Crossing:

In order to facilitate work with a minimum disturbance to an existing pipeline, the **Developer** must coordinate activities with the pipeline owner and provide to the **County** copies of crossing agreements.

If no depth is pre-specified, the top of pipe is to be a minimum of 2.5 m below the single lowest elevation within the road construction limits.

The top of pipe is to be level throughout the road widening limits.

Top of pipe elevation is to be labelled on the cross section and profile. Dimensions must be correctly labelled to ensure proper pipe elevation.

Heavy wall pipe is to be utilized throughout the road construction or road widening limits of the pipeline location.

No open cuts are permitted.

Roadway centreline profile information for 200 m in either direction from the proposed crossing location is required to be submitted for review and acceptance by the **CAO** to confirm minimum crossing elevations as compared to future profile improvements.

All elevations are to be reported and illustrated as geodetic.

No assumed elevations are permitted.

G4.11 Shallow Utility Crossings:

The full width of the crossing shall be within a conduit.

Depth of cover shall be dependent on the utility requirements.

G4.12 Concrete Curb and Gutter:

(Refer to Drawings G-10, G-11 and G-12 in Appendix C)

The vertical face curb and gutter cross section shall be used on all roads fronting public lands such as parks and public utility lots. Vertical face curbs shall also be used within the right-of-way when crossing pipelines unless separate vehicle barriers are provided to prevent unauthorized access.

The rolled face curb and gutter cross section may be used on all local/residential roadways allowing driveway access.

Curb returns on all residential street intersections shall have a minimum radius of 9 m.

Curb returns on all commercial/industrial intersections shall have a minimum radius of 15 m and shall be designed to accommodate truck turning movements.

The minimum gutter grade shall be 0.5% except for cul-de-sac bulbs, curb returns, and catch basin approaches, which shall be 0.8%. The 0.5% minimum

grade shall be maintained throughout sag vertical curves to avoid the short length at near horizontal grade.

Curbs shall be constructed using Portland cement to Canadian Standards Association (**CSA**) A3000. Materials, production, delivery, placement, and finishing shall conform to Canadian Standards Association (**CSA**) A23.1.

The minimum 28 day compressive strength of concrete shall be 25 MPa. Air entrainment shall be within five (5) – eight (8) % by volume. Concrete testing is required for every 60 m^3 of cast in place concrete.

Curbs shall be constructed on prepared subgrade, cement stabilized subgrade, granular base course, soil cement, or asphalt concrete.

For all urban cross sections, wick drains shall be placed below the curb, between the subgrade and granular base course. The wick drain shall be connected to the nearest catch basin.

Curbs must be backfilled with suitable clay within 7 days of concrete placement and prior to placement of the roadway structure. The clay material shall be backfilled to within 100 mm of the top of curb to allow for the placement of topsoil material.

The use of swale gutters shall be limited to minor and residential streets. Swale gutter cross section shall be a minimum of 1 m wide and 200 mm thick with steel reinforcing.

All driveways crossing a swale shall be reinforced with a minimum of two No. 4 rebar.

Geometric Design Requirements

Designation	Surface	AADT*	Truck Traffic	Min. ROW** (m)	Preferred ROW** (m)	Design Speed (km/h)	Posted Speed (km/h)	SSD[t] (m)	Crest k (m)	Sag k (m)	Min. Horiz. Radius (m)
Single Access Road 5.0 m	Gravel		None					85	15	20	120
Standard Local Road 8.0m	Gravel	< 200	Minimal	30	30	60	50	85	15	20	390
Gravel Collector 9.0m	Gravel	< 500		30	40	100	80	200	75	50	440
Collector 9.0m	ACP	< 500		30	40	100	80	200	75	50	440
Arterial 10m	ACP	< 2000		30	40	100	80	200	75	50	440

* AADT = Average Annual Daily Traffic

** ROW = Right-of-Way

t SSD = Stopping Sight Distance

*Note: The recommended design speeds are for **Internal Roadway** systems only. Geometric standards are from Alberta Transportation's Highway Geometric Design Guide. It has been assumed that the maximum superelevation rate will be 0.08 m/m for gravel surfaced roads and 0.06 m/m for asphalt surfaced roads.*

G5 CONSTRUCTION STANDARDS

G5.1 Preparatory Work:

The entire road right-of-way (ROW) shall be cleared of all vegetation (trees, shrubs, brush, etc.) including removal of all tree roots and stumps. All such material shall be removed from the site for disposal at approved locations. No burying of this material, or any portion thereof, shall be permitted within the ROW.

