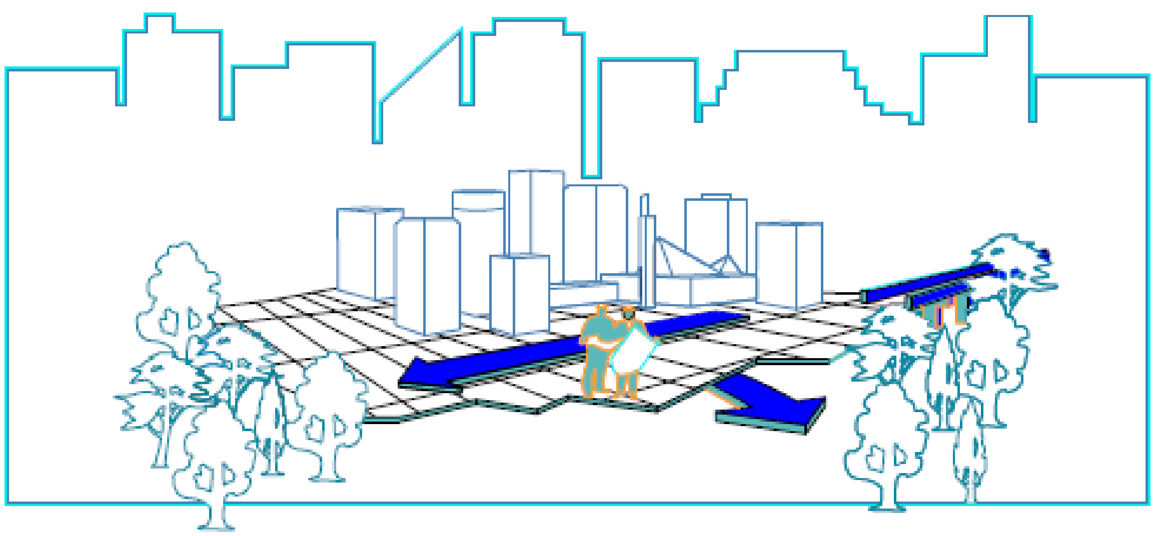
VOLUME 2

ROADWAYS

DESIGN STANDARDS

CONSTRUCTION SPECIFICATIONS



2015 EDITION

THE CITY OF Edmonton
TRANSPORTATION SERVICES

DESIGN AND CONSTRUCTION STANDARDS
VOLUME 2
ROADWAYS

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1. GENERAL REQUIREMENTS

1.1 The Developer shall present plans to the Engineer that, in the Engineer's opinion, are complete, accurate and in accordance with the standards presented and referred to in this document. The plans shall be sealed by a registered Professional Engineer and indicate the Developer's proposal for the roadway, walkway and alley system. The plans, at a minimum, must include all of the mandatory subdivision or development permit conditions. The Transportation Department will review the drawings with respect to adherence to the standards presented in this document, but shall not be responsible for engineering omissions and errors shown on or relating to these plans.

1.2 The Developer shall submit all plans a minimum of 3 months before the proposed initial date of construction. If the Engineer finds that any part of the Developer's plans or proposals do not meet the required standards; the plans shall be returned to the Developer for revisions to the satisfaction of the Engineer. The period from return to resubmission of such plans or proposals shall be in addition to that specified in this paragraph. The developer shall allow an extra 3 weeks for the initial review and response of Arterial Road Preliminary Design plans as outlined in Chapter 1, 7.3. Preliminary Design plans must be approved prior to the submission of Engineering Drawings for review and approval.

1.3 The Developer shall ensure that unapproved roadway plans are resubmitted for review within two weeks after approvals have been received for the installation of sewer mains and water pipe. Any submission received after this two week period will not relieve the Developer of making any changes to the constructed underground services due to revisions requested by the Engineer to meet the required standards.

1.4 Where the Developer's proposals include railway or high-pressure pipeline crossings, or trails within utility rights-of-way, the Developer shall be fully responsible for the preparation and submission of plans to the owners or proper approving authorities and obtaining the necessary permission to enter upon, cross over, or engage in construction upon any gas or oil transmission lines or railways. The Developer shall bear the full responsibility for any works, extra costs, damage claims, or insurance costs related to any of the above-mentioned crossings. The Developer shall also submit documentary evidence to the Engineer that such permits have been obtained 48 hours before beginning construction.

1.5 Where a Developer's proposals included construction on Provincial Lands, the Developer shall be fully responsible for the preparation and submission of plans to the Province and securing the necessary Ministerial consent for such construction. The Developer shall also submit documentary evidence to the Engineer that such approvals have been obtained at least 48 hours before beginning construction,

1.6 After the plans have been reviewed and signed by the Engineer, three complete sets of Engineering Drawings shall be submitted a minimum of 48 hours before beginning construction. The Developer shall also submit three A3-sized reductions of the approved overall road, curb and sidewalk plan.

1.7 Where regulations, bylaws, other enactments or standards are referred to, reference shall be to the version in force at the time the plans are submitted.

2. ROADWAYS

2.1 General

2.1.1 The Developer is responsible for coordination of the design criteria for roads, walkways and trails, and the designation of cross sections for each street. walkway, and path within a subdivision area.

2.1.2 The classification and designation of road, walkway, and path sections shall be performed during the subdivision planning stages. Beginning with the Area Structure Plan, the roadway, walkway, path, utility, traffic and road right-of-way requirements must be determined and established by and approved by the Subdivision Authority. The final subdivision plan registered at Alberta Land Titles office must be prepared in accordance to the conditions of the Subdivision Authority and the approved Engineering Drawings.

2.2 Classification

2.2.1 Road classification and designation should generally be established on the basis of the classification system detailed in Chapter A of the "Geometric Design Guide for Canadian Roads", Transportation Association of Canada, 1999.

2.2.2 The City of Edmonton uses the following road classifications which have been derived from the Transportation Association of Canada classification system noted above:

2.2.3 **Residential/Industrial Local**

8.0 m Urban Local Residential, Mono Walk*	Drawing 2100/2110/2120
9.0 m Urban Local Residential	Drawing 2200/2210
11.5 m Urban Local Industrial	Drawing 2300/2310/2320/2330/2340
Urban Residential Service Road	Drawing 2030
Urban Industrial Service Road	Drawing 2031

* Use and application of 8.0m Urban Local Residential standard in Subdivision Plans is contingent on approval by the Transportation Department prior to submission of Engineering Drawings. Prior to approval the proponent of this standard must be prepared to submit an application package under separate cover identifying how this standard will be integrated into the overall neighbourhood plan by identifying the varying approved land-use and both existing/proposed developments.

2.2.4 **Collector**

11.5 m Urban Collector Undivided	Drawing 2300/2310/2320/2330/2340
14.5 m Urban Collector Undivided	Drawing 2400/2410

2.2.5 **Arterial**

5-Lane Urban Arterial Undivided	Drawing 2500
4-Lane Urban Arterial Divided	Drawing 2510
6-Lane Urban Arterial Divided	Drawing 2520

2.2.6 The Developer shall submit arterial road preliminary design plan for review and approval by the Transportation Department when a development involves the improvement of an existing and / or proposed arterial road. Approval of such plan is required prior to the approval of the detailed design plans. Refer to Chapter 1, 7.3 for details. Upon construction, approved project signs are required at all construction limits of the arterial project. Refer to Drawing #6520 for further detail.

2.2.7 Based on the classifications listed above, typical road and walkway geometric design standards, recommended by the City of Edmonton, have been summarized in Section 10.

2.3 Design Standards and References

Specific details of all aspects of the geometric design of roads can be found in the following references:

Geometric Design Guide for Canadian Roads, TAC, 1999.

Design vehicle dimensions for use in geometric design, TAC, 1999.

Metric Curve Tables, TAC, 1999.

A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, 2001.

2.4 Geometric Design

The City of Edmonton, Transportation Department, does not rely exclusively on any of the above-noted references, therefore the Engineer shall make the final decision regarding design, having regard for the following:

2.4.1 In the design of local and collector roadway intersection curb returns, the minimum curb radius is to be based upon the horizontal turning movement for the anticipated vehicle traffic. In general, however, the following minimum radius are acceptable;

Arterial / Collector	15m
Collector / Collector	15m

Collector / Local	9m
Local / Local	6m

All references are to curb face. Radii for development accesses are project specific.

2.4.2 Horizontal Alignment of all roadways should give consideration to design and operating speeds first to determine proper radius and use of super-elevation or crown. Superelevation on Local or Collector Road classifications should be avoided where possible in urban areas as one step to assist with controlling operating speeds.

2.4.3 For vertical curves in a sag location only, a minimum drainage requirement of 0.5% shall be maintained along the gutter line. This requirement provides a minimum grade throughout the vertical curve and eliminates a short length at near-horizontal grade.

2.4.4 Vertical curves are required for all road profiles demonstrating an algebraic grade difference greater than;

Arterial	1.0%
Collector	1.5%
Local	1.5%
Alleys	2.0%
Shared use Path	6.0%

Successive short tangent lengths of various grades are not an acceptable design to eliminate vertical curves.

2.4.5 The design of arterial roadway intersection curb returns is to be based on vehicle capacity analysis, vehicular turning movement (WB-15) and speed reduction. In general, however, the standards shown on Drawings 3100 - 3210 and 3300 - 3350 are acceptable.

2.4.6 When a transition section is required between varying types and sizes of curbs and gutters, a detail showing how the transition is to be built must be provided.

2.4.7 In the design of major roadway islands, where drainage is a factor, the normal curb and gutter section is to be used and shall include a means of collecting island and roadway drainage. Minor roadway islands not at intersections and with low traffic volumes will allow for reverse gutter. Discretion on use and application is by the Engineer.

2.4.8 When collector or arterial roads require super elevation as shown in Section 10 or at the intersection of collector roads, the Engineer may require additional grading information. At the time of final roadway engineering design, the Developer and the Engineer must agree upon the actual details required.

2.4.9 Intersections along a main road where the main road is paralleled by an industrial service road shall have an entrance for the industrial service road using a bulb-end design. The curb line alignments of the bulb entrance should be designed to accommodate anticipated industrial vehicles. A typical example of curb and property line alignments for a bulb-end entrance, which have been passed on a WB-21 design vehicle, is shown on Drawing 3000. As illustrated on this drawing, the property line alignment is established after buffer, road and boulevard widths have been defined.

2.5 Road Structural Design

The first submission of engineering drawings shall be accompanied by a geotechnical report complete with borehole logs. The report shall specify the road structures required and all assumptions used in the road structure design, including CBR values, design traffic loading and the pavement design life. Similarly, consideration should be provided by the geotechnical report to the pavement structure associated with the construction of Shared Use Paths or Top-of-Bank Trails.

3. SIDEWALKS, WALKWAYS, PATHS AND TRAILS

3.1 General

Pedestrian environments which are designed to be used by the general public, including those with disabilities, should be accessible to all persons, as well as being safe, functional and attractive. The environments in public places should be designed to allow safe and convenient access by all pedestrian traffic.

3.2 Classification

The City of Edmonton defines four classes of walkways and trails:

1.5 m Concrete Walkway	Drawing 5140
1.5 m (or greater) Concrete Walkway	Drawing 5150
3.0m Shared Use Path	Drawing 5160
Granular Walkway	Drawing 5170

3.3 Location Requirements

3.3.1 Sidewalks, walkways, paths and trails shall form a comprehensive and integrated pedestrian circulation system within a neighbourhood.

3.3.2 Either a sidewalk, walkway, path or a trail shall directly abut each lot as described below.

Asphalt Walkway / Shared Use Paths shall be constructed adjacent to or within:

- Arterial Roads (minimum one side, must be separate)
- SWMF, Utility corridors and Utility Rights of Way wider than 6.0 metres as defined by the City of Edmonton Shared Use Path Network
- Top of Bank Walkways designated for Developments abutting the North Saskatchewan River Valley Bylaw (7188)

Granular Walkways / Trails shall be constructed adjacent to or within

- Top of Bank as defined in the Neighbourhood Plan or subdivision
- Storm Water Management Facilities (SWMF)
- Transportation and Utility Corridor (unless asphalt trails are permitted by the Province)

Concrete Sidewalks shall be constructed adjacent to:

Residential local and collector roads (both sides of the street, or as approved by the Engineer);
Industrial collector roads (one side only including bus stop connecting walks on opposite side)
School sites (2.0m monolithic);
Commercial sites;
Transit Zones / Stops; and
All other land uses that, in the opinion of the Engineer, generate significant pedestrian traffic.

Sidewalks will be required in culs-de-sac as described below and as shown on Drawing 3540.

Culs-de-sac with 10 or fewer lots fronting and/or flanking the cul-de-sac do not require a sidewalk.
Culs-de-sac with fewer than 18 lots and less than 120 m only require a sidewalk on one side.
Culs-de-sac with 18 or more lots fronting and/or flanking the cul-de-sac require a sidewalk on both sides.
Culs-de-sac with a sidewalk connection to a walk or trail system will require a sidewalk on both sides.

Sidewalk on One-Side Only (Urban Residential Local).

The Transportation Department will provide due consideration to complete proposals that vary from these standards. Proposals of “Sidewalk on 1 Side” must be able to demonstrate that mobility by all types of pedestrians is not significantly compromised. Similarly, the proposal must be able to support all current City inititiatives to promote walkability. Applications of this nature must be made under separate cover, and approval is required prior to submission of Engineering Drawings. The application should also include a plan identifying how this information will be disseminated to prospective home buyers.

3.4 Sidewalk, Walkway, Paths and Trail Geometrics

To ensure that the design of pedestrian environments accommodates the greatest possible number of people, it is desirable to adhere to the following: allow a clear path of travel, free of obstructions; provide a firm, non-slip and glare-free surface; ensure that the gradients along the path of travel are gradual to allow access by all and that landings are added as shown in 3.6.2.

3.4.1 Sidewalks

Sidewalks should be accessible by way of curb ramps (Details 5500/5510). Street furniture (i.e. hydrants, manholes, water valves, etc.) and soft landscaping (i.e. shrubs, etc.) located within road right-of-way should be located a minimum 0.5m clear from the edge of all sidewalk to provide a clear path of travel. Hard landscaping (i.e. trees) should be located a minimum 1.0m clear from the edge of all sidewalks to provide enough clearance for the tree to mature while maintaining enough space to effective maintain the sidewalk infrastructure.

	Adjacent Facility	Type	Material	Width
Sidewalk	Local / Collector	Monolithic	Concrete	1.5 m
Sidewalk/Walkway	Local/Collector/Arterial or Walkway Lot	Separate	Concrete	1.5 m
Sidewalk	Arterial	Separate	Concrete	1.5m
Shared Use Path	SWMF or Utility Lot > 10 m in width	Separate	Asphalt	3.0 m
Shared Use Path	Arterial	Separate	Asphalt	3.0m
Granular Walkway	Top of Bank & SWMF	N/A	Granular	1.5 m
Granular Walkway	TUC	N/A	Granular	3.0 m

3.4.2 Walkways Wider than 1.5 m

Walkways wider than 1.5 m may be required on a case-by-case basis. Intersection design shall, at the discretion of the Engineer, be kept simple and functional. Elaborate all-directional formats resulting in excessive concrete areas shall be avoided. A curvilinear walk alignment may be considered where walkway rights-of-way exceed 10 m in width. On all simple walkway intersections, 1.5 m fillets shall be constructed at the intersection corners.

Mid-block pedestrian crossings should generally be minimized and alignments should give consideration to directing pedestrians to established or designed controlled intersection locations. If mid-block pedestrian crossings are proposed, alternate pedestrian crossing improvements by geometric design (i.e. alignment) and traffic control (i.e. signage or pavement markings) should be considered.

3.4.3 1.5 m Wide Concrete Walkways

The horizontal alignment of minor walkways should generally be centred on the right-of-way wherever possible. In cases where utilities are located within the right-of-way, alternate alignments may be required at the discretion of the Engineer to avoid possible conflicts and maintenance concerns with the utilities. A curvilinear walk alignment may be considered where walkway rights-of-way exceed 10 m in width. On all simple walkway intersections, 1.5 m fillets must be constructed at the intersection corners.

3.4.4 Shared Use Paths

The alignment of Shared Use Paths, intended to accommodate multi-modal transportation and recreational uses, should acknowledge the most current design concepts when preparing the geometric design. A best practice is to ensure that a design speed of 30km/hr is used when laying out the alignment and determining sightlines and vertical profiles.

3.5 Vertical Alignment

3.5.1 The vertical alignment of the walkway should be integrated with the horizontal alignment, drainage and berm construction. Since the walkways are used as self-contained drainage corridors, the walkway should be designed to facilitate positive drainage flow. The normal longitudinal grade of the walkways is 0.7% and the minimum permitted grade is 0.5%. The crossfall should be a designed at 2% with a landscape swale offset from the walkway.

3.5.2 Variations from the specifications for the design or construction of improvements shall be submitted to and receive written permission from the Engineer before beginning construction. Field design is not an acceptable practice for laying out walkway, sidewalk, and Shared Use Paths.

3.5.3 The Developer shall submit the detailed walkway and grading plans for approval by the Engineer in conjunction with the detailed engineering drawings for all other municipal improvements in the development area. All landscaping plans shall conform to plan standard requirements noted in Section 1 of this document.

3.6 Walkway Details

3.6.1 Berms

Berms shall only be developed at those locations where, in the opinion of the Engineer, their construction will not interfere with the normal lot drainage of abutting properties. Where lot drainage problems occur, the berm shall be constructed to provide a positive drainage swale on the property side of the berm that has been developed in accordance with the approved lot grading plan. The berm slopes shall not be steeper than 3.5:1 where there is manicured sideslope (3:1 is acceptable with naturalized planting material). The edge of berm shall not be closer than 1 m from the edge of the walkway. Lot drainage problems affecting lots that conform to the lot grading plan and resulting directly from the development of the berm shall be the exclusive responsibility of the Developer.

3.6.2 Grading

Fine grading shall be done in accordance with the landscaping plan. The grades shall conform to the gradient of the walkway to avoid conflicts with the drainage pattern within the right-of-way. Walkway gradient details are shown on the following table.

Maximum Slope	Maximum Length	Maximum Height	Landings[3]
≤2%	None	None	Not required
>2% to <5%	None	None	[1]
5%	None	None	[1]
6.25%	12 m	750 mm	Every 12 m
8.30%	9 m	750 mm	Every 9 m
10%	1.5 m	150 mm	[2]

Notes:
1 Landings at 750 mm elevation difference are desirable
2 It is recognized that the gradient and building layout on some streets may make the provision of landings impractical
3 Landings are not practical for Shared Used Paths as they can often lead to operational hazards

3.6.3 Drainage

Catch basins shall be located a minimum of 600 mm from the edge of the walkway and shall be constructed to Section 02631 – Manholes and Catchbasins, in the Construction Specifications.

3.6.4 Pipelines

Where walkways cross or are located within an existing major utility or pipeline right-of-way, the developer/consultant will be responsible to obtain proper written permission/agreement with the appropriate authority prior to construction. The developer/consultant may be asked to produce a copy of a plan approved by the appropriate authority permitting construction of the walkway within the utility or pipeline corridor.

3.6.5 Utilities

All surface appurtenances associated with underground utilities should be located outside of the sidewalk. This includes but is not limited to; catchbasins, catchbasin manholes, water valves, power/telephone vaults, etc.

3.6.6 Pedestrian protection

Pedestrian protection where major walkways intersect roadways and alleys shall include a combination of trees, shrubs, bollards and/or berms, as required by the Engineer and shall be strategically located to form a protected zone.

3.6.7 Park sites

Walkways adjacent to school/park sites shall be designed in cooperation with the General Manager of the Asset Management and Public Works Department to coordinate walkway and trail design with the design of these sites.

3.6.8 Stormwater Management Facilities (SWMF) sites

When the alignment of a pedestrian facility is planned within the footprint of a SWMF the designer should provide due consideration to how the operation of the SWMF will impact operation of the pedestrian facility. This may include making provisions to locate the facility above certain flood frequencies to ensure minimal disruption or conflict or amending the alignment to ensure proper longitudinal drainage is maintained.

3.6.9 Construction

All concrete walks shall be constructed to Section 02770 – Concrete Curb, Gutter, Walk and Slabs, in the Construction Specifications.

3.6.10 Landscape

The location, quantity, size, condition of planting and variety listed in common and botanical names, shall be specified on the planting plan.

3.6.11 Benches

Benches shall be provided by the Developer and placed at strategic locations within the walkway. The benches should be located a minimum of 1 m from the edge of the walkway.

3.6.12 Waste receptacles

The Developer shall provide waste receptacles where major walkways intersect with streets. The waste receptacles shall be of the standard type defined for walkway use by the General Manager of the Asset Management and Public Works Department and shall be located within the walkway right-of-way and no more than 3 m from the road right-of-way. The City shall maintain the receptacles after their installation by the Developer.

3.6.13 **Lighting**

The lighting design and other utilities must be shown on the construction plan submitted for City approval.

4. ALLEYS

4.1 Classification

The City of Edmonton has developed two alley classifications:

4.0m Residential alley	Drawing 2040
6.0m Commercial alley	Drawing 2041

4.2 Alley Geometrics

4.2.1 **Horizontal alignment**

Alleys should be centred on the alley right-of-way wherever possible. A 3 m fillet shall be constructed at the intersection corners of all alley intersections. The length of an alley from the nearest street cannot exceed 120m.

4.2.2 **Vertical alignment**

The vertical alignment of alleys adjacent and parallel to collector or arterial roadways shall be designed in conjunction with the grades on the adjacent roadways. The minimum longitudinal grade for alleys is 0.7%.

4.2.3 **Culs-de-sac**

A standard cul-de-sac is required to terminate an alley, as shown on Drawing 3040 Alley cul-de-sac are not permitted without specific authorization from the Transportation Department.

5. WALKWAYS DESIGNATED FOR EMERGENCY ACCESS

5.1 Where a walkway is designated as an emergency access route by the Engineer, the following requirements apply:

5.2 The walkway shall be centred on the right-of-way (straight alignment) and constructed with 120 mm of Portland cement concrete. The walkway width shall be a minimum of 3 m to allow access by emergency vehicles, as shown on Drawing 5130.

5.3 If planting is proposed for the right-of-way a minimum 4 m clearance must be provided to allow access by emergency vehicles.

5.4 T-bollards must be placed at each end of the walkway access, as shown on Drawings 6250/6251. The posts shall prevent non-emergency vehicle access while allowing access for maintenance equipment and emergency vehicles.

5.5 Standard curbs at the approaches to the walkways are adequate; drop curbs are not required.

5.6 Walkway lighting standards and other furniture must be located a minimum of 1.0m offset from the sidewalk so that they would, in the opinion of the Engineer, not obstruct emergency vehicle access.

5.7 The normal gradient for emergency access walkways shall be 0.7% and the minimum gradient shall be 0.5%.

6. TEMPORARY ROADS AND TURNAROUNDS

6.1 When it has been determined by the subdivision approving authority that a temporary road is required in a new subdivision, the road shall be built in accordance with plans approved by the Engineer, with all costs thereof borne by the Developer, as shown on Drawing 2060.

6.2 A temporary road between a proposed subdivision and an existing local or collector road which is required as a point of access shall be constructed to one of the following standards:

6.2.1 When the residents of the proposed subdivision will use the temporary road, it shall be constructed to the completed paving stage of a roadway. A temporary road constructed through or flanking a single family lot shall have screen fencing provided to buffer the adjacent development, and a sign indicating the temporary nature of the road shall be erected.

6.2.2 When the temporary road will be used only by construction traffic and will be taken out of service before residential occupancy of the subdivision following the construction of permanent access points, the road shall be constructed to the interim gravel stage without curbs and gutters. When the temporary road crosses the curbs, gutters and sidewalks of adjoining roads, provision shall be made to permit regular vehicle movement across the curbs.

6.2.3 Where a road terminates at mid-block and has no provision for egress, a temporary circular turnaround shall be constructed to the same structure as the abutting roadway and shall be designed with a minimum 12m radius on a Local/Collector (without Transit) or a 17m radius on a Collector/Arterial (with Transit). All temporary turnarounds are required to be constructed at a gravel stage prior to opening the road to public access. If the turnaround is to be used by Transit it may be required to be paved to an asphalt hard surface standard prior to opening the roadway at the discretion of the Engineer . A temporary turnaround is not required where the roadway termination is easily visible from the adjacent intersection (a two lot maximum distance).

6.3 Temporary roadways shall be shown on detailed engineering drawings showing vertical and horizontal alignments, drainage details and typical cross sections.

7. BUS STOPS AND SHELTERS

Bus routing, being an integral part of the transportation system, requires specific stop locations connecting to the pedestrian circulation system. Required bus stops or shelters are to be designed as shown on the following drawings:

Location of Bus Stop	Drawing 4000
Bus Shelter Pad - Mono Walk	Drawing 4100
Bus Stop Pad - Boulevard Walk	Drawing 4110
Bus Stop Pad – Rural Roadway	Drawing 4200

8. VEHICULAR BARRIERS (BARRIER POSTS)

8.1 Vehicular barriers are to be constructed as shown on Drawings 6200/6210/6220 or as approved by the Engineer and are required at the following locations:

8.1.1 Across the end of a walkway which terminates in an alley.

8.1.2 Across the end of an alley cul-de-sac which abuts a roadway.

8.1.3 Along the length of an alley which parallels an adjacent roadway. The vehicular barrier shall be constructed of posts capped with a longitudinal runner to prevent any vehicular access to the adjacent roadway.

8.1.4 Along the length of an alley which parallels a park area.

9. ISLANDS IN CULS-DE-SAC

Islands in culs-de-sac shall be designed to allow minimum turning movements of passenger vehicles plus sufficient width for parallel parking. The islands may be permitted to use straight face curb and reverse gutter with a 300mm concrete monolithic header, and a standard road cross-fall of 0.025 m / m. Discretion on use and application of reverse gutter is by the Engineer. Refer to Drawings 3510, 3520, and 3530 for minimum offsets, road and island widths and standard details.

10. SUMMARY OF GEOMETRIC DESIGN STANDARDS

Classification	Drawing No.	Design speed (km/h)	Minimum curve radii [1]	Super elevation	Minimum horizontal curve lengths	Maximum gradient [2]	Minimum gradient [3]	Minimum tangent section lengths	Minimum Intersection spacing
Local									
8.0m Local Residential	2100	60	90 m	No	60 m	8%	0.6%	30 m	60 m
9.0 m Local Residential	2200	60	90 m	No	60 m	8%	0.6%	30 m	60 m
11.5 m Local Industrial	2300	60	90 m	No	60 m	8%	0.6%	60 m	60 m
Residential Service Road	2030	60	90 m	No	60 m	8%	0.6%	30 m	60 m
Industrial Service Road	2031	60	90 m	No	60 m	8%	0.6%	30 m	60 m
Collector									
11.5 m Collector Residential	2300	60	120 m	No	60 m	8%	0.6%	60 m	60 m
14.5 m Collector Residential	2400	60	130 m [4]	Optional	60 m	8%	0.6%	60 m	60 m
Arterial									
5-Lane Undivided Arterial	2500	70	190 m [6]	Yes [5]	TAC	6%	0.6%	TAC	200 m
4-Lane Divided Arterial	2510	70	190 m [6]	Yes [5]	TAC	6%	0.6%	TAC	200 m
6-Lane Divided Arterial	2520	70	190 m [6]	Yes [5]	TAC	5%	0.6%	TAC	400 m
Walkways									
1.5 m wide Walkways	5140	N/A	N/A	N/A	N/A	10% [7]	0.5%	N/A	N/A
Walkways > 1.5 m wide	5150	N/A	N/A	N/A	N/A	10% [7]	0.5%	N/A	N/A
Shared Use Paths	5160	30	17	N/A	N/A	8%	0.5%	N/A	N/A
Alleys									
Residential Alleys	2040	N/A	N/A	N/A	N/A	10%	0.7%	N/A	N/A
Commercial Alleys	2041	N/A	N/A	N/A	N/A	10%	0.7%	N/A	N/A
Rural Roads									
9.0m Local/Collector Road	2050	70	230 m	Yes [5]	TAC	6%	N/A	TAC	200 m
Temporary Roads									
Access/Detour Road	2060	N/A	90 m	No	60 m	8%	N/A	30 m	N/A

Notes:
1. Larger curve radii should be used wherever possible
2. Dependent on topography and access locations may restrict sightlines accordingly
3. Minimum gradient on curb radii ≤20 m shall be 0.8%
4. 500 m recommended when roadway is not super elevated
5. For Super elevation, refer to TAC Geometric Design Guide for Canadian Roads, September 1999
   - Design speed 60 km/hr and 70 km/hr, use Urban design Table 2.1.2.9, 0.06 maximum
   - Design speed 80 km/hr, use Table 2.1.2.6, 0.06 maximum
   - Design speed 90 km/hr or higher, use Table 2.1.2.6, 0.06 maximum or 2.1.2.7, 0.08 maximum

   Intersections are to be flattened to below 0.04
   Super elevation for rehabilitation is project specific
6. Preferred curve radius is 500 m
7. Refer to Chapter 2, 3.6.2 for landing requirements

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Designated classes, gradation and physical requirements of aggregate.

1.1.2 Production and supply of aggregate and quality assurance.

1.2 QUALITY ASSURANCE

1.2.1 The quality assurance laboratory will conduct sieve analyses to ASTM C136 and other tests to ensure that aggregate being produced and supplied meets the requirements of Tables 02060.1, 02060.2 and 02060.3. The Contractor shall provide a daily estimate of production tonnage to the quality assurance laboratory.

1.2.2 A minimum of one sieve analysis per 500 tonnes of aggregate supplied to a jobsite is required. The aggregate may be sampled from a stockpile at the jobsite or at the gravel pit / crusher site.

1.2.3 If the aggregate fails to meet the specified gradation, the contractor shall suspend gravel placement until proof of compliance with the specification is provided to the Engineer. Alternatively, the contractor may elect to remove the suspect gravel from the jobsite and provide aggregate from a different source.

1.3 SUBMITTALS

1.3.1 Provide copies of scale certificates to the Engineer prior to use.

1.3.2 Each truckload of aggregate weighed in shall have a ticket filled out and submitted to the Engineer.

1.3.3 Quality Control Plan

1.3.3.1 Submit a minimum of one sieve analysis per 500 tonnes of aggregate for stockpile or 300 tonnes of aggregate shipped directly from the crusher to the jobsite to the Engineering Services Section, Transportation Services. Do not stockpile or ship aggregate to the jobsite until the City has accepted the applicable test results. Make the test results available weekly to the City for review.

1.3.3.2 Evaluation of Tests: The average grading of the first 8 consecutive sieve tests shall conform to the specified grading band. If it does not, adjust the production process so that the average grading of material already produced and that produced in the next 8 consecutive tests will conform to specifications. Failing this, do not supply aggregate represented by the nonconforming average of 16 tests.

The preceding evaluation will be repeated for subsequent series of 8 consecutive tests.

1.4 STORAGE AND PROTECTION

Place aggregate in horizontal lifts of 750 mm maximum thickness. Avoid segregation of particle sizes. Do not dump aggregate over the edges or down the faces of the stockpile. On completion, peak the stockpile at a minimum 3% grade.

2. PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates shall conform to the requirements in Tables 02060.1, 02060.2 and 02060.3.

Table 02060.1: Aggregate Gradation Specifications for Designations 1 – 3

Designation	1				2	3				
Class	10	10	16.0	20.0	20	20	25	40	63	80
Application	10mm-HT	10mm-LT	SMA	20mm - B	Soil Cement	Granular base	Granular Base	Granular Base	Granular Base	Granular Sub-Base
80 000										100
63 000								100	100	
25 000				100			100	70 -94	55 -75	46 -85
20 000			100	97 - 100	100	100	82-97	60 -90	50 -70	40 -81
16 000			97-100	83 – 97	-	-	70-93	55 -85	44 -65	32 -76
12 500	100	100	88-100	70 – 92	60 -96	60 -96	60-86	50 -80	38 -60	30 -70
10 000	97-100	97-100	30 -80	61 - 84	-	-	52-79	44 -74	-	-
8 000	70-94	80-94	-	52 – 77	-	-	-	-	-	-
6 300	45-85	65-85	22 -45	44 – 70	-	-	-	-	23 -47	-
5 000	32-75	50-75	20 -35	38 – 65	36 -75	36 -75	35-64	32 -62	20 -45	25 -50
2 500	23-55	35-55	16 -26	26 – 52	-	-	-	-	-	-
2 000	-	-	-	-	24 -54	24 -54	24-50	20 -50	14 -38	19 -42
1 250	16-45	25-45	14 -22	18 – 41	20–43	20–43	19-43	17 -43	12 -34	15 -38
630	11-36	20-36	13 -20	13 – 31	14–34	14–34	14-34	12 -34	10 -28	10 -32
400	-	-	-	-	11 -29	11 -29	10-27	10 -28	8 -24	7 -27
315	8-26	14-26	12-18	9 – 22	9 –26	9 –26	9–24	8 -25	7 -22	6 -24
160	5-15	7-15	10 -16	6 – 14	6 -20	6 -20	6–18	5 -18	4 -17	3 -18
80	3-8	4-8	10 -14	3 - 7	2 -10	2 -10	2–10	0 -10	0 -10	0 -10

Table 02060.2: Aggregate Gradation Specifications for Designations 4 – 7

Designation	4		5		6		7	
Class	2.5	10	5	80	20	25	10	80
Application	Unit Pavers Joint Sand	Unit Pavers Bedding	Grout Sand	Culvert Bedding	Sub-Drain Rock	Sewer Rock	Sewer Backfill	Culvert Backfill
80 000				100				100
25 000						100		
20 000				85 - 100	100			
14 000					90 - 100			
10 000		100			45 - 75		100	
5000		75 - 950	100	70 - 90	0 - 15	10 max	70 - 100	30 - 60
2500	100	35 - 70			0 - 5			
1250	85 – 100	20 - 50						
800				40 - 80				
630	50 – 90	10 - 40						
315	25 – 60	5 – 20	50 – 95					
160	12 – 30	2- 8					5 - 20	
80	10 – 15	0 - 5	25 max	0 - 15		2 max	0 - 12	0 - 15

Table 02060.3: Aggregate Properties

Designation	1		2	3			
Class	**10**	**20**	**20**	**20 & 25**	**40**	**63**	**80**
Application	**10mm- HT & LT**	**20mm-B**	**Soil Cement**	**Granular Base**	**Granular Base**	**Granular Base**	**Granular Sub-Base**
+5000 µm with ≥2 fractured faces (% mass)	*	*	60 min	60 min	75 min	75 min	
Plasticity Index <400 µm	*	*	6 max	6 max	6 max	6 max	
Liquid Limit	*	*	25 max	25 max	25 max	25 Max	
LA abrasion wear (% mass)	*	*					
Soundness loss (% mass)	*	*					
Lightweight Pieces (% mass)	*	*	2 max	2 max	2 max	2 max	2 max

*** Note: See Section 02066 SGC HOT MIX ASPHALT CONCRETE for requirements**

2.2 EQUIPMENT

2.2.1 **Crushers:** capable of producing aggregate as specified.

2.2.2 **Truck Weigh Scales:** are to be furnished by the Contractor. Have the scales inspected and certified by the Weights and Measures Branch of Canada Consumer and Corporate Affairs prior to start of every construction season and as requested by the City, to ensure their accuracy.

2.2.3 **Scale Tickets:** Supply truckers with scale ticket forms approved by the City.

2.2.4 **Metric Sieves:** CAN/CGSB-8.2-M sieve sizes shall replace ASTM E11 sieves as follows:

CAN/CGSB-8.2-M Sieves (□m)	ASTM E11 Sieves (mm)
125 000	125.0
80 000	75.0
63 000	63.0
50 000	50.0
40 000	37.5
25 000	25.0
20 000	19.0
16 000	16.0
12 500	12.5
10 000	9.5
5 000	4.75
2 500	2.36
2 000	2.00
1 600	1.70
1 250	1.18
800	0.850
630	0.600
400	0.425

315	0.300
160	0.150
80	0.075

3. EXECUTION

3.1 EXAMINATION

Crushed aggregate shall consist of sound, hard and durable particles of sand, gravel and rock, free of elongated particles, injurious amounts of flaky particles, soft shale, coal, ironstone, clay lumps and organic and other deleterious material.

3.2 PREPARATION

Adjust and modify aggregate as required to meet gradation requirements by aggregate splitting, elimination of fines, or blending with sand.

3.3 HAULING AGGREGATE FROM CITY STOCKPILE

3.3.1 Provide loading equipment and load aggregate at the designated City stockpile.

3.3.2 Have loaded trucks weighed and provide weigh tickets to the City.

3.3.3 Deliver aggregate to the jobsite and discharge at the designated location.

3.3.4 The Contractor is not responsible for the quality of aggregate from a City stockpile.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Production of a hot mixture of asphalt cement, aggregate, and/or other materials, for paving.

1.1.2 Requirements for submittals, materials, mix design, quality control, quality assurance, and mix production.

1.2 RELATED SECTIONS

1.2.1 Section 02060 – Aggregate

1.2.2 Section 02067 – Stone Mastic Asphalt Concrete

1.2.3 Section 02742 – SGC Hot-Mix Asphalt Paving

1.2.4 Section 02966 – Recycled Asphalt Paving

1.3 DEFINITIONS

1.3.1 **Asphalt Cement Content**: the amount (percentage) of asphalt cement in the SGC hot-mix, as determined by ESS in Section 1.5 Quality Assurance, and is the value upon which any unit price adjustments will be based.

1.3.2 **10mm – High Traffic (10mm - HT)**: mix used primarily for paving residential collector roadways and selected arterial roadways.

1.3.3 **10mm – Low Traffic (10mm - LT)**: mix used for paving local residential roadways and alleyways.

1.3.4 **20mm - Base (20mm-B);** base course for freeways, arterials, industrial/commercial roadways and collector roadways.

1.3.5 **Bailey CA-CUW: Coarse Aggregate (CA) Chosen Unit Weight (CUW) of combined aggregate as defined by the "Bailey Method".**

1.3.6 **Bailey CA-LUW**: Bailey method CA – Loose Unit Weight (LUW).

1.3.7 **Bailey CA-RUW**: Bailey method CA – Rodded Unit Weight (RUW).

1.3.8 **Bailey FA-LUW**: Bailey method Fine Aggregate (FA) – LUW.

1.3.9 **Bailey FA-RUW**: Bailey method FA – RUW.

1.3.10 **Bailey Method**: a method of selecting asphalt concrete aggregate proportions, indicated by the most recent edition of "Achieving Volumetrics and HMA Compactability", as published by the Asphalt Institute and the Heritage Research Group.

1.3.11 **Bailey Nominal Maximum Aggregate Size (BNMAS)**: the first sieve, in the standard sieve series (2.50 mm, 5.0 mm, 10.0 mm, 12.5 mm, 20.0 mm, and 25.0 mm), larger than the first standard sieve to retain more than 15 percent by weight

1.3.12 **ESS**: The Engineering Services Section, Transportation Services of the City of Edmonton (City).

1.3.13 **Job Mix Formula**: establishes the target combined aggregate gradation, plant settings, approved asphalt cement content to be used for production of the asphalt mix, and the associated production tolerances, based on the submitted SGC mix design and the results of the trial batch of SGC hot-mix, as tested by the ESS, and requires approval of the ESS.

1.3.14 **SGC Specimens**: Test specimens prepared using the Superpave Gyratory Compactor (SGC) at a specified number of design gyrations (Ndesign) of either 75 or 100. The SGC formed specimens are be used for the determination of volumetric properties on the laboratory produced SGC hot-mix as outlined in the Asphalt Institute SP-2 Manual.

1.4 SUBMITTALS

1.4.1 Asphalt Cement Data

1.4.1.1 Submit written certification, with the SGC mix design that the asphalt cement complies with the specifications. This certification shall include, but not be limited to:

- Name of the Supplier.
- Source(s) of the base asphalt cement(s).
- Type and source(s) of admixture(s).
- Proportions of materials used in the asphalt cement.
- Current laboratory test results of the asphalt cement.
- Certification statement from the supplying agency that the asphalt cement is a straight run, non-air blown/oxidized, non-chemically modified asphalt cement and, if the asphalt cement is modified, it has been modified only with a SB-type copolymer and that it complies with the requirements of this specification.

Certification shall be submitted (1) for the asphalt cement used in the mix design as part of a submittal, and, (2) at the start of mix production, utilizing the approved job mix formula.

1.4.2 SGC Mix Design

1.4.2.1 Submit a SGC mix design, carried out by an independent laboratory, to the ESS at least 10 days before the start of any SGC hot-mix production, and for each subsequent change in supplier or source of materials. No SGC hot-mix production can proceed until the applicable mix design and job mix formula is approved by the ESS.

1.4.2.2 Submit all SGC hot-mix mix design characteristics, including but not limited to:

- Legal description of all aggregate sources;
- Source of RAP;
- Individual aggregate, RAP and mineral filler gradations;
- Individual aggregate one and two crushed face counts;
- RAP aggregate one and two crushed face counts;
- Water absorption of the individual aggregates and the combined aggregates;
- Based on the individual aggregate results the calculated water absorption of the combined aggregates;
- Aggregate blend;
- Combined aggregate gradation;

- Bulk specific gravity of individual aggregates and mineral filler;
- Based on the individual aggregate results, the calculated bulk specific gravity of the combined aggregates;
- Maximum Theoretical Density (MTD) of the RAP;
- Binder content of the RAP, determined by total mix to two significant digits;
- Bulk specific gravity of the RAP binder;
- Bailey CA-RUW for each individual coarse aggregate Stockpile;
- Bailey CA-LUW for each individual coarse aggregate stockpile;
- Bailey FA-RUW for each individual fine aggregate stockpile;
- Bailey FA-LUW for each individual fine aggregate stockpile;
- Virgin asphalt cement bulk specific gravity;
- Mixing and compaction temperature, as determined by the asphalt cement's temperature-viscosity curve, which is to be provided, or as recommended by the asphalt cement supplier;
- Two hour, short-term oven aging temperature;
- Anti-stripping agent supplier, product name, product specification sheet, and application rate;
- Bailey CA-CUW
- Comments on the other Bailey parameters (CA Ratio, FAc Ratio, and FAf Ratio);
- A hard copy of the Bailey spreadsheet with an electronic copy of the Bailey spreadsheet to be e-mailed to the ESS;
- Number of design gyrations (Ndesign) in the SGC;
- Number of maximum gyrations (Nmaximum) in the SGC:
- A minimum of five individual and separate asphalt cement contents must be used in the SGC mix design and each individual asphalt cement content must be separated by a minimum of 0.40 to a maximum of 0.60 percent (by dry weight of aggregate);
- Graph of mix's Theoretical Maximum Density (MTD) versus asphalt cement content (by total mix) reported to two significant digits;
- All other graphs used in the mix design (by total mix);
- Individual mix property results are to be plotted and a second order polynomial graph drawn through the individual data points.
- Recommended initial asphalt cement content and associated mix parameters;
- Ratio of virgin asphalt cement content to total asphalt cement content;
- Asphalt cement absorption of the combined aggregates;
- Ignition oven asphalt cement content correction factor:
- Asphalt Pavement Analyzer (APA) result;
- Tensile Strength Ratio (TSR) including the optional freeze-thaw cycle.

1.4.2.3 The review of the submitted SGC mix design will not begin until all of the information required in Section 1.4.2.2 has been provided.

1.4.2.4 A previously approved SGC hot-mix mix design, of the required mix type, may be accepted by the City, if the same materials for which the mix design was approved are used and provided that the previously approved job mix formula requirements are satisfied.

1.4.3 Plant Scale Certificate

Provide a copy of the plant scale certificates to the ESS at least 10 days prior to any SGC hot-mix production.

1.4.4 Job Mix Formula

1.4.4.1 Submit with the SGC hot-mix mix design the proportions of materials and plant settings to be used include the following:

For Batch Plant:
- Sieve analysis of combined aggregate in the mix.
- Sieve analysis of aggregate in each bin separation to be used.
- Sieve analysis of RAP if used.
- Mass of material from each bin for each batch of mix.
- Mass of asphalt cement in each batch.
- Mass of anti-stripping agent in each batch
- Mixing temperature of asphalt cement determined from its temperature-viscosity curve, or as recommended by the manufacturer.

For Continuous or Drum-Mix Plant:
- Sieve analysis of each aggregate and mineral filler.
- Sieve analysis of combined aggregate in the mix.
- Sieve analysis of RAP if used.
- Mass of asphalt cement per tonne of mix.
- Mass of anti-stripping agent per tonne of mix.
- Mixing temperature of asphalt cement determined from its temperature-viscosity curve, or as recommended by the manufacturer.
- Settings of aggregate and asphalt cement feed systems (blend).

1.4.5 Quality Control Plan

Before commencing SGC hot-mix production, submit a quality control plan to the ESS for review and approval. The quality control plan is to including the following recommended tests and frequency, as a minimum.

Submit test results, as requested, to the ESS for review.

Tests per sample:
Mix bulk specific gravity, average of two SGC specimens;
Asphalt cement content, Reported to two significant digits;
MTD of loose mix;
Gradation of the extracted mix;
Moisture content of the mix;
Air voids by calculation and by MTD;
Voids in the mineral aggregate (VMA);
Voids filled with asphalt cement;
Film thickness calculation;
Sample time and location;
Plant discharge temperature;
Asphalt storage temperature.

Frequency: Minimum of one sample for asphalt cement content and mix gradation per 500 tonnes of mix production, and minimum of two complete test samples per day of production exceeding 500 tonnes per mix type.

1.4.6 Aggregates

1.4.6.1 Submit LA abrasion, soundness, detrimental matter and Plasticity index test results for each aggregate source for each SGC mix type at least once per year. Submit results of gradation and crushed face count(s) at the following frequencies:

- For a stockpile existing at the time of contract award: a minimum of one gradation and crushed faces count(s) test per 500 tonnes of aggregate. In addition, submit the average gradation and crush faces count(s) for each entire stockpile when submitting a mix design using aggregate from the stockpile(s).
- For aggregate stockpiled during the contract: a minimum of one gradation and crushed face count(s) per 500 tonnes of aggregate, or each day's production, whichever is less.

1.4.6.2 Submit results to the ESS within 72 hours of the completion of testing. Do not use aggregate until test results have been reviewed and accepted by the Engineer.

1.5 QUALITY ASSURANCE

1.5.1 Inspection and Testing

In addition to field inspections by the Engineer, ESS will conduct plant inspection and materials sampling and testing described in the following paragraphs.

1.5.2 Asphalt Plant

Inspections will be conducted at least once a week during production to check plant calibrations, plant operation, production settings, temperatures, and materials handling. Samples of materials and mixture may be taken and tested.

1.5.3 Asphalt Cement

Quality assurance sampling and testing of the asphalt cement shall be performed by the Contractor, at no cost to the City, to verify compliance to the specification. A sample shall be taken at random during paving operations on City projects from a load(s) delivered to the Contractor's asphalt plant at least twice a month or as directed by the ESS. The sample shall be tested by an independent laboratory engaged by the Contractor to verify compliance with the specification requirements as stated in Section 2.1.1. Test results shall be reported in writing to the ESS by the Contractor. Non-complying sample test results will be reported to the ESS within 24 hours of completion of the test(s). Compliant sample test results shall be submitted in writing to the ESS, no later than 10 working days after the date of sampling.

1.5.3.1 A test report shall include, but not be limited to, (1) report date, (2) date of sampling, (3) bill of lading number of load sampled, (4) destination of load, (5) report of test results, (6) standard test identifications, (7) specification requirements, (8) statement of compliance, and (9) certification signature. Failure to comply with quality assurance testing may result in rejection of either the asphalt cement, and/or the job mix formula, and/or the associated SGC hot-mix placed on the project.

1.5.3.2 If non-complying material is identified, the paving program may be suspended for 24 hours, as directed by the Engineer, during which time the Contractor, the Engineer, and ESS will meet to determine the impact of the non-compliance, and specify the necessary remedial action to be taken by the Contractor. Remedial action shall be either acceptance, acceptance at a pay adjustment, or removal and replacement at no cost to the City. If suspended, the paving program shall only continue upon written authorization by the ESS.

1.5.3.3 Asphalt cement identified to be in non-compliance shall not be shipped to a project. SGC hot-mix mixed and placed with identified non-complying asphalt cement shall be removed and replaced, as directed by the Engineer with complying material by the Contractor at no cost to the City.

1.5.3.4 Asphalt cement substitution in an approved job mix formula shall not be allowed, without prior approval of the ESS.

1.5.4 Production Mix Analysis

Full mix sample testing will be conducted at a minimum frequency of one test, for each 1,000 tonnes of SGC hot-mix, or a day's production, whichever is less.

The mix's asphalt cement content and MTD will be determined at a minimum frequency of one test for every 250 tonnes of SGC hot-mix produced, or a day's production, whichever is less.

TSR testing, with the optional freeze-thaw cycle, and APA testing (if required), will be carried out at a minimum frequency of one set per weeks production.

The determination of the asphalt cement content will utilize the asphalt ignition oven correction factor, as determined for each SGC hot-mix, by the ESS.

1.5.5 Job Mix Formula

The ESS will test a trial batch of the SGC hot-mix job mix formula to verify the mix design. The mix design and job mix formula will not be approved by the Engineer until successful results are obtained by the ESS.

1.6 QUALITY CONTROL

1.6.1 General

The Contractor is responsible for quality control throughout all stages of the SGC hot-mix production and placement including the aggregates, asphalt cement, and any other materials used in the mix. The Contractor shall utilize a qualified testing laboratory to undertake the quality control sampling and testing to determine and monitor the properties of the materials being produced and used on the project.

1.6.2 Sampling and Testing

The Contractor shall follow the sampling and testing methods and frequencies indicated in their quality control plan and/or as accepted or modified by ESS.

2. PRODUCTS

2.1 MATERIALS

2.1.1 Asphalt Cement: premium grade 150-200(A) or 80-100(A), to Table 02066.1 or Performance Graded (PG) 58-28, PG 64-28, Polymer Modified PG 76-28 or Polymer Modified PG 70-28 to AASHTO M320, Table 2 which are included in these specification as Table 02066.2 and Table 02066.3. For Polymer Modified PG 76-28 and PG 70-28, a straight run, non-chemically modified asphalt cement shall be modified with SB-type copolymers to reach the specified performance grade. No other modifiers are allowed unless approved in writing by the ESS.