Organic soil and material are not acceptable as subgrade materials and shall be stripped within the roadway, ditch and back slope portion of the new construction.

Organic soils (horizon A) shall be stockpiled in approved locations for the re-spreading on the ditches and back slopes after completion of the roadway construction. Any remaining topsoil shall be stockpiled at approved locations and shall become the **Property** of the **County**. The topsoil, when used as fill, shall be placed such as to add to existing topsoil, thereby utilizing it for landscaping purposes. Surplus topsoil is to be stockpiled for use in final **grading** of parks, boulevards, buffer strips, and developed lots. (10 mm of top soil minimum for final **grading** of ditch).

G5.2 Roadway Excavation:

All materials excavated for placing in roadway embankment shall be suitable road construction material.

Where the subgrade is in transition from excavation to embankment the transition area shall be undercut to a minimum depth of 600 mm and replaced with suitable material.

Where unsuitable material is encountered at the subgrade level of a cut, the subgrade shall be undercut and replaced with suitable material as directed by the **Developer's engineer**.

Where suitable material is encountered at the subgrade level the subgrade shall be scarified to a minimum depth of 200 mm, shaped, and compacted.

The compaction of subgrade surfaces in excavations and the placement and compaction of materials replacing undercuts shall be in accordance with section G5.3 Roadway Embankment and section G5.4 Subgrade Preparation.

Excavation shall be carried out to conform to the lines, grades, and cross-section of the approved roadway design.

G5.3 Roadway Embankment:

All material used in roadway embankment shall be approved road construction material free from all wood, brush, roots, topsoil, and other organic materials.

Where the depth of embankment is less than 1 m, all topsoil and/or organic materials shall be excavated prior to embankment placement.

Where the proposed depth of embankment is less than 1 m from the finished subgrade, the stripped surface shall be excavated to a minimum depth of 1 m from the proposed finished subgrade before any embankment material is placed.

Where embankments are to be placed on a slope or against an existing slope, the sloped shall be benched and scarified in a manner that the new material will bond with the existing surface.

Prior to fill being placed, the exposed surface shall be scarified to a minimum depth of 150 mm and compacted to 95% of Standard Proctor Density.

Successive lifts of embankment material shall be placed in uniform layers of 150 mm maximum thickness across the entire width of the embankment.

Suitable compaction equipment shall be used to thoroughly compact each layer of embankment material.

The embankment material shall be compacted to not less than 95% of standard Proctor Density at optimum moisture content, except that the top 300 mm shall be compacted to not less than 100% of standard Proctor Density.

Embankment construction shall be carried to the lines, grade, and cross-section of the approved roadway design.

G5.4 Subgrade Preparation:

The completed subgrade shall be scarified to a minimum depth of 150 mm or as designated in the Typical Minimum Roadway Structures table on page 17.

The subgrade shall be prepared by compacting the soil below the subgrade to an average of 100% Standard Proctor Density, with no test result being less than 97% Standard Proctor Density. The soil below the subgrade shall be compacted in layers not exceeding 150 mm. Each compacted layer shall be accurately

shaped and graded parallel to the design grades and cross-sections. If compaction range cannot be met then the subgrade is to receive cement stabilization treatment as determined by a qualified Geotechnical Engineer.

During compaction, the soil shall be at its optimum moisture content as determined by a qualified Geotechnical Engineer. When a deficiency in moisture content exists, the soil shall be watered and thoroughly mixed until optimum moisture content is uniformly attained. When there is an excess of moisture. the soil shall be worked and aerated until the optimum moisture content is reached. One-mould proctor density testing will not be permitted as an alternate testing procedure due to wet soil conditions. The **Developer's engineer** will be required to suggest appropriate measures such as drying in-site material or importing suitable material in order to meet the required standard Proctor Densities.

The finished subgrade shall be shaped to conform to the required lines, grades, and cross sections of the approved roadway design.

G5.5 Pit-Run Material:

Pit-run shall be used to stabilize the sub-base in areas where silty in-situ materials exist. The minimum structure requirements are listed on the standard cross section drawings. Filter cloth, or geogrid, or proven engineered method can be used as alternative to pit run.

After over-excavation of any unsuitable sub-base material, pit-run shall be placed in the excavation and compacted to 100% of Standard Proctor Density. Additional layers of pit-run required to bring the sub-base elevation to the bottom of the base course shall be placed in layers not exceeding 150 mm in depth and compacted to 100% of Standard Proctor Density. Water shall be applied and mixed uniformly with the crushed gravel until the final moisture content is at least the optimum moisture for the mixture, and preferably from 1% to 2% above the optimum moisture. The optimum moisture content for the mixture shall be determined by a qualified Geotechnical Engineer or firm. If necessary, water shall be added or applied to the material during compaction to maintain the required uniform moisture content.

G5.6 Base Course:

Base course shall consist of a mixture of crushed aggregate and water, which is placed in layers upon the previously prepared surface, compacted, and finished to the specified thickness, approved grade, lines, and typical cross-section.

Each lift shall be compacted to 100% Standard Proctor Density. Water shall be applied and mixed uniformly with the crushed gravel until the final moisture content is at least the optimum moisture for the mixture, and preferably from 1% to 2% above the optimum moisture. The optimum moisture content for the mixture shall be determined by a qualified Geotechnical Engineer or firm. If necessary, water shall be added or applied to the material during compaction to maintain the required uniform moisture content.

Base course material shall be laid and compacted in a single layer when the compacted thickness specified does not exceed 150 mm. When a thickness in excess of 150 mm is specified the material shall be laid and compacted in layers not exceeding 150 mm.

The depth or thickness of granular base course will depend upon the soil conditions and the anticipated traffic, but should typically not be less than the thickness outlined in the Typical Minimum Roadway Structures table on page 17.

Base course material shall be consistent with the Alberta Transportation specification for Aggregate Gradation Designation 2, Class 20 as follows:

Sieve Size (µm)	Percent Passing
20,000	100
16,000	84 – 94
10,000	63 – 86
5,000	40 – 67
1,250	20 – 43
630	14 – 34
315	9 – 26
160	5 – 18
80	2 – 10
% Fractures by Weight (2 faces)	60+
Plasticity Index	WP+0.6

Typical Minimum Roadway Structures

Roadway	Residential Land Use		Commercial/Industrial Land Use
	Low Density	High Density	
Local Access	150 mm Subgrade Prep. 150 mm Granular Base Course 75 mm Asphaltic Concrete Surface	150 mm Subgrade Prep. 200 mm Granular Base Course 90 mm Asphaltic Concrete Surface 2 lifts 50 mm/40 mm final*	300 mm Subgrade Prep. (300 mm Pit run for heavy Commercial/Industrial) 300 mm Granular Base Course 125 mm Asphaltic Concrete Surface 2 lifts 80 mm/ 45 mm final*
Collector	150 mm Subgrade Prep. 200 mm Granular Base Course 75 mm Asphaltic Concrete Surface	150 mm Subgrade Prep. 300 mm Granular Base Course 100 mm Asphaltic Concrete Surface 2 lifts 60 mm/40 mm final*	300 mm Subgrade Prep. 300 mm Granular Base Course 125 mm Asphaltic Concrete Surface 2 lifts 80 mm/ 45 mm final*

NOTE: The final lift of asphaltic concrete shall be placed in the second year of the **Maintenance period.*

G5.7 Asphalt Concrete Pavement

Asphaltic concrete pavement (ACP) shall consist of mineral aggregate, filler and asphaltic binder, and shall be laid and compacted to specified thickness and shall conform to the approved lines, grades, and typical cross-sections.

Aggregate shall consist of hard, durable, uniformly graded, crushed gravel, free of coatings of silt or clay, and shall not contain organic or soft materials that break up when alternately frozen and thawed, or wetted and dried, nor other deleterious materials.