*Note: If using PG asphalt cement, PG 58-28 shall be used in 10mm–LT, 10mm–HT and in 20mm-B in all new construction applications and in residential applications, while 10mm-HT, used as overlay on arterial roadways, shall utilize a PG 64-28, or as specified in the contract documents. No modification of the asphalt cement is allowed for the PG58-28 or the 64-28 asphalt cement.

2.1.2

2.1.2 Aggregates: to Section 02060 – Aggregate and as indicated below.
The SGC hot-mix combined aggregate gradation requirements shall be as follows:

Designation	1	1	1
Class	**10.0**	**10.0**	**20**
Application	**10mm -HT**	**10mm - LT**	**20mm - B**
Sieve Size (μm)	**% Passing by Mass**	**% Passing by Mass**	**% Passing by Mass**
25 000	100	100	100
20 000	100	100	97 - 100
16 000	100	100	83 – 97
12 500	100	100	70 – 92
10 000	97 - 100	97 - 100	61 - 84
8 000	70 – 94	80 – 94	52 – 77
6 300	45 – 85	65 – 85	44 – 70
5 000	32 – 75	50 – 75	38 – 65
2 500	23 – 55	35 – 55	26 – 52
1 250	16 – 45	25 – 45	18 – 41
630	11 – 36	20 – 36	13 – 31
315	8 – 26	14– 26	9 – 22
160	5 – 15	7 – 15	6 – 14
80	3 - 8	4 - 8	3 - 7

2.1.2.1 Additional SGC hot-mix aggregate properties shall be as follows:

Virgin Coarse Aggregate Physical Properties (> 5.0 mm) at the mix design gradation:

Property	Test Method	Requirement
LA Abrasion, % loss, Charge C	AASHTO T 96	30.0% Maximum
Soundness (5 Cycles), %loss $MgSO_4$	AASHTO T 104	16.0 Maximum
Detrimental Matter, %	Alberta Infrastructure TLT 107	2.0 Maximum

Virgin Fine Aggregate Physical Properties (< 5.0 mm) at the mix design gradation:

Property	Test Method	Requirement
Soundness (5 Cycles), % loss $MgSO_4$	AASHTO T 104	16.0% Maximum
Plasticity Index	AASHTO T 90	Non-Plastic

2.1.2.3 Fine Aggregate: that fraction of the total aggregate passing the 5 000 μm sieve. Fine aggregate shall contain a minimum 75 percent manufactured or crushed fines. The total percent of manufactured fines in a mix is taken as the percentage of manufactured fines in the minus 5 000 μm sieve fraction of the total combined aggregate. When the amount of manufactured fines in the

RAP is unknown, it will be assumed that the amount of manufactured fines in the minus 5 000 μm sieve portion is 55 percent for 12.5 mm and 10 mm maximum sized RAP aggregate.

2.1.2.2 **Crushed-Face Count in Mix**: For each mix type, the minimum percentage, by mass retained down to the 5 000 μm sieve, having at least 2 crushed faces shall be as follows, provided there is a minimum 50% crushed-face count in each individual sieve size greater than 5 000 μm.

Mix Type:	10mm - HT		10 mm - LT		20mm - B	
Minimum 2 Crushed -Face	90%		85%		90%	
Sieve Fraction (μm)	1 Face	2 Face	1 Face	2 Face	1 Face	2 Face
- 25 000 to + 12 500	-	-	-	-	90	85
- 12 500 to + 10 000	95	90	90	85	95	90
- 10 000 to + 5 000	98	95	93	90	98	95

2.1.3 **Mineral Filler:** The mineral filler, if required, should consist of limestone dust or approved alternate meeting the requirements of AASHTO M-17 or ASTM D242. The mineral filler must be free from organic impurities and the portion passing the 80 μm sieve size shall have a Plasticity Index of zero.

The mineral filler shall meet the following gradation requirements:

Sieve size (μm)	Percent Passing (by Mass)
600	100
300	92 - 100
80	60 - 100

2.2 EQUIPMENT

2.2.1 Asphalt Plant

2.2.1.1 Asphalt Mixing Plant: conforming to ASTM D995, capable of consistently producing a homogeneous mixture in which all aggregate particles are uniformly and thoroughly coated with asphalt cement, heated to the mixing temperature for the grade of asphalt cement, and meeting the following supplementary requirements.

2.2.1.2 Provide free and safe access for the Engineer to verify proportions, settings, and temperatures, and to take samples of asphalt, aggregate, and mixture.

2.2.1.3 All asphalt mixing plants are required to be operated in accordance with the Alberta Environmental Protection Code of Practice. All Contractors operating asphalt plants shall provide proof of registration with Alberta Environmental Protection and agree that the asphalt plant shall be operated in accordance with the Code of Practice.

2.2.1.4 SGC hot-mix production shall not proceed unless all plant scales have been certified by Weights and Measures, Canada Consumer and Corporate Affairs prior to start of construction season and as often as deemed necessary by the Engineer to ensure their accuracy. Plant production shall not proceed until plant calibrations and recalibrations have been reviewed by the Engineer on site. Notify the Engineer at least 24 hours before plant calibrations are made or altered.

2.3 MIX DESIGN

2.3.1 The mix design for the SGC hot-mix shall be performed by a qualified laboratory following the procedures indicated in “Superpave Mix Design”, as set out in the latest editions of the Asphalt Institute manuals “For Asphalt Concrete and Other Hot-Mix Types” Manual Series No. 2 (MS-2), “Superpave Mix Design” Superpave Series No. 2 (SP-2), Section 1.4.2 SGC Mix Design, and to the following criteria:

	Requirement		
Mix Type	10mm - HT	10 mm - LT	20mm - B
Selected Parameters			
Number of Gyrations Gyrations N_{design} Gyrations $N_{maximum}$	 100 160	 75 115	 100 160
Density at $N_{maximum}$ (%G_{mm})	98.0 Max	98.0 Max	98.0 Max
Bailey CA-CUW	60 to 105 Max.	60 to 85 Max.	60 to 85 Max.
Air Voids, % of total mix (virgin mix)[1]	4.0 +/- 0.4%	3.0 +/- 0.4%	3.5 +/- 0.4%
VMA, %	13 Minimum	14 Minimum	12 Minimum
Voids filled, %	70 - 80	73 - 85	65 - 75
Tensile Strength Ratio % (AASHTO T283)[2]	80 Minimum	80 Minimum	80 Minimum
Minimum Film Thickness[3], mm	7.5 min.	7.5 min.	6.5 min.
APA (mm, 52°C, 8,000 cycles)	5.0 max.	7.0 max.	5.0 max.

Note 1: The mix design air voids shall be selected at the mid point of the specified range or the lowest value within the range in which all the other mix design criterion are met;
Note 2: Minimum Tensile Strength Ratio to be determined in accordance with AASHTO T283, with optional freeze-thaw, at air void content of 7.0+/- 0.5 percent;
Note 3: Minimum film thickness to be determined to Appendix 02066.A

2.3.1.1 **Rutting Susceptibility Testing**: SGC hot-mix mix shall be subjected to the APA procedure during the mix design process. APA testing may be carried out by the ESS or the Contractor may use an independent laboratory to perform APA testing. The APA device must meet the requirements of AASHTO T340-10 and must be equipped with an automatic rut measurement system. The APA device must be calibrated at least once per year according to the procedures in the test method. In addition, the load cell used for checking wheel loads shall be calibrated at least once per year. Each test shall have 6 cylindrical samples fabricated and tested with the interior temperature of the APA set at 52°C. The downward force shall be set at 45 Kg and the hoses shall be pressurized to 689 kPa. Each specimen shall be compacted so that 7.0+/- 0.5 percent air voids are achieved. The APA rut test results shall be provided to the nearest 0.1 mm.

2.3.2 Modifications to the SGC hot-mix mix design procedure or criteria are as follows:

- Metric sieves in accordance with CGSB Specification 8-GP-2M shall be used.
- PG asphalt cement content shall be reported based on the total mass of the mix.

2.3.3 Job mix Formula

Do not make changes to the approved job mix formula without written authorization from the ESS. Display the currently approved job mix formula in clear sight of the plant operator.

3. EXECUTION

3.1 PRODUCTION OF MIX

3.1.1 Good Practice Guide

Refer to the publication TB-1 “Hot Mix Asphalt Materials, Mixture Design and Construction” as prepared by the National Center for Asphalt Technology (NCAT) and published by the National Asphalt Pavement Association (NAPA), for guidance in good practices of handling materials and SGC hot-mix production insofar as consistent with this Section.

3.1.2 Production Rate

Produce SGC hot-mix at a rate compatible with the rate of placement and compaction on the project.

3.2 Aggregate in Stockpile

3.2.1 Stockpile aggregate in horizontal lifts. Stacking conveyors are not allowed for stockpiling. Draw aggregate from stockpile in a manner that mixes the full depth of stockpile face.

3.2.2 When it is necessary to blend aggregates from one or more sources to produce the combined gradation, stockpile each source or size of aggregate individually. Do not blend aggregates in a stockpile.

3.2.3 If one or more of the SGC hot-mix properties are not met, the ESS will order suspension of mix production until the Contractor has demonstrated to the ESS's satisfaction that corrective measures have been taken to produce a mix that meets the requirements of this Section.

END OF SECTION

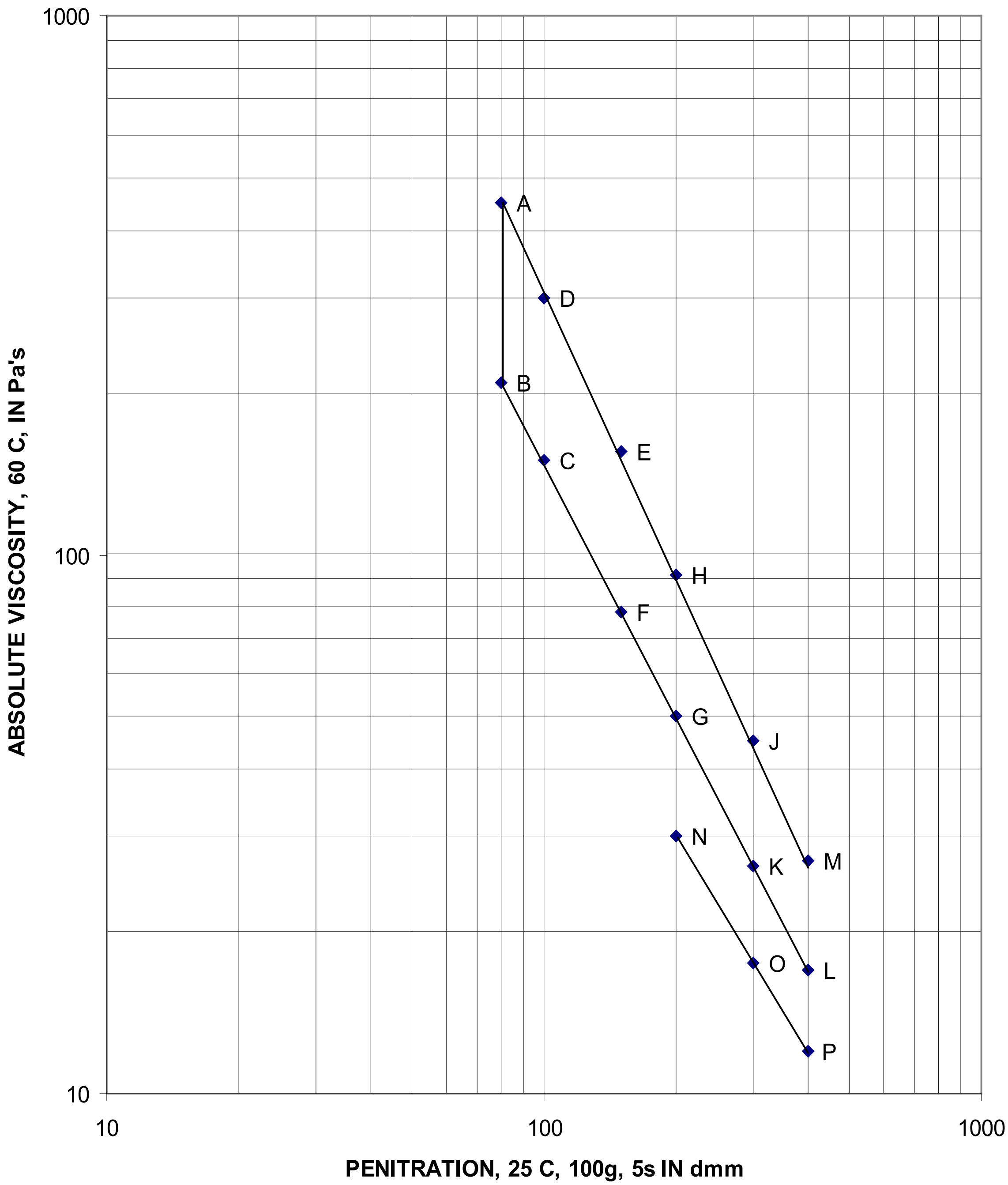
TABLE 02066.1: SPECIFICATIONS FOR PREMIUM GRADE ASPHALT CEMENTS

<table>
<tr><th rowspan="2">TEST CHARACTERISTICS</th><th rowspan="2">A.S.T.M. TEST METHOD</th><th colspan="6">Premium Grades of Asphalt Cements</th></tr>
<tr><th colspan="3">150-200 (A)</th><th colspan="3">200-300 (A))</th></tr>
<tr><td>Absolute Viscosity, 60°C, Pa - s</td><td>D2171</td><td colspan="3">The viscosity and penetration values must fall within the area bounded by A-B-C-D-A plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows:</td><td colspan="3">The viscosity and penetration values must fall within the area bounded by C-D-E-F-C plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows:</td></tr>
<tr><td rowspan="5">Penetration, 25°C, 100g, 5s, dmm</td><td>D5</td><td>Pt.</td><td>Abs. Visc.</td><td>Pen.</td><td>Pt.</td><td>Abs. Visc.</td><td>Pen.</td></tr>
<tr><td></td><td>A</td><td>155</td><td>150</td><td>C</td><td>50</td><td>200</td></tr>
<tr><td></td><td>B</td><td>70</td><td>150</td><td>D</td><td>92</td><td>200</td></tr>
<tr><td></td><td>C</td><td>50</td><td>200</td><td>E</td><td>45</td><td>300</td></tr>
<tr><td></td><td>D</td><td>92</td><td>200</td><td>F</td><td>26.5</td><td>300</td></tr>
<tr><td>Kinematic Viscosity, 135°C, sq. mm/s</td><td>D2170</td><td colspan="3">The viscosity and penetration values must fall within the area bounded by A-B-C-D-A plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows:</td><td colspan="3">The viscosity and penetration values must fall within the area bounded by C-D-E-F-C plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows:</td></tr>
<tr><td rowspan="5">Penetration, 25°C, 100g, 5s, dmm</td><td>D5</td><td>Pt.</td><td>Kin. Visc.</td><td>Pen.</td><td>Pt.</td><td>Kin. Visc.</td><td>Pen.</td></tr>
<tr><td></td><td>A</td><td>360</td><td>150</td><td>C</td><td>205</td><td>200</td></tr>
<tr><td></td><td>B</td><td>225</td><td>150</td><td>D</td><td>285</td><td>200</td></tr>
<tr><td></td><td>C</td><td>205</td><td>200</td><td>E</td><td>205</td><td>300</td></tr>
<tr><td></td><td>D</td><td>285</td><td>200</td><td>F</td><td>150</td><td>300</td></tr>
<tr><td>Flash Point, Cleveland Open Cup, °C minimum</td><td>D92</td><td colspan="3">205</td><td colspan="3">175</td></tr>
<tr><td>Solubility in Trichlorethelene, % minimum</td><td>D2042</td><td colspan="3">99.5</td><td colspan="3">99.5</td></tr>
<tr><td>Tests on Residue from Thin Film Oven Test:
Ratio of Absolute Viscosity of Residue from Thin-Film Oven Test to Original Absolute Viscosity, maximum:</td><td>D1754
D2171</td><td colspan="3">4.0</td><td colspan="3">4.0</td></tr>
<tr><td>Ductility, 25°C, cm, maximum</td><td>D113</td><td colspan="3">100</td><td colspan="3">-</td></tr>
<tr><td>Ductility, 15.6°C, cm, minimum</td><td></td><td colspan="3">-</td><td colspan="3">100</td></tr>
</table>

General Requirement:

- The asphalt shall be prepared by the refining of petroleum. It shall be uniform in character and shall not foam when heated to 175°C.
- The temperature at delivery to the site shall be between 170°C and 190°C.

CHART 02065.1A : SPECIFICATIONS FOR ASPHALT CEMENT
ABSOLUTE VISCOSITY



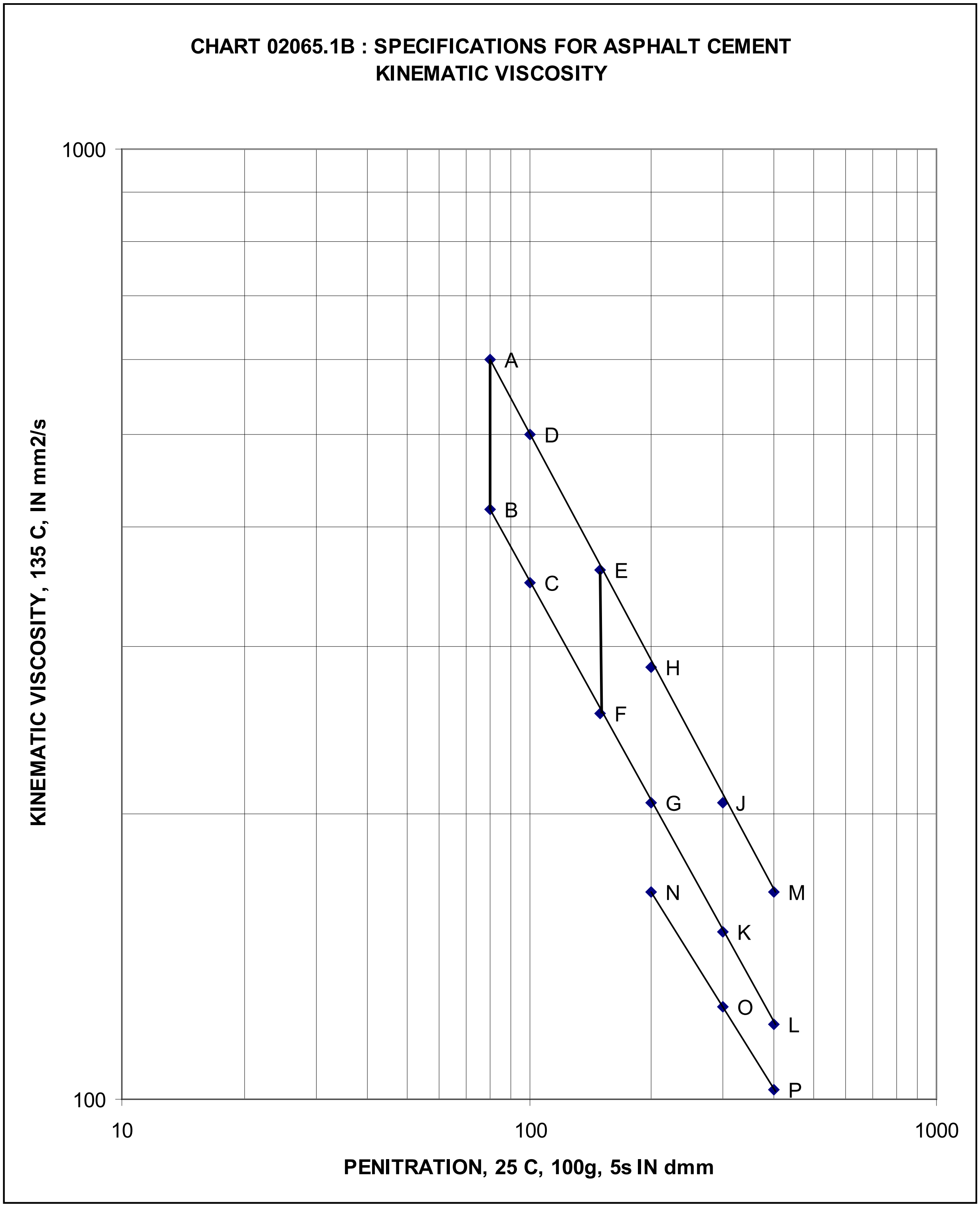


CHART 02065.1B : SPECIFICATIONS FOR ASPHALT CEMENT
KINEMATIC VISCOSITY
KINEMATIC VISCOSITY, 135 C, IN mm2/s
1000
100
10
100
1000
PENITRATION, 25 C, 100g, 5s IN dmm
A
B
C
D
E
F
G
H
J
K
L
M
N
O
P

Table 02066.2: AASHTO M320 Table 2

Table 2—Performance-Graded Asphalt Binder Specification

Performance Grade	PG 46			PG 52							PG 58					PG 64					
	34	40	46	10	16	22	28	34	40	46	16	22	28	34	40	10	16	22	28	34	40
Average 7-day max pavement design temperature, °C[a]	<46			<52							<58					<64					
Min pavement design temperature, °C[a]	>–34	>–40	>–46	>–10	>–16	>–22	>–28	>–34	>–40	>–46	>–16	>–22	>–28	>–34	>–40	>–10	>–16	>–22	>–28	>–34	>–40
Original Binder																					
Flash point temp, T 48, min °C	230																				
Viscosity, T 316:[b] max 3 Pa·s, test temp, °C	135																				
Dynamic shear, T 315:[c] $G^*/\sin\delta^d$, min 1.00 kPa test temp @ 10 rad/s, °C	46			52							58					64					
Rolling Thin-Film Oven Residue (T 240)																					
Mass change,[e] max, percent	1.00																				
Dynamic shear, T 315: $G^*/\sin\delta^d$, min 2.20 kPa test temp @ 10 rad/s, °C	46			52							58					64					
Pressurized Aging Vessel Residue (R 28)																					
PAV aging temperature, °C[f]	90			90							100					100					
Dynamic shear, T 315: $G^*\sin\delta^d$, max 5000 kPa test temp @ 10 rad/s, °C	10	7	4	25	22	19	16	13	10	7	25	22	19	16	13	31	28	25	22	19	16
Critical low cracking temp, R 49:[g] Critical cracking temp determined by R 49, test temp, °C	–24	–30	–36	0	–6	–12	–18	–24	–30	–36	–6	–12	–18	–24	–30	0	–6	–12	–18	–24	–30

[a] Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, may be provided by the specifying agency, or by following the procedures as outlined in M 323 and R 35.
[b] This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.
[c] For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be used to supplement dynamic shear measurements of $G^*/\sin\delta$ at test temperatures where the asphalt is a Newtonian fluid.
[d] $G^*/\sin\delta$ = high temperature stiffness and $G^*\sin\delta$ = intermediate temperature stiffness.
[e] The mass change shall be less than 1.00 percent for either a positive (mass gain) or a negative (mass loss) change.
[f] The PAV aging temperature is based on simulated climatic conditions and is one of three temperatures, 90°C, 100°C, or 110°C. Normally the PAV aging temperature is 100°C for PG 58-xx and above. However, in desert climates, the PAV aging temperature for PG 70-xx and above may be specified as 110°C.
[g] For verification of grade, at a minimum perform T 313 at the test temperature and at the test temperature minus 6°C and T 314 at the test temperature. Testing at additional temperatures for T 313 may be necessary if 300 MPa is not bracketed at the initial two test temperatures. Compare the failure stress from T 314 to the calculated induced thermal stress as per R 49. If the failure stress exceeds the induced thermal stress, the asphalt binder is deemed a "PASS" at the specification temperature.

Table 02066.3: AASHTO M320 Table 2 (continued)

Table 2—Performance-Graded Asphalt Binder Specification *(Continued)*

Performance Grade	PG 70						PG 76					PG 82				
	10	16	22	28	34	40	10	16	22	28	34	10	16	22	28	34
Average 7-day max pavement design temperature, °C[a]	<70						<76					<82				
Min pavement design temperature, °C[a]	>–10	>–16	>–22	>–28	>–34	>–40	>–10	>–16	>–22	>–28	>–34	>–10	>–16	>–22	>–28	>–34
Original Binder																
Flash point temp, T 48, min °C	230															
Viscosity, T 316:[b] max 3 Pa·s, test temp, °C	135															
Dynamic shear, T 315:[c] G*/sinδ[d], min 1.00 kPa test temp @ 10 rad/s, °C	70						76					82				
Rolling Thin-Film Oven Residue (T 240)																
Mass change,[e] max, percent	1.00															
Dynamic shear, T 315: G*/sinδ[d], min 2.20 kPa test temp @ 10 rad/s, °C	70						76					82				
Pressurized Aging Vessel Residue (R 28)																
PAV aging temperature, °C[f]	100 (110)						100 (110)					100 (110)				
Dynamic shear, T 315: G* sinδ[d], max 5000 kPa test temp @ 10 rad/s, °C	34	31	28	25	22	19	37	34	31	28	25	40	37	34	31	28
Critical low cracking temp, R 49:[g] Critical cracking temp determined by R 49, test temp, °C	0	–6	–12	–18	–24	–30	0	–6	–12	–18	–24	0	–6	–12	–18	–24

[a] Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, may be provided by the specifying agency, or by following the procedures as outlined in M 323 and R 35.

[b] This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.

[c] For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be used to supplement dynamic shear measurements of G*/sinδ at test temperatures where the asphalt is a Newtonian fluid.

[d] G*/sinδ = high temperature stiffness and G* sinδ = intermediate temperature stiffness.

[e] The mass change shall be less than 1.00 percent for either a positive (mass gain) or a negative (mass loss) change.

[f] The PAV aging temperature is based on simulated climatic conditions and is one of three temperatures 90°C, 100°C, or 110°C. Normally the PAV aging temperature is 100°C for PG 58-xx and above. However, in desert climates, the PAV aging temperature for PG 70-xx and above may be specified as 110°C.

[g] For verification of grade, at a minimum perform T 313 at the test temperature and at the test temperature minus 6°C and T 314 at the test temperature. Testing at additional temperatures for T 313 may be necessary if 300 MPa is not bracketed at the initial two test temperatures. Compare the failure stress from T 314 to the calculated induced thermal stress as per R 49. If the failure stress exceeds the induced thermal stress, the asphalt binder is deemed a "PASS" at the specification temperature.

APPENDIX 02066.A
METHOD FOR DETERMINING FILM THICKNESS

B1 Surface Area Factors (S_a):

Sieve Size (μm)	Surface Area Factor (m²/kg)
5000	0.38
2500	0.78
1250	1.55
630	2.90
315	5.60
160	12.20
80	29.00

Determine total surface area as the sum of the surface areas for the seven specified sieve sizes according to the formula:

$$S_a = 0.38 + \frac{\Sigma\,(\%\text{ Passing} \times \text{Surface Area Factor})}{100}$$

B2 Corrected S_a (S_{ac}):

Correct S_a for actual Aggregate Bulk Specific Gravity by the formula:

$$S_{ac} = S_a \times (2.650/\text{Actual Bulk Specific Gravity})$$

B3 Film Thickness (F_t) Calculation:

$$F_t = 10 \times (P_{ac} - P_{abs}) / S_{ac} \times SG_{ac} \quad \text{in microns (mm)}$$

Where:

P_{ac}	=	Percent Asphalt Cement Content by dry mass of Aggregate
P_{abs}	=	Percent of Absorbed Asphalt Cement by dry mass of Aggregate
S_{ac}	=	Corrected S_a
SG_{ac}	=	Specific Gravity of Asphalt Cement

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Production of a hot mixture of asphalt binder and aggregate for paving.

1.1.2 Requirements for mix design, quality control, and quality assurance.

1.2 RELATED SECTION

1.2.1 Section 02060 – Aggregate

1.2.2 Section 02743 – Stone Mastic Asphalt Paving

1.3 DEFINITIONS

1.3.1 **SGC Specimens**: Test specimens prepared using the SHRP Gyratory Compactor (SGC) at the specified number of $N_{\text{Design gyrations}}$ of 100.

1.4 SUBMITTALS

1.4.1 Submittal of Asphalt Cement Data

1.4.1.1 Submit certified test results in writing with the mix design that the asphalt cement complies with the specifications. This certification shall include, but not be limited to:

- Name of the Supplier
- Source(s) of the Base Asphalt Cement(s)
- Type and Source(s) of admixture(s)
- Proportions of materials
- Laboratory test results of the Asphalt Cement
- Certification statement that the Asphalt Cement complies with the requirements of this specification.

Certification shall be submitted (1) for a binder used in the design of a job mix formula as part of a submittal, and, (2) during the life of an approved job mix formula.

1.4.2 Mix Design

1.4.2.1 Submit a mix design carried out by an independent laboratory to the Engineering Services Section at least 10 days before the start of any SMA production, and for each subsequent change in supplier or source of materials. No hot-mix production can proceed until the applicable mix design and job-mix formula is approved by the Engineer.

1.4.2.2 Submit all SMA mix design characteristics, including graphs used in arriving at the final mix design; the bulk specific gravity of individual aggregates and the combined aggregates; individual aggregate and mineral filler gradations and combined aggregate gradations: the graph of maximum specific gravity versus asphalt content; Blends and Job Mix Formula; the asphalt absorption of the combined aggregates and the Tensile Strength Ratio (TSR) as well as results of Asphalt Pavement Analyzer (APA) testing.

1.4.2.3 Submit, with the mix design, six 4-litre containers of PMA asphalt binder, and a sufficient quantity of each aggregate component to result in a 100-kg sample of combined aggregate at the design proportions.

1.4.3 Plant Scale Certificate

Provide a copy of the plant scale certificates to the Engineering Services Section at least 10 days prior to any SMA production.

1.4.4 Job Mix Formula

1.4.4.1 Submit with the SMA Mix design the proportions of materials and plant settings to include the following.

For Batch Plant:

- Sieve analysis of combined aggregate in the mix.
- Sieve analysis of aggregate in each bin separation to be used.
- Mass of material from each bin for each batch of mix.
- Mass of asphalt binder in each batch.
- Mixing temperature of asphalt binder determined from its temperature-viscosity curve, or as recommended by the manufacturer.

For Continuous or Drum-Mix Plant:

- Sieve analysis of each aggregate and mineral filler.
- Sieve analysis of combined aggregate in the mix.
- Mass of asphalt binder per tonne of mix.
- Mixing temperature of asphalt binder determined from its temperature-viscosity curve, or as recommended by the manufacturer.
- Settings of aggregate and asphalt binder feed systems (blend).

1.4.5 Quality Control Plan

Before beginning hot-mix production, submit a quality control plan to the Engineering Services Section including the following recommended tests and frequency. Submit test results daily to the Engineer for review.

Tests:	2 Superpave Gyratory Compactor (SGC) per test
	Asphalt binder content
	Air voids
	Voids in the mineral aggregate (VMA)
	Voids filled with asphalt binder
	Moisture content of the mix
	Gradation of the mix
	Plant discharge temperature
	Asphalt storage temperature
Frequency:	A minimum of 2 tests per day of production.

1.4.6 Aggregates

1.4.6.1 **For Aggregate supplied by the Contractor**: Submit abrasion, soundness, flat and elongated, detrimental matter and clay content test results for each aggregate source. Submit results of sieve analysis to ASTM C136, and crushed face count at the following frequencies:

- For a stockpile existing at the time of contract award: a minimum of one sieve test and one crushed face count per 1 000 tonnes of aggregate. In addition, submit the average gradation of an entire stockpile when submitting a mix design using aggregate from the stockpile.

- For aggregate stockpiled during the contract: a minimum of one sieve test and one crushed face count per 1 500 tonnes of aggregate, or each day's production, whichever is less.

1.4.6.2 Submit results to the Engineering Services Section within 24 hours of testing. Do not use aggregate until test results have been reviewed and accepted by the Engineer.

1.4.6.3 **For Aggregate Supplied by the City of Edmonton**: If the aggregate is supplied by the City of Edmonton the aggregate will be available for pick-up from one of the City of Edmonton rubble recycling locations as set forth in the contract documents. The Contractor will supply the loader required to load the aggregate. However, the Contractor may choose to have the SMA material hauled directly to a stockpile location of his choice. The material haul date will be stipulated in the contract documents. The Contractor shall bid accordingly. The City of Edmonton is responsible for the quality assurance testing of the aggregate in stockpile and will provide the results of all QA testing to the successful contractor. It is the contractor's responsibility to confirm the gradation of the stockpile materials to be used; the City of Edmonton will make the stockpile available to the contractor to verify the gradation of the materials.

1.5 QUALITY ASSURANCE

1.5.1 Inspection and Testing

In addition to field inspections by the Engineer, the quality assurance laboratory will conduct plant inspection and materials sampling and testing described in the following paragraphs.

1.5.2 Asphalt Concrete Plant

Inspections will be conducted at least once a week during production to check plant calibrations, plant operation, production settings, temperatures, and materials handling. Samples of materials and mixture will be taken and tested.

1.5.3 Asphalt Cement

Quality assurance sampling and testing of the Asphalt Cement shall be performed by the contractor, at no cost to the, City of Edmonton, to verify compliance to the specification. A sample shall be taken at random during paving operations on City of Edmonton projects from a load(s) delivered to the contractor's asphalt plant at least twice a month or as directed by the Engineer. The sample shall be tested by an independent laboratory engaged by the Contractor to verify compliance with the specification requirements as stated in Section 2.1.1. Test results shall be reported in writing to the, Engineering Services Section of Transportation Services, City of Edmonton by the Contractor. Non-complying test results will be reported to the Engineering Services Section within 24 hours of completion of the test(s). Compliant sample test results shall be submitted in writing to the Engineering Services Section, no later than 10 working days after the date of sampling.

1.5.3.1 A test report shall include, but not be limited to, (1) report date, (2) date of sampling, (3) bill of lading number of load sampled, (4) destination of load, (5) report of test results, (6) standard test identifications, (7) specification requirements, (8) statement of compliance, and certification signature. Failure to comply with quality assurance testing may result in rejection of either the binder, and/or the job mix formula, and/or the associated job mix placed on a project.

1.5.3.2 If non-complying material is identified, the paving program may be suspended for 24 hours, as directed by the Engineer, during which time the Contractor and the Engineer will meet to determine the impact of the non-compliance, and specify the necessary remedial action to be taken by the Contractor. Remedial action shall be either acceptance, or acceptance at a pay adjustment, or removal and replacement at no cost to the City of Edmonton. The paving program may continue upon written authorization by the Engineer.

1.5.3.3 Production binder identified to be in non-compliance shall not be shipped to a project. Asphalt concrete batched and placed with non-complying binder shall be removed and replaced, as directed by the Engineer with complying material by the Contractor at no cost to the City of Edmonton.

1.5.3.4 Binder substitution in an authorized job mix formula shall not be allowed, without prior approval of the Engineer.

1.5.3.5 Actual asphalt cement content, in which unit price adjustments will be based on, is defined as the amount of asphalt cement in the mix as determined through the Quality Assurance testing program.

1.5.4 Production Mix Analysis

Full SGC testing will be conducted at a minimum frequency of one test, with two SGC specimens per test, for each 500 tonnes of hot-mix, or a day's production, whichever is less. Determine the asphalt cement content and the Maximum Theoretical Density (MTD) of SMA at a minimum frequency of one test for every 250 tonnes of hot-mix produced, or a day's production, whichever is less

1.5.5 Job Mix Formula

The quality assurance laboratory will test a trial batch of the job-mix formula to verify the mix design. The mix design and job-mix formula will not be approved until successful results are obtained.

1.5.6 Aggregate Gradation Tolerance

The variation from the approved job-mix aggregate gradation shall not exceed the following limits:

	% Passing by Mass	
Sieve Size (μm)	**Individual Sample**	**Average of Last 3 Samples**
5 000	± 3.0	± 3.0
1 250	± 3.0	± 2.5
630	± 3.0	± 2.0
315	± 3.0	± 2.0
160	-1.0 to +3.0	-1.0 to +2.0
80	-1.0 to +2.5	-0.5 to +1.0

1.5.7 Asphalt Content Tolerance

The allowable variation from the approved design asphalt content shall be ± 0.2% by mass of mix.

1.5.8 Air Void Tolerance

The allowable variation from the design air voids in the mix shall be ± 0.5%.

1.5.9 Mixing Temperature Tolerance

The allowable variation from the design mixing temperature shall be ± 9°C.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Polymer Modified Asphalt Cement:** to AASHTO M320, Table 2 (included in this specification as Table 02067.1), grade PMA PG 76-28, PG 70-28, or as otherwise set forth in the contract documents**.** For the Polymer Modified PG 76-28 and PG 70-28 Straight asphalt cement shall be modified with SB-type copolymers to reach the specified performance grade. No other modifiers are allowed unless approved in writing by the City of Edmonton

2.1.2 **Aggregates:** to section - 02060 – Aggregates and as shown below.

2.1.2.1 The Stone Mastic aggregate gradation requirements shall be as follows:

Sieve Size (μm)	Percent Passing by Mass
20 000	minimum 100
16 000	97 - 100
12 500	88 - 100
10 000	30 - 80
6 300	22 - 45
5 000	20 - 35
2 500	16 - 26
1 250	14 - 22
630	13 - 20
315	12 - 18
160	10 - 16
80	10 - 14

2.1.2.2 Additional Stone Mastic aggregate properties shall be as follows:

Coarse Aggregate Physical Properties:

Property	Test Method	Requirement
LA Abrasion, % loss	AASHTO T 96	18% Maximum
Flat & Elongated, % 3:1 5:1	ASTM D 4791	20% maximum. 5% Maximum
Absorption, %	AASHTO T 85	2% Maximum.
Soundness (5 Cycles), % Sodium sulfate Magnesium Sulfate	AASHTO T 104	15% Maximum 20% Maximum
Detrimental Matter, %	Alberta Infrastructure TLT 107	2% Maximum
Clay content %	AASHTO - T 176	40% minimum
Crushed Face Count, % One Face Two Faces	ASTM D 5821	100% with at least 1 100% with at least 2

Fine Aggregate Physical Properties:

Property	Test Method	Requirement
Soundness (5 Cycles), % Sodium sulfate Magnesium Sulfate	AASHTO T 104	15% Maximum 20% Maximum
Angularity, %	AASHTO TP 33	45% Minimum
Liquid Limit, %	AASHTO T 89	25% Maximum
Plasticity Index	AASHTO T 90	Non-Plastic

2.1.2.3 **Fine Aggregate:** that fraction of the total aggregate passing the 5 000 μm sieve. Fine aggregate shall contain 100% manufactured or crushed fines

2.1.3 **Mineral Filler:** The mineral filler should consist of Limestone dust or approved alternate meeting the requirements of AASHTO M-17 or ASTM D242. Filler should be free from organic impurities and the portion passing the 80 μm sieve size shall have a Plasticity Index of zero.

The mineral filler shall meet the following gradation requirements:

Sieve size (μm)	Percent Passing (by Mass)
600	100
300	92-100
80	60-100

2.1.3 **Stabilizing Agent:** Cellulose fibers shall be added at a rate of approximately 0.3 percent by total mass of mix in order to prevent draindown. The exact cellulose fibre addition rate to be determined by the SMA mix design.

The cellulose fibers shall meet the following requirements:

Property*	Requirement
Sieve Analysis: **Method A – Alpine Sieve Analysis** Fiber Length Passing 0.150 mm **Method B – Mesh Screen Analysis** Fiber Length Passing 0.850 mm Passing 0.425 mm Passing 0.160 mm	 6 mm Maximum 70 +/- 10 % 6 mm Maximum 85 +/- 10 % 65 +/- 10 % 30 +/- 10%
Ash Content	18 +/- 5% non-volatiles
pH	7.5 +/- 1.0
Oil Absorption	5.0 +/- 1.0 times fiber mass
Moisture Content	Less than 5% (by mass)

*Note: Test methods in accordance with those outlined in : Fiber Length ”Designing Stone Matrix Asphalt Mixtures Volume IV – Mixture Design Method, Construction Guidelines and

Quality Control Procedures" report dated July, 1998 and prepared by the National Center for Asphalt Technology (NCAT).

2.2 EQUIPMENT

2.2.1 Asphalt Plant

2.2.1.1 Asphalt Mixing Plant: conforming to ASTM D995, capable of consistently producing a homogeneous mixture in which all aggregate particles are uniformly and thoroughly coated with asphalt, and meeting the following supplementary requirements:

2.2.1.2 Provide free and safe access for the Engineer to verify proportions, settings, and temperatures, and to take samples of asphalt, aggregate and mixture.

2.2.1.3 All asphalt-paving plants are required to be operated in accordance with the Alberta Environmental Protection Code of Practice. All contractors operating asphalt plants shall provide proof of registration with Alberta Environmental Protection and agree that the asphalt plant shall be operated in accordance with the Code of Practice.

2.3 MIX DESIGN

2.3.1 The SMA Mix design shall be performed by an independent laboratory according to the procedures outlined in NCHRP Report 425 "Designing Stone Matrix Asphalt Mixtures for Rut Resistant Pavements – Part 2 Mixture Design Methods, Construction Guidelines and Quality Control/Quality Assurance Procedures" subject to the following parameters:

Selected Parameters	Requirement
Superpave Gyratory Compactor Design (100 Gyrations)	
Air Voids, %	3.5% +/- 0.5%
VMA, %	17 Minimum
VCA_{mix} , %	Less than VCA_{dry}
Tensile Strength Ratio % (AASHTO T283)	75 Minimum
Draindown @ production temperature, %	0.3 Maximum

2.3.1.1 **Rutting Susceptibility Testing**: SMA shall be subjected to the Asphalt Pavement Analyzer (APA) procedure during the mix design process and will be subjected to testing during actual production of the mixture, as deemed necessary by the Engineer. APA testing will be carried out by the City of Edmonton Quality Assurance laboratory or conversely the contractor may use an independent laboratory to perform APA testing. The APA device must meet the requirements of AASHTO TP63-03 and must be equipped with an automatic rut measurement system. The APA device must be calibrated at least once per year according to the procedures in the test method. In addition, the load cell used for checking wheel loads shall be calibrated at least once per year. Each test shall have 6 cylindrical samples fabricated and tested with the interior temperature of the APA set at 52^{o} C. The downward force shall be set at 45 Kg and the hoses shall be pressurized to 689 kPa. Each specimen shall be compacted so that 7+/- 0.5 percent air voids are achieved. The APA rut test results shall be provided to the nearest 0.1 mm. The average rut depth for the specimens tested shall not exceed 5.0mm.

2.3.2 Modifications to the Stone Mastic mix design procedure or criteria are as follows:

- Metric sieves in accordance with CGSB Specification 8-GP-2M shall be used in place of the sieves specified in the Asphalt Institute Manual.

- PG Asphalt Cement content shall be reported based on the total mass of the mix
- Fine aggregate angularity criteria shall be as defined in 2.1.2.2.
- The Alberta Transportation and Utilities ATT and TLT test procedures shall be used to determine fine aggregate angularity.

2.3.3 Job-Mix Formula

Do not make changes to the approved job-mix formula without written approval from the Engineer. Display the currently approved job-mix formula in clear sight of the plant operator.

3. EXECUTION

3.1 PRODUCTION OF MIX

3.1.1 Good Practice Guide

Refer to the Quality Improvement Series 122 “Designing and Constructing SMA Mixtures – State of the Art Practice” as published by The National Asphalt Pavement Association (NAPA), for guidance in good practices of handling materials and hot-mix production insofar as consistent with this Section.

3.1.2 Production Rate

Produce hot-mix at a rate compatible with the rate of placement and compaction on the job.

3.2 Aggregate in Stockpile

3.2.1 Stockpile aggregate in horizontal lifts. Stacking conveyors are not allowed for stockpiling. Draw aggregate from stockpile in a manner that mixes the full depth of stockpile face.

3.2.2 When it is necessary to blend aggregates from one or more sources to produce the combined gradation, stockpile each source or size of aggregate individually. Do not blend aggregates in a stockpile.

3.2.3 If one or more of the mix properties are not met, the Engineer will order suspension of mix production until the Contractor has demonstrated to the Engineer's satisfaction that corrective measures have been taken to produce a mix that meets the requirements of this section.

END OF SECTION

Table 02067.1: AASHTO M320 Table 2

Table 2—Performance-Graded Asphalt Binder Specification

Performance Grade	PG 46			PG 52							PG 58					PG 64					
	34	40	46	10	16	22	28	34	40	46	16	22	28	34	40	10	16	22	28	34	40
Average 7-day max pavement design temperature, °C[a]	<46			<52							<58					<64					
Min pavement design temperature, °C[a]	>−34	>−40	>−46	>−10	>−16	>−22	>−28	>−34	>−40	>−46	>−16	>−22	>−28	>−34	>−40	>−10	>−16	>−22	>−28	>−34	>−40
Original Binder																					
Flash point temp, T 48, min °C	230																				
Viscosity, T 316:[b] max 3 Pa·s, test temp, °C	135																				
Dynamic shear, T 315:[c] $G^*/\sin\delta^d$, min 1.00 kPa test temp @ 10 rad/s, °C	46			52							58					64					
Rolling Thin-Film Oven Residue (T 240)																					
Mass change,[e] max, percent	1.00																				
Dynamic shear, T 315: $G^*/\sin\delta^d$, min 2.20 kPa test temp @ 10 rad/s, °C	46			52							58					64					
Pressurized Aging Vessel Residue (R 28)																					
PAV aging temperature, °C[f]	90			90							100					100					
Dynamic shear, T 315: $G^* \sin\delta^d$, max 5000 kPa test temp @ 10 rad/s, °C	10	7	4	25	22	19	16	13	10	7	25	22	19	16	13	31	28	25	22	19	16
Critical low cracking temp, R 49:[g] Critical cracking temp determined by R 49, test temp, °C	−24	−30	−36	0	−6	−12	−18	−24	−30	−36	−6	−12	−18	−24	−30	0	−6	−12	−18	−24	−30

[a] Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, may be provided by the specifying agency, or by following the procedures as outlined in M 323 and R 35.
[b] This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.
[c] For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be used to supplement dynamic shear measurements of $G^*/\sin\delta$ at test temperatures where the asphalt is a Newtonian fluid.
[d] $G^*/\sin\delta$ = high temperature stiffness and $G^* \sin\delta$ = intermediate temperature stiffness.
[e] The mass change shall be less than 1.00 percent for either a positive (mass gain) or a negative (mass loss) change.
[f] The PAV aging temperature is based on simulated climatic conditions and is one of three temperatures, 90°C, 100°C, or 110°C. Normally the PAV aging temperature is 100°C for PG 58-xx and above. However, in desert climates, the PAV aging temperature for PG 70-xx and above may be specified as 110°C.
[g] For verification of grade, at a minimum perform T 313 at the test temperature and at the test temperature minus 6°C and T 314 at the test temperature. Testing at additional temperatures for T 313 may be necessary if 300 MPa is not bracketed at the initial two test temperatures. Compare the failure stress from T 314 to the calculated induced thermal stress as per R 49. If the failure stress exceeds the induced thermal stress, the asphalt binder is deemed a "PASS" at the specification temperature.

Table 02067.1: AASHTO M320 Table 2 (continued)

Table 2—Performance-Graded Asphalt Binder Specification *(Continued)*

Performance Grade	PG 70						PG 76					PG 82				
	10	16	22	28	34	40	10	16	22	28	34	10	16	22	28	34
Average 7-day max pavement design temperature, °C[a]	<70						<76					<82				
Min pavement design temperature, °C[a]	>–10	>–16	>–22	>–28	>–34	>–40	>–10	>–16	>–22	>–28	>–34	>–10	>–16	>–22	>–28	>–34
Original Binder																
Flash point temp, T 48, min °C	230															
Viscosity, T 316:[b] max 3 Pa·s, test temp, °C	135															
Dynamic shear, T 315:[c] G*/sinδ[d], min 1.00 kPa test temp @ 10 rad/s, °C	70						76					82				
Rolling Thin-Film Oven Residue (T 240)																
Mass change,[e] max, percent	1.00															
Dynamic shear, T 315: G*/sinδ[d], min 2.20 kPa test temp @ 10 rad/s, °C	70						76					82				
Pressurized Aging Vessel Residue (R 28)																
PAV aging temperature, °C[f]	100 (110)						100 (110)					100 (110)				
Dynamic shear, T 315: G* sinδ[d], max 5000 kPa test temp @ 10 rad/s, °C	34	31	28	25	22	19	37	34	31	28	25	40	37	34	31	28
Critical low cracking temp, R 49:[g] Critical cracking temp determined by R 49, test temp, °C	0	–6	–12	–18	–24	–30	0	–6	–12	–18	–24	0	–6	–12	–18	–24

[a] Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, may be provided by the specifying agency, or by following the procedures as outlined in M 323 and R 35.
[b] This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.
[c] For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be used to supplement dynamic shear measurements of G*/sinδ at test temperatures where the asphalt is a Newtonian fluid.
[d] G*/sinδ = high temperature stiffness and G* sinδ = intermediate temperature stiffness.
[e] The mass change shall be less than 1.00 percent for either a positive (mass gain) or a negative (mass loss) change.
[f] The PAV aging temperature is based on simulated climatic conditions and is one of three temperatures 90°C, 100°C, or 110°C. Normally the PAV aging temperature is 100°C for PG 58-xx and above. However, in desert climates, the PAV aging temperature for PG 70-xx and above may be specified as 110°C.
[g] For verification of grade, at a minimum perform T 313 at the test temperature and at the test temperature minus 6°C and T 314 at the test temperature. Testing at additional temperatures for T 313 may be necessary if 300 MPa is not bracketed at the initial two test temperatures. Compare the failure stress from T 314 to the calculated induced thermal stress as per R 49. If the failure stress exceeds the induced thermal stress, the asphalt binder is deemed a "PASS" at the specification temperature.

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Removal of existing pavement structure and concrete.

1.1.2 Salvage or disposal of materials.

1.2 RELATED SECTION

Grading Section 02310

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Pavement Removal:** asphalt, concrete, gravel and soil cement layers.

2.1.2 **Concrete Removal:** curb, curb and gutter, gutter, walk, ramp, crossing and other slabs.

2.1.3 **Salvageable Materials:** asphalt, concrete, gravel and soil cement rubble designated by the Engineer for salvage.

2.1.4 **Surplus Materials:** all debris from the removal operation and materials not designated by the Engineer for salvage.

2.2 EQUIPMENT

2.2.1 The use of drop hammer type breaking equipment is not permitted.

2.2.2 Equipment shall be suitably muffled to conform to the City of Edmonton Noise Abatement Bylaw No. 7255 and amendments thereto.

2.2.3 Only vehicles licensed for highway use shall be used for hauling on or across developed roadways.

3. EXECUTION

3.1 BREAKING AND EXCAVATING

3.1.1 **Sawcutting:** Where directed by the Engineer, or where indicated in the drawings or in the contract Special Provisions, sawcut the limits of removal on existing pavement and concrete to a depth necessary to produce a straight clean vertical edge through the full depth of the existing pavement structure or concrete before breaking. The Engineer will require resawing if this edge is not maintained straight, clean and vertical until new pavement or concrete is placed against it.

3.1.2 Break asphalt, concrete and soil cement pavement layers into pieces with no dimension >750 mm.

3.1.3 Break concrete curb, curb and gutter, gutter, walk and other slabs into pieces with no dimension >750 mm, including reinforcing bars if any.

3.1.4 Excavate broken materials.

3.2 SALVAGING

3.2.1 The Engineer will determine the suitability of removed materials for salvage. The following will not be accepted for salvage:

3.2.1.1 Concrete with wire mesh.

3.2.1.2 Pavement and concrete contaminated with topsoil or clay.

3.2.2 Haul salvageable materials to designated locations.

3.3 SURPLUS MATERIALS

3.3.1 Remove and dispose of all debris and surplus materials.

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Clearing designated areas of trees, shrubs and other vegetation.

1.1.2 Removal of stumps and roots and disposal of debris.

1.2 RELATED SECTION

Grading Section 02310

1.3 REGULATORY REQUIREMENTS

1.3.1 There shall be no burning of debris on site unless permitted by the Engineer and done in conformity with applicable legislation and regulations.

1.3.2 Maintain clearances from power lines as required by applicable legislation and regulations.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Salvage:** The Engineer may designate selected timber for salvage, and selected trees, shrubs and other plants for retrieval.

2.1.2 **Preservation:** The Engineer may designate selected trees and shrubs to remain undisturbed.

3. EXECUTION

3.1 CLEARING

3.1.1 Trees and shrubs <150 mm diameter at ground level: Cut off at ground level.

3.1.2 Trees and shrubs ≥150 mm diameter at ground level: Uproot completely and remove all trunk and primary roots.

3.1.3 Minimize damage to trees and shrubs designated for preservation. Fell trees away from preserved vegetation. Clear preserved area of all debris.

3.1.4 Trim all branches from timber designated for salvage. Store clean timber at designated area on site.

3.1.5 Remove vegetation and debris from areas outside excavation limits as designated. Make gradual transitions from cleared to undisturbed areas.

3.2 GRUBBING

3.2.1 Remove all roots and stumps >50 mm diameter to depth of topsoil. Where there is no topsoil, remove to a minimum depth of 300 mm below existing ground surface.

3.2.2 Separate grubbed material from topsoil.

3.2.2.1 Where permitted or directed by Engineer, chip grubbed material into 50 mm maximum dimension pieces and mix with native topsoil.

3.2.3 DISPOSAL

3.2.3.1 Remove and dispose of all debris, rubbish, and material not designated for salvage.

3.2.3.2 Where permitted by Engineer, chop cleared material and debris into 300 mm maximum dimension pieces and bury pieces at a designated location on site clear of any roadway structure and under a minimum of 600 mm of soil cover.

1. GENERAL

1.1 SECTION INCLUDES

Raising depressed or settled concrete boulevard walk back to grade. Slabjacking can not be used to correct deficiencies in new construction before final acceptance.

1.2 RELATED SECTIONS

Aggregate	Section 02060
Concrete Curb, Gutter, Walk, Slabs	Section 02770

1.3 SUBMITTALS

Submit a grout mix design to the Engineering Services Section, Transportation Services, at least 14 days prior to initial use and when there is a change in material, source, or proportion.

1.4 QUALITY ASSURANCE

The quality assurance laboratory will take random samples of the grout and test for spread, shrinkage and compressive strength.

2. PRODUCTS

2.1 MATERIALS

2.1.1.1 Grout Cement: **Type GU** Type GU – General use hydraulic cement conforming to CAN/CSA-A3000, A3001-03.

2.1.2 **Grout Aggregate:** to Section 02060 - Aggregate, Designation 5 Class 5.

2.1.3 **Pozzolanic Material:** to CAN/CSA-A3000, A3001-03 pozzolan type F or CI

2.1.4 **Water:** to 4.2.2, CAN/CSA-A23.1

2.1.5 **Admixtures:** powdered bentonite or water reducer as required.

2.1.6 **Material Sources:** All material shall be obtained from the same source or manufacturer. Submit a written request for change of source to the Engineer 10 days prior to proposed change. No change shall be made until approved by the Engineer.

2.2 EQUIPMENT

2.2.1 **Grout Pump:** non-pulsing, positive displacement pump, with a pressure capacity of 350 to 1750 kPa at the discharge hose outlet, with a flow capacity of 5 m^3/h minimum and equipped with a device for accurately measuring the volume of grout pumped.

2.2.2 **Drilling Rig:** capable of drilling a 75 mm maximum diameter hole through the concrete slab.

2.3 MIXES

2.3.1 The grout mix design shall meet the following criteria:

2.3.1.1 Cement Content: minimum of 160 kg/m^3.

2.3.1.2 Fly Ash: minimum of 160 kg/m^3.

2.3.1.3 Compressive Strength: minimum of 0.7 MPa at 28 days.

3. EXECUTION

3.1 PREPARATION

3.1.1 **Utilities:** The Contractor is responsible for obtaining the locations of underground utilities, including but not limited to buried electrical lines, cables, telephone lines and water and drainage pipes.

3.1.2 **Site Protection:** Provide hoarding or suitable protection around the work site for public safety and to minimize disruption to adjacent residences and businesses.

3.1.3 **Equipment Support:** Ensure that site conditions can support equipment for drilling and grouting.

3.1.4 **Air Temperature:** Work shall not proceed when the air temperature is less than 5°C.

3.2 JACKING

3.2.1 Remove sheet asphalt or grout on previously repaired walk.

3.2.2 Mark strategic locations for drill holes on the walk. Drill holes through the slab to a grouting depth of 50 mm to 300 mm as required.

3.2.3 Sawcut the slab where required to free it from binding.

3.2.4 Pump grout to fill all voids below the slab while lifting it to a controlled elevation.

3.2.5 Ensure that lifting of the slab is done in small increments to prevent slab cracking or damage.

3.2.6 After grouting, fill the drill holes with 25 MPa at 28 days concrete grout, having 10 mm maximum size aggregate.

3.2.7 Record Keeping: For each location, record the volume of grout pumped below the slab and the slab elevations on 3 m grid points before and after grouting. Submit records to the Engineer upon completion of the work at each location.

3.3 FIELD QUALITY CONTROL

3.3.1 Tolerances along Centreline of Walk: 6mm maximum variation under a 3 m straightedge or taut string line parallel to centreline of the walk.

3.3.2 Tolerances between Sections of Walk: 6mm maximum differential level at a construction joint between adjacent sections of walk.

3.4 CORRECTION OF DEFICIENCIES

3.4.1 Change the grout mix proportions and/or change the composition or source of the aggregate to correct deficiencies in the grout strength.

3.4.2 Continue jacking and grouting until the tolerances in 3.3 are met.

3.4.3 Repair cracks ≥3 mm in width caused by jacking, to the satisfaction of the Engineer.

3.4.4 Remove broken or damaged slab and replace with new concrete walk to Section 02770 - Concrete Curb, Gutter, Walk, Slabs.

3.5 CLEANUP

3.5.1 If the slab jacked walk crosses an alley, do not open the alley to vehicle traffic until the grout has cured for at least 24 hours.

3.5.2 Remove all surplus material and debris from site.

3.5.3 Remove hoarding, barricades and signs no longer needed.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Excavation of soil for construction of roadway and associated structures.

1.1.2 Construction of fill.

1.1.3 Disposal of surplus and unsuitable materials.

1.2 RELATED SECTIONS

Pavement and Concrete Removal	Section 02224
Clearing and Grubbing	Section 02231
Subgrade Preparation	Section 02335

1.3 DEFINITIONS

1.3.1 **Common Excavation**: includes topsoil, clay, silt, sand, gravel and peat within a jobsite.

1.3.2 **Borrow Excavation:** includes select topsoil, clay, sand and gravel from off the jobsite for use as fill within a jobsite.

1.3.3 **Garbage Excavation:** includes household, commercial and industrial refuse or any other deleterious material.

1.3.4 **Fill:** any earth structure built up by successive lifts of a specified material compacted to specified densities.

1.3.5 **Berm:** a type of fill for a specific purpose, such as for noise attenuation or landscaping, as indicated on the drawings.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Suitable Materials**: The Engineer will determine the suitability of excavated materials for use in embankments, subgrade, backfill, berms and any other purpose.

2.1.2 **Salvageable Materials:** When directed by the Engineer, reserve and stockpile at designated locations topsoil, sand, gravel, surplus fill and other materials deemed salvageable by the Engineer.

2.1.3 **Surplus Materials:** Remove and dispose of materials deemed surplus by the Engineer.

2.1.4 **Unsuitable Materials:** Remove and dispose of peat, roots, stumps, topsoil, frozen soil, garbage and any other material deemed unsuitable by the Engineer.

2.2 EQUIPMENT

2.2.1 Only vehicles licensed for highway use shall be used for hauling on developed roadways.

2.2.2 Off-highway earthmoving equipment shall not travel along or across developed roadways, unless authorized in writing by the City before work starts.

2.2.3 Equipment shall be adequately muffled to conform to Noise Abatement Bylaw No. 7255.

3. EXECUTION

3.1 EXCAVATION

3.1.1 Where necessary, perform clearing and grubbing to Section 02231 Clearing and Grubbing and remove designated pavement and concrete to Section 02224 Pavement and Concrete Removal. Excavate to designated cross-sections. Complete initial excavation from property line to property line, unless permitted otherwise by the Engineer. Exercise caution to preserve bank stability where necessary. Stage excavation to allow related work.

3.1.2 **Use of Excavated Soil:** Use Engineer-approved excavated soil to construct embankments, subgrade, berms, boulevard fill, trench backfill and for other purposes as directed.

3.1.3 **Borrow Excavation:** Where excavated suitable material is not sufficient for jobsite use, obtain additional material from a designated borrow site. If necessary, clear and grub the borrow site. Strip the site of topsoil and unsuitable materials. Excavate, load, haul and place where required.

3.1.4 **Undercut:** When excavation exposes unsuitable materials below the subgrade elevation and the Engineer directs removal, excavate such materials using transition slopes no steeper than 10% along the road profile. Make the bottom of the cut level, with no loose material.

3.1.5 **Over-Excavation:** Where over-excavation occurs, restore grades by backfilling, compacting and regrading as directed by the Engineer. If over-excavation is the result of the Contractor's error, no claim shall be made for the excess excavation and grade restoration.

3.2 FILL

3.2.1 **Preparation:** Where necessary, clear and grub the base of fill, remove topsoil and other unsuitable materials and scarify the base to ensure bond with fill material.

3.2.2 **Soil Moisture Alteration:** The required compaction can best be achieved if the soil is dried or moistened to within ±3% of optimum moisture content.

3.2.3 **Fill Placement and Compaction:** Place and spread fill material in successive horizontal lifts, each lift not exceeding 150 mm thickness when compacted. Compact each lift to the required density using suitable equipment.

3.2.4 **Berm:** Unless indicated otherwise on drawings or directed by the Engineer, build up the berm by spreading layers of approved material not more than 300 mm thick. Grade each layer using at least three passes of the spreading equipment.

3.2.5 **Boulevard:** Spread approved fill material in 150 mm lifts and fine grade.

3.3 SIDE SLOPES

3.3.1 Trim slopes of cuts, fills and berms from top to bottom. Leave the base of the slope neatly trimmed by removing lumps or loose material, or by blending loose material into the base. Finish slopes true to designated alignment, grade and shape.

3.4 FIELD QUALITY CONTROL

3.4.1 **Grade Tolerances:** Check graded surfaces to ensure they meet a grade tolerance of ±25 mm maximum variation from designated grade elevations and that crossfall and bottoms of ditches are graded to create positive flow.

3.4.1.1 When tolerance is exceeded: Trim high areas to within tolerance and scarify low areas, backfill with approved material, compact to required density and regrade to within tolerance.

3.4.2 Density Requirements

3.4.2.1 Maximum density: as used in this section, is the dry unit mass of sample at optimum moisture content as determined in the laboratory according to ASTM D698 Method A.

3.4.2.2 The required density for fill is a minimum of 95.0% of maximum density for each lift, or 98.0% of maximum density for lifts within 1.5 m of finished subgrade elevation on road right-of-way where uniform trench backfill is not placed.

3.4.2.3 **Testing Frequency:** The quality assurance laboratory will take a minimum of one field density test for each 2 000 m^2 of compacted lift, or approved alternate frequency, according to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A.

3.4.2.4 **Noncompliance:** If a density test result is less than the required density, that test result is discarded and 3 retests shall be performed on the area represented by the failed test. The average of the 3 retests shall represent the density of that area. If this average is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and recompacted to the required density. If the area is not retested but is reworked and recompacted the area shall be tested at normal testing frequencies.

3.4.2.5 If the lift is covered before the City has accepted the test results then the Contractor assumes the risk of uncovering and reworking the compacted lift.

3.5 PROTECTION

3.5.1 **Drainage:** If the work area floods, drain immediately by natural flow or by pumping into catch basins, manholes or ditches.

3.5.2 Protect finished grades from damage, and repair and retest as required by the engineer if damaged.

1. GENERAL

1.1 SECTION INCLUDES

The production and supply of unshrinkable fill (fillcrete) to be used for trench backfill.

1.2 SUBMITTALS

1.2.1 Submit a mix design to the Engineering Services Section, Transportation Department, at least 14 days prior to initial fillcrete production. The mix design shall be performed by a qualified laboratory, or by the supplier, if approved by the Engineer.

1.2.2 The supplier shall notify the Engineering Services Section, Transportation Department, and shall resubmit a mix design whenever there is a change in materials, sources, or proportions.

1.2.3 If requested, the supplier shall provide proof that the proportions in the mix design will produce fillcrete of the quality specified.

1.2.4 No fillcrete shall be produced until the applicable mix design has been approved.

1.3 QUALITY ASSURANCE

1.3.1 The supplier shall provide facilities to permit the inspection of equipment, materials and processes used in the production and delivery of fillcrete and to obtain samples for testing.

1.3.2 Quality assurance sampling and testing for slump, air content and compressive strength shall be performed as follows:

1.3.2.1 **Slump Tests:**
Methods: to CSA-A23.2-1C and CSA-A23.2-5C.
Test Frequency: Slump tests shall be taken between the 10% and 90% points of discharge of a fillcrete load with every strength test and as required by the Engineer.

1.3.2.2 **Air Content Tests:**
Methods: to CSA-A23.2-1C and CSA-23.2-4C.
Test Frequency: Air content tests shall be taken between the 10% and 90% points of discharge of a fillcrete load with every strength test and as required by the Engineer.

1.3.2.3 **Strength Tests:**
Methods: to CSA-A23.2-3C and CSA-A23.2-9C.
Test Frequency: Standard tests for strength shall be conducted at a frequency of not less than one strength test per day per supplier, or as required by the Engineer.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Portland Cement:** to CAN/CSA-A3000, A3001-03 of the following types.

2.1.1.1 Type GU – General use hydraulic cement

2.1.1.2 Type HE - High early-strength hydraulic cement

2.1.1.3 Type HS – High sulphate-resistant hydraulic cement

2.1.2 **Fine Aggregate:** to CSA-A23.1, Clause 5.3.2, Table 1.

2.1.3 **Water:** to clause 4.2.2, CAN/CSA-A23.1, clear, free from injurious amounts of oil, acid, alkali, organic matter, sediment, or other substance harmful to the mixing and curing of concrete.

2.1.4 **Air-Entraining Admixture:** to ASTM C260.**Chemical Admixtures:** to ASTM C494, including water-reducing agents, retarders and accelerators. Chemical admixtures shall not be used unless permitted in writing by the Engineer.

2.1.5 **Fly Ash:** to CAN/CSA-A3000, A3001-03 pozzolan type C.

2.2 MIX DESIGN

2.2.1 Supply fillcrete in accordance with the following table:

Compressive Strength at 28 Days (MPa)	Slump (mm)	Entrained Air (% by volume)	Maximum Aggregate Size (mm)	Minimum Portland Cement (kg/m^3)
Minimum - 0.15 Maximum - 0.40	100 ± 25	6.0 - 8.0	5	30

3. EXECUTION

3.1 PRODUCTION AND DELIVERY

3.1.1 Fillcrete shall be produced in accordance with CSA-A23.1, Clause 18 and shall conform to the approved mix design.

3.1.2 Prior to loading fillcrete onto rotating drum trucks, the supplier shall ensure that the drum is clean and free of any paste or concrete materials remaining from previous concrete batches.

3.2 PRODUCTION FACILITIES

3.2.1 The supplier shall maintain a minimum stockpile of 100 tonnes of cement powder at the production plant site at all times.

3.2.2 Suppliers shall have a computerized batching system that provides computer printed reports and load tickets. Hand written loading times will not be accepted.

3.2.3 Plant scale certification shall be maintained to CSA-A23.1, Clause 18.2.4.

3.3 PROTECTION OF FINISHED WORK

3.3.1 Protect fillcrete from freezing or other adverse weather conditions for a minimum of 24 hours after placement.

3.3.2 Fillcrete that is exposed to significant infiltration of water within 24 hours of placement must be removed and replaced.

3.3.3 A minimum 150mm granular base course must be placed on the fillcrete surface before allowing any vehicular traffic over the fillcrete. The granular base course must be placed to Section 02722 - Granular Base Courses, a minimum of 24 hours after fillcrete placement.

3.4 FIELD QUALITY CONTROL

3.4.1 The City will conduct an initial plant inspection prior to the production of any fillcrete. This inspection shall include, but not be limited to, an inspection of production and quality control facilities, as well as a review of supplier's quality control program.

3.4.2 **Required Strength**

The result of each compressive strength test shall be within the specified compressive strength range.

1. GENERAL

1.1 SECTION INCLUDES

Excavating and backfilling trenches and cuts for sewer and water pipe, manholes, valve chambers, catch basins, subdrains, culverts and other underground utilities and structures.

1.2 RELATED SECTIONS

Aggregate	Section 02060
Pavement and Concrete Removal	Section 02224
Grading	Section 02310
Fillcrete	Section 02317
Sewers	Section 02535
Manholes and Catch Basins	Section 02631
Topsoil	Section 02910
Seed and Sod	Section 02920
Trees, Shrubs and Ground Covers	Section 02930

1.3 REGULATORY REQUIREMENTS

1.3.1 The following legislation and related regulations shall be observed at all times:
- Alberta Occupational Health and Safety Act
- City of Edmonton Building Bylaws
- Explosives Act Canada

1.4 QUALITY ASSURANCE

1.4.1 **Testing Standards:** The quality assurance laboratory will take density and other tests on compacted soil to the following standards as directed by the Engineer:
ASTM D698 Method A., ASTM D1556, ASTM D2167, ASTM D2922 and ASTM D3017.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Native Fill Material**: Material excavated from trench or from grading as described in Section 02060 - Aggregate and approved by the Engineer.

2.1.2 Section 02224 - Pavement and Concrete Removal.

2.1.3 Section 02310 - Grading: Fill material shall be free of stones larger than 200 mm, organic matter and other deleterious material.

2.1.4 **Imported Fill Material:** Engineer approved material from off-site to supplement or replace insufficient or unacceptable material on-site. Fill material shall be free of stones larger than 200 mm, organic matter and other deleterious material.

2.1.5 **Granular Fill:** to Section 02060 - Aggregate as specified.

2.1.6 **Fillcrete:** to Section 02317 - Fillcrete as specified.

2.1.7 **Pipe Bedding Material:** Consult individual pipe installation sections for material specifications.

2.1.8 **Topsoil:** Engineer-approved material excavated from site or to Section 02910 - Topsoil.

2.1.9 **Seed and Sod:** to Section 02920 - Seed and Sod or re-use sod stripped from site if approved by the Engineer.

3. EXECUTION

3.1 TRENCHING

3.1.1 Trench Excavation

3.1.1.1 Where indicated, remove existing pavement and concrete to Section 02224 - Pavement and Concrete Removal.

3.1.1.2 Excavate trench to indicated alignment and to width and depth required to achieve indicated elevations and to accommodate required bedding. Hand trim bottom of trench where required.

3.1.1.3 The Engineer or the utility owner may require that a professional engineer design the method of support to existing or proposed utilities within the trench limits. Submit any required design drawings for the Engineer's or utility owner's review beginning trench excavation.

3.1.1.4 The Engineer may limit the amount of trench to be opened or left open at any one time.

3.1.1.5 Stockpile excavated material or imported fill at a safe distance from edge of trench.

3.1.1.6 Dispose of surplus or otherwise non-useable excavated material offsite or as directed by the Engineer.

3.1.2 Trench Dimensions

3.1.2.1 The depth of trench shall be as shown on the drawings. Unless indicated otherwise, the depth of trench shall be such that there is a minimum 2.44 m of cover from the designated curb top grade to the top of the pipe. If the minimum cover cannot be maintained, advise the Engineer and obtain instructions before proceeding.

3.1.2.2 Cut back the walls of trench in strict compliance with the Occupational Health and Safety Regulations.

3.1.2.3 For a vertical cut trench with sheeting, the width of trench shall be:

At the pipe springline: a minimum width equal to the outside diameter of pipe plus 450 mm and a maximum width equal to the outside diameter of pipe plus 600 mm.
At ground level: a maximum width of outside diameter of pipe plus 600 mm.

3.1.2.4 Do not over-excavate beyond the specified limits. If the trench must be excavated deeper or wider than specified, obtain approval from the Engineer. No additional payment for over-excavation will be made unless authorised by the Engineer.

3.1.3 Trench Shoring

3.1.3.1 Where the sides of the trench or excavation need to be sheathed, shored or braced to protect life, property, the work, structures adjacent to the work or for maintaining trench widths, the Contractor shall supply and place all material required at no additional cost. Strictly follow Occupational Health and Safety regulations or a professional geotechnical engineer's recommendations.

3.1.3.2 If required, the Contractor shall engage the services of a qualified professional engineer (the design engineer) who is registered in Alberta to design and regularly inspect cofferdams, shoring, bracing and underpinning required for the work.

3.1.3.3 Design and supporting data are to bear the stamp and signature of the design engineer. They shall be submitted to the Engineer at least two weeks prior to start of work. Reports of the design engineer's inspections shall be displayed in the engineer's site office.

3.1.3.4 The design engineer responsible for the design of the temporary structures shall submit to the City proof of insurance coverage for professional liability, except where the engineer is an employee of the Contractor, in which case the Contractor shall submit proof that the work by the design engineer is included in the Contractor's insurance coverage.

3.1.3.5 Construct temporary works to depths, heights and locations as required to prevent failure.

3.1.3.6 During backfill operations:

Unless otherwise indicated or directed by the Engineer, remove sheeting and shoring from the excavations. Do not remove bracing until backfilling has reached the level of such bracing. Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above the toe of sheeting.

3.1.3.7 When sheeting is required to remain in place, cut off tops at elevations indicated or as directed by the Engineer.

3.1.3.8 Upon completion of the substructure construction, remove shoring and bracing and remove excess materials from site.

3.1.3.9 Obtain any required permits from the authority having jurisdiction for the diversion of watercourses.

3.1.3.10 Protect excavations and adjacent properties against cave-ins, shear failure, slides, undermining, erosion and settlement. Erect shoring, cribbing, bracing, sheet piling or planking as necessary to provide such protection. Place such work so as not to interfere with operations and independent of any footing.

3.1.3.11 The contractor shall assume full responsibility for any failure, collapse or movement of shoring or bracing method, collapse of earth banks, trenches, manholes or other excavations.

3.1.4 Trenching in Poor Ground

3.1.4.1 If the bottom of the trench is in soil which, in an undisturbed state, has adequate bearing capacity, but becomes “quick” due to soil water pressure or becomes unstable due to the construction activity in the trench, the contractor shall over-excavate to a depth specified by the engineer, place geotextile fabric and cover with foundation granular material, all as specified by the engineer.

3.1.4.2 If the bottom of the trench is in peat or other unsuitable foundation material, apply one of the following corrective measures as appropriate:

- Over-excavate to suitable material and backfill with compacted gravel or washed rock to the underside of bedding if the amount of over-excavation is less than 0.5 m.
- Backfill with fillcrete if the amount of over-excavation is 0.5 m to 1.0 m.
- Do not over-excavate, but provide structural support for the pipe as specified by the engineer, if the depth to suitable foundation soil from the bottom of the pipe bedding is greater than 1.0 m.

3.1.5 Trenching in Rock

3.1.5.1 Definitions of Rock:

- Type A: Fractured sandstone or shale which can be broken by the backhoe being used for trenching.
- Type B: Rock which requires drilling and blasting or jackhammering, to break.

3.1.5.2 Trenching: Excavate only to the trench dimensions in 3.1.2.3. The trench bottom in rock shall be 150 mm below the underside of pipe barrel. If blasting is required, obtain the necessary permits and the Engineer’s written permission prior to blasting. Do not use blasting methods within 150 m of any water storage reservoir or pumping station, nor within 3 m of any underground utility. Haul away surplus excavated rock that is not suitable for backfill.

3.1.6 Boring

3.1.6.1 In areas where machinery cannot be accommodated or where machinery might damage property or existing infrastructure, excavate by hand or by boring.

3.1.6.2 Where designated on the drawings or ordered by the Engineer, bore under sidewalk, curb and gutter, roadway or existing utilities.

3.1.6.3 Submit drawings and written procedure on how the borehole will be excavated, braced or cased and backfilled to the Engineer.

3.2 EXCAVATION FOR UNDERGROUND STRUCTURES

3.2.1 Excavations for structures shall conform to the Occupational Health and Safety Act.

3.2.2 Do not over-excavate beyond the specified limits. If the excavation is larger in length or width than specified, advise the Engineer and obtain instructions.

3.2.3 Advise the Engineer If the excavation is deeper than the specified limits. Fill the over-excavation with 15 MPa (28-day strength) concrete or proceed as directed by the Engineer.

3.2.4 If, at the specified depth, unsuitable foundation material is encountered, advise the Engineer and obtain instructions. Over-excavation and replacement with competent backfill or a structural foundation may be required.

3.2.5 Minimize disturbance of the native soil at foundation level. Do not use heavy equipment at the bottom of the excavation. If necessary, provide pads for the equipment. If soil that has adequate strength in an undisturbed condition is disturbed, advise the Engineer and obtain instructions.

3.2.6 Where, at the specified depth, the soil has adequate bearing capacity in an undisturbed state, but becomes unstable due to ground water pressure, advise the Engineer. Over-excavate, place a geotextile fabric, fill to the specified depth with competent backfill material and compact, as instructed by the Engineer.

3.2.7 Haul all unsuitable or surplus excavated material to an approved site for disposal.

3.3 DEWATERING

3.3.1 Keep the excavation free of water.

3.3.2 Protect open excavations against flooding and damage due to surface run-off.

3.3.3 Do not allow ground water to drain into water pipes.

3.3.4 Water from the excavation or from a well point system shall be disposed of in accordance with the General Requirements or in a manner approved by the Engineer. Do not pump muddy water into City sewers. Obtain written approval for disposal of clean water into City sewers.

3.3.5 Dispose of water in a manner not detrimental to public and/or private property or any portion of the work completed or under construction.

3.4 BEDDING

3.4.1 Place pipe bedding for sewers in accordance with the individual pipe installation sections.

3.4.2 Place pipe bedding for water pipe in accordance with Section 02318 – Trench Bedding for Water Pipe.

3.5 BACKFILLING AND COMPACTION

3.5.1 Backfill the trench with approved fill material from the top of bedding to the designated subgrade elevation or existing ground level, whichever is lower.

3.5.2 Place backfill in uniform horizontal lifts and compact each lift according to trench and backfill types in 3.6 below.

3.5.3 Remove any free water from a lift before placing the next lift of backfill.

3.5.4 Uniform backfill, as defined in clause 3.7.3, shall be used for all backfill placed in conjunction with new roadway construction, unless waived by the City.

3.5.5 **Backfilling Alternatives:** The Engineer may consider alternative proposals from a professional geotechnical engineer to use special materials or methods that will achieve long term stability of trench backfill. Use only alternatives accepted by the Engineer, at no additional cost to the City.

3.5.6 **Backfilling in Cold Weather:**

3.5.6.1 The reference for shutdown temperatures shall be the temperature reported by Environment Canada.

3.5.6.2 Do not start daily excavation, backfilling or compaction for open cut trenches under pavement when the average air temperature is expected to be -10°C or lower or when the minimum air temperature is expected to be -20°C or lower.

3.5.6.3 For open cut trenches the shutdown temperature is -15°C. If an approved trench covering system is used the shutdown temperature is -25°C.

3.5.6.4 Frozen ground shall be thawed by an approved ground burning method before commencing excavation. Remove all frozen materials from the trench including snow and ice.

3.5.6.5 Do not backfill with frozen soil or with material containing ice, snow, straw, organic or other deleterious material.

3.5.6.6 Limit the length of open trench ahead of the backfilled portion to 10 m.

3.6 TRENCH AND BACKFILL TYPES

3.6.1 **Type 1:** Backfill with native or imported fill material over bedding up to the designated subgrade or existing ground elevation, whichever is lower, in lifts not exceeding 300 mm when compacted. Compact each lift to the applicable requirements in 3.7.2, A to C.

3.6.2 **Type 2:** Backfill with specified granular fill over bedding up to existing ground elevation if lower than the designated subgrade depth, in lifts not exceeding 300 mm when compacted and compact each lift to the requirements in 3.7.2, D. If designated subgrade elevation is level with or lower than existing ground, place native or imported fill material as the topmost 300 mm lift compacted to applicable requirements in 3.7.2, A to C.

3.6.3 **Type 3:** Cut trench sides above bedding to slopes flat enough to allow road compaction equipment to operate transversely across the trench. Backfill with native or imported fill material over bedding up to the designated subgrade or existing ground elevation, whichever is lower, in lifts not exceeding 150 mm when compacted and compact each lift to requirements in 3.7.2, E.

3.6.4 **Type 4:** Backfill with fillcrete to Section 02317 – Fillcrete over bedding to designated subgrade elevation.

3.7 DENSITY REQUIREMENTS

3.7.1 **Reference Density**:

3.7.1.1 Standard Proctor: the maximum dry density obtained from a plot of the dry densities of multiple specimens at various moisture contents, moulded and compacted in the laboratory according to ASTM D698 Method A.

3.7.1.2 One-Mould Proctor: the dry density of a single specimen moulded at the moisture content of field compaction and compacted in the laboratory according to ASTM D698 Method A.

3.7.2 Required Compaction

Required trench backfill compaction, expressed as a minimum percent of standard Proctor density or of one-mould Proctor density, is defined below.

Required Compaction	Backfill Zone
A. Under existing or proposed road, alley, walk, street light or similar structure and within a distance from such structure equal to trench depth:	
100.0% of one-mould or 98.0% of standard	From designated subgrade elevation or existing ground level, whichever is lower, to 1.5 m below.
97.0% of one-mould or 95.0% of standard	More than 1.5 m below.
B. Adjacent to existing improved road, alley, walk, street light or similar structure and within a distance from the improvement equal to trench depth:	
92.0% of standard	Through full depth of trench.
C. Outside defined areas:	
90.0% of one-mould	Through full depth of trench.
D. Trench and backfill Type 2:	
95.0% of standard	Through full depth of trench.
E. Trench and backfill Type 3:	
100.0% of one-mould or 98.0% of standard	From designated subgrade elevation or existing ground level, whichever is lower, to 1.5 m below.
97.0% of one-mould or 95.0% of standard	More than 1.5 m below.

3.7.3 Moisture Content Requirements

The maximum permitted moisture contents for compacting backfill, based on one-mould proctor tests, are shown below.

Maximum Moisture Content	Backfill Zone
A. Conventional trenching techniques:	
Plastic Limit + $\frac{\text{(Plasticity Index)}}{3}$ to a maximum of 8% above Plastic Limit	From designated subgrade elevation or existing ground level, whichever is lower, to 1.5 m below.
Plastic Limit + $\frac{\text{(Plasticity Index)}}{3}$ to a maximum of 10% above Plastic Limit	More than 1.5 m below.
B. Uniform backfill:	
Plastic Limit + $\frac{\text{(Plasticity Index)}}{2}$ to a maximum of 10% above Plastic Limit	From designated subgrade elevation or existing ground level, whichever is lower, to 1.5 m below.
Plastic Limit + $\frac{\text{(Plasticity Index)}}{2}$ to a maximum of 10% above Plastic Limit	More than 1.5 m below.
C. Alternative backfill techniques and materials	
As defined by a professional geotechnical engineer, to achieve long term stability of trench backfill	Through full depth of trench

The uniform backfill moisture requirements shall apply where the upper 1.5 m of the subgrade is excavated beyond the limits of the trench to include any roadway structures, including monolithic or boulevard walk. The excavated material, if acceptable to the Engineer, shall be replaced and recompacted in lifts not exceeding 300 mm compacted thickness, to the requirements of 3.7.2, A.

3.7.4 Testing Frequency:

3.7.4.1 Trench greater than 15 m in length: A minimum of 2 density tests per 600 mm of trench depth per 100 m of trench length. The tests shall be representative of the entire length, width and depth of trench backfill, including areas around catchbasins, manholes, valves and service connections. The Engineer or a qualified geotechnical representative, may require additional testing as deemed necessary.

3.7.4.2 Trench 15 m or less in length: A minimum of 3 density tests evenly spaced through the depth and length of the trench or as directed by the Engineer.

3.7.4.3 **Non-compliance**: If a density test result is less than the required density, that test result is discarded and 3 retests shall be performed on the area represented by the failed test. The average of the 3 retests shall represent the density of that area. If this average is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and recompacted to the required density. If the area is not retested but is reworked and recompacted the area shall be tested at normal testing frequencies.

3.8 RESTORATION AND CLEANUP

3.8.1 Restore or replace to Section 02930 - Trees, Shrubs and Ground Covers , all pavement structures, sidewalk and curb and gutter damaged or removed during trenching and backfilling, unless directed otherwise by the Engineer.

3.8.2 Restore or replace in an approved manner all fences, poles, shrubs, grass and other structures damaged or removed during trenching and backfilling, unless directed otherwise by the Engineer.

3.8.3 Remove and dispose of all debris, surplus fill and unused material excavated from the trench.

3.8.4 Leave work site clean and as nearly as possible in original condition.

1. GENERAL

1.1 SECTION INCLUDES

Working and compacting subgrade soil.

1.2 RELATED SECTIONS

Grading	Section 02310
Cement Stabilized Subgrade	Section 02342

1.3 DEFINITION

1.3.1 **Prepared subgrade:** soil immediately below a pavement structure or slab, compacted to a depth of 150 mm, 300 mm or as specified.

1.4 QUALITY ASSURANCE

1.4.1 **Maximum Density:** the dry unit mass of a soil sample at optimum moisture content as determined in the laboratory according to ASTM D698 Method A.

1.4.2 **Required Density:** a minimum of 100.0% of the maximum density for each 150 mm lift of subgrade under pavement structures, concrete curb, concrete gutter, commercial and alley crossings and asphalt walks/bikeways and a minimum of 95.0% of the maximum density for each 150 mm lift of subgrade under concrete walks, curb ramps, slabs, private crossings and walk made of concrete pavers, brick pavers, or granular materials.

1.4.3 **Testing Frequency:** the quality assurance laboratory will take a minimum of one field density test for each 1 000 m^2 of compacted subgrade lift according to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A or as directed by the Engineer.

1.4.4 **Proof Rolling:** a proof roll of the finished subgrade will be required to confirm adequate bearing capacity of the subgrade soils. The proof roll shall be supervised by the City, and must be performed in accordance with the engineer's recommendations.

2. PRODUCTS

2.1 MATERIALS

2.1.1 Use only compacted clay subgrade soil with no deleterious material approved by the City.

2.2 EQUIPMENT

2.2.1 **Equipment:** various pieces of equipment designed for and capable of disking, scarifying, spreading, spraying water, compacting and trimming soil to specified depth.

3. EXECUTION

3.1 SUBGRADE PREPARATION

3.1.1 Loosen soil to required depth. Work soil with cultivating and mixing equipment until soil is pulverized into pieces no larger than 25 mm maximum dimension, exclusive of stones.

3.1.2 The required compaction can generally best be achieved if the soil is dried or moistened to within ±3% of the optimum moisture content before compacting.

3.1.3 If the Engineer determines that it is not practical to dry an otherwise suitable soil, the Engineer may order soil stabilization to Section 02342 - Cement Stabilized Subgrade. Spread soil in lifts not exceeding 150 mm when compacted. Compact each lift to the required density in 1.4.2.

3.1.4 Leave the surface of the compacted subgrade slightly higher than required elevation; then trim to design crown and grade. Leave finished surface even and free of depressions, humps and loose material.

3.2 FIELD QUALITY CONTROL

3.2.1 Check finished surface of subgrade to ensure it meets the following tolerances:

3.2.1.1 Grade: 6 mm maximum variation above designated elevation.
25 mm maximum variation below designated elevation.

3.2.2 When Tolerance Exceeded

3.2.2.1 Trim high spots and refinish surface to within tolerance.

3.2.2.2 Add approved material to low areas, scarify and blend to full subgrade depth, recompact to required density and refinish surface at the contractor's expense. Alternatively, fill low areas with extra thickness of subsequent granular sub-base or base course at the contractor's expense.

3.2.3 If a density test result is less than the required density, that test result is discarded and 3 retests shall be performed on the area represented by the failed test. The average of the 3 retests shall represent the density of that area. If this average is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and recompacted to the required density. If the area is not retested but is reworked and recompacted the area shall be tested at normal testing frequencies.

3.2.3.1 The Contractor shall assume the risk of uncovering and reworking the subgrade if it is covered before the City has accepted test results thereof.

3.3 PROTECTION OF FINISHED WORK

3.3.1 Do not permit vehicular traffic over the prepared subgrade.

3.3.2 If folding of the subgrade occurs, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches. This shall be done at the expense of the Contractor.

3.3.3 Maintain protection of prepared subgrade until subsequent granular sub-base or base course is placed. Repair and retest as required by the engineer if damaged.

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Supply and spreading of Portland cement onto subgrade soil.

1.1.2 Mixing soil, cement and water; compacting and finishing the stabilized subgrade.

1.2 RELATED SECTIONS

1.2.1	**Grading**	**Section 02310**
1.2.2	**Subgrade Preparation**	**Section 02335**
1.2.3	Proof Rolling	Section 02345

1.3 DEFINITION

1.3.1 **Cement-Stabilized Subgrade:** soil immediately below a pavement structure or slab, mixed with portland cement and compacted to a depth of 150 mm, 300 mm, or as specified**.**

1.4 QUALITY ASSURANCE

1.4.1 **Maximum Density:** the dry unit mass of a soil sample at optimum moisture content as determined in the laboratory according to ASTM D698 Method A.

1.4.2 **Required Density:** a minimum of 100.0% of the maximum density for each 150 mm lift of stabilized subgrade.

1.4.3 **Testing Frequency:** The quality assurance laboratory will take a minimum of one field density test for each 1 000 m^2 of compacted subgrade lift according to ASTM D2167 or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A or as directed by the Engineer.

1.4.4 **Proof Rolling:** a proof roll of the finished subgrade will be required to confirm adequate bearing capacity of the subgrade soils. The proof roll shall be supervised by the City, and must be performed in accordance with Section 02345 or the engineer’s recommendations.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Portland Cement:** to CAN/CSA-A3000, A3001-03, Type GU – General use hydraulic cement.

2.1.2 **Water:** may be obtained from City fire hydrants according to the General Requirements of Section 02310 **-** Grading Other water sources are subject to the City's approval.

2.2 EQUIPMENT

2.2.1 **Cement Spreader:** capable of spreading cement uniformly.

2.2.2 **Mixing Equipment:** designed for and capable of mixing the full depth of the subgrade in one pass, subject to the City's approval.

3. EXECUTION

3.1 PREPARATION

3.1.1 Subgrade areas to be stabilized will be indicated on plans or designated by the Engineer.

3.1.2 Pre-grade and shape soil to designated grade and cross section.

3.2 3.2 STABILIZATION

3.2.1 Loosen soil to required depth. Work soil with cultivating and mixing equipment until soil is pulverized into pieces no larger than 25 mm maximum dimension, exclusive of stones.

3.2.2 **Dust Control:** Contain cement dust within site area. Do not spread cement during or when there is imminent danger of high winds or rain.

3.2.3 Spread and blend cement into soil at a rate of 10 kg/m^2 of 150 mm compacted depth, or as directed by the Engineer.

3.2.4 Add sufficient water to the blended soil and cement to best achieve the required compaction. Mix until homogeneous.

3.2.5 Spread the mixture uniformly in lifts of 150 mm compacted thickness. Compact each lift to the required density.

3.2.6 Complete mixing, compaction and finishing on the same day.

3.2.7 Water may be lightly sprayed with a pressurized distributor for surface finishing.

3.2.8 Leave the surface of the compacted subgrade slightly higher than required elevation; then trim to design crown and grade. Leave finished surface even and free of depressions, humps or loose material.

3.3 FIELD QUALITY CONTROL

3.3.1 Check finished surface of stabilized subgrade to ensure it meets the following tolerances:

3.3.1.1 Grade: 6 mm maximum variation above design elevation.

25 mm maximum variation below design elevation.

3.3.2 When Tolerance Exceeded

3.3.2.1 Trim high spots and refinish surface to within tolerance.

3.3.2.2 Add approved mixed material to low areas, scarify and blend to full subgrade depth, recompact to required density and refinish surface. Alternatively, fill low areas with extra thickness of subsequent sub-base or base course.

3.3.3 If a density test result is less than the required density, that test result is discarded and 3 retests shall be performed on the area represented by the failed test. The average of the 3 retests shall represent the density of that area. If this average is less than the required density, the area shall be reworked to the full depth of the lift, the soil moisture altered as necessary and recompacted to the required density. If the area is not retested but is reworked and recompacted the area shall be tested at normal testing frequencies.

3.3.3.1 The Contractor shall assume the risk of uncovering and reworking the subgrade if it is covered before the City has accepted test results thereof.

3.4 PROTECTION OF FINISHED WORK

3.4.1 Do not permit vehicular traffic over the stabilized subgrade.

3.4.2 If subgrade floods, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches. This shall be done at the expense of the Contractor.

3.4.3 Maintain protection of stabilized subgrade until subsequent sub-base or base course is placed. Repair and retest as required by the engineer if damaged.

3.5 RECONSTRUCTION

3.5.1 Break up and pulverize rejected stabilized subgrade into no larger than 25 mm pieces. Spread the pulverized material for addition of cement.

3.5.2 Add cement as follows:

3.5.2.1 For a section reprocessed within 24 hours and 48 hours of the original construction, add 50% of the original cement content.

3.5.2.2 For a section reprocessed more than 48 hours following the original construction, add 100% of the original cement content.

3.5.3 Process the new mixture using pulverization equipment, to Section 02968 - Full Depth Reclamation

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

Verifying the stability and uniformity of the subgrade compaction. This procedure shall be performed in the presence of the Engineer or it's designate. Actual requirements for representation on the project site for the proof rolling operation will be site dependant.

1.2 RELATED SECTIONS

Grading	Section 02310
Subgrade Preparation	Section 02335
Cement Stabilized Subgrade	Section 02342

1.3 EXECUTION

1.3.1 Equipment

1.3.1.1 The vehicle used to perform the Proof rolling shall conform to the following:

- Tandem axle, dual wheel dump truck.
- Tire pressure shall be no less than 90 percent of the manufacturer's recommended maximum inflation.
- The minimum gross weight of the loaded truck shall be 24,800 kg. A weigh scale slip shall be available upon request to confirm the truck weight.

1.2 PROCEDURE

1.2.1 The proof rolling vehicle shall be operated at a rate not to exceed 3.0 to 6.0 km/hr. or a comfortable walking pace. Adjust the speed to allow the Inspector/Engineer to measure any deflections and/or areas of rutting.

1.2.2 Operate the proof roll in a pattern so that all areas are loaded with at least one pass of the Proof rolling vehicle.

1.2.3 After proof rolling, check the subgrade for conformance to the plans, and correct all surface irregularities. Re-shape the subgrade to specified tolerances.

1.3 EVALUATION

1.3.1 There shall not be any discernable rutting during the proof roll. Rutting of not more than 100 mm, shall be considered a failure and will require the subgrade to be reworked and compacted.

1.3.2 There shall not be any discernable deflection (pumping) of the subgrade during the proof roll. Deflections of not more than 100 mm, shall be considered a failure, and will require the subgrade be reworked and compacted.

1.3.3 Rutting and/or deflections in excess of 100 mm must be reviewed by a Geotechnical Engineer who is to provide recommendations as to how to meet density and performance requirements.

1.3.4 When remedial work is performed under Item 1.3.3, a final proof roll must be performed upon completion of the work. If remedial work is performed as directed under 1.3.1 or 1.3.2, a second proof roll may be required at the discretion of the Engineer or his designate.

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Supply and installation of gabion baskets and rock fill.

1.2 DEFINITIONS

1.2.1 **Gabion:** a galvanized steel wire mesh basket filled with rock or broken concrete, and forming part of a larger monolithic structure of several such baskets, used for erosion control or other purposes.

1.2.2 **Selvedge:** the thicker perimeter and edge wires to which the wire mesh is securely tied to withstand stress from any direction.

1.2.3 **Corner Wire:** the thicker reinforcing wire built into each corner of a gabion basket fabricated as a single unit.

1.2.4 **Binding Wire:** wire used to tie together components forming a gabion basket and to tie together adjoining baskets.

1.2.5 **Connecting Wire:** internal wire used to connect opposite walls inside a basket cell to resist bulging.

1.2.6 **Diaphragm:** a wire mesh used to partition a gabion basket into equal-sized cells.

1.3 RELATED SECTION

1.3.1 Section 02310 - Grading

2. PRODUCTS

2.1 GABIONS

2.1.1 **Wire:** made of steel, hot-dip galvanized at a zinc coating of 256 g/m^2 minimum, with a tensile strength of 410 MPa minimum, capable of elongation of 10% minimum, and of the following diameters (±2%):

2.1.1.1 Wire for Mesh: 2.95 mm

2.1.1.2 Selvedge and Corner Wires: 3.85 mm

2.1.1.3 Binding and Connecting Wires: 2.20 mm

2.1.2 **Wire Mesh:** to be fabricated as follows:

2.1.2.1 Pre-galvanized wire woven in a double twist pattern with uniform hexagonal openings approximately 80 mm by 100 mm.

2.1.2.2 To be non-ravelling, that is, to resist pulling apart at any twist or connection forming the mesh.

2.1.2.3 Perimeter edges of mesh to be securely selvedged, to ensure that joints formed by tying selvedges are as strong as the body of the mesh.

2.1.3 **Gabion Basket:** to be constructed as follows:

2.1.3.1 To be of single unit construction, or with joints having strength and flexibility equal to that of the mesh.

2.1.3.2 For jointed construction, bases, sides, ends, lids, and diaphragms can be readily assembled at site into rectangular baskets of sizes detailed on drawings.

2.1.3.3 When length exceeds 1.5 times the horizontal width, diaphragms of same mesh as gabion wall shall be securely placed to divide the basket into equal cells of a length not exceeding the width.

2.1.4 **Alternate Fasteners:** Galvanized steel wire fasteners may be used in lieu of binding wire for gabion basket assembly and fastening baskets to one another, subject to prior approval of the Engineer. Such fasteners shall conform to the following:

2.1.4.1 Wire Diameter and Coating: 3.05 mm (±2%) with zinc coating of 256 g/m^2 minimum.

2.1.4.2 Wire Tensile Strength: 1 700 MPa minimum.

2.1.4.3 Pull Strength: Fastener to remain locked and closed while resisting a pulling force of 110 kg minimum for assembling basket components, and 410 kg minimum for binding adjoining baskets.

2.2 ROCK FILL

2.2.1 **Quality:** Rock shall be clean, hard and durable, and may be broken rock, quarry rock, or broken concrete which will not disintegrate when exposed to water, wave action, wetting and drying, or freezing and thawing cycles.

2.2.2 **Sizes:** Rock pieces shall range from 100 mm minimum dimension to 300 mm maximum dimension.

3. EXECUTION

3.1 SITE PREPARATION

3.1.1 Perform excavation and grading for the gabion structure to the indicated lines and grades according to Section 02310 - Grading. Remove and dispose of stumps, roots, and debris.

3.2 PLACING GABIONS

3.2.1 **Basket Assembly:** Assemble each gabion basket, if not of single unit fabrication, by tying the selvedges of components at the joints with binding wire.

3.2.2 **Binding Method:** Throughout the length of selvedge, loop the binding wire tightly around every other mesh opening, alternating single and double loops. Alternatively, place specified fasteners locked tight against the selvedge or seam.

3.2.3 **Use of Fasteners:** In lieu of binding wire, where permitted by the Engineer, install approved fasteners at a maximum spacing of 75 mm, using suitable manual pliers or a hand-held pneumatic gun with magazine feed. Wrap each fastener tight around the seam to prevent ravelling. The Engineer will withdraw permission to use fasteners if he finds them loose or ravelling.

3.2.4 **Placing Baskets:** Place the initial level of empty baskets into position. Secure adjacent baskets together with binding wire along corners and contacting selvedged edges as in 3.2.2.