Coarse aggregate is aggregate retained on the 5,000 µm sieve. Fine aggregate is aggregate passing the 5,000 µm sieve. The combined aggregates shall meet the following gradation requirements when tested to American Society for Testing and Materials (**ASTM**) C136 and C117. 3.

Mix Type H2, M1, L1	
Sieve Size (µm)	**% Passing by Mass**
12,500	100
10,000	83 – 92
5,000	55 – 70
1250	26 – 45
630	18 – 38
315	12 – 30
160	8 – 20
80	4 - 10

Mix Type H1	
Sieve Size (µm)	**% Passing by Mass**
16,000	100
12,500	80 – 92
10,000	70 – 84
5,000	50 – 65
1250	26 – 45
630	18 – 38
315	12 – 30
160	8 – 20
80	4 - 10

Additional properties that shall be met are as follows:

- Material retained on the 5,000 micron sieve shall not contain more than 3% detrimental matter based on the total mass of the combined aggregates in the final product. The detrimental Matter in Coarse Aggregate shall be carried out in accordance with Alberta Transportation TLT-107 test method.

- The asphaltic binder shall be uniform in character, shall not foam when heated to 177 °C, and shall meet the following requirements:

  i) Designation AC – 150 – 200,
  ii) Penetration at 25 °C, 100gm, 5 sec. 150 – 200,
  iii) Flash point (C.O.C.) -°C 205 min,
  iv) Ductility at 25°C, -cm. 100 min,
  v) Solubility in Carbon Tetrachloride - % 99.9 min,
  vi) Penetration after thin film oven test, at 25°C - % of original 40 min,
  vii) Kinematic Viscosity in Centistokes @ 135 °C 150 min.

- A mix design shall follow the Marshall Method as outlined in the most recent version of the Asphalt Institute's Mix Design Methods for Asphalt Concrete (MS-2) as outlined in the table below.

Mix Designs

	Heavy Industrial H1	Arterial/ Industrial H2	Collector M1	Local Residential L1
Number of compaction blows each face of specimen	75	75	75	50
Min. Stability (kN) at 60ºC	12.0	11.5	8	5.3
Flow (mm)	2 to 3.5	2 to 3.5	2 to 3.5	2 to 4
% Air Voids total mix (Note 1)	3.5 to 4	3.5 to 4	3.5 to 4	3.5 to 4
% Air Voids in Mineral Aggregate (min) **At 3.5% air voids** **At 4% air voids**	 13.0 13.5	 13.5 14	 13.5 14	 13.5 14
% Aggregate Voids Filled with Asphalt	65 to 75	65 to 75	65 to 75	65 to 78
Retained Stability (%) (min)	70	70	70	70
Minimum Theoretical Film Thickness (µm) **Design Air Voids (%)** **4.0 and 3.9** **3.7 and 3.8** **3.5 and 3.6**	 6.0 6.1 6.2	 6.0 6.1 6.2	 6.0 6.1 6.2	 6.5 6.6 6.7
Crushed Fragments: minimum material retain on the 5000 µm with two crushed faces	98 (one face) 90	80	60	60
Manufactured fines content as a percentage of fine aggregate mass (minimum)	80	70	50	Note 2

Note 1 – The Design Air Voids shall be chosen as the lowest value, within the range of 3.5 to 4.0% inclusive, such that all other mix design criteria are met.
Note 2 – All fines manufactured by the process of crushing shall be incorporated into the mix.

The mix produced shall conform to the job mix formula approved by the **Developer's engineer** and to the following tolerances:

- The percent of asphalt cement in the mix shall not vary by more than 0.3% from the percentage indicated in the approved mix design.
- The mix design shall be carried out by an accredited testing agency and shall be submitted to the **CAO** for approval. A minimum of 10 working days shall be required to evaluate the mix design and issue an approval.

G5.8 Surface Smoothness:

The finished surface shall be uniform and true to established crown and grade and have entirely smooth riding quality. The surface shall have a tightly knit texture and shall be free from segregation and surface cracking.

The surface of the finished pavement shall be free from depressions exceeding 6 mm as measured with a 3 m straight edge, parallel to the center of the road.

Any low or defective areas shall be immediately remedied by cutting out the asphalt layer and using fresh hot mixtures and compacting immediately to conform to the surrounding area and be thoroughly bonded to the underlying and **adjacent** asphalt surfaces.

G5.9 Weather Limitations:

Asphaltic Concrete Surfaces shall be placed and compacted during daylight hours, when the air temperature is not less than 0°C and the road surface is dry from frost or rain.

G5.10 Final Density Results:

All asphaltic concrete to be compacted to minimum 97% of Marshal Density prepared from the samples of the asphalt mixture being used.

Asphaltic densities less than 96% of Marshal Density require asphalt to be removed, or alternately the **Developer** may be required to provide an extended **Maintenance** period at his entire cost.

G5.11 Asphalt Thickness:

All asphaltic concrete pavements shall be of the thickness indicated on the approved design drawings.

Areas deficient in thickness by more than 10% of the design thickness shall require the **Developer** to place an additional 25 mm thickness of asphalt over the portion of roadway that is deficient.

G5.12 Testing:

The following tests shall be carried out for each 1000 tonnes of asphalt pavement or at least one each shift during placing operations:

- Sieve analysis,
- Bulk specific gravity of compacted mixture,
- Bitumen content,
- % voids in the mineral aggregate,
- Air voids in compacted mix.

A minimum of three core density tests are required to obtain on average for each project, with a maximum of one test for each 1000 m^2 of compacted asphalt.

G5.13 Staged Asphalt Construction:

All roadways shall be constructed with the final lift placed in the year the subdivision is eligible for Final Acceptance.

Asphalt placement shall bring the roadway to its original design crown as shown on the approved engineering drawings.

An additional one (1) year materials and workmanship warranty shall be required for the final lift after the **Final Acceptance Certificate** is issued for surface improvements.

G5.14 Asphalt Stabilized Base Course:

Asphalt stabilized base course shall consist of an intimate mixture of crushed aggregate and asphalt, which is placed upon the previously prepared surface, compacted, and finished to the specified thickness, approved grades, lines, and typical cross-section.

G5.15 Aggregate in Mix:

When tested by means of laboratory sieves, the combined aggregates in the mix shall meet the following gradation:

Sieve Size Cumulative	% Passing by Weight
16 mm	100
12.5 mm	89 – 100
10 mm	78 – 94
5 mm	55 – 70
1.25 mm	26 – 45
0.630 mm	18 – 38
0.315 mm	12 – 30
0.160 mm	8 – 20
0.080 mm	4 – 10

G5.16 Asphaltic Binder:

The asphaltic binder shall be MC 250 or HF 500 m.

G5.17 ASBC Mix Design:

The ASBC mix design shall follow the Marshall Method of Mix Design (modified as described below) and meet the following design criteria at the recommended design cutback asphalt:

	MC 250	HF 500m
Blows per Face	75	75
Marshall Stability (N) at 25ºC (water bath)	6700+	3000+
Marshall flow (mm) at 25ºC	2 – 4	2 – 4
Air Voids (%)	3 – 6	3 – 6

Modifications to the Marshall Design Procedure:

The design procedure shall be performed using MC 250 asphalt with 50% of the solvent removed,

- Stability – use a water bath at 25ºC with a soak time of 35 minutes.

G5.18 Approval of Mix Design:

The **Developer** shall retain the service of a Professional Engineer and a qualified testing laboratory to prepare an ASBC mix design for submission to the **CAO** for approval, it should include the following information:

- The gradation of each aggregate to be used in the mixture,
- The percentage by mass of each aggregate to be used in the mixture,
- The job mix formula gradation of the combined aggregates,
- All Marshall Mix design characteristics including graphs used to arrive at the final mix design, the bulk specific gravity of the combined aggregates, and the asphalt absorption of the combined aggregates,
- The recommended design residual asphalt content as a percentage of the dry weight of the aggregates, and
- NOTE: Residual asphalt is determined at the optimum cutback asphalt content and is calculated based on the cutback asphalt asphalt/solvent ration.