3.2.5 **Filter Fabric:** If specified in the contract Special Provisions, place geotextile fabric against the gabion wall and top in contact with surrounding ground. Lap the fabric at joints a minimum of 500 mm.

3.2.6 **Initial Filling and Stretching:** Partially fill the first basket in a row with enough rock to provide weight. Then stretch up to 4 or 5 baskets in a row taut, to the proper alignment.

3.2.7 **Succeeding Level of Gabions:** Secure each new basket to the top of a fully filled gabion with binding wire along the base perimeter. In each succeeding level of gabions, stagger vertical joints between baskets so that no vertical joint is directly in line with a vertical joint in the next lower level.

3.3 ROCK FILLING

3.3.1 **Exposed Face:** On the exposed faces of gabion baskets, place rock by hand with flattest surfaces bearing against the face mesh to produce a satisfactory alignment and appearance. Fill the rest of the gabions by hand or by mechanical means, taking care to minimize voids and bulges.

3.3.2 **Lifts:** Fill each basket cell to a depth of 300 mm at a time.

3.3.3 **Connecting Wires:** After each 300 mm lift, connect opposite walls of cell with 2 connecting wires in each direction on top of lift. Loop each wire around 2 adjoining mesh openings, pull hand tight and twist the ends secure to prevent loosening.

3.3.4 **Staged Filling:** To prevent local deformation, fill a cluster of gabion baskets in stages so that no basket is filled more than 300 mm higher than the adjoining baskets.

3.3.5 **Securing Lids:** When a gabion basket is filled full, bend over the lid by hand and secure with binding wire to the basket rim and diaphragms in the same manner as in 3.2.2.

3.3.6 **Backfill and Cover:** Backfill gaps between the gabions and surrounding ground, and place clay cover as indicated on the drawings or as directed by the Engineer.

3.4 WORKMANSHIP

3.4.1 No wire ends shall be left projecting outside exposed surfaces.

3.4.2 All exposed geotextile fabric shall be trimmed flush with the cover material.

3.4.3 There shall be no voids left between adjacent baskets. The use of binding wire or wire mesh to correct voids is not permitted.

3.4.4 Joints between gabion baskets shall be as strong as the wire mesh, thereby making a monolithic structure.

3.4.5 The installed gabions shall have proper alignment and a neat, compact, square appearance.

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 **This specification is for the supply, delivery, and installation of heavy rock riprap.** This work shall include all necessary trimming, excavation, and fill required to satisfactorily place the rock riprap, such as:

- excavation, trimming and shaping head slope
- excavation at head slope toe, and for rock apron
- excavation for rock in stream bank transition zone
- supply and placing of geotextile filter fabric
- supply and placing of gravel or granular bedding material

1.2 RELATED SECTION

1.2.1 Section 02310 - Grading

2. PRODUCTS

2.1 Rock Material

2.1.1 **Quality:** Rock shall be clean, hard, durable and angular in shape, and may be broken rock, quarry rock, or broken concrete which will not disintegrate when exposed to water, wave action, wetting and drying, or freezing and thawing cycles, free from overburden, spoil, shale or shale seams and organic material, and shall meet the gradation requirements for the class specified. No sandstone will be permitted for all classes. The minimum dimension of any single rock shall be not less than one-third of its maximum dimension. The minimum acceptable unit weight if the rock is 2.5 tonnes/m^3.

2.1.2 **Sizes:** The material provided for each class specified shall have a gradation that conforms to the following table:

		Class			
		1M	1	2	3
Nominal Mass (kg) **Nominal Diameter (mm)**		**7** **175**	**40** **300**	**200** **500**	**700** **800**
None Greater than:	Kg or mm	40 300	130 450	700 800	1800 1100
20% to 50%	Kg or mm	10 200	70 350	300 600	1100 900
50% to 80%	Kg or mm	7 175	40 300	200 500	700 800
100% greater than	Kg or mm	3 125	10 300	40 300	200 50

Percentages quoted are by mass.
Sizes Quoted are equivalent spherical diameters, and are for guidance only.

2.1.3 Rip Rap shall meet the following minimum requirements for specific gravity, absorption and durability:

Method of Test	Requirements
California Department of Transportation Method of Test for Specific Gravity and Absorption of Coarse Aggregate (California Test 206)	Maximum Specific Gravity = 2.60 Maximum Absorption = 2.0%
California Department of Transportation Method of test for Durability Index (California Test 229)	Minimum Durability Index = 52 Durability Index may be less than 52 if DAR*>23

* Durability Absorption Ratio (Dar) = Durability Index/ (absorption% = 1%)\

2.2 SANDBAG RIP-RAP

2.2.1 Sandbag riprap is a "man-made" riprap consisting of burlap bags filled with fresh concrete and placed in a dense layer before the concrete has set.

2.3 GEOTEXTILE FILTER FABRIC

2.3.1 Where geotextile filter fabric is specified, the slope shall be graded to provide a smooth, uniform surface. All stumps, large rock, brush or other debris that could damage the fabric shall be removed. All holes and depressions shall be filled so that the fabric does not bridge them. Loose or unstable soils shall be replaced.

2.3.2 Non-woven geotextile filter fabric shall be used under all riprap in accordance with the following table of minimum average roll value properties (MARVs) for each specific Class of riprap:

Non-Woven Geotextile Filter Fabric		
Specifications and Physical Properties		
	Class 1M, 1 and 2	Class 3
Grab strength	650 N	875 N
Elongation (Failure)	50%	50%
Puncture Strength	275 N	550 N
Burst Strength	2.1 MPa	2.7 MPa
Trapezoidal Tear	250 N	350 N
Minimum Fabric Lap to be 300 mm		

The non-woven geotextile filter fabric shall meet the specifications and physical properties as listed above.

2.3.3 Placement:

2.3.3.1 The fabric shall be laid parallel to the slope direction. It shall be placed in a loose fashion; however folds and wrinkles shall be avoided. Adjacent strips of fabric shall be overlapped a minimum of 300 mm, except where placed underwater, the minimum lap width shall be 1 m. Overlaps shall be pinned using 6 mm diameter steel pins fitted with washers and spaced at 1 m intervals along the overlaps.

2.3.3.2 The top edge of the filter fabric shall be anchored by digging a 300 mm deep trench, inserting the top edge of the fabric and backfilling with compacted soil.

2.3.3.3 Care shall be taken to prevent puncturing or tearing the geotextile. Any damage shall be repaired by use of patches that extend at least 1 m beyond the perimeter of the tear or puncture.

2.3.3.4 The fabric shall be covered by rock riprap within sufficient time so that ultraviolet damage does not occur; in no case shall this time exceed 7 days for ultraviolet material and 14 days for ultraviolet protected and low ultraviolet susceptible polymer geotextiles.

2.3.3.5 Riprap placement shall commence at the base of the blanket area and proceed up the slope. The height of drop of riprap shall be limited to 1.0 m or less, and the riprap shall not be allowed to roll down the slope. Heavy equipment will not be permitted to operate directly on the geotextile

3. EXECUTION

3.1 SITE PREPARATION

3.1.1 Perform excavation and grading for the Rip Rap to the indicated lines and grades according to Section 02310 - Grading. Remove and dispose of stumps, roots, and debris.

3.2 PLACING OF ROCK

3.2.1 The rock shall be handled, dumped or placed into position to conform to the specified gradation and to the cross section shown on the drawings. The finished surface shall be reasonably uniform, free from bumps or depressions, and with no excessively large cavities below or individual stones projecting above the general surface.

3.3 PLACING OF SANDBAG RIPRAP

3.3.1 Sandbag riprap is to be placed on a surface that is trimmed and dressed to the lines and grades shown on the plans. A trench may be required at the base of the slope to receive the bags. Sandbag riprap is used mainly as drain trough terminal protection as detailed in the applicable specification.

- The bags are to be filled approximately two-thirds full with concrete with the tops folded closed and they are to be placed immediately when the concrete is fresh.
- The bags are to be the prepared surface with the ends in the same direction in a manner that results in a shingled effect.
- The upstream end of any bag must be under the end of the bag placed next to it.
- The bags are to be placed from the downstream edge towards the upstream edge, and from the bottom row towards the top.
- The folded ends of the bags must be placed underneath.

- The bags are to be rammed and packed against each other to leave a uniform surface, with the layer not less than 130 mm thick.

3.4 INSPECTION OF ROCK

3.4.1 Control of gradation will be by visual inspection. The Contractor shall provide a minimum of two samples of rock, of the minimum sample size specified below. These samples shall be proven to acceptably conform to the required gradation by direct weighing of all the individual pieces with suitable scales; the mass of each piece in the sample shall be painted on the piece. These samples, located as required by the Consultant at the construction site and at the source or quarry site, may be incorporated in the finished riprap when they are no longer required for reference purposes. The samples shall be used for frequent reference in judging the gradation of the riprap being loaded at the source and placed at the site. The minimum sample size in area shall be as follows:

Class	Maximum Sample Size
1M	1 m x 1 m
1	2 m x 2 m
2	3 m x 3 m
3	4 m x 4 m

3.4.2 The Contractor shall provide, at no additional cost to the Department, whatever facilities are required to assist the Consultant in checking gradation and measuring riprap in place.

3.4.3 If, during the delivery of the material to the site, a particular load is found to be made up of pieces predominantly one size, or to be lacking in pieces of one size, it shall be dumped in a suitable location outside the area to be protected. Additional material as required to make up the deficient sizes shall be added to this load such that the combination can then be placed to ensure uniformity.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

Construction of nonreinforced Portland cement concrete base for streets and alleys intended for asphalt surfacing.

1.2 RELATED SECTIONS

1.2.1 **Section 02060 Aggregate**

1.2.2 **Section 03055 Portland Cement Concrete**

1.2.3 **Section 03060 Concrete for Roadways**

1.2.4 **Section 03100 Concrete Forms and Accessories**

1.2.5 **Section 03210 Reinforcing Steel**

1.2.6 **Section 02066 SGC Hot-Mix Asphalt Concrete**

1.2.7 **Section 02742 SCG Hot-Mix Asphalt Paving**

1.3 QUALITY ASSURANCE

1.3.1 **Slump, air content and strength tests and acceptance criteria:** to Section 03060 - Concrete for Roadways.

2. PRODUCTS

2.1 MATERIALS

2.1.1 Concrete: class B, to Section 03060 - Concrete for Roadways.

2.1.2 Tie bars, reinforcement if required, preformed joint filler and curing compound: to Section 03055 - Portland Cement Concrete, Section 03060 - Concrete for Roadways and Section 03210 - Reinforcing Steel.

2.1.3 **Granular Backfill:** to Section 02060 - Aggregate, Designation 3 Class 20A.

2.2 EQUIPMENT

2.2.1 **Slipform Paver:** to Section 03100 - Concrete Forms and Accessories, equipped with adequate internal vibrators to consolidate concrete to the full depth and width of the slab; adjustable to crown and crossfall; subject to approval by the City.

3. EXECUTION

3.1 PREPARATION

3.1.1 Have prepared subgrade or sub-base inspected by the City prior to placing concrete.

3.1.2 Repair and retest disturbed subgrade or sub-base and remove debris and loose material from the surface.

3.2 HAND FORMING AND PLACING CONCRETE

3.2.1 Place forms, reinforcement if required and concrete to Section 03055 - Portland Cement Concrete, Section 03060 - Concrete for Roadways, Section 03100 - Concrete Forms and Section 03210 - Accessories and Reinforcing Steel and as supplemented in this section.

3.2.2 Place concrete continuously until scheduled pour is complete. Arrange the rate of concrete delivery to ensure that the discharge interval between successive loads does not exceed 30 minutes. If this discharge interval is exceeded, place a construction joint.

3.3 SLIPFORMING

3.3.1 Place concrete by slipform paver to Section 03100 - Concrete Forms and as supplemented below.

3.3.2 Remove excess mortar that may accumulate on slipformed vertical edges.

3.3.3 If the slab edge sags, repair immediately by hand forming; do not use concrete mortar to top off the sag. If edge sagging persists, suspend operations and perform corrective measures.

3.4 FINISHING

3.4.1 Finish concrete to Section 03055 - Portland Cement Concrete and Section 03060 - Concrete for Roadways.

3.4.2 Continually check the concrete surface while it is still plastic to ensure that surface and grade tolerances are met. Immediately correct excessive variations.

3.5 JOINTS

3.5.1 **Crack-Control Joints:** formed or tooled, to Section 03060 - Concrete for Roadways; at 6 m maximum spacing.

3.5.2 **Isolation and Construction Joints**: to Section 03060 - Concrete for Roadways.

3.6 PROTECTION AND CURING

3.6.1 Protect and cure concrete to Section 03060 - Concrete for Roadways.

3.7 BACKFILL ALONG ALLEY EDGES

3.7.1 Backfill areas between alley pavement and parking lots or driveways with specified granular material compacted to a minimum of 97.0% of maximum density according to ASTM D698 Method A.

3.7.2 Backfill other areas along alley edges with 150 mm of lightly tamped topsoil shaped to match adjacent landscaped areas.

3.8 FIELD QUALITY CONTROL

3.8.1 **Surface:** Maximum variation under a 3 m straightedge:

Parallel to the direction of travel: 6 mm.
Transverse to the direction of travel: 6 mm.

3.8.2 **Grade:** ±6 mm maximum variation from designated elevation.

3.8.3 **Thickness:** At the City's request, the quality assurance laboratory will take one or more sets of cores from suspect concrete base, each set comprising 3 cores whose average thickness represents not more than 500 m^2 of concrete base.

3.8.3.1 **Deficient Thickness:** If the average core thickness is deficient, that area of concrete base will be assessed a pay factor according to Table 02712.1.

Table 02712.1 Concrete Base Thickness Pay Factors

THICKNESS DEFICIENCY (mm)	PAY FACTOR (% of Contract Price)
6	100.0
7	97.0
8	93.7
9	90.0
10	85.5
11	80.5
12	75.0
13	68.0
14	60.0
15	50.0
>15	Remove and replace

3.8.3.2 **Excess Thickness:** Concrete base with excess thickness may be accepted if surface and grade tolerances are met, but no claim for additional payment will be accepted.

3.9 REJECTED CONCRETE BASE

3.9.1 Remove and replace rejected concrete base by full slabs between transverse and longitudinal joints.

3.10 ASPHALT SURFACING

3.10.1 Asphalt surfacing to Section 02741 - Hot-Mix Asphalt Paving may proceed when the concrete has attained at least 75% of its specified strength, as confirmed by a test on a field-cured cylinder.

3.10.2 If surfacing cannot proceed on schedule, do not allow vehicular traffic on the new concrete base until cylinder testing has confirmed that the concrete has attained 75% of its specified strength.

3.10.3 The Contractor shall at the Contractor's expense remove and replace asphalt surfacing if the concrete base requires removal due to unacceptable strength test results.

3.11 OPENING TO TRAFFIC

3.11.1 Do not open finished pavement to traffic until directed by the City.

3.11.2 When opening to traffic, leave pavement clean and free of debris and remove signs and barricades no longer required.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Production and supply of plant-mixed aggregate, Portland cement and water.

1.1.2 Spreading the mixture, compacting and finishing the soil cement base or sub-base.

1.2 RELATED SECTIONS

Aggregate	Section 02060
Liquid Asphalt Coats	Section 02963

1.3 DEFINITION

1.3.1 **Soil cement:** Granular base or sub-base course stabilized with Portland cement and constructed to this Section.

1.3.2 **Maximum Density**: The dry unit mass of a sample at optimum moisture content as determined in the laboratory according to ASTM D558 Method B.

1.4 SUBMITTALS

1.4.1 Mix Design

1.4.1.1 Submit a mix design based on the PCA Shortcut Method B, performed by a qualified laboratory, to the Engineering Services Section, transportation Department at least 7 days prior to commencing production.

1.4.1.2 Submit the following information with the mix design:

- a minimum of one sieve analysis for each 2 000 tonnes of aggregate in the stockpile and the overall average gradation of the stockpile,
- the mass of cement per tonne of dry aggregate and
- the mass of water per tonne of dry aggregate.

1.4.2 Job Mix Formula

Submit the proportions of materials and plant settings based on the approved mix design to the Engineering Services Section at least 7 days prior to production.

1.5 QUALITY ASSURANCE

1.5.1 **Thickness:** At the City's request, the quality assurance laboratory will take one or more sets of cores from suspect soil cement, each set comprising 3 cores whose average thickness represents not more than 1 000 m^2 of soil cement per supplier per day.

1.5.2 **Required Density:** Minimum 95% of maximum density for each lift where soil cement is used under concrete curb and gutter in a rehabilitation scenario, or in front of the curb and gutter in a foamed asphalt scenario where no subgrade preparation is carried out. In all other cases a minimum of 100% of Maximum dry density for each lift of Soil Cement is required.

1.5.3 **Representative Tests:** The quality assurance laboratory will take a field density test, representing not more than 1 000 m^2 of soil cement per supplier per day, according to ASTM D2167 or ASTM D2922 for comparison with a maximum density determined according to ASTM D558 Method B. If a tested density fails, 2 more tests will be taken from the same area and the average of the 3 tests will represent that area.

1.5.4 The quality assurance laboratory will conduct plant checks, sampling and testing.

1.5.5 **Plant Check:** Soil cement plant inspections will be conducted at random to check settings, operation, materials and mixture produced. The City will order the plant shut down if deficiencies are found, including deviation from the approved job-mix formula, segregation in the mix, or inconsistent plant operation.

1.5.6 **Compressive Strength Test:** Samples of soil cement will be taken at the plant or at the jobsite. Specimens will be moulded on site or in the laboratory into 101.6 mm diameter by 116.4 mm height cylinders using the compactive effort specified in ASTM D558 Method B. The specimens will be cured for 7 days to ASTM D1632:9.1. After 7 days curing, the specimens will be tested for compressive strength to ASTM D1633 Method A. At least one strength test will be taken per 500 tonnes of mix per supplier per day.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Portland Cement:**: to CAN/CSA-A3000, A3001-03 Type GU – General use hydraulic cement

2.1.2 **Aggregate:** to Section 02060 - Aggregate, Designation 2 Class 20.

2.1.3 **Water:** potable, approved by the City.

2.1.4 **Curing Seal:** liquid asphalt prime coat, to Section 02963 - Liquid Asphalt Coats**.**

2.2 MIXING PLANT

2.2.1 **Mixing Plant:** subject to the City's approval; capable of producing a uniform mixture; and equipped with synchronized metering devices and feeders to maintain correct proportions of aggregate, cement and water.

2.3 MIX DESIGN

The mix design shall meet the following criteria:

- Minimum compressive strength: 3.0 MPa at 7 days.

2.4 MIX PRODUCTION

2.4.1 Job-Mix Formula

Display the approved job-mix formula in sight of the plant operator. Failure to display the job-mix formula will result in a shut down order by City. Do not make changes to the formula without the City's approval.

2.4.2 Mixing

Mix aggregate, cement and water to obtain uniformity in cement content and moisture content without segregation of aggregate.

3. EXECUTION

3.1 PREPARATION

3.1.1 Have the prepared or stabilized subgrade, or the prepared subbase, inspected by the City before placing soil cement.

3.1.2 Repair imperfections to the prepared subgrade or subbase and clean the surface of debris and loose material.

3.1.3 Moisten the subgrade or the subbase surface without creating mud or ponding water, to minimize absorption of water from deposited soil cement mix.

3.2 PLACING MIXTURE

3.2.1 Transport the soil cement mixture to the site in trucks with protective covers in place until discharge, to minimize evaporation.

3.2.2 Do not place the soil cement mixture when the subgrade or subbase is frozen, or when the ambient air temperature is likely to drop below 2°C within 24 hours. Protect the soil cement from freezing for at least 7 days after placement.

3.2.3 Deposit the mixture within one hour after plant mixing and immediately spread the mixture in sufficient depth to achieve the designated cross-section and thickness when compacted. Do not dump the mixture into piles or windrows.

3.2.4 Limit the time interval between adjacent spreads to not more than 30 minutes. If the time interval is exceeded, form a construction joint to 3.3.7 below.

3.3 COMPACTION AND FINISHING

3.3.1 Begin compaction within one hour of plant mixing and complete finishing within 2 hours of plant mixing.

3.3.2 Keep the surface moist at not less than optimum moisture content during compaction, finishing and until the surface seal is applied.

3.3.3 Compact mixture in one lift to the required density. Spread and compact the mixture in two lifts if the designated thickness is greater than 200 mm.

3.3.4 Finish the compacted surface to be smooth and dense, free of compaction planes, cracks, ridges, equipment imprints, segregation or loose material and to the correct grade and cross-section.

3.3.5 **Smoothness and Grade:** Check the finished surface with a 3 m straightedge and against survey stakes to ensure that surface and grade tolerances are met. Rework deficient areas. Filling low spots with a thin application of the soil cement mixture is not permitted.

3.3.6 Apply curing seal to the surface after finishing.

3.3.7 **Construction Joint:** Place a construction joint between adjacent spreads more than 30 minutes apart and at the end of a day's work. Trim the compacted mixture to a clean vertical edge along a straight line perpendicular to the centreline of the road or along a straight line between parallel spreads.

3.4 FIELD QUALITY CONTROL

3.4.1 **Surface Tolerance:** 12 mm maximum variation under 3 m straightedge.

3.4.2 **Grade Tolerance:** 6 mm maximum variation above designated elevation and
15 mm maximum variation below designated elevation.

3.4.3 Where surface and grade tolerances are exceeded:

3.4.3.1 Grind down excessively high areas without destroying the surface, provided specified thickness is met.

3.4.3.2 Compensate low areas with extra thickness of subsequent paving course. This will be done at the expense of the Contractor..

3.4.3.3 **Deficient Thickness:** If the average core thickness is deficient, that area of soil cement will be assessed a pay factor according to Table 02713.1.

Table 02713.1 Soil Cement Thickness Pay Factors

THICKNESS DEFICIENCY (mm)	PAY FACTOR (% of Contract Price)
15	100.0
16	97.8
17	95.3
18	92.3
19	88.8
20	84.8
21	80.0
22	74.5
23	68.0
24	60.0
25	50.0
>25	Remove and replace or reconstruct

3.4.3.4 **Excess Thickness:** Soil cement with excess thickness may be accepted if surface and grade tolerances are met, but no claim for additional payment will be accepted.

3.5 SOIL CEMENT DENSITY

3.5.1 **Deficient Density:** If the average density is less than the required density, that area of soil cement will be assessed a pay factor according to Table 02713.2.

Table 02713.2 Soil Cement Density Pay Factors (100% Compaction Requirement)

AVERAGE PERCENT (Of Maximum Density)	PAY FACTOR (% of Contract Price)
99.0	100.0
98.8	99.8
98.6	99.4
98.4	98.8
98.2	97.9
98.0	96.8
97.8	95.5
97.6	94.0
97.4	92.2
97.2	90.1
97.0	87.8
96.8	95.3
96.6	82.5
96.4	79.5
96.2	76.2
96.0	72.7
95.8	68.9
95.6	64.7
95.4	60.2
95.2	55.3
95.0	50.0
<95.0	Remove and replace or reconstruct

Table 02713.2 Soil Cement Density Pay Factors (95% Compaction Requirement)

AVERAGE PERCENT (Of Maximum Density)	PAY FACTOR (% of Contract Price)
95.0	100.0
94.8	95.5
94.6	90.0
94.4	85.5
94.2	80.0
93.0	75.5
93.8	70.0
93.6	65.5
93.4	60.0
93.2	55.5
93.0	50.0
<92.0	40.0

3.5.1.1 The Contractor shall assume the risk of uncovering and replacing the soil cement if it is covered before the City has accepted the test results.

3.5.1.2 **Deficient Strength:** If strength test results are less than 3.0 MPa, the Contractor will be required to perform immediate corrective measures. In addition, if the average strength of any 3 consecutive cylinders is below 2.0 MPa, payment for soil cement in place represented by the 3 cylinders will be reduced to 50%.

3.6 RECONSTRUCTION

3.6.1 Break up and pulverize rejected soil cement into no larger than 25 mm pieces. Spread the pulverized material for addition of cement.

3.6.2 Add cement as follows:

3.6.2.1 For a section reprocessed within 24 hours of the original construction, add 50% of the original cement content.

3.6.2.2 For a section reprocessed between 24 and 48 hours following the original construction, add 75% of the original cement content.

3.6.2.3 For a section reprocessed more than 48 hours following the original construction, add 100% of the original cement content.

3.6.3 Process the new mixture using pulverization equipment, to Section 02968 - Full Depth Reclamation.

3.7 SUBSEQUENT PAVING

3.7.1 If paving of the finished soil cement does not begin within 24 hours after placement then paving must not begin until the soil cement has cured for a minimum of 7 days.

3.7.2 If the road is required for traffic before paving, cover the surface with sand and open the road to traffic not earlier than 72 hours after soil cement placement. When ready to pave, remove the sand, repair any damage, clean the soil cement surface and apply prime coat.

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Spreading and compacting imported aggregate into a base or sub-base.

1.1.2 Scarifying, shaping and compacting existing granular base or sub-base.

1.1.3 Windrowing existing gravel, preparing the subgrade and spreading and compacting granular base or sub-base.

1.2 RELATED SECTIONS

Aggregate	Section 02060
Grading	Section 02310
Subgrade Preparation	Section 02335

1.3 DEFINITION

Maximum Density: The dry unit mass of a sample at optimum moisture content as determined in the laboratory to ASTM D698 Method A.

1.4 QUALITY ASSURANCE

1.4.1 Testing Frequency

The quality assurance laboratory will take a minimum of one field density test on a compacted granular lift for each 1 500 m^2 of road, 1 000 m^2 of alley, or 500 m^2 of walk, monolithic walk, curb ramp, alley crossing, commercial crossing, private crossing, or median or island strip, according to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A.

1.4.2 Required Density

The compacted lift thickness of a granular course shall not exceed 150 mm, or as directed by the City. The required density of granular base courses is shown in the following table.

Compacted Granular Base Course	Required Percentage of Maximum Density
under roads, curb and gutter	100%
under commercial or alley crossings	100%
under asphalt or concrete walk, transit pads	97%
under walk portion of monolithic walk	97%
under curb ramps	97%
under private crossings	97%
under median or island strips	97%
as granular walkways	95%

2. PRODUCTS

2.1 MATERIALS

Granular Materials: to Section 02060 Aggregate, Designation 3, classes as indicated on the Drawings.

2.2 EQUIPMENT

Equipment: Graders, rollers and other equipment of adequate design and capacity to produce a granular base or subbase as specified.

3. EXECUTION

3.1 PREPARATION

3.1.1 The prepared subgrade shall be inspected by the City before placing the granular course.

3.1.2 On existing gravel roads or lanes, clean the surface of clay lumps, vegetation and other deleterious material. To assess the condition of subgrade and depth of gravel, make exploratory cuts along the third points of the road width, or along the centreline of the alley. After assessment, regrade and compact the gravel to prevent ponding water.

3.2 NEW GRANULAR BASE OR SUBBASE COURSE

3.2.1 Deposit aggregate and spread uniformly in lifts not exceeding 150 mm thickness when compacted.

3.2.2 **Segregation:** If segregation occurs:

3.2.2.1 In Class 20 aggregate: blade the lift and mix thoroughly before final spreading and shaping to crown and grade.

3.2.2.2 In Class 63 or Class 80 aggregate: remove and replace the segregated material.

3.3 EXISTING GRAVEL ON SUITABLE SUBGRADE

3.3.1 If subgrade is found to be acceptable by the City and is on designated grade and if there is sufficient depth of gravel, scarify the existing gravel to 75 mm depth and pulverize material to no larger than 50 mm pieces. Remove rocks larger than 75 mm.

3.3.2 If there is insufficient depth of gravel and subgrade is on grade, scarify to 50 mm depth, remove rocks larger than 75 mm, pulverize to no larger than 50 mm pieces, add the designated class of imported aggregate and mix thoroughly with existing gravel.

3.3.3 Spread and shape to crown and grade in lifts not exceeding 150 mm when compacted.

3.4 EXISTING GRAVEL ON SUBGRADE TO BE REWORKED

3.4.1 If subgrade is found to be unsuitable or not on designated grade, windrow existing gravel to one half of the road or lane and rework the exposed subgrade as required.

3.4.2 When directed by the Engineer, excavate and remove unsuitable subgrade soil and backfill with approved material to Section 02060 - Aggregate.

3.4.3 Prepare 150 mm subgrade to Section 02335 - Subgrade Preparation or Section 02342 - Cement Stabilized Subgrade.

3.4.4 If subgrade is found to be too low, scarify and blend with approved imported fill and compact in 150 mm lifts to Section 02335 - Subgrade Preparation or Section 02342 - Cement Stabilized Subgrade.

3.4.5 If subgrade is found to be too high, remove excess soil, scarify to 150 mm depth and compact to Section 02335 - Subgrade Preparation or Section 02342 - Cement Stabilized Subgrade.

3.4.6 Repeat 3.4.1 to 3.4.4 on the other half of the road or alley.

3.4.7 After reworking the subgrade, prepare gravel for compaction to clause 3.3.

3.5 COMPACTION

3.5.1 Bring the moisture content of the aggregate to near optimum.

3.5.2 **Non-compliance:** If a density test result is less than the required density, that test result is discarded and 3 retests shall be performed on the area represented by the failed test. The average of the 3 retests shall represent the density of that area. If this average is less than the required density, the area shall be reworked to the full depth of the lift; the aggregate moisture content altered as necessary and recompacted to the required density. If the area is not retested but is reworked and recompacted the area shall be tested at normal testing frequencies.

3.5.3 The Contractor shall assume the risk of uncovering and reworking the granular base if it is covered before the City has accepted test results thereof.

3.6 FIELD QUALITY CONTROL

Check finished surface of granular base to ensure that it meets the following tolerances:

3.6.1.1 Surface Tolerance: 15 mm maximum variation under 3 m straightedge.

3.6.1.2 Grade Tolerance: 6 mm maximum variation above designated elevation and 15 mm maximum variation below designated elevation.

3.6.2 **When Tolerance Exceeded**

3.6.2.1 Trim high spots and refinish surface to within tolerance.

3.6.2.2 Add approved aggregate to low areas, scarify, blend, respread and recompact to required density and refinish surface. Alternatively, compensate low areas with extra thickness of subsequent granular base course.

3.7 SUBSEQUENT PAVING COURSE

3.7.1 Do not permit vehicular traffic on the compacted granular base before paving.

3.7.2 If the granular base floods, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches.

3.7.3 Repair any damage, including freezing, to the granular base course and retest for density before paving.

1. GENERAL

1.1 Work Included

1.1.1 Provide all labour, materials, products arid equipment required to remove existing asphalt from bridge decks and supply and place a polymer modified asphalt membrane/mastic surface wearing course to the bridge deck and approaches.

1.1.2 Milling of asphalt is not allowed. Existing asphalt shall be removed by an excavator or backhoe.

1.2 Related Sections

1.2.1 Section 02066 – SGC Hot-Mix Asphalt Concrete

1.2.2 Section 02963 - Liquid Asphalt Coats

1.2.3 Section 02742 – SGC Hot-Mix Asphalt Paving

1.3 Quality Assurance

1.3.1 Inspection and Testing

1.3.1.1 All products and workmanship will be inspected by the Engineer. The Engineering Services Section, Transportation Services of the City of Edmonton (ESS) will conduct plant inspection and materials sampling and testing described in the following paragraphs.

1.3.1.2 The Contractor shall notify the Engineer and the Testing Agency in ample time to permit inspection and testing.

1.3.1.3 The Contractor shall co-operate with the Engineer and Testing Agency on the inspection of materials and sampling.

1.3.1.4 The Contractor shall not cover any work before inspection and testing unless authorized by the Engineer, in writing.

1.3.2 The Contractor shall remove and replace or repair defective products or work that fails to meet the specified requirements as directed by the Engineer, at no cost to the City.

1.3.3 Asphalt Plant

Inspections will be conducted at least once during production to check plant calibrations, plant operation, production settings, temperatures, and materials handling. Samples of materials and mixture may be taken and tested.

1.3.4 Asphalt Cement

Quality assurance sampling and testing of the asphalt cement shall be performed by the Contractor, at no cost to the City, to verify compliance to the specification. A sample shall be taken at random during paving operations on City projects from a load(s) delivered to the Contractor’s asphalt plant at least twice a month or as directed by the ESS. The sample shall be tested by an independent laboratory engaged by the Contractor to verify compliance with the specification requirements as stated in Section 2.1.1. Test results shall be reported in writing to the ESS by the Contractor. Non-complying sample test results will be reported to the ESS within 24 hours of completion of the test(s). Compliant sample test results shall be submitted in writing to the ESS, no later than 10 working days after the date of sampling.

1.3.4.1 A test report shall include, but not be limited to, (1) report date, (2) date of sampling, (3) bill of lading number of load sampled, (4) destination of load, (5) report of test results, (6) standard test identifications, (7) specification requirements, (8) statement of compliance, and (9) certification signature. Failure to comply with quality assurance testing may result in rejection of either the asphalt cement, and/or the job mix formula, and/or the associated SGC hot-mix placed on the project.

1.3.4.2 If non-complying material is identified, the paving program may be suspended for 24 hours, as directed by the Engineer, during which time the Contractor, the Engineer, and ESS will meet to determine the impact of the non-compliance, and specify the necessary remedial action to be taken by the Contractor. Remedial action shall be either acceptance, acceptance at a pay adjustment, or removal and replacement at no cost to the City. If suspended, the paving program shall only continue upon written authorization by the ESS.

1.3.4.3 Asphalt cement identified to be in non-compliance shall not be shipped to a project. SGC hot-mix mixed and placed with identified non-complying asphalt cement shall be removed and replaced, as directed by the Engineer with complying material by the Contractor at no cost to the City.

1.3.5 Production Mix Analysis

Full mix sample testing will be conducted at a minimum frequency of one test, for each day's production. Three briquettes will be made and tested for Marshall Properties and Maximum Theoretical Density, and three briquettes will be made and tested for permeability.

1.3.5.1 The determination of the asphalt cement content will utilize the asphalt ignition oven correction factor, as determined by the ESS.

1.3.5.2 ESS will conduct nuclear density testing on the compacted mat at locations which represent 1,000 m^2

1.3.5.3 Basis of Acceptance: Bridge deck hot-mix pavement compaction will be accepted based on the ratio (in percent) of the results obtained from the calibrated nuclear densometer density to the MTD. If results are obtained from a mat where no MTD are available, acceptance will be based on the ratio of nuclear densometer density to the average MTD for that day's production.

1.3.6 Job Mix Formula

The ESS will test a trial batch of the Bridge Deck hot-mix job mix formula to verify the mix design. The mix design and job mix formula will not be approved by the Engineer until successful results are obtained by the ESS.

1.3.6.1 The ESS will use the mix provided in the Trail Batch to produce specimens with which to calibrate the nuclear densometer for performing field density determinations.

1.4 QUALITY CONTROL

1.4.1 General

The Contractor is responsible for quality control throughout all stages of the SGC hot-mix production and placement including the aggregates, asphalt cement, and any other materials used in the mix. The Contractor shall utilize a qualified testing laboratory to undertake the quality control sampling and testing to determine and monitor the properties of the materials being produced and used on the project.

1.4.2 Sampling and Testing

The Contractor shall follow the sampling and testing methods and frequencies indicated in their quality control plan and/or as accepted or modified by ESS.

1.5 Curing Requirement

1.5.1 No traffic shall be allowed on newly placed asphalt until densities have been reached and surface has cooled down to 32^{o} C.

1.6 Existing Asphalt Depth

1.6.1 Asphalt depth data is described in the Special Provisions. No additional payments will be made for removal of asphalt below indicated depths.

1.7 Haul Routes

1.7.1 Haul routes shall be approved by the Engineer and in accordance with the General Conditions.

1.7.2 Ensure that all vehicles used are equipped to prevent spilling or leaking of any part of the load.

1.8 Equipment

1.8.1 **Pavers**: mechanical automatic grade controlled self-powered pavers capable of spreading mix within specified tolerance, true to line, grade and crown indicated.

1.8.2 **Rollers**: sufficient number of rollers of type and weight to obtain specified density of compacted mix. Vibrators on vibratory rollers shall **NOT** be activated. The Engineer, at his sole discretion, may allow the Contractor to activate vibrators on vibratory rollers not exceeding 5 tonnes in weight.

1.8.3 **Haul trucks**: of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

1.8.3.1 Clean, tight, smooth sided boxes.

1.8.3.2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

1.8.3.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

1.8.4 **Hand Tools**:

1.8.4.1 Lutes or rakes with covered teeth shall be used during spreading and finishing operations.

1.8.4.2 Tamping irons having mass not less than 13 kg and a bearing area not exceeding 310 cm^2 for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by the Engineer, may be used instead of tamping irons.

1.8.4.3 Straight edges, 4.5 m in length, to test finished surface.

1.9 Longitudinal Joints

1.9.1 If application of the wearing course is to be stopped and delayed for 6 hours or more, the temperature of the joint material cannot be maintained at a minimum of 115 ^{o}C and/or the edge of the longitudinal joint has been deformed due to vehicles driven over, carefully roll the edge of the mat. Prior to placement of the adjoining mat, trim off the rolled material from the first mat to a width of 150mm resulting in a clean vertical face to the full depth of the mat and paint with a tack coat sealer before placing the adjacent mat.

2. PRODUCTS

2.1 Materials for Polymer Modified Asphalt

2.1.1 Asphalt Cement: Polymer Modified Bridge Mastic, supplied by Husky Oil Ltd., meeting the requirements given in Table A. No alternatives will be allowed.

2.1.2 Aggregates shall be approved by the Engineer and shall meet the gradation requirements given in Table B.

2.1.3 Fine aggregate: That fraction of the total aggregate passing the 5 000 μm sieve. Fine aggregate shall contain **a minimum 75 percent manufactured or crushed fines. The total percent of manufactured fines in a mix is taken as the percentage of manufactured fines in the minus 5 000 μm sieve fraction of the total combined aggregate.**

2.1.4 Coarse aggregate: That fraction of the total aggregate retained on the 5 000 μm sieve. A minimum of 75% **of the coarse aggregate particles shall have at least two crushed faces.**

2.1.5 Tack coat: Cutback Asphalt, grade MC-30 or approved alternate, subject to approval by the Engineer. Tack coat utilizing water as a carrier will not be allowed.

2.2 Mix Properties for Polymer Modified Asphalt

2.2.1 Submit a mix design carried out by a qualified laboratory, to the ESS for review a minimum of 4 weeks prior to commencement of the work.

2.2.1.1 The mix design should include:

- Legal description of all aggregate sources;
- Individual aggregate gradations;
- Water absorption of the individual aggregates and the combined aggregates;
- Aggregate blend;
- Combined aggregate gradation;
- Bulk specific gravity of individual aggregates and mineral filler;
- Based on the individual aggregate results, the calculated bulk specific gravity of the combined aggregates;
- A minimum of five individual and separate asphalt cement contents must be used in the mix design and each individual asphalt cement content must be separated by a minimum of 0.40 to a maximum of 0.60 percent (by dry weight of aggregate);
- Graph of mix's Theoretical Maximum Density (MTD) versus asphalt cement content (by total mix) reported to two significant digits;
- All other graphs used in the mix design (by total mix);
- Individual mix property results are to be plotted and a second order polynomial graph drawn through the individual data points.
- Recommended initial asphalt cement content and associated mix parameters;
- Asphalt cement absorption of the combined aggregates;
- Ignition oven asphalt cement content correction factor:
- The results of permeability testing carried out on briquettes at the design binder content.

2.2.2 Mix design for single lifts shall meet the requirements given in Table C for a laboratory compacted mix mixed at 180°C and compacted at 168°C with 50 blows from a mechanical compactor. Mix temperature at the plant shall **NOT** exceed 185 °C.

2.2.3 Mix design for membrane in multiple lifts shall meet the requirements given in Table D for a laboratory compacted mix mixed at 180°C and compacted at 168°C with 50 blows from a mechanical compactor. Mix temperature at the plant shall **NOT** exceed 185 °C.

2.2.4 Mix design for overlays in multiple lifts shall meet the requirements given in Table E for a laboratory compacted mix mixed at 180°C and compacted at 168°C with 50 blows from a mechanical compactor. Mix temperature at the plant shall **NOT** exceed 185 °C.

2.2.5 Allowable variations in aggregate gradation between the job mix and the approved mix design:

2.2.5.1 ± 3% on material retained on the 160 μm and coarser sieve.

2.2.5.2 ± 1% on material retained on the 80 μm sieve.

2.3 Tolerances

2.3.1 Marshall Tolerances

The tolerances for the required Marshall properties for quality assurance testing are detailed in Tables C, D, or E depending on the mix designation.

2.3.2 Permeability Tolerance

Permeability testing shall be carried out in accordance with ASTM D 5084-90 on three briquettes molded at the time of Marshall field sample preparation.

2.3.2.1 If the average permeability of the tests of the three samples does not meet the permeability specified, the Contractor shall remove and replace the deficient areas at no cost to the Owner. The replacement of the mat shall be performed in accordance with these specifications.

2.3.3 Desnsity Tolerance

2.3.3.1 Required Density: Each mat of hot-mix placed shall be compacted to a minimum of 94 Percent of Maximum Theoretical Density (MTD), or as indicated in the contract Special Provisions.

2.3.3.2 Deficient Density: If the average core density is below specified, the represented area of mat may be accepted subject to a pay factor according to Table 02742.2 to be applied to the price of the quantity of hot-mix in that mat area

2.3.4 Thickness Tolerance

As detailed in Section 02742 SGC Hot-Mix Asphalt Paving

2.4 Field Quality Control

2.4.1 Smoothness Tolerances

Maximum variation under 4.5 m straight edge as follows:

2.4.1.1 Longitudinal in direction of travel: 6 mm.

Transverse to direction of travel: 6 mm.

(Straight crossfall)

2.4.1.2 Grade: +/- 6 mm maximum variation from designated grade elevations.

2.4.1.3 Texture: The finished surface shall have a tightly knit texture free of visible signs of poor workmanship including but not limited to :

Segregation, waves, hairline cracks, roller marks or other unevenness.

2.4.1.4 If the finished surface of the mat does not comply with the above requirements, the Contractor shall remove and replace the deficient areas at no cost to the Owner. The replacement of the mat shall be performed in accordance with these specifications.

2.5 Plant and Mixing Requirements

2.5.1 Refer to City of Edmonton Specification Section 02066.

3. EXECUTION

3.1 Removal of Asphalt

3.1.1 The use of milling equipment is prohibited. A minimum of 90% of the area of the concrete bridge deck must be visible after the removal operation. Any asphalt left in place shall not exceed 10 mm in height. Remove all unbounded, loose asphalt by scraping and sandblasting.

3.1.2 Place protection in all expansion joints prior to the removal operation. Protection to be left in place until after paving is completed.

3.1.3 Clean bridge surface after removal operation is complete and blow dry entire concrete deck.

3.1.4 Temporary ramping is to be placed at all manholes and expansion joint and left in place until just prior to paving.

3.2 Site Preparation

3.2.1 The Contractor must provide, at his expense, a satisfactory working area at both ends of the bridge to maneuver trucks and clean truck tires, paving equipment, including the spreader, steel rollers and pneumatic rollers, etc., using concrete, Asphaltic Concrete or other material acceptable to the Engineer.

3.2.2 Blow dry the deck using min. of 125 CFM compressed air to ensure that no mud, dirt, standing water, or surface moisture is left in place.

3.2.3 Depressions greater than 10 mm in depth shall be brought level with surrounding areas by manual application and tamping of the mastic pavement mixture.

3.2.4 Apply a tack coat of MC-30 or approved alternate at a rate of 0.3 liters per square meter. Complete drying of the tack coat is required before paving can commence.

3.2.5 Adjacent structures and appurtenances shall not be spattered by the tack coat. The Contractor shall remove any spattering and make good the affected surface to the satisfaction of the Engineer at no cost to the Owner.

3.2.6 Apply a uniform coating of MC-30 or approved alternate along gutter lines, adjacent to expansion joints and around drainpipes using a brush or squeegee. Vertical faces of curbs and other appurtenances shall be brush coated with a rubberized asphaltic compound such as Bakor 570-05 rubber asphalt edge sealer or approved equal.

3.2.7 The tack coat shall be applied only when the surface to be treated is dry, when the weather is not foggy or rainy, and when the surface temperature is above 15°C.

3.2.8 The tack coat shall be applied by means of a self-propelled pressure bituminous material distributor subject to the approval of the Engineer.

3.2.9 The tack coat shall be applied in a single application.

3.2.10 The Contractor must be responsible for accidents or damage resulting from the use of excessive temperatures and shall replace, at no expense to the Owner, any material destroyed.

3.2.11 Areas missed by the distributor or inaccessible to the distributor, shall be treated using hand spray prior to tacking section adjacent.

3.2.12 No traffic shall be allowed on the tack coat until the material is fully cured and approved by Engineer.

3.3 Mix Delivery

3.3.1 Transport mix to the job site in vehicles cleaned of foreign material.

3.3.2 Paint or spray truck beds with light oil, limewater, soap or detergent solution at least once a day or as required. Elevate truck bed and thoroughly drain. No excess solution will be permitted.

3.3.3 Schedule delivery of material for placing in daylight, unless the Engineer approves artificial light.

3.3.4 Deliver material to paver at a uniform rate in an amount within capacity of paving and compacting equipment.

3.3.5 Deliver loads continuously in covered vehicles and immediately spread and compact.

3.3.6 Loaded or empty trucks shall not be turned around on the bridge deck.

3.3.7 Ensure vehicle tires are clean of deleterious material prior to driving onto the bridge deck.

3.3.8 Maintain asphalt within truck at a temperature greater than 160°C. The load will be rejected by the Engineer or his representative if the asphalt temperature of the truckload falls below 160°C.

3.4 Placing

3.4.1 Placing - Single Lift

3.4.1.1 Standard paving machines shall be adjusted to place a continuous mat of asphalt to match existing thickness.

3.4.1.2 Place asphalt mixtures only when air temperature is above 12°C and deck temperature is above 10°C. Secondary rolling will be completed before the temperature of the mat falls below 90°C.

3.4.1.3 Coverage of the single lift membrane/wearing course pavement shall be a minimum of no less than 45 mm pavement thickness in any area, and no more than 80 mm. Some adjustment of mat thickness may be required to match the elevations of existing features.

3.4.1.4 The Engineer may suspend spreading if segregation of mix material occurs until such time as the cause can be determined and corrected.

3.4.2 Placing - Multiple Lifts

3.4.2.1 Membrane Placement

3.4.2.1.1 Standard paving machines shall be adjusted to place a continuous mat of 25 mm nominal thickness.

3.4.2.1.1 The thickness of the mastic membrane shall at no time be less than 20 mm.

3.4.2.1.3 Place asphalt mixtures only when air temperature is above 12°C and deck temperature is above l0°C. Secondary rolling will be completed before the temperature of the mat falls below 90°C.

3.4.2.2 Overlay Placement

3.4.2.2.1 Surface course asphalt shall be applied at a minimum thickness of 75 mm or as indicated on the drawings. Some adjustment of mat thickness may be required to match elevations of existing features.

3.4.2.2.2 If application of the wearing course is delayed for more than 48 hours, or if construction traffic creates a visible coating of dust or dirt, a tack coat of emulsion, approved for standard pavement construction, shall be applied. Use of tack coat on top of the membrane pavement shall be subject to the approval of the Engineer.

3.4.2.2.3 Longitudinal joints in the surface course shall be offset 300 mm lateral distance, or greater, from the longitudinal joint in the underlying membrane mix.

3.4.2.2.4 The Engineer may suspend spreading if segregation of mix material occurs until such time as the cause can be determined and corrected.

3.5 Compacting

3.5.1 Asphaltic concrete shall be compacted to not less than 94 percent **of Maximum Theoretical Density (MTD)**.

3.5.2 Steel and pneumatic-tired rollers shall be kept slightly moistened by water. Steel rollers shall be equipped with scrapers. Pneumatic tire rollers shall be equipped skirting. Excessive use of water will not be permitted.

3.5.3 The roller shall not be driven onto or off the mat over the longitudinal edge of mat.

3.5.4 Do not turn rollers around on the deck. The roller must run off the deck to stop and turn.

3.5.5 The line of rolling shall not suddenly be changed or the direction of rolling suddenly reversed. Any pronounced change or direction shall be made on stable material.

3.5.6 Rollers shall not be permitted to stand on the mat.

End of Section

Table A

Property	Units	ASTM No.	Minimum	Maximum
LOW SERVICE TEMPERATURE CHARACTERISTICS				
Stiffness Modulus @ -20°C (Loading Time 500sec) (Recommended Method)	Pa			5×10^7
Pen @ 0°C, 200g 60sec. (Alternate Method Only)	Dmm	D5	30	
HIGH SERVICE TEMPERATURE CHARACTERISTICS				
Viscosity @ 60°C (Shear Rate $5\times10^{-2}s^{-1}$)	Pa·s		600	
Elastic Behavior (@ Room Temperature)				
Toughness	J	Benson Test (or Equivalent)	10	
Tenacity	J	Benson Test (or Equivalent)	8	
TECHNOLOGICAL CHARACTERISTICS				
Kinematic Viscosity @ 135°C	mm^2/s	D2170		3000
Flashpoint	°C	D92	230	
AGING CHARACTERISTICS (Test After Thin Film Oven Test)				
Weight Loss Aging Index	%	D1754		1.0 4.0

$$\text{Aging Index} = \frac{\text{Viscosity @ 60 °C (Shear rate } 5 \times 10^{-2}s^{-1}\text{) after TFOT}}{\text{Viscosity @ 60 °C (Shear rate } 5 \times 10^{-2}s^{-1}\text{) before aging}}$$

Table B

Sieve Size (μm)	% Passing
10 000	100
5 000	90 – 95
2 500	70 – 76
160	8 – 16
80	6 – 10

Table C

Property	Limit	ASTM Designation
Binder Content (%)	8.5 min.	D2172/ATT-12 Part II
Marshall Stability (N)	6000 min.	D1559
Flow (250 μm)	20 max.	D1559
VMA (%)	14 min.	
Air Voids (%)	3 – 5	
Permeability @ 70 kPa (cm/s)	10^{-7} max.	D5084-90
Film Thickness (microns)	8.0 min.	