Void calculations are based on the MC 250 content with 50% solvent removed.

The **CAO** will require a minimum of 10 working days from the time of receipt of the design to evaluate the mix design.

A separate and complete mix design will be required from the **Developer** for any changes in the source and/or nature of the aggregate.

An asphalt mix supplied or placed by the **Developer** without receiving written approval of the mix design from the **CAO** may not be accepted.

G5.19 Production:

Asphalt stabilized material shall be mixed through a central mixing plant.

The asphalt plant shall be calibrated to produce the designated mix graduation and asphalt content to ensure mix uniformly and consistency.

Crushed aggregate shall be dried such that the moisture content of the final mix is 1% or less at the plant discharge. Asphalt binder shall be uniformly applied to the crushed aggregate at the rate designated in the mix design. Neither aggregate nor asphalt shall exceed 95°C at the time of plant mixing. Mixing shall continue until all asphalt is uniformly dispersed throughout the mix and the aggregate particles are coated with asphalt. The drying and mixing process shall not reduce the cutback level to such a degree that the mix cannot be properly placed. Up to the time of spreading and placing, the amount of cutback in the mix shall not be reduced to less than 40% of the original cutback weight.

G5.20 Spreading and Compaction

The mix shall be spread and compacted to specified grade and cross-section, be uniform in gradation, density and asphalt content at the values specified, and the finished surface shall be smooth, waterproof, and free of roller marks.

The mix design shall be compacted to not less than 98% of Marshall Density.

The mix design shall be produced, placed, and compacted in a uniform and non-segregated manner at the application rate and asphalt temperatures designated. Air temperature in the extreme shade at the time of application shall be 10ºC or higher. All necessary steps should be taken to remedy any of the causes of aggregate segregation of non-uniform asphalt distribution that may occur. Any areas, which are segregated, or excessively rich, lean, or wet shall be corrected by whatever means necessary.

Additions such as asphalt binder, mixing, and/or aeration of the mix to reduce cutback shall be performed as is necessary to produce a satisfactory mix prior to final spreading and compaction.

G5.21 Final Density Requirements:

All asphaltic stabilized base courses shall to be compacted to minimum 98% of Standard Proctor Dry Density.

Asphaltic densities less than 95% may require asphalt to be removed, or alternately, the **Developer** may be required to provide an extended **Maintenance** period at their entire cost.

G5.22 Asphaltic Thickness:

All asphaltic stabilized base courses shall be of the thickness indicated on the approved design drawings.

Areas deficient in thickness by more than 10% of the total design thickness shall require the **Developer** to place an additional 25 mm thickness of asphalt over the portion of roadway deficient.

G5.23 Testing:

A minimum of one (1) moisture content and one (1) extraction test shall be taken for each 1000 tonnes of mix placed.

A minimum of one (1) density test for each 1500 m^2 of compacted 50 mm lift of ASBC shall be taken.

A minimum of three (3) material thickness tests per 100 linear metres of compacted ASBC shall be taken.

G5.24 Prime Coats, Tack Coats and Fog Coats:

Prime coats shall be the application of bituminous material to subgrade on previously prepared gravel base course prior to placing bituminous surfacing materials.

Tack coats shall be the applications of bituminous material to a previously constructed asphalt surface of any type in preparation of placing bituminous surfacing materials.

Fog coat shall be the application of bituminous material to seal small cracks and surface voids and as a curing seal for asphalt stabilized base course.

The bituminous material for priming the base course shall be liquid asphalt. The asphalt types may vary from MC30 to MC250, from SS-1 to a special emulsified primer (S.E.P.1) top suit the conditions of the base. The rate of application may vary from 0.50 L/m to 1.50 L/m based on the nature of the base materials. The rate should permit a good penetration of the base without ponding on the surface. Excess asphalt materials remaining 6 hours after applications shall be absorbed and removed with sand blotter material. Temperature of application shall fall within the following limits:

Medium Curing Asphalt:	Emulsified Asphalt:
MC30 – (51°C – 68°C)	SS-1 – (24°C – 54°C)
MC70 – (74°C – 88°C)	S.E.P.1 – (15°C – 50°C)
MC250– (100°C –110°C)	

The asphalt for the tack coat may vary from SS-1 to SS-1H; from RC 30 to RC 250 depending on conditions to suit the base. The SS emulsion shall be applied by adding an equal amount of water prior to application. The rate of application shall be 0.25 L/m to 0.90 L/m, based on the application of the asphalt base. The rate shall ensure that a uniform coverage providing a good bond after curing is achieved.