Table D

Property	Limit	ASTM Designation
Binder Content (%)	9.5 min.	D2172/ATT-12 Part II
Marshall Stability (N)	5200 min.	D1559
Flow (250 μm)	20 max.	D1559
VMA (%)	18 min.	
Air Voids (%)	3 - 5	
Permeability @ 70 kPa (cm/s)	10^{-7} max.	D5084-90
Film Thickness (microns)	8.0 min.	

Table E

Property	Limit	ASTM Designation
Binder Content (%)	6.5 ± 0.3%	D2172/ATT-12 Part II
Marshall Stability (N)	7000 min.	D1559
Flow (250 μm)	20 max.	D1559
VMA (%)	14 min.	
Air Voids (%)	3 – 5	
Permeability @ 70 kPa (cm/s)	10^{-7} max.	D5084-90
Film Thickness (microns)	7.0 min.	

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Supply and placement of SGC hot-mix asphalt concrete for roadway paving.

1.2 RELATED SECTIONS

1.2.1 Section 02066 – SGC Hot-Mix Asphalt Concrete

1.2.2 Section 02961 - Pavement Cold Milling

1.2.3 Section 02963 - Liquid Asphalt Coats

1.3 DEFINITIONS

1.3.1 **ESS**: The Engineering Services Section, Transportation Services of the City of Edmonton (City).

1.3.2 **Overlay:** paving over an existing pavement for rehabilitation purposes and not as part of staged paving.

1.3.3 **Staged Paving:** paving where a lift or lifts that form part of the total pavement structure are deferred to a future date.

1.3.4 **SGC Density:** the Superpave Gyratory Compactor (SGC) shall be used to prepare laboratory formed specimens at Ndesign of either 75 or 100 gyrations. The SGC formed specimens shall be used for the determination of volumetric properties on a field produced SGC hot-mix as outlined in the Asphalt Institute SP-2 Manual.

1.4 QUALITY ASSURANCE

1.4.1 Thickness Cores

ESS will:

1.4.1.1 Take a minimum of one core per 1,000 m^2 of SGC hot-mix asphalt pavement and determine the thickness of the mat, for each stage of paving.

1.4.1.2 A thickness deficiency at the completion of the first stage of paving may be accepted by the City provided the deficiency is less than 12mm and the deficient thickness can be included in the subsequent stage of paving.

1.4.1.3 If the initial core thickness is deficient at the completion of the final lift of paving, that initial thickness is discarded, and 3 new cores will be taken within 10 m of the original core location at a minimum spacing of 2.5 m between cores. The average thickness of the 3 new cores represents that area.

1.4.2 Asphalt Cement Content and Density Specimen Sampling and Testing

ESS will:

1.4.2.1 Determine the Maximum Theoretical Density (MTD) and asphalt cement content of the SGC hot-mix at a minimum frequency of one test for every 250 tonnes of SGC hot-mix produced, or a day's production, whichever is less.

1.4.2.2 Obtain one core from compacted mat placed from same load of SGC hot-mix from which SGC specimens were obtained, or from suspect compacted mat, and test for density. Where specified in the special provisions of the contract obtain a second core from the compacted mat for rut testing in the Asphalt Pavement Analyzer (APA).

1.4.2.3 Obtain one core from compacted mat representing 1,000 m^2 and test for density.

1.4.2.4 Basis of Acceptance: SGC hot-mix pavement compaction will be accepted based on the ratio (in percent) of the core density to the MTD. If cores were taken from a mat where no MTD are available, acceptance will be based on the ratio of core density to the average MTD for that day's production.

1.4.2.5 Representative Cores: A single core is initially taken representing the quantity of SGC hot-mix in not more than 1,000 m^2 of mat, with a minimum of one core taken from a day's production. If the initial core density is below specified, that initial density is discarded, and 3 new cores will be taken within 10 m of the original core location at a minimum spacing of 2.5 m between cores. The average density of the 3 new cores represents that area.

1.4.3 Rutting Susceptibility Specimen Sampling and Testing (Where Specified)

ESS will:

1.4.3.1 Where specified determine the rutting susceptibility of laboratory SGC hot-mix specimens at a minimum frequency of one test for every 5,000 tonnes of SGC hot-mix produced, for an individual project by subjecting the SGC hot-mix specimens to the APA procedure. The APA device will meet the requirements of AASHTO TP63-03 and is equipped with an automatic rut measurement system. The APA device will be calibrated at least once per year according to the procedures in the test method. In addition, the load cell used for checking wheel loads will be calibrated at least once per year. Each test shall have 6 cylindrical samples fabricated and tested with the interior temperature of the APA set at 52^{o}C. The downward force shall be set at 45 Kg and the hoses shall be pressurized to 689 kPa. Each specimen shall be compacted so that 7.0+/-0.5 percent air voids are achieved. The APA rut test results shall be provided to the nearest 0.1 mm

1.4.3.2 Where specified, determine the rutting susceptibility of SGC hot-mix field core specimens taken at the location of the SGC hot-mix samples by subjecting the field core specimens to the APA procedure as described in the above section. The average rut depth for the specimens tested shall not exceed the specified APA requirements for the mix type. If the initial APA rutting is above specified, that initial APA result is discarded, and 6 new cores will be taken within 10 m of the original core location at a minimum spacing of 2.5 m between cores. The average APA result of the 6 new cores will be taken as to represent that area.

1.4.4 Tensile Strength Ratio (TSR) Specimen Sampling and Testing (Capital Program)

ESS will:

1.4.4.1 Determine the TSR of SGC hot-mix field samples at a minimum frequency of one test for every 5,000 tonnes of SGC hot-mix produced, for an individual project, in accordance with AASHTO T283, including the optional freeze-thaw cycle.

2. PRODUCTS

2.1 MATERIALS

2.1.1 SGC Hot-Mix Asphalt Concrete

To Section 02066 – SGC Hot-Mix Asphalt Concrete.

2.1.2 Tack Coat

To Section 02963 - Liquid Asphalt Coats

2.2 EQUIPMENT

2.2.1 Trucks for Transporting Mix:

Trucks shall be compatible with size and capacity of the paver; with clean, tight, smooth-sided boxes equipped with waterproof tarpaulins of sufficient size to securely cover all material when boxes are fully loaded. The side of the truck box shall have a 12-mm diameter hole 300 mm from bottom for checking mix temperature. Use only approved release agents, such as water based liquid soap, dry soap powder or approved material and drain all excess release agents from truck beds prior to loading SGC hot-mix. Petroleum derivatives are not permitted as release agents.

2.2.2 Paver

Pavers shall be self-propelled; with automatic screed controls to maintain grade from a reference string line or ski and to control crossfall, smoothness and joint matching; with vibratory screed equipped with vibratory extensions and augers capable of uniformly spreading the mixture to specified widths and depths without segregation or tearing. Follow the manufacturer's recommended operating procedures.

2.2.3 Rollers

Shall be self-propelled, reversible; static, oscillating or vibratory steel-drum or pneumatic-tired rollers; with wetting and scraping devices to prevent adhesion of mix to drums or tires (petroleum derivatives are not permitted for cleaning); capable of attaining required density and smoothness; and pneumatic-tired rollers to be equipped with wind skirts. Follow the manufacturer's recommended operating procedures.

2.2.4 Hand Tools

Rakes, lutes, tampers, straightedges, levels, and other hand tools as necessary to complete the work shall be available.

3. EXECUTION

3.1 GOOD PAVING PRACTICE

Production, Placement, Compaction and Quality Assurance of the SGC hot-mix mix should be pursuant to the requirements of TB-1 “Hot Mix Asphalt Materials, Mixture Design and Construction” as prepared by the National Centre for Asphalt Technology (NCAT) and published by the National Asphalt Pavement Association (NAPA), for guidance in good practices of handling materials and hot-mix production insofar as consistent with this Section.

3.1.1 Refer to the latest edition of the “*Construction of Hot Mix Asphalt Pavements”*, Asphalt Institute Manual Series No. 22 (MS-22), for guidance in good paving practice insofar as consistent with this Section.

3.1.2 Provide an experienced foreman who shall be in full time attendance on the paving site to take charge of the entire paving operation from transporting of the mix to final rolling.

3.2 PREPARATION

3.2.1 The Engineer will inspect the existing pavement, base, or subbase before SGC hot-mix paving. The Contractor shall repair imperfections and clean up as directed by the Engineer. Surface shall be true to line and grade within tolerance, firm, dry, and free of loose and deleterious material.

3.2.2 For new construction or as directed by the Engineer all Catch basins, manholes, water valves, and other fixtures shall be brought to proper grade before final lift paving. Provide temporary protection where necessary until completion of paving. If catch basins, manholes, water valves, and other fixtures are not raised prior to final lift paving as required and are required to be raised subsequent to final lift paving a $2,000.00 penalty per occurrence, as documented by the Engineer, will be assessed.

3.2.3 Multiple Lift Paving

Apply tack coat to the previous lift before placing a lift, unless permitted otherwise by the Engineer. Clean the exposed surface before tacking.

3.2.4 Preparation for Overlay or for Succeeding Stage Paving

3.2.4.1 Sweeping and Cleaning: Sweep the existing pavement surface with an approved mechanical sweeper. Remove all residual debris and accumulations of deleterious material.

3.2.4.2 Surface Milling: If specified, grind the existing surface to specified depth according to Section 02961 – Pavement Cold Milling

3.2.4.3 Tack Coat: When the existing surface has passed inspection by the Engineer, apply tack coat to Section 02963 - Liquid Asphalt Coats.

3.2.4.4 Apply tack coat to surfaces intended to be in contact with SGC hot-mix, including the sides of gutters, catch basins, manholes, and other concrete and metal fixtures. Before placing SGC hot-mix, let tack coat completely cure and have tacked surfaces inspected by the Engineer

3.2.4.5 Asphalt Levelling Course: The Engineer will designate those areas having 20 mm or greater depressions for levelling course application. Spread the levelling course of SGC hot-mix with a paver one lift at a time, not exceeding 60 mm compacted thickness, and compact to required density.

3.3 WEATHER LIMITATIONS

- No paving is permitted when rain or snow is imminent, or when the surface or base to be paved is wet, icy, snow-covered, or frozen, unless waived by the Engineer.

- No paving is permitted when air temperature and wind speed conditions are below the applicable mat curve in Chart 02742.1, unless waived by the Engineer.

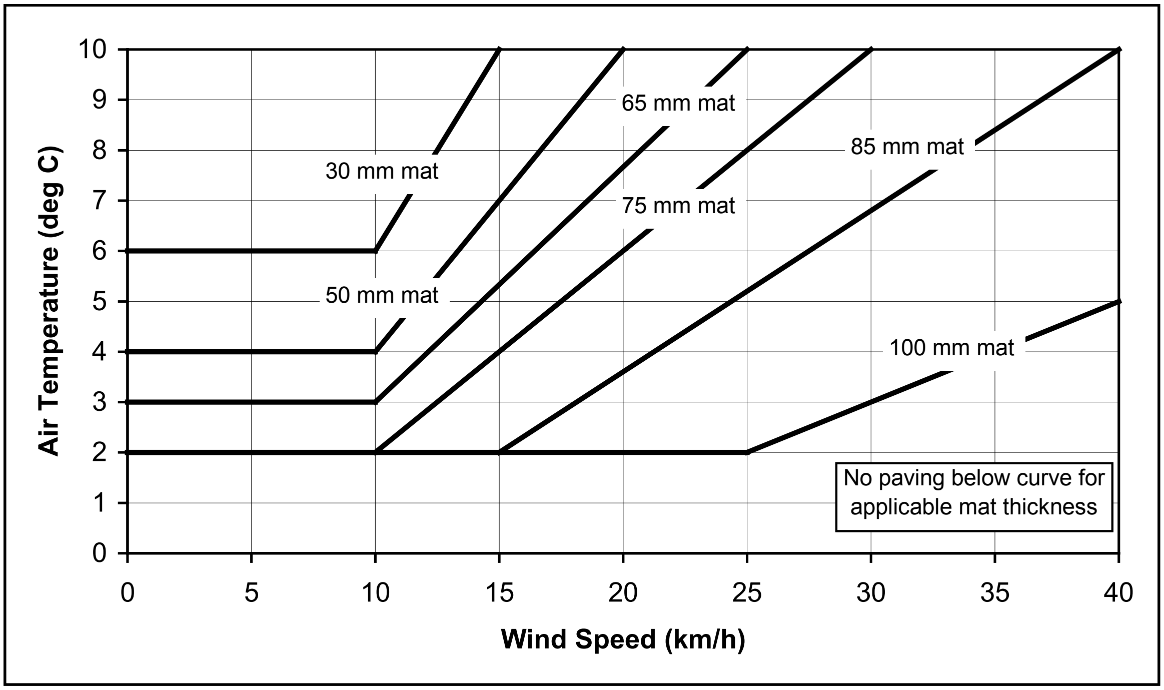


CHART 02742.1: AIR TEMPERATURE AND WIND LIMITATIONS ON PAVING

3.4 TRANSPORTATION OF SGC HOT-MIX

3.4.1 Transport the SGC hot-mix in approved trucks with protective covers properly secured to the sides and back of truck box so that no funnelling air movement develops under the cover during hauling.

3.4.2 Before loading with SGC hot-mix, thoroughly clean the box of any accumulation of asphaltic material. Lubricate inside surfaces with a light coating of soap, detergent solution or an approved release agent. Petroleum derivatives are not permitted.

3.4.3 Maintain trucks clean of mud and other material that could contaminate the paving area.

3.4.4 Discharge SGC hot-mix into the paver hopper without spilling and without the truck box bearing down on the hopper.

3.4.5 If the unit for payment is tonnes, no payment will be made for SGC hot-mix tonnage unless the Engineer is provided with a copy of the corresponding asphalt mix load ticket immediately upon arrival at the site.

3.5 SPREADING

3.5.1 Placing the SGC hot-mix shall be a continuous operation with the paver moving at a uniform speed compatible with the rate of compaction rolling and SGC hot-mix mix delivery.

3.5.2 Spreading of Mix

3.5.2.1 Ensure that mix compaction temperature meets the asphalt cement manufacturer's requirements, as measured in the mat, immediately behind the paver.

3.5.2.2 Spread the SGC hot-mix uniformly in one or more lifts, or as directed by the Engineer, to depths sufficient to obtain a minimum compacted thickness of 30 mm for 10mm–LT and 10mm–HT mixes and 45 mm for 20mm-B mixes and a maximum compacted thickness of 75 mm for 10mm–LT and 10mm–HT mixes and 100 mm for 20mm-B mixes.

3.5.2.3 Excess SGC hot-mix is to be wasted. Do not pick up any SGC hot-mix materials that has been placed through a paver and put back into the paver hopper. Placing of any excess paver laid SGC hot-mix back into the paver hopper will be assessed a $500.00 penalty per occurrence, as documented by the Engineer.

3.5.3 Segregation

3.5.3.1 If segregation of mix material occurs, the Engineer will immediately suspend spreading until the cause is determined and corrected.

3.5.3.2 Prior to roller compaction, remove fat spots, sandy accumulations, high and low spots, and other irregularities and repair with SGC hot-mix. Scratch surface with rake tines to ensure bonding of added mix. Do not spread loose SGC hot-mix that has been raked off onto the mat.

3.6 HAND SPREADING

3.6.1 Hand spread SGC hot-mix in small areas not accessible to paver, and where permitted by the Engineer.

3.6.2 Do not broadcast SGC hot-mix. Hand place mix carefully to avoid the segregation of coarse and fine aggregate. Use lutes and rakes to thoroughly loosen and uniformly distribute the SGC hot-mix. Remove lumps that do not break down readily.

3.6.3 Heat hand tools to prevent asphalt sticking. Do not overheat tools to prevent damaging of the SGC hot-mix.

3.6.4 Before rolling, check surface with template or straightedge, and correct irregularities.

3.7 COMPACTION

3.7.1 Compact the SGC hot-mix mat with rollers in good working order and operated by competent operators. Use the number, type, and mass of rollers required to obtain the required compaction within the available compaction time and compatible with the rate of SGC hot-mix placement.

3.7.2 Develop and follow the best pattern of rolling to obtain the uniform compaction across the mat including joints and edges without degrading the aggregate through over compaction. Indicate the rolling pattern to the Engineer when requested.

3.7.3 Perform compaction rolling with rollers following the paver as closely as possible, until required density is obtained. Perform finish rolling to eliminate equipment marks and to create a surface with a uniform tightly knit texture.

3.7.4 Complete final rolling before the mat surface temperature reaches 40°C as determined with an infrared thermometer.

3.7.5 For small areas inaccessible to rollers, use an approved vibratory plate compactor or hand tamper to thoroughly compact the SGC hot-mix.

3.7.6 If compaction or finish rolling difficulties occur, suspend paving operations, redesign the mix and obtain Engineer's approval of a trial batch before resuming paving.

3.8 JOINTS

3.8.1 Transverse Joint

3.8.1.1 Plan length of spread to provide for a minimum 1 m offset of transverse joints in successive lifts and adjacent mats.

3.8.1.2 Transverse joints shall be straight, have a vertical face painted with tack coat before placement of the adjacent mat, be thoroughly compacted, and meet surface tolerances.

3.8.2 Longitudinal Joint

3.8.2.1 Location: Plan mat limits to ensure that surface longitudinal joints will be offset not more than 150 mm from the centre of a proposed pavement marking line between travel lanes. If permitted by the Engineer, the joint may be located at the centre of a travel lane.

3.8.2.2 Plan width of spread to provide for a minimum 150 mm offset (in a dovetail pattern) of longitudinal joints in successive lifts.

3.8.2.3 Create a longitudinal joint while the temperature at the edge of the first of two adjacent mats is above 80°C. Allow an overlap of 25 to 50 mm between mats. This may be accomplished by multiple pavers in staggered formation, or by limiting paver advance.

3.8.2.4 Do not roll the 150 mm wide strip along edge of first mat until the adjacent mat is placed. Roll the joined mat immediately to insure bonding while the mix at the joint is about 80°C.

3.8.2.5 If a hot longitudinal joint as described in 3.8.2.3 cannot be created, then carefully roll the edge of the first mat, form or cut a clean vertical face 150 mm back from the mat edge and to the full depth of the mat, and paint with tack coat before placing the adjacent mat.

3.8.2.6 Should the longitudinal joint treatment indicated in 3.8.2.5 not be performed where required, the area of asphalt pavement will be assessed a pay factor of 95 percent. This pay factor will be applied to the price of the total quantity of asphalt placed in the mat area

3.8.2.7 The finished longitudinal joint shall be thoroughly compacted and shall meet surface tolerances.

3.9 MIX PRODUCTION AND PAVING TOLERANCES

3.9.1 Aggregate Gradation Tolerance

The variation from the approved job-mix aggregate gradation shall not exceed the following limits:

Sieve Size (μm)	% Passing by Mass	
	Individual Sample	Average of Last 3 Samples
20 000	± 2.0	± 1.0
16 000	± 3.0	± 1.0
12 500	± 4.0	± 2.0
10 000	± 5.0	± 3.0
8 000	± 4.0	± 3.0
6 300	± 4.0	± 3.0
5 000	± 3.0	± 3.0
1 250	± 3.0	± 2.5
630	± 3.0	± 2.0
315	± 3.0	± 2.0
160	-3.0 to +1.0	-2.0 to +1.0
80	-2.5 to +1.0	-1.0 to +0.5

3.9.2 **Asphalt Content Field Mix Tolerance**: Allowable variation from approved design asphalt content shall be ±0.3 percent by mass of mix.

3.9.3 **Tolerance for Air Voids in Field Mix**:

Mix Type:	10mm - HT	10mm - LT	20mm - B
Air Voids, %:	4.0 ± 0.5	3.0 ± 0.5	3.5 ± 0.5

3.9.4 **Minimum Film Thickness in Field Mix**:

Mix Type:	10mm - HT	10mm - LT	20mm - B
Min Film Thickness, μm:	7.5 min.	7.5 min.	6.5 min.

3.9.5 **Voids Filled in field Mix:**

Mix Type:	10mm - HT	10mm - LT	20mm - B
Voids Filled, %:	70 - 80	73 - 85	65 - 75

3.9.6 Mixing Temperature Tolerance

The allowable variation from the design mixing temperature shall be ± 10°C.

3.9.7 3.9.7 Mixture Handling Tolerance

In accordance with Section 3.5.2.3; $500.00 penalty per documented occurrence.

3.9.8 Smoothness Tolerances

Maximum variation under 3 m straightedge as follows:

3.9.8.1 Longitudinal (in the direction of travel): 3 mm.
Transverse (across the direction of travel): 6 mm.
(straight crossfall)

3.9.8.2 Grade: ±6 mm maximum variation from designated grade elevations.

3.9.8.3 Texture: Finished surface shall be free of visible signs of poor workmanship such as, but not limited to:

- Segregation, as demonstrated through sandy spots or excessively open spots (areas of water bleeding from the mat),
- Areas exhibiting excess or insufficient asphalt cement, as demonstrate through fat spots or open textured spots,
- Improper matching of longitudinal and transverse joints,
- Dimpling, roller marks, cracking, or tearing.

If surface and grade tolerances are exceeded, or if surface texture is not met, grind down and resurface defective areas as directed by the Engineer.

3.9.9 Thickness Tolerance

3.9.9.1 Deficient Thickness: If average core thickness is deficient that area of asphalt pavement will be assessed a pay factor according to Table 02742.1 to be applied to the price of the quantity of SGC hot-mix in that mat area.

3.9.9.2 Excess Thickness: Asphalt pavement with excess thickness may be accepted with no extra payment, if surface and grade tolerances and texture are met.

TABLE 02742.1 ASPHALT THICKNESS PAY FACTORS

THICKNESS DEFICIENCY (%)	PAY FACTOR (%)
10.0	100.0
11.0	97.0
12.0	93.7
13.0	90.0
14.0	85.5
15.0	80.5
16.0	75.0
17.0	68.0
18.0	60.0
19.0	50.0
Over 19.0 %	Grind and Resurface

3.9.10 Density Tolerance

3.9.10.1 Required Density: Each mat of hot-mix placed shall be compacted to the following minimum density (Percent of Maximum Theoretical Density (MTD)) for the type of paving, or as indicated in the contract Special Provisions.

Minimum Density	Type of Paving
94%	All stages in staged paving for freeways, arterials, industrial/commercial roadways and residential collector roadways, and residential local roadways including FAC Overlays
93%	Alley paving.
93%	Rehabilitation overlay
93%	Asphalt walk/bikeway.

3.9.10.2 Deficient Density: If the average core density is below specified, the represented area of mat may be accepted subject to a pay factor according to Table 02742.2 to be applied to the price of the quantity of SGC hot-mix in that mat area.

TABLE 02742.2 ASPHALT DENSITY PAY FACTORS

Percentage of MTD 94% MTD Required	Pay Factor (%)	Percentage of MTD 93% MTD Required	Pay Factor (%)
94.0	100.0	93.0	100.0
93.9	99.9	92.9	98.4
93.8	99.8	92.8	96.8
93.7	99.6	92.7	95.2
93.6	99.4	92.6	93.9
93.5	99.1	92.5	92.0
93.4	98.7	92.4	90.4
93.3	98.3	92.3	88.8
93.2	97.8	92.2	87.3
93.1	97.2	92.1	85.7
93.0	96.5	92.0	84.1
92.9	95.8	91.9	82.5
92.8	95.0	91.8	80.9
92.7	94.2	91.7	79.3
92.6	93.3	91.6	77.7
92.5	92.3	Less than 91.5	Grind and Resurface
92.4	91.1		
92.3	89.8		
92.2	88.5		
92.1	87.1		
92.0	85.5		
91.9	83.8		
91.8	82.0		
91.7	80.0		
91.6	77.7		
Less than 91.5	Grind and Resurface		

3.9.11 APA Tolerance (Where Required)

3.9.11.1 Maximum APA rutting: If average core APA rutting is above 5.0 mm for 10mm-HT and 20mm–B and 7.0 mm for 10mm-LT, that area of asphalt pavement will be assessed a pay factor according to Table 02742.3 to be applied to the price of the quantity of SGC hot-mix in that mat area.

TABLE 02742.3 APA RUTTING PAY FACTORS

10mm - HT & 20mm - B, APA RUTTING MEASUREMENT (mm)	10 mm - LT, APA RUTTING MEASUREMENT (mm)	PAY FACTOR (%)
5.0	7.0	100.0
5.2	7.2	95.0
5.4	7.4	90.0
5.6	7.6	85.0
5.8	7.8	80.0
6.0	8.0	75.0
6.2	8.2	70.0
6.4	8.4	65.0
6.6	8.6	60.0
6.8	8.8	55.0
Over 7.0 mm	Over 9.0 mm	Grind and Resurface

3.9.12 Asphalt Cement Content Tolerance

3.9.12.1 The allowable variation from the approved design asphalt content shall be ± 0.30 Percent by mass of mix.

3.9.12.2 Deficient Asphalt Cement Content: If the asphalt cement content, as determined by ESS indicates low or high asphalt cement content, the represented area of mat may be accepted subject to a pay factor according to Table 02742.4 and is to be applied to the unit price of the 250 tonnes or equivalent area of hot-mix in the mat.

TABLE 02742.4 ASPHALT CEMENT CONTENT PAY FACTOR

ESS Asphalt Cement Content (%)	PAY FACTOR (%)
± 0.00 – 0.30	100.0
± 0.31 - 0.35	94.0
± 0.36 – 0.40	90.0
± 0.41 – 0.45	86.0
± 0.46 –0.50	78.0
± 0.51	Grind and Resurface

3.9.12.3 Asphalt Cement Content Appeal Mechanism (Capital Projects)

In the event of a Deficient Asphalt Cement Content result the following Asphalt Cement Content Appeal Mechanism will be allowed by the City of Edmonton:

3.9.12.3.1 The original core location shall be confirmed by the ESS;

3.9.12.3.2 The ESS will then re-core for determination of asphalt cement content. The re-coring (which may require multiple cores to obtain the required quantity of materials for a re-test) will be taken from the mat representing the original test within 10 meters on either side of the original test location. Only a single test is required for verification process. All core holes to be filled with hot-mix asphalt, by the Contractor, to the satisfaction of the Engineer.

3.9.12.3.3 The asphalt cement content test result from the re-core will supersede the original QA result**.**

3.9.12.3.4 If the asphalt cement content of the re-core is within the penalty range the penalty will be calculated in accordance with TABLE 02741.3 ASPHALT CEMENT PAY FACTORS for the quantity of asphalt represented by the test. No further re-coring is allowed.

3.9.12.3.5 If the asphalt cement content of the re-core is in the "remove and replace" range, additional cores will be taken at equal distances on either side of the original core and tested for asphalt cement content. This process is to be repeated until locations on either side of the re-core identify asphalt within specification. The spacing is at the discretion of the contractor.

3.9.12.3.6 Once the area of asphalt to be removed and replaced" is identified, the area inclusive of the last core used to delineate the deficient area shall be removed and replaced to the satisfaction of the Engineer.

3.9.12.4 Asphalt Cement Content Appeal Mechanism (Private Development):

In the event of a Deficient Asphalt Cement Content result the following Asphalt Cement Content Appeal Mechanism will be allowed by the City of Edmonton and shall be paid for by the Contractor:

3.9.12.4.1 The original core location shall be confirmed by Engineer, the Quality Assurance agency and the City Inspector;

3.9.12.4.2 The Contractor will then be allowed to re-core for determination of asphalt cement content. The re-coring (which may require multiple cores to obtain the required quantity of materials for a re-test) will be taken from the mat representing the original test within 10 meters on either side of the original test location. Only a single test is required for verification process. All core holes to be filled with hot-mix asphalt, by the contractor, to the satisfaction of the Engineer.

3.9.12.4.3 The asphalt cement content test result from the re-core, along with the original test result, shall be submitted to the City of Edmonton for review. The result from the asphalt cement content test from the re-core will supersede the original QA result**.**

3.9.12.4.4 If the asphalt cement content of the re-core is within the penalty range the penalty will be calculated in accordance with TABLE 02741.3 ASPHALT CEMENT PAY FACTORS for the quantity of asphalt represented by the test. No further re-coring is allowed.

3.9.12.4.5 If the asphalt cement content of the re-core is in the "remove and replace" range, additional cores will be taken at equal distances on either side of the original core and tested for asphalt cement content. This process is to be repeated until locations on either side of the re-core identify asphalt within specification. The spacing is at the discretion of the contractor.

3.9.12.4.6 Once the area of asphalt to be removed and replaced" is identified, the area inclusive of the last core used to delineate the deficient area shall be removed and replaced to the satisfaction of the Engineer.

3.9.13 TSR Tolerance

3.9.13.1 Deficient TSR (Capitol Program): If the TSR result, as determined by ESS, of field samples is below 80.0 percent (for laboratory prepared samples of field mix), the following actions will be taken by ESS:

- First occurrence; the contractor will receive a warning letter from the ESS indicating the deficient TSR value.
- Second consecutive occurrence; In the event of a second consecutive low TSR value below 80.0 percent the contractor will have their production suspended until it can provide acceptable TSR test results to the ESS. During this period of time the Contractor, the Engineer, and ESS will meet to determine the impact of the non-compliance, and specify the necessary remedial action to be taken by the Contractor. Remedial action shall be either acceptance, acceptance at a pay adjustment as detailed in the following table 02742.5, or removal and replacement at no cost to the City. If suspended, the paving program shall only continue upon approval by ESS.

TABLE 02742.5 TSR PAY FACTORS

Percentage of TSR	Pay Factor (%)
80.0 or higher	100.0
78.0 to 79.9	99.0
76.0 to 77.9	97.0
74.0 to 75.9	95.0
72.0 to 73.9	92.0
70.0 to 71.9	89.0
68.0 to 69.9	85.0
66.0 to 67.9	81.0
64.0 to 65.9	76.0
62.0 to 63.9	71.0
60.0 to 61.9	65.0
Less than 59.9	Grind and resurface

3.10 CLEANUP

3.10.1 Leave site clean and free of debris and surplus materials.

3.10.2 Opening to Traffic: Open new SGC hot-mix pavement to traffic when the surface has cooled to ambient temperature or when authorized by the Engineer. Remove barricades and signs when no longer needed.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Supply and placement of Stone Mastic Asphalt (SMA) concrete for roadway paving.

1.2 RELATED SECTIONS

1.2.1 Section 02067 – Stone Mastic Asphalt Concrete

1.2.2 Section 02961 - Pavement Cold Milling

1.2.3 Section 02963 - Liquid Asphalt Coats

1.3 DEFINITIONS

1.3.1 **Overlay:** paving over an existing pavement for rehabilitation purposes and not as part of staged paving.

1.3.2 **Staged Paving:** paving where a lift or lifts that form part of the total pavement structure are deferred to a future date.

1.3.3 **SGC Density:** The SHRP Gyratory Compactor (SGC) shall be used to prepare formed specimens at N_{Design} of 100. The SGC formed specimens shall be used for the determination of volumetric properties on a field produced mix as outlined in the Asphalt Institute SP-2 Manual.

1.4 QUALITY ASSURANCE

1.4.1 Thickness Cores

At the Engineer's request, the quality assurance laboratory will take one or more sets of cores from SMA pavement suspected to be deficient in total thickness, each set comprising 3 cores whose average thickness represents an area of not more than 1 000 m^2 of SMA pavement.

1.4.2 Asphalt Cement Content and Density Specimen Sampling and Testing

The quality assurance laboratory will:

1.4.2.1 Determine the Maximum Theoretical Density (MTD) and asphalt cement content of SMA at a minimum frequency of one test for every 250 tonnes of SMA produced, or a day's production, whichever is less.

1.4.2.2 Obtain two sets of cores from compacted mat placed from same load of SMA from which SGC specimens were obtained, or from suspect compacted mat, and test one set for density and the second set for rut testing (APA).

1.4.2.3 Obtain one core from compacted mat placed representing 1,000 $m^{2,}$ and test for density.

1.4.2.4 Basis of Acceptance: Pavement compaction will be accepted on the basis of the ratio (in percent) of the core density to the Maximum Theoretical Density (MTD). If cores were taken from a mat where no MTD are available, acceptance will be based on the ratio of core density to the average MTD for that day’s production.

1.4.2.5 Representative Cores: A single core is initially taken representing the quantity of SMA in not more than 1 000 m^2 of mat, with a minimum of one core taken from a day's production. If the initial core density is below specified, that initial density is discarded, and 3 new cores will be taken within 10 m of the original core location at a minimum spacing of 2.5 m between cores. The average density of the 3 new cores represents that area.

1.4.3 Rutting Susceptibility Specimen Sampling and Testing

The quality assurance laboratory will:

1.4.3.1 Determine the rutting susceptibility of SMA on SGC specimens at a minimum frequency of one test for every 500 t of SMA produced, or a day's production, whichever is less by subjecting the SMA SGC specimens to the Asphalt Pavement Analyzer (APA) procedure. APA testing will be carried out by the City of Edmonton Quality Assurance laboratory or conversely the contractor may use an independent laboratory to perform APA testing. The APA device must meet the requirements of AASHTO TP63-03 and must be equipped with an automatic rut measurement system. The APA device must be calibrated at least once per year according to the procedures in the test method. In addition, the load cell used for checking wheel loads shall be calibrated at least once per year. Each test shall have 6 cylindrical samples fabricated and tested with the interior temperature of the APA set at 52^{o} C. The downward force shall be set at 45 Kg and the hoses shall be pressurized to 689 kPa. Each specimen shall be compacted so that 7+/- 0.5 percent air voids are achieved. The APA rut test results shall be provided to the nearest 0.1 mm. The average rut depth for the specimens tested shall not exceed 5.0mm

1.4.3.2 Determine the rutting susceptibility of SMA Field core Specimens taken at the location of the SGC samples by subjecting the SMA Field core specimens to the Asphalt Pavement Analyzer (APA) procedure as described in the above section. The average rut depth for the specimens tested shall not exceed 5.0mm. If the initial APA rutting is above specified, that initial APA result is discarded, and 3 new cores will be taken within 10 m of the original core location at a minimum spacing of 2.5 m between cores. The average APA result of the 3 new cores will be taken as to represent that area.

1.4.4 Tensile Strength Ratio (TSR) Specimen Sampling and Testing

The quality assurance laboratory will:

1.4.4.1 Determine the TSR of SMA Field Specimens at a minimum frequency of one test for every 1,000 t of SMA produced, or a day's production, whichever is less in accordance with AASHTO T283. The TSR must Exceed 75%

2. PRODUCTS

2.1 MATERIALS

2.1.1 Stone Mastic Asphalt Concrete

To Section 02067 – Stone Mastic Asphalt Concrete.

2.1.2 Tack Coat

2.1.3 To Section 02963 - Liquid Asphalt Coats

2.2 EQUIPMENT

2.2.1 Trucks for Transporting Mix:

Trucks shall be compatible with size and capacity of the paver; with clean, tight, smooth-sided boxes equipped with waterproof tarpaulins of sufficient size to securely cover all material when boxes are fully loaded. The side of the truck box shall have a 12-mm diameter hole 300 mm from bottom for checking mix temperature. Use only approved release agents, such as water based liquid soap or dry soap powder and drain all excess release agents from truck beds.

2.2.2 Paver

Pavers shall be self-propelled; with automatic screed controls to maintain grade from a reference stringline or ski and to control crossfall, smoothness and joint matching; with vibratory screed equipped with vibratory extensions and augers capable of uniformly spreading the mixture to specified widths and depths without segregation or tearing. Follow the manufacturer's recommended operating procedures.

2.2.3 Rollers

Shall be self-propelled, reversible; static, oscillating or vibratory steel-drum rollers; with wetting and scraping devices to prevent adhesion of mix to drums or tires (petroleum derivatives are not permitted for cleaning); capable of attaining required density and smoothness. Follow the manufacturer's recommended operating procedures. Pneumatic-tired rollers are not to be used on SMA. .

2.2.4 Hand Tools

Rakes, lutes, tampers, straightedges, levels, and other hand tools as necessary to complete the work shall be available.

3. EXECUTION

3.1 GOOD PAVING PRACTICE

3.1.1 Production, Placement, Compaction and Quality Assurance of the SMA mix should be pursuant to the requirements of Chapter Three "Construction Procedures" as outlined in National Asphalt Paving Association's QIP-122 booklet entitled "Designing and Constructing SMA Mixtures, State-of the Practice".

3.1.2 Refer to the latest edition of the "*Construction of Hot Mix Asphalt Pavements"*, Asphalt Institute Manual Series No. 22 (MS-22), for guidance in good paving practice insofar as consistent with this Section.

3.1.3 Provide an experienced foreman who shall be in full time attendance on the paving site to take charge of the entire paving operation from transporting of the mix to final rolling.

3.1.4 **Test Strips and JMF Adjustment.** Do not begin full production of the SMA until receiving authorization from the Engineer. This authorization will be based on the successful construction of one or more test strips. Test strips will consist of 100 - 150 tons of SMA produced and placed in accordance with these specifications. No further SMA production will occur that day unless another test strip is needed. A test strip will consist of a full roadway width and be consistent with the contractor's proposed laydown procedure. Test strips are incidental to the pay item. During the construction of a test strip, perform 1 set of quality control tests as described above and obtain and test 3 random cores of the compacted pavement. Within 1 working day after a test strip is completed, the Engineer, the Quality Control Laboratory and the Contractor will determine if any changes in the SMA JMF, production, or placement procedures are needed. If there is a redesign of the JMF another test strip may be required. The Quality Control Laboratory will notify the Engineer of any JMF adjustments. Do not start production until notified by the Engineer.

3.2 PREPARATION

3.2.1 The Engineer will inspect the existing pavement, base or subbase before SMA paving. The Contractor shall repair imperfections and clean up as directed by the Engineer. Surface shall be true to line and grade within tolerance, firm, dry and free of loose and deleterious material.

3.2.2 Catch basins, manholes, water valves, and other fixtures shall be brought to proper grade before the final lift. Provide temporary protection where necessary until completion of paving.

3.2.3 Multiple Lift Paving

Apply tack coat to the previous lift before placing a lift, unless permitted otherwise by the Engineer. Clean surface before tacking.

3.2.4 Preparation for Overlay or for Succeeding Stage Paving

3.2.4.1 Sweeping and Cleaning: Sweep the existing pavement surface with an approved mechanical sweeper. Remove all residual debris and accumulations of deleterious material.

3.2.4.2 Surface Milling: If specified, grind the existing surface to specified depth according to Section 02961 - Pavement Cold Milling

3.2.4.3 Tack Coat: When the existing surface has passed inspection by the Engineer, apply tack coat to Section 02963 - Liquid Asphalt Coats.

3.2.4.4 Apply tack coat to surfaces intended to be in contact with SMA, including the sides of gutters, catch basins, manholes, and other concrete and metal fixtures. Before placing SMA, let tack coat completely cure and have tacked surfaces inspected by the Engineer

3.2.4.5 Asphalt Levelling Course: The Engineer will designate those areas having 25 mm or greater depressions for levelling course application. Spread the levelling course of SMA with a paver one lift at a time, not exceeding 75 mm compacted thickness, and compact to required density.

3.3 WEATHER LIMITATIONS

- No paving is permitted when rain or snow is imminent, or when the surface or base to be paved is wet, icy, snow-covered or frozen, unless waived by the Engineer.

- No paving is permitted when air temperature and wind speed conditions are below the applicable mat curve in Chart 02742.1, unless waived by the Engineer.

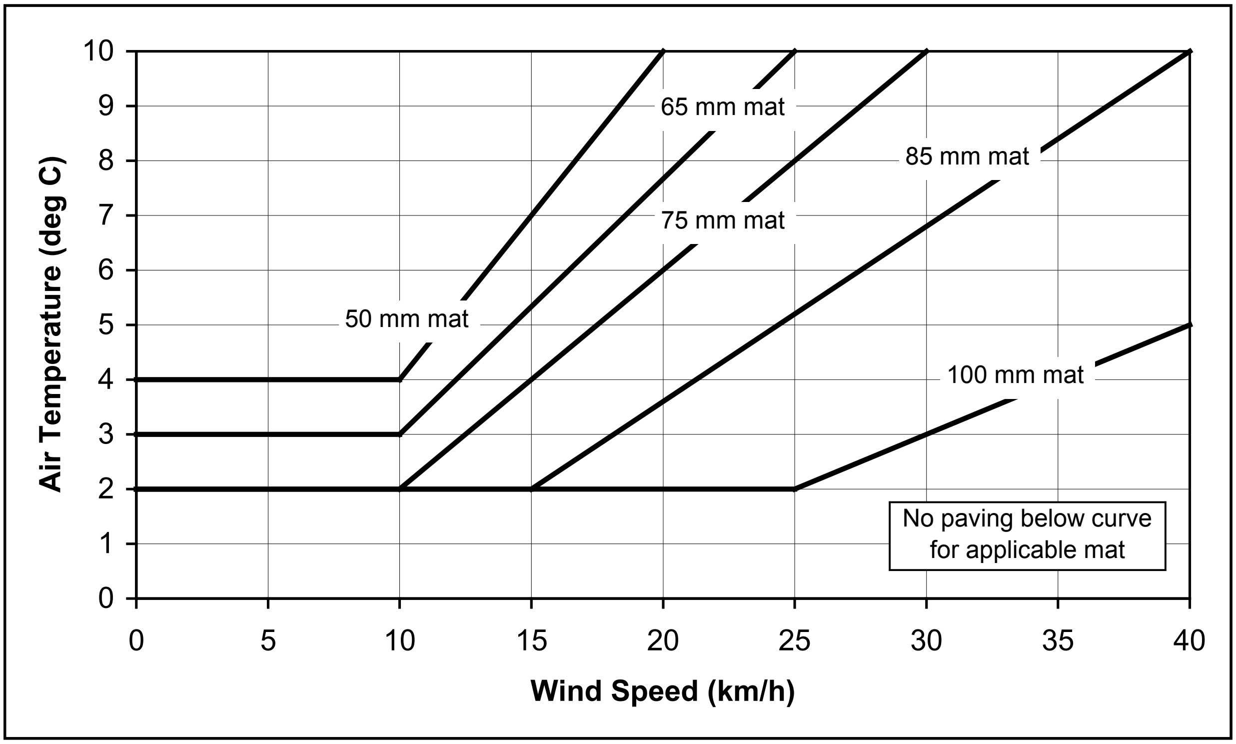


CHART 02743.1: AIR TEMPERATURE AND WIND LIMITATIONS ON PAVING

3.4 TRANSPORTATION OF SMA

3.4.1 Transport the SMA in approved trucks with protective covers properly secured to the sides and back of truck box so that no funneling air movement develops under the cover during hauling.

3.4.2 Before loading with SMA, thoroughly clean the box of any accumulation of asphaltic material. Lubricate inside surfaces with a light coating of soap or detergent solution. Petroleum derivatives are not permitted.

3.4.3 Maintain trucks clean of mud and other material that could contaminate the paving area.

3.4.4 Discharge SMA into the paver hopper without spilling and without the truck box bearing down on the hopper.

3.4.5 If the unit for payment is tonnes, no payment will be made for SMA tonnage unless the Engineer is provided with a copy of the corresponding asphalt mix load ticket immediately upon arrival at the site.

3.5 SPREADING

3.5.1 Placing the SMA shall be a continuous operation with the paver moving at a uniform speed compatible with the rate of compaction rolling and SMA mix delivery.

3.5.2 **Spreading Temperature of Mix**
Ensure that mix temperature meets the PMA binder manufacturer's requirements.

3.5.3 Segregation

If segregation of mix material occurs, the Engineer will immediately suspend spreading until the cause is determined and corrected.

3.5.4 Prior to roller compaction, remove fat spots, sandy accumulations, high and low spots, and other irregularities and repair with SMA. Scratch surface with rake tynes to ensure bonding of added mix. Do not spread loose SMA that has been raked off onto the mat.

3.6 HAND SPREADING

3.6.1.1 Hand spread SMA in small areas not accessible to paver, and where permitted by the Engineer.

3.6.1.2 Do not broadcast SMA. Hand place carefully to avoid segregation of coarse and fine aggregate. Use lutes and rakes to thoroughly loosen and uniformly distribute the SMA. Remove lumps that do not break down readily.

3.6.1.3 Heat hand tools to prevent asphalt sticking. Do not overheat tools to prevent damaging of the SMA.

3.6.1.4 Before rolling, check surface with template or straightedge, and correct irregularities.

3.7 COMPACTION

3.7.1 Compact the asphalt mat with rollers in good working order and operated by competent operators. Use the number, type and mass of rollers required to obtain the required compaction within the available compaction time and compatible with the rate of hot-mix placement.

3.7.2 Develop and follow the best pattern of rolling to obtain the most uniform compaction across the mat including joints and edges without degrading the aggregate through over compaction. Indicate the rolling pattern to the Engineer when requested.

3.7.3 Perform compaction rolling with rollers following the paver as closely as possible, until required density is obtained. Perform finish rolling to eliminate equipment marks and to create a surface with a uniform tightly knit texture.

3.7.4 Complete final rolling before the mat temperature reaches 90°C.

3.7.5 For small areas inaccessible to rollers, use an approved vibratory plate compactor or hand tamper to thoroughly compact the SMA.

3.7.6 If compaction or finish rolling difficulties occur, suspend paving operations, redesign the mix and obtain Engineer's approval of a trial batch before resuming paving.

3.8 JOINTS

3.8.1 Transverse Joint

3.8.1.1 Plan length of spread to provide for a minimum 1 m offset of transverse joints in successive lifts and adjacent mats.

3.8.1.2 Transverse joints shall be straight, have a vertical face painted with tack coat before placement of the adjacent mat, be thoroughly compacted, and meet surface tolerances.

3.8.2 Longitudinal Joint

3.8.2.1 Location: Plan mat limits to ensure that surface longitudinal joints will be offset not more than 150 mm from the centre of a proposed pavement marking line between travel lanes. If permitted by the Engineer, the joint may be located at the centre of a travel lane.

3.8.2.2 Plan width of spread to provide for a minimum 150 mm offset (in a dovetail pattern) of longitudinal joints in successive lifts.

3.8.2.3 Create a longitudinal joint while the temperature at the edge of the first of two adjacent mats is above 100 °C. Allow an overlap of 25 to 50 mm between mats. This may be accomplished by multiple pavers in staggered formation, or by limiting paver advance. Allow an overlap of 25 to 50 mm between mats

3.8.2.4 Do not roll the narrow strip along edge of first mat until the adjacent mat is placed. Roll the joined mat immediately to insure bonding while the mix is still hot.

3.8.2.5 If a hot longitudinal joint as described in 3.8.2.3 can not be created, then carefully roll the edge of the first mat, form or cut a clean vertical face to full depth of the mat, and paint with tack coat before placing the adjacent mat.

3.8.2.6 The finished longitudinal joint shall be thoroughly compacted and shall meet surface tolerances.

3.9 FIELD QUALITY CONTROL

3.9.1 Smoothness Tolerances

Maximum variation under 3 m straightedge as follows:

3.9.1.1 Longitudinal (in the direction of travel): 3 mm.
Transverse (across the direction of travel): 6 mm.
(straight crossfall)

3.9.1.2 Grade: ±6 mm maximum variation from designated grade elevations.

3.9.1.3 Texture: Finished surface shall be free of visible signs of poor workmanship such as, but not limited to:

- Segregation, as demonstrated through sandy spots or excessively open spots (areas of water bleeding from the mat),
- Areas exhibiting excess or insufficient PMA Binder, as demonstrate through Fat spots or open textured spots,
- Improper matching of longitudinal and transverse joints,
- Dimpling, roller marks, cracking, or tearing.

If surface and grade tolerances are exceeded, or if surface texture is not met, grind down and resurface defective areas as directed by the Engineer.

3.9.2 Thickness Tolerance

3.9.2.1 Deficient Thickness: If average core thickness is deficient that area of asphalt pavement will be assessed a pay factor according to Table 02743.1 to be applied to the price of the quantity of SMA in that mat area.

3.9.2.2 Excess Thickness: Asphalt pavement with excess thickness may be accepted with no extra payment, if surface and grade tolerances and texture are met.

TABLE 02743.1 ASPHALT THICKNESS PAY FACTORS

THICKNESS DEFICIENCY (%)	PAY FACTOR (%)
10.0	100.0
11.0	97.0
12.0	93.7
13.0	90.0
14.0	85.5
15.0	80.5
16.0	75.0
17.0	68.0
18.0	60.0
19.0	50.0
Over 19.0 %	Grind and resurface

3.9.3 Density Tolerance

3.9.3.1 Required Density: Each mat of SMA placed shall be compacted to 94% of MTD.

3.9.3.2 Deficient Density: If the average core density is below specified, the represented area of mat may be accepted subject to a pay factor according to Table 02743.2 to be applied to the price of the quantity of SMA in that mat area.

TABLE 02743.2 ASPHALT DENSITY PAY FACTORS

Percentage of MTD	Pay Factor (%)
94.0	100.0
93.9	99.9
93.8	99.8
93.7	99.6
93.6	99.4
93.5	99.1
93.4	98.7
93.3	98.3
93.2	97.8
93.1	97.2
93.0	96.5
92.9	95.8
92.8	95.0
92.7	94.2
92.6	93.3
92.5	92.3
92.4	91.1
92.3	89.8
92.2	88.5
92.1	87.1
92.0	85.5
91.9	83.8
91.8	82.0
91.7	80.0
91.6	77.7
Less than 91.5	REJECT

3.9.4 APA Tolerance

3.9.4.1 Maximum APA rutting: If average core APA rutting is above 5.0mm that area of asphalt pavement will be assessed a pay factor according to Table 02743.3 to be applied to the price of the quantity of SMA in that mat area.

TABLE 02743.3 ASPHALT APA RUTTING PAY FACTORS

APA RUTTING MEASUREMENT (mm)	PAY FACTOR (%)
5.0	100.0
5.2	95.0
5.4	90.0
5.6	85.0
5.8	80.0
6.0	75.0
6.2	70.0
6.4	65.0
6.6	60.0
6.8	55.0
Over 7.0 mm	Grind and resurface

3.9.5 Asphalt Cement Content Tolerance

3.9.5.1 Deficient Asphalt Cement Content: If the asphalt cement content as determined by the Quality Assurance agency indicates low or high asphalt cement content, the represented area of mat may be accepted subject to a pay factor according to Table 02743.4 to be applied to the unit price of the 250 tonnes or equivalent area of hot-mix in the mat.