Temperatures of application shall fall within the following limits:

Rapid Curing Asphalts:	Emulsified Asphalt:
RC 30 – (51°C – 68°C)	SS-1 – (24°C – 54°C)
RC70 – (74°C – 88°C)	SS-1H – (24°C – 54°C)

The bituminous material for the fog coat shall be SS-1 or MC30 to suit the conditions of the ASBC surface. The rate of applications may vary from 0.3 L/m to 0.7 L/m. The rate shall ensure that a uniform coverage is achieved. Temperatures of application shall fall within the following limits:

Medium Curing Asphalts:	Emulsified Asphalt:
MC30 – (51°C - 68°C)	SS-1 – (24°C – 54°C)

G5.25 Quality Control and Testing:

The **Developer** shall be responsible for quality control and the cost of all testing related to roadway construction, including sieve analysis, densities, mix designs, core sampling, at his entire cost.

Copies of all quality control testing shall be forwarded for review to the **CAO** prior to the issuance of a **Construction Completion Certificate** (CCC).

G5.26 Pavement Payment Penalties:

If the average core thickness does not meet specifications, at the discretion of the **CAO**, the asphalt may be assigned a pay factor according to the design specs of material, Hot-Mix Asphalt Paving, Table 02741.1 Asphalt Thickness Pay Factors.

If the average core density does not meet specifications, at the discretion of the **CAO**, the asphalt may be assigned a pay factor according to the Hot-Mix Asphalt Paving, Table 02741.2, Asphalt Density Pay Factors.

It shall be the responsibility of the **Developer's engineer** to submit the pay factor calculations as applied to the contract price to the **County** for approval prior to acceptance of the **Construction Completion Certificate** (CCC).

G6 CONCRETE

Material requirements to be met are Portland cement to Canadian Standards Association (**CSA**) A3000, Type 10 Normal, Type 30 High Early Strength or Type 50 Sulphite Resistant.

Aggregate requirements to be met are to Canadian Standards Association (**CSA**) –A23.1, Clause 5.3.2, Table 1.

Water requirements are to be to **CSA**-A23.1, Clause 4, clear and free of deleterious materials, oil, acid, alkali, organics, sediments, and any other foreign material harmful to the mixing or curing of concrete.

If Air-Entraining Admixtures are required for use they are to be in accordance with American Society for Testing and Materials (**ASTM**) C260.

Chemical Admixtures will be in accordance with American Society for Testing and Materials (**ASTM**) C494. Chemical admixtures include water reduction

agents, accelerators, or retarders. The use of Admixtures must have prior approval in writing from the **CAO**.

The pouring of concrete in cold weather conditions must have prior approval from the **CAO**. Approval requests must include mix design, additives, and hoarding details.

Placement of hot or cold weather concrete is to conform to **CSA**-A23.1.

Flyash to **CSA**-A23.5.

Production of concrete is to conform to **CSA**-A23.1, Clause 18, and is to be in conformance with all approved mix design requirements.

All concrete reinforcement structures, formwork, inserts, or accessories are securely fastened and will not move during concrete placement. All form work is to be inspected to verify this work may properly commence. The **CAO** is to receive 48 hours' notice prior to the placement of concrete.

Delivery of concrete to the jobsite to be in conformance with Clause 18.4, **CSA**-A23.1.

Transport of concrete only with equipment with mixing capability, rotating drum truck. Prior to discharge the drum is to be rotated at mixing speed for 3 minutes.

Retempering of concrete is only permitted to be performed by a qualified Quality Control Technician. The QC Technician shall perform a slump test and air content test on each load of concrete retempered and shall provide the results immediately to the **CAO**.

Concrete is to be discharged within 1.5 hours or prior to 300 revolutions of the drum, whichever occurs first, after the initial introduction of the mixing water to the cement and aggregates at the plant.