TABLE 02743.4 ASPHALT CEMENT PAY FACTORS

Quality Assurance Asphalt Cement Content (%)	PAY FACTOR (%)
± 0.0 – 0.20	100.0
± 0.21 - 0.25	98.0
± 0.26 – 0.30	94.0
± 0.31 - 0.35	90.0
± 0.36 – 0.40	86.0
± 0.41 – 0.45	82.0
± 0.46 – 0.50	78.0
± 0.51	Reject

3.10 CLEANUP

3.10.1 Leave site clean and free of debris and surplus materials.

3.10.2 Opening to Traffic: Open new pavement to traffic when the surface has cooled to ambient temperature and when authorized by the Engineer. Remove barricades and signs when no longer needed.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

Construction of one-course nonreinforced Portland cement concrete pavement for streets and alleys.

1.2 RELATED SECTIONS

Aggregate	Section 02060
Portland Cement Concrete	Section 03055
Concrete for Roadways	Section 03060
Concrete Forms and Accessories	Section 03100
Reinforcing Steel	Section 03210

1.3 QUALITY ASSURANCE

1.3.1 The quality assurance laboratory will conduct slump, air content, nuclear density tests, air-void examination, strength tests and acceptance criteria to Section 02060 - Aggregate and Section 03055 - Portland Cement Concrete.

1.3.2 **Thickness**
At the City's request, the quality assurance laboratory will take one or more sets of cores from suspect concrete pavement, each set comprising 3 cores whose average thickness represents not more than 500 m^2 of concrete pavement.

2. PRODUCTS

2.1 MATERIALS

2.1.1 Concrete Class A to Section 02060 - Aggregate and Section 03055 - Portland Cement Concrete.

2.1.2 Tie bars, reinforcement if required, joint sealant, preformed joint filler, curing compound to Section 03210 - Reinforcing Steel.

2.1.3 Granular backfill to Section 02060 - Aggregate, Designation 3 class 20A.

2.2 EQUIPMENT

Slipform Paver: To Section 03100 - Concrete Forms and Accessories; equipped with adequate internal vibrators to consolidate concrete to full depth and width of slab; adjustable to crown and crossfall; subject to the approval of the Engineer.

3. EXECUTION

3.1 PREPARATION

3.1.1 The prepared subgrade or sub-base shall be inspected by the City prior to placing concrete.

3.1.2 Repair and retest disturbed subgrade or sub-base and remove debris and loose material from the surface.

3.2 SLIPFORMING

3.2.1 Slipform concrete to Section 03100 - Concrete Forms and Accessories and as supplemented below.

3.2.2 Remove excess mortar that may accumulate on a slipformed vertical edge.

3.2.3 If slab edge sags, repair immediately by hand forming; do not use concrete mortar to top off the sag. If edge sagging persists, suspend operations and perform corrective measures.

3.3 HAND FORMING AND PLACING CONCRETE

3.3.1 On areas impractical for slipforming, place forms, reinforcement if required and concrete to Section 03055 - Portland Cement Concrete, Section 03060 - Concrete for Roadways, Section 03100 - Concrete Forms and Accessories and Section 03210 - Reinforcing Steel and as supplemented below.

3.3.2 Place concrete continuously until the scheduled pour is complete. Arrange the rate of concrete delivery to ensure that the discharge interval between successive loads does not exceed 30 minutes. If the discharge interval is exceeded, place a construction joint.

3.4 FINISHING

3.4.1 Finish concrete to Section 03055 - Portland Cement Concrete and Section 03060 - Concrete for Roadways. Apply a burlap final finish.

3.4.2 Continually check the plastic concrete surface to ensure that surface and grade tolerances are met. Immediately correct excessive variations.

3.5 JOINTS

3.5.1 Crack-Control Joints

Sawcut, to Section 03060 - Concrete for Roadways, at a 6 m maximum spacing, to the width and depth detailed on the drawings.

3.5.2 Isolation and Construction Joints

To Section 03060 - Concrete for Roadways.

3.6 PROTECTION AND CURING

Protect and cure concrete to Section 03060 - Concrete for Roadways.

3.7 BACKFILL ALONG ALLEY EDGES

3.7.1 Backfill areas between alley pavement and parking lots or driveways with specified granular material compacted to a minimum of 97% of maximum density according to ASTM D698 Method A.

3.7.2 Backfill other areas along alley edges with 150 mm of lightly tamped topsoil shaped to match adjacent landscaped areas.

3.8 SITE QUALITY CONTROL

3.8.1 Surface Tolerance

Maximum variation under a 3 m straightedge:

Mainline parallel to direction of travel:	3 mm
Transverse to direction of travel and at intersections and ramps:	6 mm

3.8.2 Grade Tolerance

Maximum variation from designated grade elevations:	±3 mm

3.8.3 Correction of Hardened Surface

The following techniques shall be used to correct excessive variations from flatness or grade once the concrete has set.

3.8.3.1 Areas higher than the designated grade from 3 mm to 15 mm: Grind down with an approved machine to within tolerance and not to a polished surface but to a texture as close as possible to a burlap finish.

3.8.3.2 Areas exceeding 3 mm below, or exceeding 15 mm above, the designated grade: Remove and replace pavement to the full width between longitudinal joints and not less than 1.5 m in length. If the area extends to within 1.5 m of a transverse joint, replace the pavement to that joint.

3.8.4 Deficient Thickness

If the average core thickness is deficient, that area of concrete pavement will be assessed a pay factor according to Table 02751.1.

Table 02751.1 Concrete Pavement Thickness Pay Factors

THICKNESS DEFICIENCY (mm)	PAY FACTOR (% of Contract Price)
3	100.0
4	99.5
5	98.6
6	97.4
7	95.6
8	93.2
9	90.0
10	85.5
11	80.5
12	75.0
13	68.0
14	60.0
15	50.0
Over 15	Remove and Replace

3.8.5 Excess Thickness

Concrete pavement with excess thickness may be accepted if surface and grade tolerances are met, but no claim for additional payment will be accepted.

3.9 REJECTED CONCRETE PAVEMENT

Remove and replace rejected concrete pavement by full slabs between transverse and longitudinal joints.

3.10 OPENING TO TRAFFIC

3.10.1 Do not open new pavement to vehicular traffic until cylinder testing has confirmed that the concrete has attained 75% of the specified strength, or until directed by the City.

3.10.2 When opening the new pavement to traffic, leave the pavement clean and free of debris and remove signs and barricades no longer required.

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Production of roller-compacted concrete (RCC) and construction of RCC pavement for roadways, with or without asphalt surfacing.

1.2 RELATED SECTIONS

1.2.1 Section 02060 – Aggregate.

1.2.2 Section 02342 – Cement-Stabilized Subgrade.

1.2.3 Section 02722 – Granular Base Courses.

1.2.4 Section 02066 – SGC Hot-Mix Asphalt

1.2.5 Section 02742 – SGC Hot-Mix Asphalt Paving.

1.2.6 Section 02963 – Liquid Asphalt Coats.

1.3 SUBMITTALS

1.3.1 Mix Design

1.3.1.1 Submit to the Engineering Services Section (ESS), a RCC mix design performed by a qualified laboratory at least 14 days before the initial RCC work and when there is a change in materials, sources or proportions.

1.3.1.2 If requested, provide evidence that the proportions in the mix design will produce RCC of the quality specified. Include strength tests on trial mixes made under plant conditions.

1.3.2 Optional Coring Test Results

Optional coring test results shall be submitted to the Engineer with a copy sent to the Engineering Services Section.

1.3.3 Job-Mix Formula

Submit to ESS, at least seven days before production, the proportions of materials and plant settings, based on the approved mix design.

1.4 QUALITY ASSURANCE

1.4.1 ESS will conduct the plant checks, sampling and testing described in the following paragraphs.

1.4.2 Plant Check

1.4.2.1 RCC plant inspections will be conducted at random to check the settings, operation, materials and mixtures produced. The Engineer will order the plant shut down if deficiencies are found, such as deviation from the approved job-mix formula, segregation in the mix, or inconsistent plant operation.

1.4.3 RCC Unit Area and Cores

1.4.3.1 RCC pavement will be accepted or rejected, based on a unit area of 1,000 sq. m. or less. The unit area is represented by three cores taken according to A23.2M-14C when the RCC is 28 days old. The cores will be measured for thickness and tested for compressive strength.

1.4.3.2 Fill the core holes with Portland cement mortar as directed.

1.4.4 Thickness

1.4.4.1 Required Thickness: The average thickness of the three cores, taken for a unit area of RCC, shall equal the specified thickness.

1.4.4.2 Deficient Thickness: A unit area of RCC, represented by a deficient thickness, will be assessed a pay factor according to Table 02757.1.

1.4.4.3 Excessive Thickness: A unit area of RCC, with excessive thickness, may be accepted if surface and grade tolerances are met, but without extra payment.

1.4.5 Compressive Strength

1.4.5.1 Procedure: The 28-day cores will be tested for compressive strength according to CAN/CSA-A23.2 - 9C (current edition). Additional cores may be taken if necessary for a 7-day strength test.

1.4.5.2 Required Strength: The average compressive strength of three, 28-day cores, taken for a unit area of RCC, shall not be less than 85% of the specified 28-day strength, with no single core strength below 75% of specified strength.

1.4.5.3 Deficient Strength: A unit area of RCC, represented by a deficient strength, may be accepted subject to a pay factor according to Table 02757.2. If strength deficiencies persist, the Engineer will also require changes to mix proportions for the remainder of the work. The Contractor is responsible for taking corrective actions in the mix production and placement operations.

1.4.5.4 Optional Coring by the Contractor: The Contractor has the option, at his expense, to show evidence of strength by coring and testing according to CAN/CSA-A23.1-14C (current edition), performed by a qualified laboratory within seven days after the failed 28-day core test. Three cores shall be drilled from the RCC unit area represented by a failed core strength test. If the average strength of the three new cores is equal to 85% of the specified strength and on one core is less than 75% of the specified strength, then the specified strength will be considered met. Otherwise, the RCC will be subject to a pay factor as stated in Table 02757.2 on the basis of the original core strength test.

2. PRODUCTS

2.1 MATERIALS FOR RCC

2.1.1 Portland Cement

To CSA-A3000, A5, Type GU General Use Portland Cement. Submit to the Material Engineering Section, the cement manufacturer's mill test reports monthly or as requested by the Engineer.

2.1.2 Fly Ash

To CAN/CSA-A3000, A3001-03 pozzolan type C. Submit to the Materials Engineering Section, physical test reports monthly or as requested by the Engineer.

2.1.3 Water

To Clause 4.2.2, CAN/CSA-A23.1 (current edition), clear, free from injurious amounts of oil, acid, alkali, organic matter, sediment, or other substance harmful to the mixing and curing of RCC.

2.1.4 Aggregates

Normal-density, coarse and fine aggregates, conforming to Clause 5, CAN/CSA-A23.1 (current edition), modified as follows:

2.1.4.1 Combined Grading: Conforming to Section 02060, Designation 1, Class 20.

2.1.4.2 Gradation Tolerances: Gradation of the aggregate used in the mix shall match the gradation of samples furnished for the mix design within the following tolerances:

Sieves (μm)	Tolerance (±% Points)
12,500; 10,000	5
5,000; 1,250; 630	4
315; 160	3
80	2

2.1.4.3 Crushed Faces: Not less than 50%, by mass of the aggregate portion larger than 5,000 mm to have at least two crushed faces.

2.1.4.4 Particle Shape: Flat particles (length to thickness ratio >5) and elongated particles (length to width ratio >5) not to exceed 15% by mass, of the aggregate portion larger than 5,000 mm, as determined according to A23.2-13A (current edition).

2.1.5 Curing Compound

2.1.5.1 RCC without Asphalt Surfacing: white pigmented, liquid, membrane-forming compound conforming to ASTM C309, Type 1.

2.1.5.2 RCC with Asphalt Surfacing or with Deferred Asphalt Surfacing: SS-1, emulsified asphalt conforming to Section 02963.

2.2 EQUIPMENT

2.2.1 Mixing Plant

A central batch concrete plant or a continuous flow mobile concrete plant with a twin shaft pugmill mixer, capable of continuous or batch mixing; equipped with synchronized metering devices and feeders to maintain the correct proportions of aggregate, cement and water; and capable of producing a uniform mixture. The pugmill shall be equipped with a discharge hopper having the capacity of at least one tonne. The discharge hopper shall be equipped with dump gates to ensure rapid and complete discharge without segregation.

2.2.2 Paver

An asphalt type paver modified or equipped with dual tamping bars and vibrating screed, capable of laying down the RCC mix to at least 90% of required density. The paver shall be of suitable weight and stability to spread and finish the concrete without segregation to the required thickness, smoothness, surface texture, cross-section, and grade; subject to approval by the Engineer.

2.2.3 Compaction Rollers

Self-propelled steel drum rollers of the 9-tonne to 18-tonne class, capable of vibratory, primary compaction; self-propelled steel drum or rubber-tired rollers of the 18-tonne class, for static finish rolling; and suitable vibratory compaction equipment of adequate mass for areas inaccessible to the large rollers.

2.3 MIX DESIGNS

2.3.1 Cement Content

A minimum of 13% by mass of dry aggregate.

2.3.2 Fly Ash

Not more than 25% of the cement content may be replaced with fly ash. After September 15, no fly ash shall be used in the mix.

2.3.3 Water Content

Within +2% of optimum moisture content to achieve the maximum density of the mix when compacted and to produce zero slump.

2.3.4 Compressive Strength

A minimum of 30 MPa at 28 days to A23.2-12C (current edition), or as designated by the Engineer.

3. EXECUTION

3.1 SUBBASE PREPARATION

3.1.1 Prepare the subgrade according to Section 02335, or alternatively stabilize the subgrade with cement according to Section 02342. If required, construct a granular subbase according to Section 02722.

3.1.2 Moisten the surface of the subgrade or subbase, without creating mud or the ponding of water, to minimize absorption of water from the RCC mix to be deposited.

3.2

3.3 RCC PRODUCTION

3.3.1 Display Formula

Display the approved job mix formula in sight of the plant operator. Failure to display will result in a shutdown order by the Engineer. Do not make changes to the formula without the Engineer's concurrence.

3.3.2 Mixing

Operate the mixing plant to consistently produce a uniform mixture of aggregate, cement and water.

3.4 UNSUITABLE WEATHER CONDITIONS

3.4.1 Wet Weather

Do not place RCC during rain or when rain is imminent. Take precautions that a light mist will not result in RCC tracking by the rollers.

3.4.2 Cold Weather

3.4.2.1 Do not place RCC on frozen subbase or subgrade, and when ambient air temperature is 5^{o}C and falling, or when 0^{o}C weather is expected within 48 hours.

3.4.2.2 Do not place RCC after September 30, unless permitted by the Engineer as a result of favourable weather.

3.4.2.3 Protect RCC from freezing for at least seven days.

3.4.3 Hot Weather

Provide protective measures from hot-weather and drying conditions, according to Clause 21.2.2, CAN/CSA-A23.1 (current edition).

3.4.4 If the above measures are not effective in preventing plastic cracking of the RCC surface, suspend placement immediately until favourable conditions exist.

3.5 PLACING RCC

3.5.1 Test Strip

The Contractor shall construct a test strip of thickness, equal to the design thickness with a minimum of 75 tonnes of mix. The strip will be used to resolve anticipated problems with equipment, mix behaviour, compaction, or strength characteristics. The test strip shall be constructed at a location chosen by the Contractor, at least 35 days prior to the start of paving operations. The Contractor shall cooperate fully with the Engineer during the construction and testing of the test strip.

3.5.2 Transporting

Transport the RCC mixture to site in dump trucks with boxes cleaned out before loading, and provided with protective covers, properly secured in place until discharge. The trucks shall dump directly into the hopper of the paver unless placement is by hand as directed by the Engineer. Dumping the RCC mix directly onto the underlying course will not be permitted. Hauling over the freshly placed RCC will not be permitted.

3.5.3 Continuity

Coordinate RCC delivery, so that the mix can be spread and rolled within the appropriate time limit and to ensure uniform progress of the paver until the scheduled spread is complete. The time between mixing and placing the RCC shall not exceed 45 minutes. This time limit may be increased or decreased by the Engineer dependent upon ambient conditions of temperature and humidity.

3.5.4 Spreading

With the paver, spread the mix to a sufficient depth that will produce the specified thickness when compacted and conform to the required cross-section and grade. Operate the paver in a manner that will prevent segregation and produce a smooth, continuous surface without tearing, pulling or shoving. Placing of the RCC mix shall be done in a pattern so that the water from previously placed RCC will not pose a runoff problem on the fresh RCC surface.

3.5.5 Segregation

If segregation occurs, suspend the spreading operation until the cause is determined and corrected. Rake off the segregated, coarse aggregate before rolling. Broadcasting or fanning of the RCC mixture onto areas being compacted is not permitted.

3.5.6 Length of Spread

Limit the length of the RCC spread to that, which can be compacted and finished within the appropriate, time limit under the prevailing air temperature, wind and other climactic conditions.

3.5.7 Placing Adjacent Lanes

Not more than 45 minutes shall elapse between the placement of the RCC in adjacent lanes, unless a cold joint is provided. Joints shall be made to assure a continuous bond between the old and the new sections of pavement. The time limit may be increased or decreased, depending on ambient conditions of temperature and humidity.

3.6 COMPACTION AND FINISHING

3.6.1 Required Density

The Contractor is responsible for achieving 98% of the maximum dry density, when the maximum dry density is defined as the dry unit mass of the sample at the optimum moisture content as determined in the laboratory to ASTM D1557.

3.6.2 Start of Rolling

Begin compaction rolling with fifteen (15) minutes after spreading the RCC mix. Any additional delay will result in the coring of the affected areas at the Contractor's expense to ensure that it meets the requirements of this specification.

3.6.3 Rolling Pattern

Establish a rolling pattern that will achieve the required density with a minimum number of roller passes.

3.6.4 Vibratory Rolling

During vibratory compaction, never let the roller start or stop in vibratory mode. Stagger the stopping point of successive rolling passes to avoid forming a depression on the surface.

3.6.5 Surface Check

Continually check the RCC surface, while still plastic, to ensure surface and grade tolerances are met. Immediately correct excessive variations.

3.6.6 Finish Rolling

Immediately follow vibratory compaction with passes of the rubber-tired roller so that surface voids and fissures are closed to form a tight, surface texture. Remove any roller marks on the surface using a steel drum roller in static mode.

3.6.7 Lane Edge

Each edge of each lane shall be constructed with a vertical or 15 degree from vertical configuration.

3.7 SMALL AREAS

3.7.1 Spread the RCC mix by hand in areas not accessible by the paver, as directed by the Engineer.

3.7.2 Compact the mix to the required density using suitable, vibratory compaction equipment.

3.8 RCC JOINTS

3.8.1 Fresh Joint

A fresh joint is made when an adjacent RCC lane is placed within 45 minutes after placing the previous lane. Ensure that the contact face is vertical. Before rolling, hand-finish the joint as necessary to produce a tight surface. Roll extra passes, as necessary, to achieve the required density and smoothness in the joint area.

3.8.2 Cold Joint

A cold joint is made when an adjacent RCC lane is placed more than 45 minutes after placing the previous lane. Sawcut the edge of the previous lane back to sound RCC to form a vertical face. Trimming by grader blade may be permitted if done at the end of the workday or first thing the following morning. Dampen the vertical face just before placing the fresh RCC against it. Before rolling, hand-finish the joint, as necessary, to produce a tight surface. Roll extra passes, as necessary, to achieve the required density and smoothness in the joint area. Every effort shall be made to maintain longitudinal joints as a fresh joint as described in 3.7.1 above. Longitudinal, cold joints shall be avoided at all times.

3.8.3 Transverse Joint

May be a fresh or a cold joint.

3.9 RCC CURING

3.9.1 RCC without Asphalt Surfacing

Keep the RCC surface continuously moist by water or fog spray, or wet burlap, for a minimum of seven days before applying the curing compound. Apply the specified membrane-forming, curing compound at a rate of not less than 0.25 litre/m^2 of surface, ensuring that a continuous, void-free membrane is formed.

3.9.2 RCC with Asphalt Surfacing (within 24 hours)

Immediately after final rolling, apply the SS-1 curing compound, according to Section 402, at a rate of 0.5 ± 0.2 litre/m^2 of surface.

3.9.3 RCC with Deferred Asphalt Surfacing

Keep the RCC surface continuously moist by water or fog spray, or wet burlap, for a minimum of seven days before applying the SS-1 curing compound according to Section 402, at a rate of 0.5 ± 0.2 litre/m^2 of surface, ensuring that a continuous, void-free membrane is formed.

3.10 BACKFILL

Backfilling of the edge of the RCC pavement shall not commence prior to the approval of the Engineer. Backfill shall be done in accordance with Section 02310 – Grading.

3.11 QUALITY CONTROL

3.11.1 Surface Tolerances

A 6 mm maximum variation, under 3 m straightedge. Surface texture shall be tight.

3.11.2 Grade Tolerances

A 3 mm maximum variation above designated elevation, a 9 mm variation below designated elevation.

3.12 DEFECTIVE RCC

3.12.1 Repairs

All repairs are subject to the Engineer’s approval. Correct deficiencies while the RCC is still plastic; otherwise, repair after seven days. After seven days, the RCC shall be removed by sawcutting full-depth before removal. Replace the RCC utilizing Cast-in-Place concrete which meets the requirements of Section 03060, Class B Concrete. The new concrete shall be doweled into the existing RCC utilizing epoxy-coated, 15M reinforcing bars.

3.12.2 Remove and replace the RCC if surface cracks, wider than 15 mm, occur after seven days.

3.12.3 Remove and replace the RCC if deficient in thickness by more than 10% of the specified total thickness.

3.12.4 Remove and replace the RCC if the compressive strength is under 80% of specified strength.

3.12.5 Grind off, high surface variations to a finish acceptable by the Engineer.

3.12.6 Filling low areas with fresh RCC is not permitted.

3.12.7 If asphalt surfacing is specified, low areas shall be made up with additional surfacing material without extra payment.

3.13 ASPHALT SURFACING

3.13.1 Do not allow traffic, except for the water truck, on the RCC until it has cured for at least seven days or as directed by the Engineer.

3.13.2 If specified, asphalt surfacing according to Section 02965 may proceed after seven days of curing of the RCC or as directed by the Engineer.

3.13.3 The Contractor shall, at his expense, remove and replace asphalt surfacing if the RCC pavement has to be removed and replaced because of unacceptable thickness or strength.

TABLE 02757.1 RCC THICKNESS PAY FACTORS

THICKNESS DEFICIENCY (% of Total Thickness)	PAY FACTOR (% of Contract Price)
4.8	100.0
5.2	97.0
5.8	93.7
6.4	90.0
7.0	85.5
7.6	80.5
8.2	75.0
8.8	68.0
9.4	60.0
10.0	50.0
Over 10.0	Remove and Replace

TABLE 02757.2 RCC STRENGTH PAY FACTORS

CORE STRENGTH (% of Specified Strength)	PAY FACTOR (% of Contract Price)
85.0	100.0
84.5	97.5
84.0	95.0
83.5	92.5
83.0	90.0
82.5	87.5
82.0	85.0
81.5	82.5
81.0	80.0
80.5	77.5
80	75.0
Under 80.0	No Payment

End of Section

1. GENERAL

1.1 SECTION INCLUDES

Construction of Portland cement concrete curb, curb and gutter, gutter, walk, monolithic curb, gutter and walk, median or island slabs, curb ramp and crossings.

1.2 RELATED SECTIONS

Aggregate	Section 02060
Portland Cement Concrete	Section 03055
Concrete for Roadways	Section 03060
Concrete Forms and Accessories	Section 03100
Reinforcing Steel	Section 03210
Subgrade Preparation	Section 02335

1.3 QUALITY ASSURANCE

Slump, Air Content, Nuclear Density Tests, Air-Void Examination, Strength Tests and Acceptance Criteria to Section 03055 - Portland Cement Concrete.

2. PRODUCTS

2.1 MATERIALS

2.1.1 Concrete

Class A or Class C, to Section 03055 - Portland Cement Concrete and Section 03060 - Concrete for Roadways.

2.1.2 Joint Sealant, Preformed Joint Filler, Curing Compound and Probe Hole Grout

To Section 03060 - Concrete for Roadways.

2.1.3 Reinforcement Bars, Tie Bars, Dowels, Welded Steel Wire Fabric

To Section 03210 - Reinforcing Steel

3. EXECUTION

3.1 TYPES OF CONSTRUCTION

3.1.1 The Contractor has the option of constructing the following types of work by hand forming or by slipforming methods, or by a combination of both. Construct as detailed on plans and drawings, or in the contract Special Provisions, or as directed by the Engineer.

3.1.2 Curb, Curb and Gutter, Gutter

Construct curb, curb and gutter and gutter on prepared subgrade, cement stabilized subgrade, granular base course, soil cement, or asphalt concrete, as indicated on the drawings.

3.1.3 Walk

Construct walk on a granular base course.

3.1.4 Monolithic Walk Curb and Gutter

Construct the walk portion of monolithic walk, curb and gutter on a granular base course. If the walk portion is wider than 2 m, place longitudinal and transverse crack control joints at the proper spacing.

3.1.5 Curb Ramps

Curb ramps are an incline built monolithically into curb cut and walk. Construct curb ramps on a granular base course.

3.1.6 Alley Crossings

The Engineer will set stakes for alley crossings. Construct alley crossings on a granular base course and monolithically with the drop curb and gutter. All alley crossings are to be Class A concrete.

3.1.7 Commercial and Private Crossings

Commercial and private crossings will be staked by the property owner who has obtained the required permit. Do not construct the crossing beyond the extension of the property line across the walk or boulevard. Construct commercial or private crossings on a granular base course and monolithically with the drop curb and gutter. Commercial crossings are to be Class A concrete.

3.1.8 Median or Island Strip

Construct median or island strips on a granular base course between curbs in the median or island.

3.1.9 Slab-on Median or Island

Construct slab-on medians or islands on the existing pavement surface.

3.2 PREPARATION

3.2.1 Verify that the prepared subgrade or base is ready for concrete placement and repair any deterioration or damage.

3.2.2 Cut behind Curb

Compact soil to Section 02335 - Subgrade Preparation and trim to within 25 mm of the back of curb.

3.2.3 Granular Base Course

The granular base course under concrete walk, curb ramps, lane crossings, commercial and private crossings, median or island strips and the walk portion of monolithic walk, curb and gutter shall consist of 150 mm compacted thickness of Designation 3 Class 20A aggregate. Compaction and tolerance testing shall be to Section 02722 – Granular Base Courses.

3.3 HAND FORMING

3.3.1 Place forms to Section 03100 - Concrete Forms and Accessories and as supplemented below.

3.3.2 Use flexible forms to construct curves of less than 40 m radius.

3.3.3 Place a minimum 50 m of forms before a concrete pour to allow checking for true line and grade.

3.3.4 The Engineer will not allow the use of forms that are out of shape, dented, rough, or otherwise unsuitable.

3.4 PLACING REINFORCEMENT

Place reinforcement of the type, size and spacing as detailed on drawings or as required by Engineer, to Section 03210 - Reinforcing Steel.

3.5 PLACING CONCRETE

3.5.1 Place concrete to Section 03055 - Portland Cement Concrete and Section 03060 - Concrete for Roadways and as supplemented below.

3.5.2 Use 50 mm pencil vibrators for curb and gutter and approved vibrating screeds for walk and slabs.

3.5.3 Place concrete continuously until the scheduled pour is complete. Arrange the rate of concrete delivery to ensure that the discharge interval between successive loads does not exceed 30 minutes. If the discharge interval is greater than 30 minutes, place a construction joint.

3.5.4 Where possible curbline walk, curb ramps and curb crossings shall be poured monolithically. Where it is possible to pour the curbline walk, curb ramps and curb crossings monolithically the use of dowels and joint sealant at the back of the curb is not permitted.

3.6 **SLIPFORMING**

3.6.1 Slipform concrete to Section 03100 - Concrete Forms and Accessories and as supplemented below.

3.6.2 Hand form and place concrete at corners, driveways and catch basins concurrent with the slipforming operation. Where concurrent work is not practical, complete this work within 7 days of the slipforming of adjacent work.

3.7 **FINISHING**

3.7.1 Finish concrete to Section 03055 - Portland Cement Concrete and Section 03060 - Concrete for Roadways and as supplemented below.

3.7.2 Tool all edges and joints to a width of 50 mm and round edges to a 6 mm radius unless indicated otherwise.

3.7.3 Apply a brush final finish longitudinally along curb and gutter and transversely on walk and slabs.

3.7.4 **Name Plate**

Stamp the Contractor's name and year of construction in the plastic concrete on:

- The top of the curb in each block or at 200 m intervals, whichever is less and
- The walk at the end of each block on an extension of a property line.

3.8 **CRACK-CONTROL JOINTS**

3.8.1 Formed or tooled to Section 03060 - Concrete for Roadways and as supplemented below.

3.8.2 **Joint Size**

3 mm to 5 mm wide at the following depths:

3.8.2.1 For curb and gutter: 50 mm minimum to a maximum of 25% of the gutter depth.

3.8.2.2 For walk and slabs: 25 mm minimum to a maximum of 25% of the walk or slab thickness.

3.8.2.3 Joint Spacing: 3 m maximum.

3.8.2.4 Surface Dummy Joints: tooled 5 mm wide by 10 mm deep, centred between contraction joints across walk and slabs. In monolithic construction, place surface joints across the walk portion and contraction joints on the curb and gutter, both joints being on same line. Where required, place a longitudinal surface joint on walk and slabs continuing on through alley crossings and driveways.

3.9 **TRANSVERSE CONSTRUCTION JOINTS**

3.9.1 Place to Section 03060 - Concrete for Roadways and as supplemented below.

3.9.2 Use 10M deformed tie bars at 300 mm spacing and extending 300 mm minimum into both sides of the joint.

3.9.3 Vary joint spacing near the end of a concrete pour as follows:

3.9.3.1 If a concrete pour ends within 300 mm of a required joint location, average the spacing of last two joints.

3.9.3.2 If a concrete pour ends within 800 mm of a required joint location, average the spacing of last 3 joints.

3.10 **LONGITUDINAL CONSTRUCTION JOINTS**

3.10.1 Place according to Section 03060 - Concrete for Roadways and as supplemented below.

3.10.2 Use 10M deformed tie bars at 1 m spacing and extending 300 mm minimum into both sides of the joint.

3.11 JOINTS ABUTTING EXISTING CURB

3.11.1 Form a 10 mm wide by 30 mm deep slot between the back of curb and the walk or slab.

3.11.2 Fill the slot with a specified joint sealant.

3.12 ISOLATION JOINTS

Construct to Section 03060 - Concrete for Roadways.

3.13 PROTECTION AND CURING

Protect and cure concrete to Section 03060 - Concrete for Roadways.

3.14 BACKFILLING

3.14.1 Backfill Material

If excavation is part of the work, use approved material from site excavation. If excavation is not part of the work, supply fill material approved by the Engineer.

3.14.2 Behind Curb

Backfill with suitable clay within 7 days of concrete placement and before placing the initial paving course against the curb and gutter, a minimum of 300 mm width behind the curb in two 150 mm lifts. Tamp each lift with mechanical tampers to a minimum 95% of maximum density. Backfill to the top of curb elevation, unless topsoil placement or walk/slab construction immediately follows, in which case leave backfill low to accommodate subsequent work.

3.14.3 Along Slab Edges

Backfill along the edge of the walk or slab as soon as practical after the removal of concrete forms, allowing for topsoil depth, unless otherwise directed by the Engineer. Tamp with mechanical tampers a minimum 300 mm width along the slab edge to a minimum 92% of maximum density.

3.14.4 Maximum Density

As used in this Section, is the dry unit mass of sample at optimum moisture content as determined in the laboratory according to ASTM D698 Method A.

3.15 FIELD QUALITY CONTROL

3.15.1 Walk or Slab Surface Tolerances

Maximum variation under a 3 m straightedge:	6 mm.
Maximum variation from walk crossfall:	±1% provided the finished crossfall is not less than 1% nor more than 4%.

3.15.2 Gutter Surface and Curb Top Tolerances

Maximum variation under a 3 m straightedge: 6 mm.

3.15.3 Grade of Gutter Lip and Walk/Slab Tolerances

3.15.3.1 Maximum variation from designated elevation at any station as established from the survey stake: ±6 mm.

3.15.3.2 Maximum variation from the difference in designated elevations between 2 consecutive stations as established from survey stakes, provided there is positive drainage in the designated direction: ±12 mm.

3.15.4 Lip of Gutter Alignment Tolerances

Maximum deviation: ±12 mm in 30 m.

3.15.5 **When Tolerances Exceeded:** If any of the tolerances in 3.15.1 to 3.15.4 are exceeded, remove or correct the concrete work in question as directed by the Engineer.

3.15.6 Walk, Median Strip, Slab-on, Ramps or Crossing Thickness:

3.15.6.1 At the City's request, the quality assurance laboratory will take one or more sets of cores from suspect concrete walk or crossing, each set comprising 3 cores whose average thickness represents not more than 500 m^2 of concrete walk or crossing. If the average core thickness is deficient, that area will be assessed a pay factor according to Table 02770-3.1.

Table 02770-3.1 Concrete Walk/Crossing Thickness Pay Factors

THICKNESS DEFICIENCY (mm)	PAY FACTOR (% of Contract Price)
6	100.0
7	97.0
8	93.7
9	90.0
10	85.5
11	80.5
12	75.0
13	68.0
14	60.0
15	50.0
Over 15	Remove and replace

3.15.6.2 Concrete walk or crossing with excess thickness may be accepted if surface and grade tolerances are met, but no claim for additional payment will be accepted.

3.16 REJECTED CONCRETE WORK

Remove and replace rejected concrete work by full segments or slabs between crack control or construction joints.

3.17 PROTECTION OF FINISHED WORK

3.17.1 Protect finished work from damage. Repair if damaged.

3.17.2 Do not open walk or crossings to traffic until permitted by the City. When opening to traffic, leave walk or crossings clean and free of debris and remove signs and barricades no longer needed.

1. GENERAL

1.1 SECTION INCLUDES

Supply and placement of clay paving brick with sand bedding on soil cement base, for pedestrian and light vehicle traffic.

1.2 RELATED SECTIONS

Aggregate	Section 02060
Plant-Mix Soil Cement	Section 02713

1.3 SUBMITTALS

1.3.1 Submit the manufacturer's product data together with 2 samples representative of style, size, colour range and surface texture to the City at least 14 days prior to delivery of brick pavers on site. Submit further samples as requested by the City.

1.3.2 Submit source and gradation of bedding and joint sand to the Engineering Services Section, Transportation and Streets Department at least 7 days prior to use.

1.4 QUALITY ASSURANCE

1.4.1 The quality assurance laboratory will test paving brick for compressive strength and absorption to ASTM C902.

1.4.2 Brick not meeting specifications shall be replaced.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Paving Brick:** to ASTM C902, class SX, type 1, solid fired clay units, conforming to the following:

2.1.1.1 Compressive strength at time of delivery: minimum 55 MPa average of 5 test samples with no unit less than 50 MPa.

2.1.1.2 Moisture absorption at time of delivery: maximum 8% average of 5 test samples with no unit more than 11%.

2.1.1.3 Size: 200 mm x 100 mm x 60 mm ±2 mm in any dimension.

2.1.1.4 Shape and Colour: as indicated on drawings or as ordered.

2.1.2 **Bedding Sand:** to Section 02060 - Aggregate, Designation 4, class 10.

2.1.3 **Joint Sand:** to Section 02060 - Aggregate, Designation 4, class 2.5, with 6% bentonite.

2.1.4 **Edge Restraint:** pressure treated wood, concrete or other material or structure as indicated on drawings.

2.1.5 **Weed Barrier:** as indicated on drawings.

2.1.6 **Insulation:** as indicated on drawings.

3. EXECUTION

3.1 PREPARATION

3.1.1 Construct soil cement base to 02713 - Plant Mix Soil Cement with the following modified tolerances:

3.1.1.1 Smoothness: 8 mm maximum variation under 3 m straightedge.

3.1.1.2 Grade: 0 mm maximum variation above designated elevation.
8 mm maximum variation below designated elevation.

3.1.2 The soil cement base shall be inspected by the City before placing bedding sand. Repair imperfections and clean surface of debris and loose material. Do not use bedding sand for corrective levelling.

3.1.3 **Edge Restraint:** Install as detailed on drawings.

3.1.4 **Weed Barrier:** Install as detailed on drawings.

3.1.5 **Insulation:** Install as detailed on drawings.

3.2 SAND BEDDING

3.2.1 Bedding sand shall have a uniform moisture content of 6% to 8% by mass when spread.

3.2.2 Spread sand uniformly and screed lightly to achieve a uniform thickness of 30 ±8 mm after placement and tamping of paving brick.

3.2.3 Alternatively, spread sand in a loose lift of sufficient thickness to achieve 2/3 of the required thickness and lightly tamp with one pass of a plate vibrator. Then spread and screed the remaining lift of loose sand onto which the paving brick can be laid.

3.2.4 Once screeded, the sand shall not be disturbed. If screeded sand is disturbed or exposed to rain or dew, it shall be removed or loosened, respread and rescreeded.

3.2.5 Place no more sand than will be covered with paving brick on the same day.

3.3 LAYING PAVING BRICK

3.3.1 Lay paving brick on sand bed in the specified pattern, leaving joint spaces no wider than 3 mm.

3.3.2 Arrange brick to maximize the use of full bricks and to minimize the use of slivers. Fill edge gaps with units cut with a masonry saw.

3.3.3 Use planks for foot and wheelbarrow traffic to prevent disturbance of units prior to tamping.

3.3.4 Tamp brick with a flat plate vibrator shortly after laying to bring surface to correct grade, eliminate lipping between adjacent units and consolidate sand bedding. Remove and replace damaged brick.

3.3.5 Tamp all brick laid in a day's work except brick within 1 m of laying edge.

3.3.6 Brush and vibrate joint sand to completely fill joints between units. Sweep and remove excess sand and leave finished surface clean.

3.3.7 Check finished surface to ensure surface and grade tolerances are met.

3.4 FIELD QUALITY CONTROL

3.4.1 Surface Tolerance: 6 mm maximum variation under 3 m straightedge.

2 mm maximum differential level between adjacent units and between units and edge restraint.

3.4.2 Grade Tolerance: 6 mm maximum variation above designated elevation.

0 mm maximum variation below designated elevation.

3.5 PROTECTION AND CLEANUP

3.5.1 Do not open newly installed paving brick to pedestrian or vehicle traffic until directed by the Engineer.

3.5.2 Before opening to traffic, ensure that surface is clean and free of surplus material or debris.

1. GENERAL

1.1 SECTION INCLUDES

Supply of materials and construction of integrally coloured concrete pavement, walk or slab with a stamped pattern surface finish.

1.2 RELATED SECTIONS

Portland Cement Concrete	Section 03055
Concrete for Roadways	Section 03060
/Concrete Pavement	Section 02751
Concrete Curb, Gutter, Walk, Slabs	Section 02770

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Concrete:** to Section 03055 - Portland Cement Concrete and Section 03060 - Concrete for Roadways, modified as follows:

2.1.1.1 For hand-placed concrete, a slump of 80 ±20 mm is allowable for Classes A and C.

2.1.1.2 Colouring Agent: iron oxide pigments conforming to ASTM C979, colours as designated on plans and approved by the City. The pigment shall be added during concrete mixing to produce a uniform colour throughout the pavement or walk/slab.

2.1.1.3 Release Agent: generally consisting of talc, colour, binder and bentonite-like material; shall be kept absolutely dry prior to use so it can be powdered on; shall be capable of preventing adhesion of stamping tools to the concrete surface, preventing loss of entrained air from the surface and being power-washed off when the concrete has partially cured.

2.1.1.4 Curing Agent: to ASTM C309, type **I**, class B, clear, resin based.

2.1.1.5 Concrete Sealer: apply a proprietary slip resistant sealer to the concrete surface in accordance with the manufacturer's recommendations.

2.1.1.6 Concrete Stamping Tools: capable of stamping the specified pattern and texture.

2.2 MIX DESIGN

2.2.1 Submit a concrete mix design to Section 03060 - Concrete for Roadways and including the following:

2.2.1.1 The brand and colour of colouring agent used.

2.2.1.2 The amount of colouring agent expressed as a percentage by mass of cement in the mix (10% maximum).

2.2.1.3 The amount of entrained air adjusted as may be required by the type of colouring agent used.

2.2.1.4 Confirmation that no admixtures containing calcium chloride will be used.

2.2.1.5 Relevant information on reinforcing fibres, if used.

2.3 QUALITY CONTROL

Prior to installing patterned colored concrete, provide a 2.5 m x 2.5 m mock-up at the job site for the City's approval of colour, pattern, texture and workmanship. The approved mock-up shall serve as a standard for judging the completed work.

3. EXECUTION

3.1 CONCRETE PLACEMENT

3.1.1 **Concrete Pavement:** to Section 02751 - Concrete Pavement.

3.1.2 **Concrete Walk**: to Section 02770 - Concrete Curb, Gutter, Walk, Slabs.

3.1.3 **Curb Ramp:** to Section 02770 - Concrete Curb, Gutter, Walk, Slabs; surface finish according to standard drawings. No stamped pattern is permitted.

3.1.4 **Manhole, Valve and Other Fixtures:** Concrete pavement around such fixtures shall be poured separately using isolation joints as detailed on drawings. Isolation joints are not required on concrete walk or other slabs.

3.2 INSTALLING PATTERNED CONCRETE SURFACE

3.2.1 **Temperature:** When colour additives are used, a minimum air temperature of 8°C in shade is required. If dark pigmentation is used, the maximum air temperature shall not exceed 27°C in shade.

3.2.2 **Surface Float:** Float the concrete surface instead of applying a burlap or broom finish.

3.2.3 **Release Agent Application:** Before using the stamping tool, apply the specified release agent according to manufacturer's specifications.

3.2.4 **Polyethylene Sheet:** If appropriate for the work, a polyethylene sheet may be used in lieu of a release agent to prevent the stamping tool from adhering to the concrete surface. Carefully cover the floated concrete surface with the sheet. After stamping and while the surface is still plastic, carefully remove the sheet and apply a brush finish if specified.

3.2.5 **Stamping:** While the concrete is still in its plastic state, impress the specified pattern on the surface using the stamping tools. Tamp the tools properly into the surface to achieve the desired texture.

3.2.6 **Pavement Joints:** Sawcut and seal pavement joints to Section 03060 - Concrete for Roadways. Immediately remove excess release agent, sawcut debris and stains.

3.2.7 **Walk or Slab Joints:** These joints may be hand-tooled to Section - 02770 Concrete Curb, Gutter, Walk, Slabs before applying release agent and stamping. Remove excess release agent and stains before applying the curing seal.

3.2.8 **Curing:** Apply at least one coat of the specified curing seal to the dry concrete surface according to the manufacturer's specifications.

3.3 WORKMANSHIP

3.3.1 The concrete work is subject to the same tolerances and quality assurance as specified in Section 02751 - Concrete Pavement, or Section 02770 - Concrete Curb, Gutter, Walk, Slabs.

3.3.2 The patterned concrete surface shall be uniform in colour, pattern and texture, conforming to the approved job mock-up.

3.3.3 The patterned concrete surface shall exhibit no efflorescence, discoloration and other defects for a period of 24 months after placement. Any such defects occurring during that period shall be remedied before final acceptance of the work.

3.4 OPENING TO TRAFFIC

3.4.1 Do not open the completed work to traffic until cylinder testing has confirmed that the concrete has attained 75% of its specified strength, or until directed by the City.

3.4.2 Before opening to vehicle traffic, clean all debris from the pavement, walk or slab and remove signs no longer required.

3.5 TOOLS FOR REPAIR

Provide stamping tools of the specified patterns to the City for the sole purpose of repair work when maintenance of the work is assumed by the City, unless otherwise directed by the City.

1. GENERAL

1.1 SECTION INCLUDES

Supply and placement of interlocking concrete paving units on soil cement base for pedestrian and vehicle traffic.

1.2 RELATED SECTION

Aggregate	Section 02060
Plant Mix Soil Cement	Section 02713

1.3 SUBMITTALS

1.3.1 Submit the manufacturer's product data together with 2 samples representative of style, size, colour range and surface texture to the City at least 14 days prior to delivery of concrete pavers on site. Submit further samples as requested by the City.

1.3.2 Submit source and gradation of bedding and joint sand to the Engineering Services Section, Transportation and Streets Department at least 7 days prior to use.

1.4 QUALITY ASSURANCE

1.4.1 The quality assurance laboratory will test paving units for compressive strength and absorption according to ASTM C936.

1.4.2 Units not meeting specifications shall be replaced.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Concrete Paving Units:** manufactured to ASTM C936 and conforming to the following:

2.1.1.1 Compressive strength at delivery: minimum 55 MPa average of test samples with no unit less than 50 MPa.

2.1.1.2 Moisture absorption at delivery: maximum 5% average of test samples with no unit more than 7%.

2.1.1.3 Size: to manufacturer's standard size within a tolerance of ±2 mm in length and width.

2.1.1.4 Thickness: 60 mm or 80 mm as indicated, within a tolerance of ±3 mm.

2.1.1.5 Shape and Colour: as indicated on drawings or as ordered.

2.1.2 **Bedding Sand:** to Section 02060 - Aggregate, Designation 4, class 10.

2.1.3 **Joint Sand:** to Section 02060 - Aggregate, Designation 4, class 2.5, with 6% bentonite.

2.1.4 **Edge Restraint:** pressure treated wood, concrete or other material or structure as indicated on drawings.

2.1.5 **Weed Barrier:** as indicated on drawings.

2.1.6 **Insulation:** as indicated on drawings.

3. EXECUTION

3.1 PREPARATION

3.1.1 Construct soil cement base to Section 02713 - Plant Mix Soil Cement with the following modified tolerances:

3.1.1.1 Smoothness: 8 mm maximum variation under 3 m straightedge.

3.1.1.2 Grade: 0 mm maximum variation above designated elevation.
8 mm maximum variation below designated elevation.

3.1.2 The soil cement base shall be inspected by the City before placing bedding sand. Repair imperfections and clean surface of debris and loose material. Do not use bedding sand for corrective levelling.

3.1.3 **Edge Restraint:** Install as detailed on drawings.

3.1.4 **Weed Barrier:** Install as detailed on drawings.

3.1.5 **Insulation:** Install as detailed on drawings.

3.2 SAND BEDDING

3.2.1 Bedding sand shall have a uniform moisture content of 6% to 8% by mass when spread.

3.2.2 Spread sand uniformly and screed lightly to achieve a uniform thickness of 30 ±8 mm after placement and tamping of pavers.

3.2.3 Alternatively, spread sand in a loose lift of sufficient thickness to achieve 2/3 of the required thickness and lightly tamp with one pass of a plate vibrator. Then spread and screed the remaining lift of loose sand onto which the pavers can be laid.

3.2.4 Once screeded, the sand shall not be disturbed. If screeded sand is disturbed or exposed to rain or dew, it shall be removed or loosened, respread and rescreeded.

3.2.5 Place no more sand than will be covered with paving units on the same day.

3.3 LAYING PAVING UNITS

3.3.1 Lay paving units on sand bed in the specified pattern, leaving joint spaces no wider than 3 mm.

3.3.2 Arrange units to maximize the use of full units and to minimize the use of slivers. Fill edge gaps with units cut with a masonry saw.

3.3.3 Use planks for foot and wheelbarrow traffic to prevent disturbance of units prior to tamping.

3.3.4 Tamp units with a flat plate vibrator shortly after laying to bring surface to correct grade, eliminate lipping between adjacent units and consolidate sand bedding. Remove and replace damaged units.

3.3.5 Tamp all units laid in a day's work except units within 1 m of laying edge.

3.3.6 Brush and vibrate joint sand to completely fill joints between units. Sweep and remove excess sand and leave finished surface clean.

3.3.7 Check finished surface to ensure surface and grade tolerances are met.

3.4 FIELD QUALITY CONTROL

3.4.1 Surface Tolerance: 6 mm maximum variation under 3 m straightedge.

2 mm maximum differential level between adjacent units and between units and edge restraint.

3.4.2 Grade Tolerance: 6 mm maximum variation above designated elevation.

0 mm maximum variation below designated elevation.

3.5 PROTECTION AND CLEANUP

3.5.1 Do not open newly installed paving units to pedestrian or vehicle traffic until directed by the Engineer.

3.5.2 Before opening to traffic, ensure that surface is clean and free of surplus material and debris.

1. GENERAL

1.1 SECTION INCLUDES

Construction of granular walkway.

1.2 RELATED SECTIONS

Aggregate	Section 02060
Grading	Section 02310
Subgrade Preparation	Section 02335
Topsoil	Section 02910
Seed and Sod	Section 02920

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Gravel:** to Section 02060 - Aggregate, Designation 3, Class 20A.

2.1.2 **Geotextile:** woven fabric, Nilex Type P500 or equivalent.

3. EXECUTION

3.1 PREPARATION

3.1.1 **Clearing:** Clear to a minimum of 1.0 m wider than walkway width and to ensure a minimum vertical clearance of 3.0 m above finished grade.

3.1.2 **Grading:** Excavate and grade to the required subgrade elevation to Section 02310 - Grading.

3.1.3 **Subgrade Compaction:** Prepare and compact the subgrade to a minimum 95% of maximum density to Section 02335 - Subgrade Preparation. Subgrade must be free of stumps, roots and rocks greater than 100 mm diameter and other deleterious material.

3.1.4 **Geotextile:** Line the excavation with geotextile fabric. Stretch the fabric taut and free of wrinkles. Ensure fabric completely covers the base and both sides of the excavation. Overlap each new strip of fabric by 500 mm over the previously laid strip. Remove and replace damaged or deteriorated fabric.

3.2 WALK CONSTRUCTION

Gravel Surfaces: Spread gravel uniformly on the geotextile and compact to 95% of Standard Proctor Density.

3.3 WORKMANSHIP

3.3.1 **Surface Finish:**

The finished gravel surface shall be smooth and free of loose material and shall conform to the crown or crossfall and longitudinal slope as shown on drawings.

3.3.2 Trim high spots and refinish surface.

3.3.3 Add gravel to low areas, scarify, blend, re-spread and re-compact to the required finish.

3.4 CLEANUP

3.4.1 Trim all protruding geotextile level with the graded surface.

3.4.2 Restore areas disturbed by construction to original condition.

3.4.3 Rehabilitate disturbed edges with topsoil and seed to Section 02910 – Topsoil and Section 02920 – Seed and Sod.

3.4.4 Clean up and dispose of all debris and surplus material.

1. GENERAL

1.1 SECTION INCLUDES

Construction of median or roadside Portland cement concrete barrier by slipforming, by casting in place or with precast units.

1.2 RELATED SECTION

Portland Cement Concrete	Section 03055
Concrete for Roadways	Section 03060
Concrete Forms and Accessories	Section 03100
Reinforcing Steel	Section 03210

1.3 SUBMITTALS

Submit a concrete mix design for precast barrier units or precast mini barrier unit to the Engineering Services Section, Transportation and Streets Department at least 14 days prior to delivery.

1.4 QUALITY ASSURANCE

Slump, air content, air-void examination, strength tests and acceptance criteria: to Section 03055 - Portland Cement Concrete

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Slipform or Cast-In-Place Concrete:** Class C, to Section 03055 - Portland Cement Concrete and Section 03060 - Concrete for Roadways.

2.1.2 **Reinforcement and Tie Bars for Cast-In-Place Units:** epoxy-coated, deformed, to Section 02310 - Reinforcing Steel.

2.1.3 **Preformed joint filler and curing compound for Slipformed or Cast-In-Place Units:** to Section 03060 - Concrete for Roadways.

2.1.4 **Precast Barrier Unit:** manufactured to CSA-A23.4 and to the following requirements:

2.1.4.1 Dimensions: 3 m long and cross-section as detailed on drawings, with tolerances to CSA-A23.4.

2.1.4.2 Concrete: 30 MPa minimum compressive strength at 28 days, with 5.5% to 8% entrained air.

2.1.4.3 Reinforcement: epoxy-coated, deformed, to Section 03210 - Reinforcing Steel.

2.1.4.4 End connection: 2 vertical tongue and groove keys, dimensioned to a tolerance of ±5 mm for a tight fit.

2.1.4.5 Surface finish: steel form finish, not rubbed, smooth, dense, unpitted and free from honeycomb.

2.1.4.6 Curing methods: accelerated steam curing, moist curing, or membrane curing.

2.1.5 **Precast Mini-barrier Unit:** manufactured to CSA-A23.4 and to following requirements:

2.1.5.1 Dimensions: 3 m long and cross-section as detailed on drawings, with tolerances to CSA-A23.4.

2.1.5.2 Concrete: 30 MPa minimum compressive strength at 28 days, with 5.5% to 8% entrained air. Submit concrete mix design to the Engineering Services Section at least 14 days prior to delivery.

2.1.5.3 Surface finish: steel form finish, not rubbed, smooth, dense, unpitted and free from honeycomb.

2.1.5.4 Curing methods: accelerated steam curing, moist curing, or membrane curing.

2.2 EQUIPMENT

Slipform Machine: to Section 03100 – Concrete Forms and Accessories.

3. EXECUTION

3.1 PREPARATION

3.1.1 Construct base of barrier as detailed on drawings.

3.1.2 Light pole bases and conduits shall be in place prior to slipforming or casting in place.

3.1.3 Have Engineer inspect base before slipforming or installing precast units.

3.2 SLIPFORM CONSTRUCTION

3.2.1 Prior to slipforming, cast concrete in place for segments where slipforming is not practical.

3.2.2 Slipform concrete to Section 03100 – Concrete Forms and Accessories.

3.2.3 Slipform over top of pole bases. Once machine is past, immediately remove concrete over pole base and clean thoroughly.

3.2.4 Finish: Slipformed surfaces shall be smooth, dense, unpitted and free of honeycombing. Perform the minimum amount of work required to correct minor irregularities.

3.2.5 Joints:

3.2.5.1 Crack-Control Joints: Saw cut or tool vertically 12 mm wide by 50 mm deep at maximum 6 m spacing to Section 03055 - Portland Cement Concrete. Match with joints of curb, gutter, or pavement.

3.2.5.2 Isolation and Construction Joints: vertical, to Section 03055 - Portland Cement Concrete.

3.2.6 **Protection and Curing:** to Section 03055 - Portland Cement Concrete.

3.3 CAST-IN-PLACE CONSTRUCTION

3.3.1 Construct to Section 03055 - Portland Cement Concrete and Section 03060 - Concrete for Roadways as supplemented below.

3.3.2 **Finish:** Formed surfaces shall be smooth, dense and free of honeycombing.

3.3.3 **Joints:** Saw cut or form crack-control joints to Section 03060 - Concrete for Roadways. Place isolation and construction joints

3.4 PRECAST CONSTRUCTION

3.4.1 Place precast units true to alignment.

3.4.2 Make tight tongue and groove connection between units.

3.5 PRECAST MINIBARRIER

3.5.1 Place minibarrier units to designated alignment.

3.5.2 Make proper connections between units.

3.6 QUALITY CONTROL

3.6.1 **Slipform and Cast-In-Place Surface Tolerances:** 6 mm maximum variation under a 3 m straightedge.

3.6.2 **Slipform and Cast-In-Place Barrier Top Elevation Tolerances:** ±6 mm maximum variation from designated elevation.

3.6.3 **Slipform and Cast-In-Place Barrier Top Alignment Tolerances:** ±10 mm maximum variation from designated alignment in any 20 m length.

3.6.4 **Slipform and Cast-In-Place Barrier Shape Tolerances:** ±10 mm maximum variation from indicated cross-sectional dimensions.

3.6.5 In slipforming, continually check tolerances and immediately correct excessive variations while concrete is still plastic.

3.6.6 The Engineer will suspend the Contractor's operations if poor workmanship persists or is not corrected.

3.6.7 **Precast Barrier Top Elevation Tolerances:** ±10 mm maximum variation from designated grade elevations.

3.6.8 **Precast Barrier Top Alignment Tolerances:** ±10 mm maximum variation from designated alignment in any 20 m length.

3.6.9 **Tolerance for Lipping between Adjacent Precast Units:** 10 mm maximum.

3.7 PROTECTION OF FINISHED WORK

3.7.1 Protect finished work from damage. Repair if damaged.

3.7.2 Leave completed work clean and free of debris and remove signs and barricades no longer needed.

1. GENERAL

1.1 SECTION INCLUDES

Supply and installation of box beam guard rail.

1.2 RELATED SECTIONS

Portland Cement Concrete	Section 03055
Hot-Mix Asphalt Concrete	Section 02065

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Box Beam Rail:** steel tubing to ASTM A501, size as specified on drawings.

2.1.2 **Posts, Plates and Shapes:** of steel conforming to ASTM A36M.

2.1.3 **Fastenings:** steel bolts, U-bolts, studs, nuts and washers conforming to ASTM A325M.

2.1.4 **Zinc Coating:** all steel products to be hot-galvanized according to ASTM A123.

2.1.5 **Hot-Mix Asphalt:** appropriate mix to Section 02065 - Hot-Mix Asphalt Concrete.

2.1.6 **Concrete:** to Section 03055 - Portland Cement Concrete, class D.

2.2 FABRICATION

2.2.1 **Welding:** to CSA-W47.1 and CSA-W59-M.

2.2.2 Edges cut by a welding torch shall be ground to a smooth finish.

2.2.3 Galvanize steel products after fabrication and welding.

3. EXECUTION

3.1 POST SETTING

3.1.1 **Without Asphalt or Concrete Base:** Drive post into the ground.

3.1.2 **With Asphalt ≤75 mm and without Concrete Base:** Drive post through the existing asphalt pavement. Patch with hot-mix asphalt concrete tamped around the post flush with existing surface.

3.1.3 **With Asphalt >75 mm, or with Concrete Base:** Drill a 300 mm diameter hole, or sawcut a 300 mm square hole, through the existing asphalt pavement or through the existing concrete base. Drive the post into the hole. Tamp clay or gravel into the remaining void around the post and cap with 50 mm of hot-mix asphalt concrete tamped flush with existing surface.

3.1.4 Each post shall have at least half of its length set below ground or pavement surface elevation.

3.2 FIELD CUTTING

Steel material may be cut with a saw or with a welding torch. Grind smooth and round all rough and sharp edges.

3.3 FIELD WELDING

Perform field welding if permitted by the Engineer. Remove slag and spatter and smooth surfaces.

3.4 TOUCH UP

Apply a coat of "Galvacon" to cut, welded and other surfaces where the galvanizing has been damaged.

3.5 CONCRETE ANCHOR

3.5.1 **Precast Anchor:** Bury the anchor in a hole backfilled with clay compacted to a minimum 98% of maximum standard Proctor density according to ASTM D698 Method A.

3.5.2 **Cast-in-Place Anchor:** Dig a hole to the specified anchor dimensions and fill with concrete. Trowel exposed surface to a smooth finish.

3.5.3 **Surface Restoration:** Restore the surface around anchors with tamped hot-mix asphalt or with concrete to match the existing surface.

3.6 FIELD QUALITY CONTROL

3.6.1 **Elevation Tolerances:** 13 mm maximum variation from designated grade of top of guard rail.

3.6.2 **Alignment Tolerances:** 50 mm in 10 m maximum deviation from designated alignment of guard rail.

3.6.3 **Post Tolerances:** 13 mm maximum deviation from plumb position of post.

3.6.4 **Deficiencies:** Guard rail not meeting the above tolerances shall be removed and replaced.

1. GENERAL

1.1 SECTION INCLUDES

Cold milling or grinding of existing asphalt or concrete pavement surfaces.

2. PRODUCTS

2.1 MATERIALS

Millings: Unless stated otherwise in the Special Provisions, millings shall become the property of the Contractor, who shall remove and transport the millings to the location of the Contractor's choice at the Contractor's expense.

2.2 EQUIPMENT

2.2.1 **Cold Planer:** Self-propelled; capable of milling 4,000 m^2 of pavement surface in an 8 hr shift; capable of loading millings into haul vehicles; with a mandrel cutting a minimum width of 1.52 m; with sufficient power to cut a minimum 50 mm depth in one pass; with slope and grade adjustment controls.

2.2.2 All equipment shall be suitably muffled to conform to Noise Abatement Bylaw No. 7255 and amendments thereto.

3. EXECUTION

3.1 TRAFFIC SAFETY

3.1.1 Provide signed advance warning of cold milled areas opened to traffic before paving, as follows:

'Bump' - all transverse milled edges and edges at exposed utility structures.

'Uneven Pavement' - all longitudinal milled edges, and edges within pedestrian crosswalk areas.

3.1.2 Ramp vertical edges created by milling operations according to the following tables. Material used in ramping must be approved by the Engineer and must be maintained until removal prior to paving.

Transverse Edges

Depth of Milling (mm)	Speed Limit (km/h)	Length of Ramp (mm)	Location of Ramp
0 - 50	< 60	600	At end of milled area (up ramp)
0 - 50	≥ 60	1200	At end of milled area (up ramp)
> 50	< 60	600 600	At start of milled area (down ramp) At end of milled area (up ramp)
> 50	≥ 60	600 1200	At start of milled area (down ramp) At end of milled area (up ramp)

Localized Edges - Manholes, Vault Covers, Valves, Etc.

Depth of Milling (mm)	Speed Limit (km/h)	Length of Ramp (mm)	Location of ramp
< 25	all speeds	N/A	Paint all edges in fluorescent colour
25 or greater	all speeds	600	At all edges of milled area

Patch Milled Edges

Length of Milled Area (m)	Speed Limit (km/h)	Length of Ramp (mm)	Location of Ramp
0 - 15	< 60	600 600	At start of milled area (down ramp) At end of milled area (up ramp)
0 - 15	≥ 60	600 1200	At start of milled area (down ramp) At end of milled area (up ramp)

3.2 PREPARATION

3.2.1 Sweep the pavement surface with a mechanical sweeper to remove debris and dirt accumulations.

3.2.2 Remove any standing water from the pavement surface.

3.3 MILLING

3.3.1 Mill to depth and/or gradeline as determined by the Engineer.

3.3.2 Mill pavement to expose vertical surface of gutter face, manhole frames, water valves, survey monuments, power, telephone, or water vaults, or any other structures within milling area for the full required depth of milling.

3.3.3 Load millings into haul vehicles and transport to the Contractor's chosen location.

3.3.4 Minimize use of water during milling.

3.4 CLEANUP

3.4.1 Leave milled areas clean to the satisfaction of the City upon the completion of milling.

3.4.2 Immediately remove and dispose of any spilled millings on milled areas and on haul routes.

1. GENERAL

1.1 SECTION INCLUDES

The Work includes the supply and installation of both non-woven and woven geotextile at locations shown on the drawings, stated in the Special Provisions or as directed by the consultant

2. PRODUCTS

2.1 MATERIALS

2.1.1 Non-Woven Geotextile includes:

- Continuous monofilaments or staple fibers;
- Random fibers that are physically entangled by punching with needles;
- Random fibers that are pressed together and melted together at the contact points.

The non-woven geotextile fabric shall meet the following requirements:

Property	ASTM Test	Material Specification [1] Average Roll Value		
		Type A [(2)]	Type B [(3)]	Type C [(4)]
Grab Tensile Strength (N)	D4632	400 min	650 min	875 min
Grab Tensile Elongation (%)	D4632	50 % min	50 % min	50 % min
Mullen Burst (MPa)	D3786	1.2 min	2.1 min	2.7 min
Puncture (N)	D4833	240 min	275 min	550 min
Trapezoid Tear (N)	D4533	180 min	250 min	350 min
Ultraviolet Stability (% Retained Strength)	D4355	70 % @ 150 hr.	70 % @ 150 hr	70 % @ 150 hr
Apparent Opening Size (mm)	D4751	0.2 max	0.2 max	0.2 max
Permittivity (per sec)	D4491	2.1 min	1.5 min	1.2 min
Flow Rate (l/sec/m^{2})	D4491	102 min	102 min	102 min
Minimum fabric lap shall be 300 mm				

Note 1: All numeric values except A.O.S. represent minimum average roll value as measured in the weaker principal direction.
2: Typically used with perforated pipe and similar applications;
3: Typically used in medium duty situations such as under rip rap;
4: Typically used in heavy duty situations such as large rip rap.

2.1.2 Woven Geotextile

2.1.2.1 Woven Geotextiles consist of continuous monofilaments, staple fibers; multi-filament yearns, or slit films that are woven into a fabric.

Woven geotextiles shall have the following material properties:

Property	ASTM Test	Material Specification[1] Average Roll Value		
		Class 1	Class 2	Class 3
Elongation (%)	D 4632	<50 min	<50 min	<50 min
Grab Strength (N)	D 4632	1 400 min.	1 100 min.	800 min
Sewn seam strength (N)	D 4632	1 260 min.	990 min.	720 min
Tear Strength (N)	D 4533	500 min.[2]	400 min.[2]	250 min.
Puncture Strength (N)	D 4833	500 min.	400 min.	300 min
Permittivity (per sec)	D 4491	0.05 min. [3]	0.02 min.[3]	0.02 min.[3]
Apparent Opening Size (mm)	D 4751	0.43 max.	0.60 max.	0.60 max.
Ultraviolet stability (% retained strength)	D 4355	50% after 500 hrs of exposure	50% after 500 hrs of exposure	50% after 500 hrs of exposure

Note 1: All numeric values except A.O.S. represent minimum average roll value as measured in the weaker principal direction.
Note 2: For woven monofilament geotextiles, the required minimum average roll value for tear strength is 250 N.
Note 3: Default value. Permittivity of the geotextile should be greater than that of the soil. The Consultant may also require the permeability of the geotextile to be greater than that of the soil.

3. EXECUTION

3.1. PLACEMENT

Unless otherwise directed in the applicable specification, the placement of geotextile shall be in accordance with the following:

3.1.1 The surface to receive the geotextile shall be prepared to a relatively smooth condition free of obstructions, depressions, debris, and soft or low density pockets of material. The geotextile fabric shall be installed free from tensile stresses, folds, wrinkles, or creases.

3.1.2 If more than one width of geotextile fabric is used, the Contractor shall either overlap the joints by a minimum of 400 mm with no stitching, or overlap the joint by 200 mm and provide two rows of stitching at each joint.

3.2.3 The geotextile fabric shall be protected all times during construction. Wheeled or tracked vehicles shall not be allowed to travel directly on the geotextile fabric. Any geotextile fabric damaged during installation or during placement of granular material shall be replaced by the Contractor at his own expense.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 **Asphalt prime coat:** the supply and application of liquid asphalt to seal the surface of granular base courses or soil cement and to provide a bond with subsequent paving courses.

1.1.2 **Asphalt tack coat:** the supply and application of liquid asphalt to provide a bond between an existing asphalt or concrete surface and the overlying asphalt course.

1.1.3 Specifications for liquid and emulsified asphalts.

1.2 SUBMITTALS

Submit refinery data to the Engineering Services Section, Transportation and Streets Department, prior to first use and as requested by the Engineer.

1.3 QUALITY ASSURANCE

The quality assurance laboratory may take and test samples of liquid asphalt used weekly from each source. Material not meeting specifications shall be replaced.

2. PRODUCTS

2.1 MATERIALS

2.1.1 Liquid or Emulsified Asphalt: types and grades as indicated below and conforming to related properties in Tables 02963.1 and 02963.2.

	Liquid Asphalt Type & Grade	Application Rate litres/m^2	Concentration
Prime Coat	MS-1	1.5 ±0.5	100%
Tack Coat	SS-1	0.5 ±0.2	50%
	MS-1	0.5±0.2	100%
	MC-30*	0.3 ±0.1	100%

***Note: only to be used for paving on Bridge Decks**

2.1.2 Dilute SS-1 emulsified asphalt with an equal amount of water.

2.2 EQUIPMENT

2.2.1 **Pressure Distributor**: shall be self-powered, equipped with a tachometer, a pressure gauge, an adjustable length spray bar, a positive displacement asphalt pump with a separate power unit, heating coils and a burner for even heating of asphalt and a thermometer. The pressure distributor shall be capable of maintaining a uniform speed and provide uniform application of liquid asphalt at the designated rate to areas up to 4 m wide.

2.2.2 **Hand Spray Wand:** shall have a nozzle connected by a hose to a pressure distributor and shall be capable of the uniform application of liquid asphalt.

3. EXECUTION

3.1 COMMON REQUIREMENTS

3.1.1 Prepare surface to be coated to the applicable Section. Have the surface inspected by the City before coating.

3.1.2 Protect adjoining curb, gutter, walk, slabs, barrier, poles and other surfaces not intended for coating, from splattering or overspray. Remove any splattering stains.

3.1.3 Do not apply liquid asphalt when the weather is foggy, rainy, windy, or when the air temperature is below 2°C, unless otherwise permitted by the Engineer.

3.1.4 Spray liquid asphalt to a uniform coat. Do not spray excessively to create ponding. Hand spray areas missed by or inaccessible to the distributor.

3.2 PRIME COAT

3.2.1 Apply prime coat while the soil cement surface is still moist.

3.2.2 Do not allow traffic on prime coat within 6 hours of application or until the prime coat has cured.

3.3 TACK COAT

3.3.1 Do not apply tack coat unless the surface is dry and free of dust and other material that could reduce the bond.

3.3.2 Apply tack coat only to an area that can be paved in the next 24 hours.

3.3.3 Minimize construction traffic on the cured tack coat. Reapply the tack coat if damaged by traffic.

Table 02963.1 – Specifications for Medium Curing Asphalt

ASPHALT GRADE REQUIREMENTS	ASTM TEST	MC-30 Min	MC-30 Max
Flash Point, Open Tag, °C	D-1310	38	-
Kinematic Viscosity at 60°C, mm^2/s	D-2170	30	60
Distillation Test:			
% by volume of total distillate to 360°C	D-402		
- 190°C		-	-
- 225°C		-	25
- 260°C		40	70
- 315°C		75	93
Residue from distillation to 360°C			
Volume % by difference		50	-
Tests on Residue from Distillation:			
Penetration at 25°C, 100 g, 5 s, dmm	D-5	120	250
Ductility at 25°C, cm	D-113	100	-
Solubility in Trichloroethylene, % by mass	D-2042	99.5	-
Water, % by mass or volume	D-95	-	0.2
Delivery Temperature, °C		35	55

Note: If the ductility at 25°C is <100 cm, the material will be acceptable if the ductility at 15°C is >100 cm

General Requirements: The asphalt shall not foam when heated to the application temperature range. The asphalt shall be produced by the refining of petroleum and shall be uniform in character.

Table 02963.2 – Specifications for Anionic Emulsified Asphalts

ASPHALT GRADE REQUIREMENTS	ASTM TEST	SS-1		SS-1H		MS-1	
		Min	Max	Min	Max	Min	Max
Viscosity at 25°C, SF s	D-88	20	60	20	60	20	100
Residue by Distillation, % by mass	D-244	55	-	55	-	55	-
Settlement in 5 days, % difference by mass	D-244	-	5	-	5	-	5
Storage Stability Test, 24 hour, % by mass	D-244	-	1	-	1	-	1.5
Retained on No. 1000 sieve, % by mass	D-244	-	0.10	-	0.10	-	0.10
Cement Mixing Test, % by mass	D-244	-	2.0	-	2.0	-	2.0
Tests on Residue from Distillation:							
Penetration at 25°C, 100 g, 5 s, dmm	D-5	100	200	40	100	100	200
Ductility at 25°C and 5 cm/minute, cm	D-113	60	-	60	-	40	-
Solubility in Trichloroethylene, % by mass	D-2042	97.5	-	97.5	-	97.5	-
Delivery Temperature, °C		40	70	40	70	40	70

Notes: The upper limit on % residue is governed by the consistency limits.
The test for settlement may be waived when the emulsified asphalt is used in less than 5 days time.
The 24 hour storage test may be used in place of the 5 day settlement test. However, in case of dispute the 5 day storage settlement test shall govern.
CAN/CGSB-8.2-M Sieves, woven wire, metric shall be used for the sieve test.

General Requirements: All tests shall be performed within 15 days of the date of delivery.
The asphalt shall be uniform in character and shall have a refined petroleum base.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Removal and restoration of road, laneway, curb, gutter, walk, and crossing disturbed by a utility cut.

1.2 RELATED SECTIONS

1.2.1 Section 02060 - Aggregate

1.2.2 Section 02066 – SGC Hot-Mix Asphalt Concrete

1.2.3 Section 02224 - Pavement and Concrete Removal

1.2.4 Section 02318 - Trench and Backfill

1.2.5 Section 02335 - Subgrade Preparation

1.2.6 Section 02342 - Cement-Stabilized Subgrade

1.2.7 Section 02712 - Concrete Base

1.2.8 Section 02713 - Plant-Mix Soil Cement

1.2.9 Section 02722 - Granular Base Courses

1.2.10 Section 02742 – SGC Hot-Mix Asphalt Paving

1.2.11 Section 02751 - Concrete Pavement

1.2.12 Section 02770 - Concrete Curb, Gutter, Walk, Slabs

1.2.13 Section 02961 - Pavement Cold Milling

1.2.14 Section 02963 - Liquid Asphalt Coats

1.2.15 Section 03055 - Portland Cement Concrete

1.3 DEFINITIONS

1.3.1 **Utility Cut:** Utility work undertaken by City of Edmonton departments, other government agencies, private companies, or individuals involving trenching or cutting across or along, or in any way causing damage to, existing roadway infrastructure on road right-of-way, in particular, road, laneway, curb, gutter, walk, and crossings.

1.3.2 **Drive Lane:** That width of road delineated for driving by lane markings. If there are no lane markings, one quarter of the road width is deemed to be a drive lane. The full width of a laneway is considered to be one drive lane.

1.3.3 **Streetscape Location:** An area where improvements are made to roadway infrastructure specifically for the purpose of beautification.

1.4 ROAD INFORMATION

1.4.1 **Road Classification Map:** (Appendix A to the Transportation System Bylaw) available from the Transportation Planning Branch, Transportation and Streets Department, 13th Floor Century Place.

1.4.2 **Existing Pavement Structure and Visual Condition Index:** available from Pavement Management Systems, Streets Engineering Branch, Transportation and Streets Department, 10517 - 95 Street.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Hot-Mix Asphalt:** to Section 02066 – SGC Hot Mix Asphalt Concrete.

2.1.2 **Concrete:** to Section 03055 – Portland Cement Concrete.

3. EXECUTION

3.1 Perform utility cut and restoration in accordance with the applicable specification Sections, drawings, and as supplemented or modified by the following requirements.

3.2 ROAD AND LANEWAY

3.2.1 Pavement Removal:

3.2.1.1 Remove the full pavement structure disturbed by a utility cut, to a minimum width of 300 mm (Drawing 1500). Remove all cracked or disturbed pavement leaving a clean straight vertical butting edge for the replacement paving materials.

3.2.1.2 Full-depth sawcutting of pavement structure shall include asphalt, concrete and soil cement layers.

Sawcutting Asphalt <100 mm Thick: Remove disturbed pavement by suitable means without presawing. Sawcut full-depth prior to pavement replacement, to provide a clean straight vertical edge at the time replacement paving materials are placed. In cold weather, when sawcutting is not practical, sawcutting before pavement replacement is not required if there is a clean straight vertical edge against which the replacement paving materials can be placed.

Sawcutting Asphalt ≥100 mm Thick or Concrete Base: Sawcut full-depth prior to pavement removal, to prevent disturbance of the adjacent pavement structure. Resaw prior to pavement replacement if adjacent pavement is cracked or disturbed, or if a clean straight vertical edge is not maintained. In cold weather, when sawcutting is not practical, and in emergency repair situations, disturbed pavement may be removed by suitable means without presawing. Sawcut prior to pavement replacement when whether permits, to obtain a clean straight vertical edge against which the replacement paving materials can be placed.

3.2.1.3 Removal Limits:

Asphalt and Soil Cement: Remove pavement structure to the edge of pavement, if the edge of the utility cut is less than 1.0 m from the edge of pavement on freeways and arterials, or less than 1.5 m from the edge of pavement on collector, industrial and residential roadways, and laneways.

One-Course Concrete and Concrete Base: Remove pavement structure to the edge of pavement, if the edge of utility cut is less than 1.0 m from the edge of pavement, a joint, or an existing crack. In one-course concrete streetscape locations, remove concrete pavement to the nearest joint.

3.2.1.4 Avoid sharp angles in cutting the pavement in order to allow continuous compaction of replacement material longitudinally along the entire length of the cut. (Drawing 1500)

3.2.1.5 Remove the pavement structure that is undermined by the failure of the sides of a utility cut.

3.2.2 Trench Backfill: to Section 02318 - Trench and Backfill.

3.2.3 Replacement Pavement Structure

3.2.3.1 For Asphalt Surfaced Road and Laneway: Place hot-mix asphalt concrete of the type and thickness as follows:

Roadway Class	Surface Asphalt	Base Asphalt
Arterial Roadway or Freeway	50 mm, 10mm-HT	250 mm, 20mm-B
Collector or Industrial Roadway	50 mm, 10mm-HT	175 mm, 20mm-B
Commercial Laneway	50 mm, 10mm-HT	175 mm , 20mm-B
Residential Street or Laneway	150 mm, 10mm-LT (minimum)	

Place hot-mix asphalt to Section 02742 – SGC Hot Mix Asphalt Paving. Use appropriate equipment to achieve the required compaction in confined space.

If a utility cut is to be done in a current construction year coordination must be coordinated with roadway design and construction.

3.2.3.2 For One-Course Concrete and Concrete Base Road and Laneway: Place Portland cement concrete, class A one-course pavement to Section 02751 - Concrete Pavement, or Class B concrete base to Section 02712 –

Concrete Base, of a thickness matching the existing concrete one-course pavement or base. Tie the new concrete to the existing concrete using 15M deformed bars, 300 mm long, at 750 mm spacing on each side of the utility cut. Stagger the tie bars from side to side, with the bars extending 150 ±25 mm into the existing concrete at mid-depth (Drawing 1504).

3.2.3.3 Alternate Structure: The Engineer may approve an alternate replacement pavement structure if the entire width of the road or laneway is being replaced.

3.2.3.4 For Gravel Road: Place 200 mm of 20 mm crushed aggregate (Designation 3 Class 20C) on a 150 mm prepared subgrade.

3.2.3.5 For Oiled Road: Place 150 mm of approved oil-mix material on a 150 mm prepared subgrade.

3.2.4 Overlay on Adjacent Pavement:

Mill the adjacent asphalt pavement 50 mm deep and overlay to the full width of any drive lane or lanes disturbed by the utility cut with 50 mm of 10mm-HT, or with 50 mm of 10mm-LT on residential streets or laneways, when a utility cut runs more than 30 m longitudinally on an asphalt road or laneway (Drawing 1502), or a number of utility cuts run transverse to the pavement edge over a longitudinal distance of 50 m or greater and are at intervals of 15 m or less (edge of cut to edge of cut) on any drive lane (Drawing 1504).

3.2.4.1 Roads and Laneways To Be Overlayed:

All freeways, arterial and industrial roadways. Collector roadways and residential streets, and laneways having a visual condition index (VCI) of 5.0 or greater. Overlay to Section 02742 – SGC Hot-Mix Asphalt Paving. Ensure that the weather limitations are strictly adhered to.

3.3 CONCRETE CURB, CURB AND GUTTER, WALK, CROSSING

3.3.1 Cutting and Removal of Concrete:

3.3.1.1 Remove concrete work disturbed by a utility cut or undermined by the failure of the sides of a utility cut.

3.3.1.2 Before removal, sawcut the concrete through its full depth, leaving a straight vertical face.

3.3.1.3 Concrete may be broken at crack-control joints without sawcutting provided a straight vertical face free of loose material remains.

3.3.2 Curb, Curb and Gutter:

3.3.2.1 Remove any length less than 1.5 m to the next crack-control joint.

3.3.2.2 Remove a minimum length of 600 mm on both sides of a catch basin to be moved or installed.

3.3.3 Walk

3.3.3.1 Remove walk in full panels to the nearest crack-control or surface joints, transverse or longitudinal.

3.3.3.2 Walk ≥3 m wide without Longitudinal Joints: If the utility cut runs parallel to the walk, divide the walk longitudinally into equal 1.5 m minimum width strips. Remove only the strip or strips disturbed by the utility cut.

3.3.3.3 Monolithic Walk:

- Walk <3 m wide: Remove the full width of the walk including the curb and gutter.
- Walk ≥3 m wide: Curb and gutter may remain if in good condition. Remove walk as in 3.3.3.2 above.

3.3.4 Crossing

3.3.4.1 On Monolithic or Curbline Walk: If the crossing has crack-control joints, remove to the nearest joint; remove remaining crossing if cracked or less than 1.5 m in least dimension. If crossing has no crack-control joints, remove to the width of the utility cut.

3.3.4.2 On Boulevard Walk or Crossing Pad: Remove a minimum section of 1.5 m by 1.5 m. Remove remaining crossing with less than 1.5 m in least dimension. There shall be only 1 or 2 panels in the crossing when replacement work is complete.

3.3.5 Curb Ramp

Remove the entire curb ramp.

3.3.6 Replacement Concrete

3.3.6.1 Construct replacement concrete work to Section 02770 - Concrete Curb, Gutter, Walk, Slabs..

3.3.6.2 Construct a curb ramp at any street corner with walk being replaced even if no curb ramp existed before.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Reclaiming existing asphalt pavement.

1.1.2 The design and production of recycled asphalt hot-mix.

1.1.3 Placing recycled asphalt hot-mix.

1.2 RELATED SECTIONS

1.2.1 Section 02066 SGC Hot-Mix Asphalt Concrete

1.2.2 Section 02742 SGC Hot-Mix Asphalt Paving

1.2.3 Section 02961 Pavement Cold Milling

1.3 QUALITY ASSURANCE

To Section 02066 – SGC Hot-Mix Asphalt Concrete.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Reclaimed Asphalt Pavement (RAP);** Rap is salvaged, milled, pulverized, broken, or crushed asphalt pavement removed from an existing pavement.

2.1.2 **Recycled Asphalt Shingles (RAS)**: pre-consumer or post consumer shingles that have been processed, sized, and are ready for incorporation into a hot mix Asphalt mixture.

2.1.3 **Virgin Aggregate:** new aggregate to Section 02066 – SGC Hot-Mix Asphalt Concrete.

2.1.4 **Aggregate in Recycled Asphalt Mix:** to Section 02066 – SGC Hot-Mix Asphalt Concrete modified as follows:

Mix Type:	**20mm - B**	**10mm - HT**	**10mm - LT**
Designation 1 class:	20	10.0	10.0
Sieve Size (μm)	**Total % Passing by Mass**		
160	9-16	7 – 16	8 – 16
80	4-9	4 - 9	4 - 9

2.1.5 **Asphalt Cement:** The extracted blended asphalt cement shall meet the PG requirements as detailed in 02066 – SGC Hot-Mix Asphalt Concrete.

2.2 MIX DESIGN AND PROPORTIONING

2.2.1 Submit a recycled asphalt mix design to Section 02066 – SGC Hot-Mix Asphalt Concrete for the specified mix type based on the following maximum RAP, RAS, or combination of RAP and RAS content:

Mix type:	20mm - B	10mm - HT	10mm - LT
Maximum RAP content if only using RAP in the mix (% by mass of total mix)	25	10	20
Maximum RAS content if only using RAS in the mix (% by mass of total mix)	3	3	3
Maximum RAP and RAS content if using both RAP and RAS in the mix, subject to the above noted individual maximums (% by mass of total mix)	25	10	20

2.2.2 Determine asphalt content and gradation of the RAS material for mixture design purposes in accordance with AASHTO T-164, Method A or B and AASHTO T-30. Calculate and ensure the ratio of the virgin binder to total binder is greater than 80% in surface mixtures and 75% in non-surface mixtures. “Surface” mixtures are defined as mixtures that will be final lifts or riding surfaces of a pavement structure. “Non-Surface” mixtures are defined as mixtures that will be intermediate or base layers in a pavement structure.

2.2.3 RAS shall contain no more that 0.5% by total cumulative weight of extraneous waste materials including but not limited to, metals, glass, paper, rubber, wood nails, plastics, soil, brick tars, and other contaminating substances. This percentage shall be determined on material retained on the 5.000mm sieve

2.2.4 RAS shall be free from asbestos fibers.

2.2.5 The Contractor shall, with the mix design, furnish PG test results from the virgin binder, the binder extracted from the individual RAP or RAS materials and PG test results indicating that the binder in the mix resulting from the blending of the RAP, RAS, or RAP and RAS materials meets the grade specified in the contract.

2.3 ASPHALT PLANT

2.3.1 In addition to the requirements of Section 02066 – SGC Hot-Mix Asphalt Concrete, the mixing plant shall be capable of receiving and mixing the proportions of RAP, RAS, virgin aggregate and asphalt cement as designed.

2.3.2 The mixing plant shall be capable of thorough degradation and heating of RAP and RAS particles and blending with virgin aggregate and asphalt cement to produce a homogeneous mix at the point of discharge.

2.4 EQUIPMENT

2.4.1 **Cold Planer:** to Section 02961 - Pavement Cold Milling.

2.4.2 **Haul Vehicle:** capable of receiving milled material directly from the cold planer and hauling directly to a stockpile.

2.4.3 **Weigh Scale:** shall meet the following requirements:

2.4.3.1 Inspected and certified by Weights and Measures Inspection Services of Canada Consumer and Corporate Affairs as often as directed by the Engineer, with the inspection certificate exhibited as required.

2.4.3.2 Of sufficient size and capacity for weighing any haul vehicle in one operation with all wheels on the platform.

2.4.3.3 Scale house to be provided complete with furnishings, subject to the approval of the Engineer..

2.4.4 **Mechanical Sweeper:** capable of removing loose material and debris from the milled surface

2.4.5 **Asphalt Shingle Grinder**: capable of receiving and processing asphalt shingles meeting the end product size requirements listed.

3. EXECUTION

3.1 RECLAIMING ASPHALT PAVEMENT

3.1.1 **Cold Milling:** Mill the designated pavement with a cold planer to Section 02961 - Pavement Cold Milling, supplemented as follows:

3.1.1.1 Sweeping before Milling: Before milling, sweep the pavement surface with a mechanical sweeper to remove debris and dirt accumulations that may contaminate the millings.

3.1.1.2 Operate the planer in a manner that will minimize tearing and breaking of the underlying and adjacent pavement.

3.1.1.3 Water Use: Carefully control the amount of water used in milling. Moisture in the RAP is of critical importance during hot-mix production.

3.1.1.4 Load milled material directly from the planer into the haul vehicle.

3.1.1.5 Sweeping after Milling: Immediately sweep the milled surface clean with a mechanical sweeper following the planer by not more than 100 m.

3.1.1.6 Milling Stop Line: Terminate milling at a uniform line across the roadway at the end of a working day. Provide a transition in the road surface profile at a slope of not more than 25 mm/m.

3.1.1.7 Rain: Suspend the milling operation in the event of rain or other inclement weather. Fill the milled area with a paving mix if the potential to pond water exists. Remove the temporary cover before resuming milling operations.

3.1.1.8 Traffic Hazard: Promptly repair, to the Engineer's satisfaction, any distress in the newly milled surface which could become a hazard to vehicular traffic.

3.1.1.9 Minimize contamination of the RAP with granular, clay and other deleterious materials at all times.

3.1.2 **Stockpiling RAP**

The RAP becomes the Contractor's property after removal from the jobsite, unless otherwise stated in the Special Provisions of the contract. The Contractor is responsible for stockpiling RAP in accordance with the following guidelines.

3.1.2.1 Drainage: Choose a site that has positive surface drainage away from the base of the stockpile.

3.1.2.2 Stockpile Base: Must have adequate strength to support the anticipated volume of RAP in the stockpile.

3.1.2.3 Particle Sizes: RAP being stockpiled shall meet the following gradation, or must be crushed to obtain the required gradation.

Sieve Size (mm)	Total % Passing by Mass
125	100
80	99 - 100
40	95 - 100

3.1.2.4 Ensure that the RAP is not disturbed after stockpiling. The RAP shall remain loose and uncompacted. No equipment shall be permitted to operate on the stockpile.

3.2 Recycled Asphalt Shingles (RAS)

3.2.1 RAS Production

Process the RAS by ambient grinding or granulating to meet the requirements in the following table when tested in accordance with AASHTO T27 (prior to extraction process)

Sieve Size (µm)	Total % Passing by Mass
10 000	100
5 000	70.0 - 95.0
160	15.0 Max.
80	7.0 Max.

3.2.2 Stockpiling RAS:

The Contractor is responsible for stockpiling RAS in accordance with the following guidelines.

3.2.2.1 Drainage: Choose a site that has positive surface drainage away from the base of the stockpile.

3.2.2.2 Stockpile Base: Must have adequate strength to support the anticipated volume of RAS in the stockpile

3.2.2.3 Ensure that the RAS is not disturbed after stockpiling. The RAS shall remain loose and uncompacted. No equipment shall be permitted to operate on the stockpile.

- The Contractor may uniformly blend sand or fine aggregate with RAS in stockpiles if needed to keep the processed material workable. The sand or fine aggregate added must be considered in the final gradation of the new HMA.
- Use RAS that is sufficiently dry to be- free flowing and to prevent foaming when blended with the hot binder.

3.2.3 If the Contractor elects to use RAS, the following additional conditions shall apply:

3.2.3.1 The Contractor shall have an approved Quality Control Plan (QCP) that details how the RAS will be processed and controlled. When the Contractor intends to use RAS from a RAS Supplier, that supplier's QCP shall be submitted by the Contractor. The QCP shall be submitted with the Contractor's HMA mix design and shall address the following:

3.2.3.1.1 RAS Processing Techniques. This requires a schematic diagram and narrative that explains the processing (grinding, screening, and rejecting) and stockpile operation for this specific project. Hand sorting of deleterious material prior to grinding is required. In addition, this plan must address the control of agglomeration and moisture.

3.2.3.1.2 Determination and Control of RAS Asphalt Binder Content (AASHTO T-164, Method A or B): Frequency: 1/200 tonnes of processed RAS material (minimum five tests).

3.2.3.1.3 Control of RAS Gradation (CP31 or AASHTO T-30): Frequency: 1/200 tonnes of processed RAS material (minimum three tests)

3.2.3.1.4 Asbestos content of RAS: Frequency: 1/1000 tonnes of processed RAS material (minimum three tests)

3.2.3.1.5 Moisture content of RAS: Frequency: 1/day

3.2.3.1.6 Deleterious Material: Frequency: 1/1000 tonnes of RAS material (minimum three tests)

3.3 PRODUCTION OF RECYCLED ASPHALT MIX

3.3.1 **Production:** Produce recycled asphalt mixture in accordance with the approved mix design and to Section 02066 – SGC Hot-Mix Asphalt Concrete.

3.4 PAVING

3.4.1 **Paving Operation**: to Section 02742 – SGC Hot-Mix Asphalt Paving.

3.4.2 **Substitute Mix**: Provide at least 24 hours notice to the Engineer if recycled asphalt hot-mix cannot be produced as intended.

3.4.3 **Tolerances**: to Section 02742 – SGC Hot-Mix Asphalt Paving.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Pulverization of existing asphalt, soil cement and/or aggregate roadway structures.

1.1.2 Addition and mixing of stabilizing agents into the reclaimed base.

1.1.3 Grading and compaction of the reclaimed base course.

1.2 RELATED SECTIONS

1.2.1 Section 02310 - Grading.

1.2.2 Section 02342 – Cement Stabilized Subgrade.

1.2.3 Section 02722 – Granular Base Courses.

1.3 DEFINITION

1.3.1 **Reclaimed Base Course:** pulverized and processed roadway structure to the depths shown on the drawings or defined by the Engineer.

1.4 QUALITY ASSURANCE

1.4.1 **Maximum Density:** the dry unit mass of a reclaimed base course sample at optimum moisture content as determined in the laboratory according to ASTM D698 Method A.

1.4.2 **Required Density:** a minimum of 100% of the maximum density for each 150 mm of reclaimed base course.

1.4.3 **Testing Frequency:** the quality assurance laboratory will take a minimum of one field density test for each 1 000 m^2 of compacted reclaimed base course according to ASTM D2167 or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Portland Cement:** to CAN/CSA-A3000, A3001-03, Type GU – General use hydraulic cement

2.1.2 **In-Situ Materials:** the existing pavement structure to be pulverized has been investigated, and the results are included in the contract Special Provisions. If additional coring or sampling is desired, the coring or sampling shall be at the expense of the Contractor, upon approval of the Engineer.

2.1.3 **Stabilizing Agents:** fluid chemical or bituminous stabilizing agents as specified in the contract Special Provisions, and as directed by the Engineer

2.1.4 **Water:** may be obtained from City fire hydrants according to the General Requirements. Other water sources are subject to the Engineer's approval.

2.2 EQUIPMENT

2.2.1 **Reclaimer/Stabilizer:** a roadway structure pulverizing machine with the following characteristics, and subject to the Engineers approval:

2.2.1.1 The capability of pulverizing asphalt, soil cement and gravel roadway structures to depths of at least 400 mm in a single pass, and accurately maintaining a pre-set depth of cut.

2.2.1.2 A milling drum that rotates upward into the direction of advance with a minimum cut width of 2.0 m.

2.2.1.3 A system to apply and to regulate the addition of water or fluid stabilizing admixtures in relation to the depth of mixing and rate of advance of the machine.

2.2.2 **Compaction Equipment:** self-propelled vibratory steel drum or sheepsfoot/padfoot rollers capable of achieving the required compaction of the reclaimed base course, and providing a surface suitable for the placement of hot-mix asphalt concrete.

3. EXECUTION

3.1 PREPARATION

3.1.1 Roadway areas to be reclaimed will be indicated on plans or designated by the Engineer.

3.1.2 Ensure that any conflicts with underground utilities in the zone of reclamation are resolved prior to pulverization.

3.2 PULVERIZATION

3.2.1 Pulverize the existing roadway structure into fragments no larger than 25 mm maximum dimension, exclusive of existing aggregate.

3.2.2 Ensure that the reclaimed base course mixture is homogeneous and well graded using additional passes of the reclaimer/stabilizer if required.

3.3 ADDITION OF STABILIZING ADMIXTURES.

3.3.1 Add stabilizing admixtures to the reclaimed base course as shown on the Drawings or as directed by the Engineer.

3.3.1.1 Portland Cement: to Section 02342 – Cement Stabilized Subgrade

3.3.1.2 Liquid chemical or bituminous stabilizers: as defined in the contract Special Provisions.

3.3.2 Ensure that the stabilizing admixtures are uniformly distributed and mixed with the pulverized material.

3.4 GRADING AND COMPACTION.

3.4.1 To Section 02310 – Grading and Section 02722 – Granular Base Courses.

3.4.2 Leave the surface of the compacted reclaimed base course slightly higher than the required elevation; then trim to the design crown and grade. Leave the finished surface even and free of depressions, humps or loose material.

3.5 FIELD QUALITY CONTROL

3.5.1 Check the finished surface of the reclaimed base course to ensure it meets the following tolerances:

3.5.1.1 Grade: 6 mm maximum variation above design elevation.
25 mm maximum variation below design elevation.

3.5.2 When Tolerance Exceeded

3.5.2.1 Trim high areas and refinish surface to within tolerance.

3.5.2.2 Add reclaimed base material or approved granular material to low areas, scarify and blend to full reclamation depth, recompact to required density, and refinish surface.

3.5.3 **Density Tests::** If a density test result is less than the required density, that test result is discarded and 3 retests shall be performed on the area represented by the failed test. The average of the 3 retests shall represent the density of that area. If this average is less than the required density, the area shall be reworked to the full depth of the lift; the aggregate moisture content altered as necessary and recompacted to the required density. If the area is not retested but is reworked and recompacted the area shall be tested at normal testing frequencies.

3.6 PROTECTION OF FINISHED WORK

3.6.1 Do not permit vehicular traffic over the reclaimed base course until permitted by the Engineer.

3.6.2 If the reclaimed base course floods, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches.

3.6.3 Maintain protection of the reclaimed base course until paved with hot-mix asphalt concrete. Repair base course if damaged.

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Pulverization of existing asphalt, soil cement and/or aggregate roadway structures.

1.1.2 Addition and mixing of stabilizing agents into the reclaimed base.

1.1.3 Grading and compaction of the reclaimed base course.

1.2 RELATED SECTIONS

Grading	Section 02310
Cement Stabilized Subgrade	Section 02342
Proof Rolling	Section 02345
Granular Base Courses	Section 02722
Full Depth Reclamation	Section 02968

1.3 DEFINITION

1.3.1 **Full Depth Reclamation Using Foamed Asphalt:**

1.3.1.1 Full Depth Reclamation (FDR) Using Foamed Asphalt shall consist of a full depth recycling process, where the existing bituminous cover and the top portion of the underlying base material are reclaimed and transformed into a homogenous mixture by an in-place process using foamed asphalt and if required additional course aggregate and granular material;

1.3.1.2 FDR shall be performed by utilizing a recycling machine to pulverise, to the depth shown on the plans, the materials in the upper layers of the existing pavement structural section together with any imported aggregate base and to achieve the required grading and consistency of mix in a single pass. The recycled material shall exit from the mixing chamber in a manner that prevents particle segregation. Spreading and placing to form the new structural section shall be by motor grader or screed mounted on the rear of the recycling machine. Pre-pulverizing may be done prior to the foamed asphalt application with no extra compensation.

1.3.1.3 Pulverize and reuse materials in the upper layers of the existing roadway structural section;

1.3.1.4 Adjust the gradation of the existing materials by the addition of imported aggregate base (Admixture Aggregate) if and where necessary;

1.3.1.5 Procure, furnish, and mix in a combination of foamed bitumen and cementitious stabilizing agents together with sufficient water to approximate the optimum moisture content; and

1.3.1.6 Place and compact to achieve a new structural section, as shown on the plans, as specified in the Standard Specifications and these special provisions, unless otherwise directed by the Engineer.

1.4 QUALITY ASSURANCE

1.4.1 **Maximum Density:** the dry unit mass of a sample at optimum moisture content as determined in the laboratory according to ASTM D1557

1.4.2 **Required Density:** a minimum of 98% of the maximum density in accordance with ASTM D1557 for the full depth foam in-place recycled material.

1.4.3 **Testing Frequency:** the quality assurance laboratory will take a minimum of one field density test for each 1 000 m^2 of compacted full depth foam in-place recycled material according to ASTM D2167 or ASTM D2922 for comparison with a maximum density determined according to ASTM D1557.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Cementitious Stabilizing Agent:** Portland Cement to, CAN/CSA-A3000, A3001-03 Type GU, General use hydraulic cement shall be the only cementitious stabilizing agent employed in the full depth foam in-place Recycling process

2.1.2 **In-Situ Materials:** The existing pavement structure to be pulverized has been investigated, and the results are included in the contract Special Provisions. If additional coring or sampling is desired, the coring or sampling shall be at the expense of the Contractor.

2.1.3 **Bituminous Stabilizing Agents:** Foamed bitumen shall be the only bituminous stabilizing agent employed in the full depth foam in-place recycling process. Foamed bitumen shall be produced from Asphalt Cement: premium grade 150-200(A), to Table 02970.1 or PG 58-28 to AASHTO M320, Table 2 which are included in these specification as Table 02970.2 and Table 02970.3.

2.1.4 **Water:** may be obtained from City fire hydrants according to the General Requirements. Other water sources are subject to the Engineer's approval.

2.1.5 **Admixture Aggregate:** 20mm aggregate to be incorporated into the existing road structure to ensure adequate fines for stabilization shall meet the following gradation:

Sieve Size	Percent Passing
20 000	100
12 500	60-90
5 000	40-60
2 000	25-45
400	15-25
160	10-20
80	10-15

2.2 FOAMED BITUMEN MIX DESIGN

2.2.1 Submit to the ESS for approval a Foamed Bitumen Mix Design performed by a qualified laboratory at least 14 days before initial Foamed Bitumen Recycling work for each location. The mix design should be carried out in accordance with the mix design method detailed in the Wirtgen Cold Recycling Manual current edition.