Provide the **Municipal Engineer** with the delivery ticket showing the batch plant location, ticket and truck number, and supplier's name. The date and time are to be mechanically punched recording the initial mixing time at the plant. The class and mix designation are to be identified illustrating the cement type, aggregate size, type and amount of admixtures, water added, volume of concrete, the site arrival time, and time of discharge.

Concrete placement is to be in accordance with Clause 19 of **CSA**-A23.1.

Forms and substrate surfaces are to be slightly moistened to minimize absorption of water drawn from the concrete mix.

Concrete is not to be placed during periods of rain. Subgrade following rain events must be checked to ensure concrete is not placed on mud or pooled water.

Reinforcing steel materials are to meet CAN/**CSA**-G30.18. Steel wire to meet **CSA**-G30.3M. Welded steel wire fabric to **CSA**-G30.5M. Epoxy coating to American Society for Testing and Materials (**ASTM**) A775/A775M. Galvanizing to CAN/**CSA**-G164. Supplementary materials and their use to meet **CSA**-A23.5.

Field bending or welding of reinforcement is permitted only where authorized by the **Developer's engineer**. Any bars that develop cracks or splits will be replaced.

Place reinforcements as indicated on the approved drawings and in accordance with **CSA**-A23.1. Approval of reinforcement material placement is required before placing of concrete.

All vertical face curb structures require a minimum compressive strength of concrete at 28 days of 30 MPa.

All other curb and gutter to have 25 MPa compressive strengths at 28 days.

Cured in place samples must be provided with test results provided.

All other concrete structures require a minimum compressive strength of concrete at 28 days of 30 MPa.

Concrete placement is to be poured as rapidly and continuously as possible between the predetermined construction joints as designed by the **Developer's engineer**.

Concrete is to be consolidated and finished in accordance with **CSA**-A23.1 and to good industry practice. Provide cover as required to protect the work.

G7 SIGNAGE

The supply and installation of a traffic control and street identification signs is the responsibility of the **Developer**.

Traffic control signs shall be manufactured and installed in accordance with the latest edition of “Uniform Traffic Control Devices for Canada”.

Street addressing signs shall be located within 10 m of the intersection in the direction of the near-side approaching traffic. Signs shall be offset at least 1 m from the edge of the road and mounted 3 m to 3.5 m above the finished road surface. Street addressing signs shall be a minimum size of 15 cm x 60 cm and a maximum of 15 cm x 90 cm. The lettering shall be 10 cm high. If the address does not fit on the maximum size, two signs may be joined with an end bracket and H-clip. Signs shall have silver lettering with a blue background.

Except in urban areas, a clearly visible panel containing the proper number of the parcel of land accompanied by the proper road number or number which complies with the following specifications; numbers and letters are not to be less than 10 cm (4 inches) in height, light reflective, white in color, mounted on a light reflective green panel, and the sign is to be posted 1.8 m (6 feet) to the left of the access/entrance of the parcel of land, and 0.3 m (one (1) foot) inside the **Property** line and a minimum of 1.22 m (4 feet) above the natural ground level so as to be clearly visible from the road.

In urban areas, the proper number for the parcel of land, such numbers being not less than 10 cm (4 inches) in height.

All signs shall be placed so as not to obstruct the view of oncoming vehicles.

Permanent subdivision identification signs located at the entrance shall:

- Be designed to be **Maintenance** free for a minimum of 15 years,
- Be constructed and installed to hold signs rigidly in their proper and permanent position,
- Be constructed of concrete, masonry, stone, non-ferrous metal or a combination thereof,
- Be maintained by the **Developer** to the end of the **Maintenance** period.

Material for temporary signs, such as subdivision layout signs, shall be approved by the **County** prior to installation. Removal of temporary signs shall be the responsibility of the **Developer** prior to the end of the **Maintenance** period.

The **County** shall install rural address signs within the proposed **Property**. **Developer** will be responsible for all costs, both new and replacement.

All parcels of land fronting upon a **County** road, which are occupied by a residence, shall be assigned a municipal address by the **County**.