2.2.1.1 The design of the foamed asphalt shall be completed with a laboratory asphalt expanding plant. The half -life and expansion ratio of the expanded asphalt bitumen shall be determined at a minimum of five (5) moisture contents. A minimum of two (2) trials shall be completed at each moisture content and the average values obtained shall be used in the final analysis. The moisture content of the expanded asphalt bitumen shall be established to provide a maximum expansion ratio and maximum half-life. The moisture content of the binder shall be selected to provide a minimum half-life of eight (8) seconds.

2.2.1.2 The mix design sample shall be a representative sample of the roadway being rehabilitated and shall be obtained using the anticipated recycling equipment.

2.3 FOAMED BITUMEN MIX DESIGN CRITERIA

2.3.1 **Aggregate Gradation:** The combined/pulverized material should meet the following gradation:

Sieve Size	Percent Passing
38 000	100
20 000	70-100
12 500	60-85
5000	45-70
2 500	33-60

400	15-35
160	10-25
80	5-20

2.3.2 **Portland Cement Content:** minimum 1.0% by mass of dry aggregate

2.3.3 **Bitumen:** Minimum 2.6% by mass of dry aggregate

2.3.4 The mix design should be performed at various bitumen contents using Marshall criteria of 75 blows per face. The Indirect Tensile Strength (ITS) of the specimens should be determined for both the soaked and unsoaked specimens. The soaked specimens should be placed under water at 25^{o} C ± 1^{o} C for 24 hours. Remove the specimens from the water and surface dry the specimen prior to performing ITS testing The ratio of unsoaked to soaked Tensile Strength (TSR) must be a minimum of 50%

2.3.5 The final design shall be based on a foamed bitumen content that provides:

2.3.5.1 Optimum bulk Density

2.3.5.2 Optimum dry strength properties

2.3.5.3 Optimum wet strength properties

2.3.5.4 Optimum resistance to moisture penetration

2.4 EQUIPMENT

2.4.1 **Reclaimer/Stabilizer:** a roadway structure pulverizing machine with the following characteristics, and subject to the Engineers approval:

2.4.1.1 A minimum power capacity of 600 horsepower;

2.4.1.2 A milling drum that rotates upward into the direction of advance with a minimum cut width of 2.0 m;

2.4.1.3 The capability of pulverizing asphalt, soil cement and gravel roadway structures to depths of at least 400 mm in a single pass, and accurately maintaining a pre-set depth of cut;

2.4.1.4 Due to the cut depths as detailed in the contract documents, there is no requirement for the effective volume of the mixing chamber to be increased in relation to the depth of cut.

2.4.1.5 Two microprocessor controlled systems, complete with two independent pumping systems and spraybars, one to regulate the application of foamed bitumen stabilizing agent and a separate system to regulate the water (for increasing the moisture content of the recycled material), both in relation to the forward speed and mass of the material being recycled;

2.4.1.6 Two spraybars shall each be fitted with nozzles at a maximum spacing of one nozzle for each 155mm width of chamber; the contractor shall ensure that all nozzles utilized in the foamed asphalt process shall be maintained in working order for the duration of the process;

2.4.1.7 The foamed bitumen shall be produced at the spraybars in individual expansion chambers, or one large expansion chamber, into which hot bitumen and water are injected under pressure through orifices that promote atomization. The rate of addition of water into hot bitumen shall be kept at a constant (percentage by mass of bitumen) by the same microprocessor;

2.4.1.8 An inspection (or test) nozzle shall be fitted at one end of the spraybar that produces a representative sample of foamed bitumen;

2.4.1.9 An electrical heating system capable of maintaining the temperature of all bitumen flow components above 150^{0}C;

2.4.1.10 A single bitumen feed pipe installed between the modified milling or recycling machine and the supply tanker can be used. A system that incorporates a return pipe to the supply tanker may be used providing the overall temperature of the bitumen can be maintained;

2.4.2 **Compaction Equipment:** self-propelled vibratory steel drum, sheepsfoot/padfoot rollers and pneumatic-tired rollers capable of achieving the required compaction of the cold foam in-place recycled material, and providing a surface suitable for the placement of hot-mix asphalt concrete.

The frequency and amplitude of vibrating rollers shall exceed a static mass of 15 tons and shall be adjustable.

2.4.3 **Supply Tankers for Bituminous Stabilizing Agent:** Only tankers with a capacity exceeding 10,000 L shall be used to supply the recycling machine with bitumen. Each tanker shall be fitted with two recessed pin-type two hitches, on in front and the other in the rear, thereby allowing the tanker to be pushed from behind by the recycling machine, and to push a water tanker in front. No leaking tanker will be permitted on the job site. In addition, each tanker shall be equipped with the following:

2.4.3.1 A thermometer to show the temperature of the bottom third of the tank;

2.4.3.2 A rear feed valve, with a minimum internal diameter of 75mm, capable of draining the contents of the tank when fully opened;

2.4.3.3 All-round cladding to retain heat;

2.4.3.4 A calibrated dipstick marked at intervals of no more than 100 litres, for measuring the contents of the tank.

3. EXECUTION

3.1 PREPARATION

3.1.1 Roadway areas to be reclaimed will be indicated on plans or designated by the Engineer.

3.1.2 Ensure that any conflicts with underground utilities in the zone of reclamation are resolved prior to pulverization.

3.1.3 The Contractor is responsible for clearing all foreign matter from the entire roadway width, including any adjacent lanes or shoulders that are not to be recycled.

3.1.4 The contractor is responsible for the removal of all standing water.

3.2 UNSUITABLE WEATHER CONDITIONS

3.2.1 **Wet Weather:** No full depth foam reclamation work shall be performed during wet conditions, nor started without completing before wet conditions set in.

3.2.2 **Cold Weather:** No full depth foam reclamation work shall be performed if the ambient pulverized roadway material temperature is below 0^{0}C other than finishing and compaction operations.

3.2.3 **Windy Weather:** Spreading of cementitious stabilizing agents on the roadway ahead of the recycling machine will not be allowed when windy conditions adversely affect the operations.

3.2.4 **Time Limitations**

3.2.5 The maximum time period between mixing the recycled material with a stabilizing agent and compacting the placed material shall be determined by the type of stabilizing agent applied. Where combinations of two or more different stabilizing agents are used, the stabilizing agent that predominates shall dictate the time limitation. Where Portland Cement is added in conjunction with a bituminous stabilizing agent at an application rate of less than 2 percent, the time limit of the bituminous stabilizing agent shall apply. The maximum time periods shall be as follows:

Stabilizing Agent	Time Limit
Portland Cement	3 Hours
Bitumen Emulsion	Before the emulsion breaks
Foamed Bitumen	24 Hours if kept moist

3.3 PRODUCTION PLAN

3.3.1 Prior to beginning with the recycling work each day, the Contractor shall prepare a production plan detailing proposals for the forthcoming day's work. The production plan shall contain the following information:

3.3.1.1 A sketch showing the overall layout of the length and width of roadway intended for recycling during the day, broken into the number of parallel cuts required to achieve the stated width, and the overlap dimensions at each joint between cuts;

3.3.1.2 The sequence and length of each cut to be recycled before starting on the adjacent or following cut;

3.3.1.3 An estimate of the time required for pulverizing, mixing and compacting the cut. The sketch shall also show the time when completion of each is expected;

3.3.1.4 The proposed water addition for each cut;

3.3.1.5 The quantity and location where aggregate base is to be imported;

3.3.1.6 The amount and type of stabilizing agent, or agents, to be applied to each cut;

3.3.1.7 The proposed quality control testing program; and

3.3.1.8 Any other information that is relevant for the intended work.

3.4 PULVERIZATION

3.4.1 Pulverize the existing roadway structure into fragments no larger than 25mm maximum dimension, exclusive of existing aggregate. The forward speed of the recycling machine, rotation rate of the recycling drum, and the positioning of the gradation control beam shall be set to break down the in-situ material to an acceptable grading.

3.4.2 The Contractor shall take all necessary steps to ensure that the grading of the recycled material conforms to the requirements specified in "Test Sections" of these specifications.

3.4.3 In the event that the roadway is pre-pulverized, shaped and recompacted prior to the addition of stabilizing admixtures. The pre-pulverized material shall be compacted to the satisfaction of the Engineer to allow use of the roadway prior to further processing.

3.5 ADDITION OF WATER AND STABILIZING ADMIXTURES.

3.5.1 Add stabilizing admixtures to the reclaimed base course as specified or as directed by the Engineer.

3.5.1.1 Portland Cement: as detailed in Section 2.1.1 of these Specifications.

3.5.1.2 Bituminous stabilizers: as detailed in Section 2.1.3 of these Specifications.

3.5.2 Ensure that the stabilizing admixtures are uniformly distributed and mixed with the pulverized material. The microprocessor control system for the addition of water and foamed bitumen shall be set and carefully monitored to meet the required compaction moisture and stabilizer content. Bulk bitumen tankers shall be dipped at the end of each cut in order to determine actual usage against the calculated theoretical demand.

3.6 OVERLAP OF LONGITUDINAL JOINTS

3.6.1 Premark cut lines on the road surface designating the width of each cut in a section of the roadway.

3.6.2 To ensure complete recycling across the full width of the roadway, longitudinal joints between successive cuts shall overlap a minimum of 150mm.

3.6.3 Premarked cut lines on the road surface shall be checked to ensure that the width of the first cut is equal to that of the milling drum and that the width of all successive cuts shall be narrower than the drum width by at least 150mm. The milling/Recycling machine shall be steered so as to accurately follow the premarked lines. Any deviation in excess of 50mm shall be rectified immediately by reversing to where the deviation commenced and reprocessing along the correct line, without the addition of any further water or stabilizing agent.

3.6.4 The overlap width shall be confirmed before starting each new cut sequence and any adjustments made to ensure that the amount of water and fluid stabilizing agents to be added is reduced proportionately by the width of the overlap.

3.7 CONTINUITY OF STABILIZED LAYER

3.7.1 The Contractor shall ensure that there is no gap of unrecycled material created between successive cuts (along the same longitudinal cut line), nor any untreated wedges created by the entry of the milling drum into existing material by:

3.7.1.1 Carefully marking the exact location at which each cut terminates, this mark shall coincide with the position of the center of the pulverizing drum at the point at which the supply of stabilizing agent ceased.

3.7.1.2 Start the next successive cut at least 0.5m behind this mark to ensure continuity.

3.8 SUBGRADE INSTABILITY

3.8.1 Where subgrade instability is encountered during the recycling process, the subgrade shall be:

3.8.1.1 Excavated and removed to a depth of 600mm; and

3.8.1.2 Replaced and backfilled with 3-20A granular base placed in lifts not exceeding 150mm when compacted and followed by successive layers until the level of the existing roadway is reached.

3.9 GRADING AND COMPACTION.

3.9.1 To Section 02310 – Grading and Section 02722 – Granular Base Courses.

3.9.2 Leave the surface of the compacted recycled material slightly higher than the required elevation; then trim to the design crown and grade. Leave the finished surface even and free of depressions, humps or loose material.

3.9.3 Rolling shall commence as soon as it is practical, and follow the predetermined sequence specified in “Test Sections” of these specifications.

3.10 WATERING, FINISHING AND CURING

3.10.1 After compaction the roadway surface shall be treated with a light application of water, and rolled with pneumatic-tired rollers to create a close-knit texture. The finished layer shall be free from:

3.10.1.1 Surface Laminations;

3.10.1.2 Segregation of fine and course aggregate;

3.10.1.3 Corrugations or any other defects that may adversely affect the performance of the layer.

3.10.2 Tack coat shall not be applied until the moisture content of the recycled layer is at least 2 percent below the as placed moisture content.

3.11 TEST SECTIONS

3.11.1 At the start of the project the contractor shall assemble all items of plant and equipment for the recycling operations and process a section of the roadway to:

3.11.1.1 Demonstrate that the equipment and processes and produce recycled layers to meet the requirements specified in these provisions;

3.11.1.2 Determine the effect on the grading of the recycled material by varying the forward speed of the recycling machine and the rotation of the pulverizing drum;

3.11.1.3 Determine the sequence and manner of rolling necessary to obtain the minimum compaction requirements.

3.11.2 The test section shall be at least 100m in length of a full lane-width.

3.11.3 If the test section fails or if modifications are made to the methods, processes, equipment, and materials, additional test sections shall be performed in accordance with the requirements listed above before further work can be performed.

3.12 FIELD QUALITY CONTROL

3.12.1 Check the finished surface of the reclaimed base course to ensure it meets the following tolerances:

3.12.1.1 Grade: 6 mm maximum variation above design elevation.
6 mm maximum variation below design elevation.

3.12.2 When Tolerance Exceeded

3.12.2.1 Trim high areas and refinish surface to within tolerance.

3.12.2.2 Add recycled material to low areas, scarify and blend to full reclamation depth, recompact to required density, and refinish surface.

3.12.2.3 **Density Tests**: If a density test result is less than the required density, the initial test result is discarded and three retests shall be performed on the area represented by the failed test. The average of the three retests shall represent the density of that area. If this average is less than the required density, the area shall be reworked to the full depth of the lift; the moisture content altered as necessary and recompacted to the required density. If the area is not retested but is reworked and recompacted the area shall be tested at normal testing frequencies.

3.13 PROTECTION OF FINISHED WORK

3.13.1 Do not permit vehicular traffic over the recycled material until permitted by the Engineer.

3.13.2 If the recycled material floods, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches.

3.13.3 Maintain protection of the recycled material until paved with hot-mix asphalt concrete. Repair recycled material if damaged.

END OF SECTION

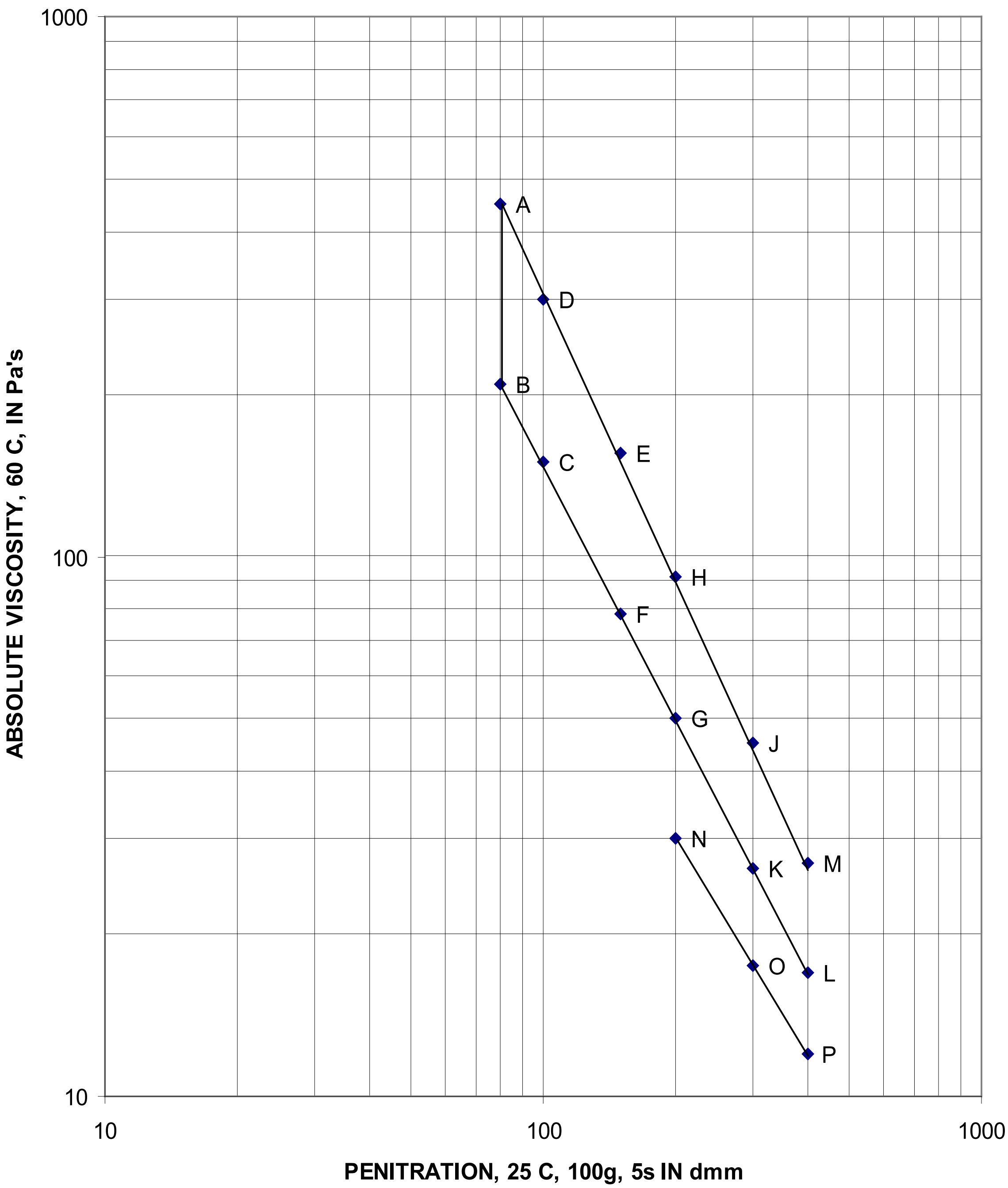
TABLE 02970.1: SPECIFICATIONS FOR PREMIUM GRADE ASPHALT CEMENTS

TEST CHARACTERISTICS	A.S.T.M. TEST METHOD	Premium Grades of Asphalt Cements					
		150-200 (A)			200-300 (A))		
Absolute Viscosity, 60°C, Pa - s	D2171	The viscosity and penetration values must fall within the area bounded by A-B-C-D-A plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by C-D-E-F-C plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows:		
Penetration, 25°C, 100g, 5s, dmm	D5	Pt.	Abs. Visc.	Pen.	Pt.	Abs. Visc.	Pen.
		A	155	150	C	50	200
		B	70	150	D	92	200
		C	50	200	E	45	300
		D	92	200	F	26.5	300
Kinematic Viscosity, 135°C, sq. mm/s	D2170	The viscosity and penetration values must fall within the area bounded by A-B-C-D-A plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by C-D-E-F-C plotted as straight lines on a full logarithmic plot (log-log), with the co-ordinates of the points as follows:		
Penetration, 25°C, 100g, 5s, dmm	D5	Pt.	Kin. Visc.	Pen.	Pt.	Kin. Visc.	Pen.
		A	360	150	C	205	200
		B	225	150	D	285	200
		C	205	200	E	205	300
		D	285	200	F	150	300
Flash Point, Cleveland Open Cup, °C minimum	D92	205			175		
Solubility in Trichlorethelene, % minimum	D2042	99.5			99.5		
Tests on Residue from Thin Film Oven Test: **Ratio of Absolute Viscosity of Residue from Thin-Film Oven Test to Original Absolute Viscosity, maximum:**	D1754 D2171	4.0			4.0		
Ductility, 25°C, cm, maximum	D113	100			-		
Ductility, 15.6°C, cm, minimum		-			100		

General Requirement:

- The asphalt shall be prepared by the refining of petroleum. It shall be uniform in character and shall not foam when heated to 175°C.
- The temperature at delivery to the site shall be between 170°C and 190°C.

CHART 02065.1A : SPECIFICATIONS FOR ASPHALT CEMENT ABSOLUTE VISCOSITY



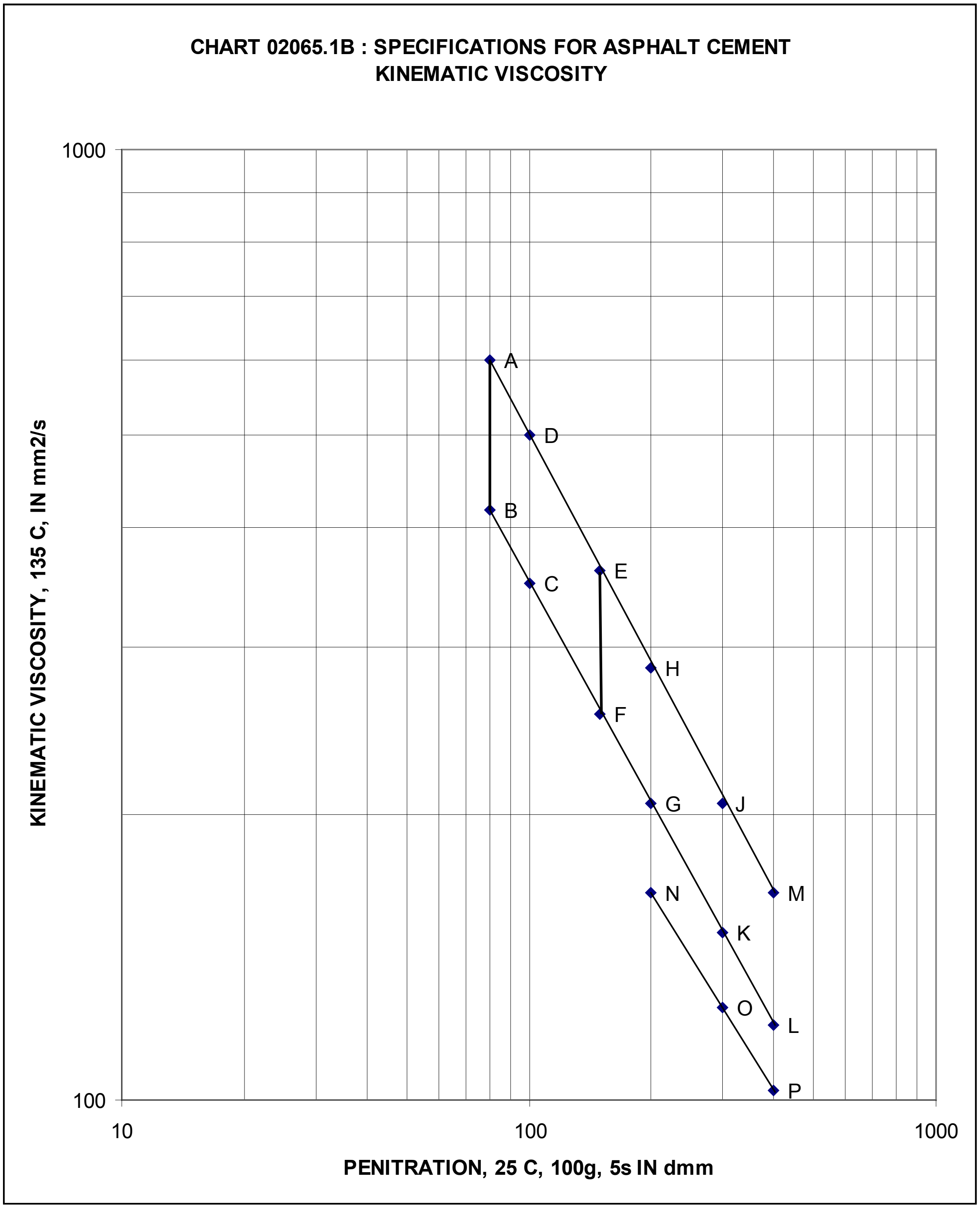


CHART 02065.1B : SPECIFICATIONS FOR ASPHALT CEMENT
KINEMATIC VISCOSITY
KINEMATIC VISCOSITY, 135 C, IN mm2/s
1000
100
10
100
1000
PENITRATION, 25 C, 100g, 5s IN dmm
A
B
C
D
E
F
G
H
J
K
L
M
N
O
P

Table 02970.2: AASHTO M320 Table 2

Table 2—Performance-Graded Asphalt Binder Specification

Performance Grade	PG 46			PG 52							PG 58					PG 64					
	34	40	46	10	16	22	28	34	40	46	16	22	28	34	40	10	16	22	28	34	40
Average 7-day max pavement design temperature, °C[a]	<46			<52							<58					<64					
Min pavement design temperature, °C[a]	>–34	>–40	>–46	>–10	>–16	>–22	>–28	>–34	>–40	>–46	>–16	>–22	>–28	>–34	>–40	>–10	>–16	>–22	>–28	>–34	>–40
Original Binder																					
Flash point temp, T 48, min °C	230																				
Viscosity, T 316:[b] max 3 Pa·s, test temp, °C	135																				
Dynamic shear, T 315:[c] $G^*/\sin\delta^d$, min 1.00 kPa test temp @ 10 rad/s, °C	46			52							58					64					
Rolling Thin-Film Oven Residue (T 240)																					
Mass change,[e] max, percent	1.00																				
Dynamic shear, T 315: $G^*/\sin\delta^d$, min 2.20 kPa test temp @ 10 rad/s, °C	46			52							58					64					
Pressurized Aging Vessel Residue (R 28)																					
PAV aging temperature, °C[f]	90			90							100					100					
Dynamic shear, T 315: $G^* \sin\delta^d$, max 5000 kPa test temp @ 10 rad/s, °C	10	7	4	25	22	19	16	13	10	7	25	22	19	16	13	31	28	25	22	19	16
Critical low cracking temp, R 49:[g] Critical cracking temp determined by R 49, test temp, °C	–24	–30	–36	0	–6	–12	–18	–24	–30	–36	–6	–12	–18	–24	–30	0	–6	–12	–18	–24	–30

[a] Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, may be provided by the specifying agency, or by following the procedures as outlined in M 323 and R 35.

[b] This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.

[c] For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be used to supplement dynamic shear measurements of $G^*/\sin\delta$ at test temperatures where the asphalt is a Newtonian fluid.

[d] $G^*/\sin\delta$ = high temperature stiffness and $G^* \sin\delta$ = intermediate temperature stiffness.

[e] The mass change shall be less than 1.00 percent for either a positive (mass gain) or a negative (mass loss) change.

[f] The PAV aging temperature is based on simulated climatic conditions and is one of three temperatures, 90°C, 100°C, or 110°C. Normally the PAV aging temperature is 100°C for PG 58-xx and above. However, in desert climates, the PAV aging temperature for PG 70-xx and above may be specified as 110°C.

[g] For verification of grade, at a minimum perform T 313 at the test temperature and at the test temperature minus 6°C and T 314 at the test temperature. Testing at additional temperatures for T 313 may be necessary if 300 MPa is not bracketed at the initial two test temperatures. Compare the failure stress from T 314 to the calculated induced thermal stress as per R 49. If the failure stress exceeds the induced thermal stress, the asphalt binder is deemed a "PASS" at the specification temperature.

Table 02970.3: AASHTO M320 Table 2 (continued)

Table 2—Performance-Graded Asphalt Binder Specification *(Continued)*

Performance Grade	PG 70						PG 76					PG 82				
	10	16	22	28	34	40	10	16	22	28	34	10	16	22	28	34
Average 7-day max pavement design temperature, °C[a]	<70						<76					<82				
Min pavement design temperature, °C[a]	>–10	>–16	>–22	>–28	>–34	>–40	>–10	>–16	>–22	>–28	>–34	>–10	>–16	>–22	>–28	>–34
Original Binder																
Flash point temp, T 48, min °C	230															
Viscosity, T 316:[b] max 3 Pa·s, test temp, °C	135															
Dynamic shear, T 315:[c] G*/sinδ[d], min 1.00 kPa test temp @ 10 rad/s, °C	70						76					82				
Rolling Thin-Film Oven Residue (T 240)																
Mass change,[e] max, percent	1.00															
Dynamic shear, T 315: G*/sinδ[d], min 2.20 kPa test temp @ 10 rad/s, °C	70						76					82				
Pressurized Aging Vessel Residue (R 28)																
PAV aging temperature, °C[f]	100 (110)						100 (110)					100 (110)				
Dynamic shear, T 315: G* sinδ[d], max 5000 kPa test temp @ 10 rad/s, °C	34	31	28	25	22	19	37	34	31	28	25	40	37	34	31	28
Critical low cracking temp, R 49:[g] Critical cracking temp determined by R 49, test temp, °C	0	–6	–12	–18	–24	–30	0	–6	–12	–18	–24	0	–6	–12	–18	–24

[a] Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind program, may be provided by the specifying agency, or by following the procedures as outlined in M 323 and R 35.
[b] This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.
[c] For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be used to supplement dynamic shear measurements of G*/sinδ at test temperatures where the asphalt is a Newtonian fluid.
[d] G*/sinδ = high temperature stiffness and G* sinδ = intermediate temperature stiffness.
[e] The mass change shall be less than 1.00 percent for either a positive (mass gain) or a negative (mass loss) change.
[f] The PAV aging temperature is based on simulated climatic conditions and is one of three temperatures 90°C, 100°C, or 110°C. Normally the PAV aging temperature is 100°C for PG 58-xx and above. However, in desert climates, the PAV aging temperature for PG 70-xx and above may be specified as 110°C.
[g] For verification of grade, at a minimum perform T 313 at the test temperature and at the test temperature minus 6°C and T 314 at the test temperature. Testing at additional temperatures for T 313 may be necessary if 300 MPa is not bracketed at the initial two test temperatures. Compare the failure stress from T 314 to the calculated induced thermal stress as per R 49. If the failure stress exceeds the induced thermal stress, the asphalt binder is deemed a "PASS" at the specification temperature.

1. GENERAL

1.1 SECTION INCLUDES

Routing, cleaning and sealing cracks and joints in asphalt pavement.

1.2 SUBMITTALS

Submit crack or joint sealant manufacturer's product data to the Engineering Services Section, Transportation and Streets Department at least 7 days prior to use.

1.3 QUALITY ASSURANCE

1.3.1 The quality assurance laboratory will perform the following to determine acceptability of the work and end product:

1.3.1.1 Evaluate rout width, depth and centering along the crack.

1.3.1.2 Check sealant temperatures at the heating kettle and at application.

1.3.1.3 Test sealant penetration and flow.

1.3.2 **Definitions:** For purposes of evaluating rout width, depth and centering accuracy, a lot is equal to a day's production of a sealing crew, or a portion thereof as designated by the Engineer. Each lot will be represented by a series of measurements at a minimum of 40 points in the lot. The compliance percentage each for width/depth ratio and centering accuracy will be the number of points meeting the specified tolerances divided by the total number of points, expressed in percent.

1.3.3 For each day's production of a sealing crew, a sample of molten sealant will be taken and tested for penetration and flow.

2. PRODUCTS

2.1 MATERIALS

Crack or Joint Sealant: hot-poured rubberised asphalt sealant conforming to physical requirements in ASTM D1190. The sole acceptable brand of sealant at this time is Hydrotech 6160. Alternates will not be accepted at time of tender.

2.2 EQUIPMENT

2.2.1 **Mechanical Router:** portable and capable of cutting the pavement surface in a single pass to a width of 40 mm and to a depth of 8 mm. The Contractor shall demonstrate that the router is capable of following meandering cracks and keeping the crack centred within ±8 mm of the centre of rout.

2.2.2 **Compressed Air Lance:** capable of blowing dry, oil-free compressed air at a minimum line pressure of 690 kPa.

2.2.3 **Melting Kettle**: mobile, rubber tired, double jacketed oil bath kettle, using high flash point oil heat transfer medium; with an automatic agitator to continuously stir the sealant during heating; with 2 thermocouple devices to monitor the temperatures of the heating oil and the sealant with temperature indicators which can be read by the Engineer at road level. The temperature readings shall be in Celsius degrees with an accuracy of ±2%. The use of a direct fired kettle is not permitted.

2.2.4 **Sealant Dispenser:** wand fitted with the proper size tip and connected to a low pressure pump from the melting kettle.

3. EXECUTION

3.1 ROUTING AND SEALANT PREPARATION

3.1.1 Before routing, sweep designated pavement area clean of dirt accumulations to expose cracks and joints.

3.1.2 Rout cracks and joints that are 2 mm to 25 mm wide, unless directed otherwise by the Engineer. Do not rout cracks in areas with severe block cracking.

3.1.3 Rout crack or joint to a width of 40 mm and a depth of 8 mm.

3.1.4 **Sealant Preparation:** Slowly melt the sealant in the heating kettle with continuous agitation. Do not add any other material to the sealing compound. The preferred temperature range for sealant heating is 190°C to 200°C and sealant shall not be heated to temperatures greater than 205°C at any time. Discard overheated or burnt sealant.

3.2 SEALANT APPLICATION

3.2.1 After routing, air-blow loose debris to the edge of the road away from the area to be sealed to ensure that fresh sealant is not contaminated. Sealed cracks that are contaminated with routing debris will be rejected.

3.2.2 Immediately before pouring the sealant, use the compressed air lance to blow any remaining dust and loose debris from the routed groove.

3.2.3 Carefully apply the sealant with the tip of wand placed close to the bottom of the routed groove to ensure uniform application. Fill the groove only to the extent that when cooled the sealant is flush with the adjacent pavement surface within ±2 mm.

3.2.4 Use traffic barriers to prevent tracking of uncured sealant. Newly sealed cracks may be dusted with an approved material only when permitted by the Engineer. Do not open the road to traffic until the sealant has properly set up and no danger of damage to the sealant exists, a minimum of 20 minutes after sealant placement.

3.2.5 Allow the sealant to set and cure for 48 hours after application prior to cleanup sweeping, unless permitted otherwise by the Engineer.

3.3 FIELD QUALITY CONTROL

3.3.1 **Rout Cross-Section Dimensions:** Width: 40 mm
Depth: 8 mm
Width/Depth Ratio: 3.5 to 6.0

Non-compliance: A lot with a compliance percentage of less than 90% for width/depth ratio shall be subject to a pay factor equal to the compliance percentage.

3.3.2 Rout Centering along Crack

Centre of crack shall not be more than 8 mm from the centre of rout.

Non-compliance: A lot with a compliance percentage of less than 80% shall be subject to a pay factor equal to 1.25 multiplied by the compliance percentage for centering.

3.3.3 Heating Temperature

At no point in the heating process shall the sealant temperature exceed 205°C. Discard all overheated or burnt sealant.

3.3.4 Application Temperature

The sealant temperature at the time of application shall not be less than 185°C. If the application temperature is less than 185°C, suspend application until sealant temperatures are corrected in the kettle without overheating.

3.3.5 Sealant Quality

When tested according to ASTM D5329, the sealant shall have the following properties:

Penetration at 25°C: 90 maximum
Flow at 60°C: 5 mm maximum

Non-compliance: If the maximum penetration is exceeded, the day's production represented by the failed test shall be subject to the following pay factors:

Penetration at 25°C	Pay Factor
91-92	100.0%
93-94	99.4%
95-96	98.6%
97-98	97.2%
99-100	95.6%
101-102	93.5%
103-104	91.1%
105-106	88.4%
107-108	85.3%
109-110	80.0%
>110	Reject

3.3.6 The pay factors shall be individually applied, where applicable, to the contract price.

3.4 REJECTED WORK

3.4.1 Sealed cracks shall be rejected if there is evidence of poor workmanship or obvious defects, including:

Routed crack not filled completely
Lack of bond to sides of rout
Excessive debris or moisture in the rout
Contamination of the sealant
Routed crack not filled flush within ±2 mm
Tracking of uncured sealant
Excessive rounding or spalling of the routed edges

3.4.2 Repair of Rejected Work

Repair rejected sealed cracks by removing the sealant and resealing the cracks, to the Engineer's satisfaction and at no further cost to the City.

3.5 WARRANTY

3.5.1 Completed and accepted pavement crack sealing shall be guaranteed for a one year period following the date of the Construction Completion Certificate.

3.5.2 If, during the warranty period, there is evidence of bond failure or of water or material ingress through the crack, remove the sealant, clean the crack and reseal, to the Engineer's satisfaction.

3.6 CLEANUP AND OPENING TO TRAFFIC

3.6.1 Remove excess material and clean up soiled pavement and concrete surfaces within 48 hours after the sealant has properly cured.

3.6.2 Keep traffic off the newly sealed pavement until the sealant has properly set up and is in no danger of being damaged or pulled out by traffic.

3.6.3 Repair damage to the sealant caused by traffic and by the Contractor's operations.

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Production of portland cement concrete

1.1.2 Requirements for concrete mix design, quality control, quality assurance and placement.

1.2 RELATED SECTIONS

1.2.1 Section 03060 Concrete for Roadways

1.2.2 Section 03100 Concrete Forms and Accessories

1.2.3 Section 03210 Reinforcing Steel

1.2.4 Section 03310 Concrete for Water and Drainage Structures

1.3 SUBMITTALS

1.3.1 Submit the cement manufacturer's mill test reports to the Engineering Services Section, Transportation Department, monthly or as requested by the City.

1.3.2 Submit physical fly-ash test reports to the Engineering Services Section, Transportation Department, monthly or as requested by the City.

1.4 QUALITY ASSURANCE

1.4.1 Provide, without charge, facilities for the City to inspect equipment, materials and processes used in the production and delivery of concrete and to obtain samples for testing.

1.4.2 Approval of a mix design, or inspection and testing by the City shall not relieve the Contractor of responsibility for the quality of concrete used in the Work.

1.4.3 The quality assurance laboratory will perform concrete plant checks and quality assurance sampling and testing for slump, air content, air voids and compressive strength.

1.4.4 Quality assurance testing shall be performed by a technician certified by CSA or ACI.

1.4.5 Slump Tests

1.4.5.1 Methods: to CAN/CSA-A23.2-1C and CAN/CSA-A23.2-5C.

1.4.5.2 Test Frequency: Slump tests will be taken between the 10% and 90% points of discharge of a concrete load with every strength test and as required by the Engineer.

1.4.6 Air Content Tests

1.4.6.1 Methods: to CAN/CSA-A23.2-1C and CAN/CSA-A23.2-4C or CANCSA-A23.2-6C.

1.4.6.2 Test Frequency: Air content tests will be taken between the 10% and 90% points of discharge of a concrete load with every strength test and as required by the Engineer.

1.4.7 Air-Void Examination

1.4.7.1 Method: to ASTM C457, modified point-count traverse method at 100X magnification.

1.4.7.2 Sample: a 100 mm diameter core drilled from hardened concrete.

1.4.7.3 Cross-Section Preparation: The top of the core shall be ground to 2 mm ±0.5 mm below and parallel to the finished concrete surface to produce a surface suitable for microscopic examination.

1.4.7.4 Maximum Allowable Spacing Factor: If the spacing factor obtained by a full traverse of the cross-section of the single core is greater than 0.23 mm, the concrete represented by the core shall be removed and replaced.

1.4.8 Strength Tests

1.4.8.1 Methods: Compressive strength test specimens shall be cast and cured in accordance with CAN/CSA A23.2-3C. Initial curing Temperatures must be reported. Test specimens cast from concrete mixes with slump levels equal to or less than 40mm shall be consolidated by rodding. The testing agency shall ensure complete densification of the test cylinders and will confirm that corresponding unit weights are characteristic of the mix design unit weights. Test cylinders exhibiting a lack of consolidation will be weighed and the unit weight and accompanying remarks recorded on the concrete test report. Compressive strength determination shall be in accordance with CAN/CSA A23.2-9C.

1.4.8.2 Test Frequency: Standard tests for strength will be conducted at a frequency of not less than one strength test for each 60m^3 of concrete or fraction thereof, for each class of concrete produced in any one day from each individual plant/supplier.

1.4.8.3 Definition of a Strength Test: to CAN/CSA A23.1 clauses 4.4.6.4.1 and 4.4.6.4.2.

1.4.8.4 For standard strength tests, either 150mm x 300mm cylinders or 125mm x 250mm cylinders may be used.

1.4.8.5 Required Strength: The result of each compressive strength test shall equal or exceed the specified minimum compressive strength.

2. PRODUCTS

2.1 CONCRETE MATERIALS

2.1.1 **Portland Cement:** to CAN/CSA-A3000, A3001-03 of the following types.

2.1.1.1 Type GU – General use hydraulic cement

2.1.1.2 Type HE - High early-strength hydraulic cement

2.1.1.3 Type HS – High sulphate-resistant hydraulic cement

2.1.2 **Aggregate:** to clause 4.2.3, CAN/CSA-A23.1, testing shall include but not be limited to: unconfined Freeze-thaw in course aggregate, $MgSO_4$ soundness loss, petrographic examination, alkali-aggregate reactivity, and ironstone content.

2.1.3 **Water:** to clause 4.2.2, CAN/CSA-A23.1, clear, free from injurious amounts of oil, acid, alkali, organic matter, sediment, or other substance harmful to the mixing and curing of concrete. For concrete and fillcrete, the City of Edmonton will allow a Maximum of 20% of the mix water can consist of recycled slurry water. If recycled slurry water is utilized in the production of concrete or fillcrete the supplier shall provide quality assurance reports for the slurry water to the Engineering Services Section, Transportation Department.

2.1.4 **Air-Entraining Admixture:** to ASTM C260.

2.1.5 **Chemical Admixtures:** to ASTM C494, including water-reducing agents, retarders and accelerators. Chemical admixtures shall not be used unless permitted in writing by the City.

2.1.6 **Fly Ash:** to CAN/CSA-A3000, A3001-03 pozzolan type F or CI.

2.2 FORMS

To Section 03100 - Concrete Forms and Accessories.

2.3 REINFORCEMENT

To Section 03210 - Reinforcing Steel.

2.4 PRODUCTION OF CONCRETE

Produce concrete to clause 5.2, CAN/CSA-A23.1 and conforming to the approved mix design requirements of Section 03060 - Concrete for Roadways or Section 03310 - Concrete for Water and Drainage Structures.

3. EXECUTION

3.1 INSPECTION OF FORMWORK AND REINFORCEMENT

3.1.1 Carefully inspect the installed work of all other trades prior to all of the Work of this section, and verify that all such work is complete to the point where this Work may properly commence.

3.1.2 Provide 48 hours notice and obtain the City's approval before placing concrete.

3.1.3 Ensure that reinforcement, formwork, inserts or accessories are securely fastened and will not be disturbed during concrete placement.

3.1.4 Verify that all items to be embedded in concrete are in place.

3.1.5 Verify that concrete may be placed to the lines and elevations indicated on the Drawings with all required clearance for reinforcement. In the event of any discrepancy, immediately notify the City. Do not proceed with installation until all such discrepancies have been fully resolved.

3.2 DELIVERY OF CONCRETE

3.2.1 Deliver concrete to the job site to clause 5.2.4, CAN/CSA-A23.1, as supplemented or modified below.

3.2.2 Rotating Drum Trucks: Transport concrete using only equipment with mixing or agitating capability.

3.2.3 Rotate the drum on the job site at mixing speed for 3 minutes immediately before discharge.

3.2.4 The minimum load size to be delivered to site is 3 cubic meters.

3.2.5 **Retempering with Water:** Do not add water after the initial introduction of mixing water at the plant except as follows:

3.2.5.1 When the slump at the point of initial discharge is less than specified

3.2.5.2 Introduce additional water into the drum mixer in an amount not exceeding 12 litres/m^3, to bring the slump to within specified limits.

3.2.5.3 Rotate the drum a minimum of 30 revolutions at mixing speed until the required uniformity of concrete is attained.

3.2.5.4 Do not subsequently add any further water to the load.

3.2.5.5 If a load of concrete is retempered with water and the resulting slump exceeds the specified maximum slump, that load of concrete will be rejected.

3.2.5.6 If the need for retempering with water becomes persistent or continuous, the Engineer or his representative may refuse to accept concrete loads that have been retempered with water.

3.2.6 Slow rotation of the drum for extended periods of time for the purpose of slump reduction in loads of concrete delivered with a slump exceeding the specified maximum slump will only be permitted for concrete placed by extrusion.

3.2.7 Retempering with Air-Entraining Admixtures is only permitted under the following conditions:

3.2.7.1 Retempering on site with an approved air-entraining admixture shall only be performed by a quality control technician working for the concrete supplier or the Contractor. Dry, powdered, bagged or pre-measured liquid air-entraining admixtures may be added by the concrete truck operator under the direction of the supplier's quality control technician. For retempering purposes the concrete supplier shall use a comparable air-entraining admixture to what was originally approved for use in the mix design. Rotate the drum for 3 to 5 minutes or until the mix is uniform, after the addition of the air entraining admixture.

3.2.7.2 The quality assurance technician shall perform an air content test on each load of concrete retempered with air-entraining admixtures and shall immediately provide the test results to the Engineer.

3.2.7.3 Guidelines for retempering with air-entraining admixtures

Measured Air Content (%)	Action
5.0 – 5.4	Addition of water or air-entraining admixtures as deemed necessary by the supplier to meet specifications
4.0 – 4.9	Air-entraining admixtures or air-entraining admixtures and water must be added as deemed necessary by the supplier to meet specifications
< 3.9	No re-tempering with air-entraining admixtures or water is permitted; load will be rejected

3.2.7.4 When retempering with air-entraining admixtures, the supplier will be given one opportunity to meet the specified air content.

3.2.7.5 When initial load requires retempering, the quality assurance technician shall perform an air content test to verify air content on subsequent loads until such time air content is acceptable.

3.2.7.6 If the need for retempering with air-entraining admixtures becomes persistent or continuous, the Engineer or his representative may refuse to accept concrete loads that have been retempered with air-entraining admixtures.

3.2.7.7 The use of deairentraining admixtures is not permitted.

3.2.7.8 A load of concrete will be rejected if it is retempered with air-entraining admixtures and the resulting air content exceeds the specified maximum air content.

3.2.7.9 A load of concrete that is rejected at the jobsite may not be retempered at the concrete plant with cement, aggregate, sand or admixtures and subsequently returned to the jobsite.

3.2.7.10 On site mix adjustments with cementitious materials, sand aggregate or any chemical admixtures other than air-entraining admixtures and superplasticizers will not be permitted.

3.2.8 When the ambient air temperature in the shade is 23º C or higher, concrete at time of placement shall not have a temperature exceeding 30º C.

3.2.9 When the ambient air temperature is lower than 5º C, the concrete delivered to the site shall have a temperature between 15º C and 30º C.

3.2.10 Discharge Time: Complete the discharge of concrete within 90 minutes of the initial introduction of mixing water to the cement and aggregate at the plant. The discharge time may be extended to 120 minutes by incorporating hydration control admixtures. The supplier must submit mix designs for approval and provide evidence that the plastic concrete properties (slump, air content and temperature) can be maintained through the extended discharge time period.

3.2.11 Delivery Record: Provide the Engineer with a delivery ticket showing the batch plant location, the supplier's name, ticket and truck numbers, mechanically punched date and time of initial plant mixing, class and mix design designation, cement type and aggregate sizes, type and amount of admixtures, water added, volume of concrete, site arrival time, start and end of discharge time and other information requested by the Engineer.

3.3 PLACING CONCRETE

3.3.1 Handle, deposit and consolidate fresh concrete to CAN/CSA-A23.1 and as supplemented below.

3.3.2 Moisten the surface of the subgrade or subbase before placing concrete to minimize absorption of water from the deposited concrete. Do not create mud, nor let water pond.

3.3.3 Ensure that reinforcement and formwork are thoroughly clean and wetted before placing concrete.

3.3.4 Do not place concrete during rain or when there is imminent danger of rain or if the weather, in the opinion of the Engineer, is not suitable**.**

3.3.5 Place hot and cold weather concrete to CAN/CSA-A23.1. Ensure that the procedures used are approved by the Engineer.

3.3.6 Pour concrete continuously and as rapidly as possible between predetermined construction joints to the approval of the Engineer.

3.3.7 Locate construction joints to Section 03100 - Concrete Forms and Accessories.

3.3.8 Consolidate concrete in accordance with CAN/CSA-A23.1.

3.3.9 Concrete cover over reinforcing steel shall be to CAN/CSA-A23.1.

3.4 FINISHING

3.4.1 Perform the initial and final finishing of the plastic concrete surfaces to CAN/CSA-A23.1 and as supplemented below.

3.4.2 Do not apply water to concrete the surface to facilitate finishing under any circumstances. To retain surface moisture and facilitate concrete finishing, the contractor may elect to fog the surface with Master Builders Confilm or an approved equivalent.

3.4.3 Protect the Work from rain to avoid excessive moisture on the unfinished surface and to prevent pitting to the finished surface if still plastic.

3.4.4 Concrete finishing shall be performed by or under the direction of certified Journeyman concrete finishers.

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Production of Portland cement concrete for pavement and associated structures.

1.1.2 Additional requirements for concrete mix design, quality control, quality assurance, and placement for pavement and associated structures.

1.2 RELATED SECTIONS

1.2.1 Section 02318 Trench and Backfill

1.2.2 Section 03055 Portland Cement Concrete

1.2.3 Section 03100 Concrete Forms and Accessories

1.2.4 Section 03210 Reinforcing Steel

1.3 SUBMITTALS

1.3.1 Submit a mix design for each designated class of concrete to the Engineering Services Section, Transportation Department, at least 14 days prior to initial concrete work and when there is a change in materials, sources or proportions. Submit separate mix designs specifically designed for particular placement applications (i.e. pumping, hand placement, slip form placement, etc.)

1.3.2 Submit a complete petrographic analysis of the fine and coarse aggregate proposed for use with the concrete mix design. The petrographic analysis shall include the results of unconfined Freeze-thaw in course aggregate, $MgSO_4$ soundness loss and alkali-aggregate reactivity evaluation.

1.3.3 Submit the results of ironstone determination to the Engineering Services Section, Transportation Department, at least once per week.

1.3.4 Submit physical fly-ash test reports to the Engineering Services Section, Transportation Department, monthly or as requested by the City.

1.4 QUALITY ASSURANCE

1.4.1 To **Section 03055** Section 03055 Portland Cement Concrete.

1.5 QUALITY CONTROL

1.5.1 The supplier shall conduct a quality control program that will ensure their concrete product meets the specifications. The supplier shall provide test results, if requested by the Engineer. The quality control program should be conducted at the plant with corresponding spot checks at the jobsite. Construction sites are not to be used as reactionary quality control points by the supplier to deficiencies in the supplied product through excessive or continuous retempering of the mix.

1.5.2 Quality control testing initiated by the supplier shall be performed by a CSA or ACI certified technician.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Portland Cement:** To **Section 03055** Portland Cement Concrete

2.1.2 **Aggregate:** To **Section 03055** Portland Cement Concrete, and as supplemented below:

2.1.2.1 **Petrographic Analysis**: To be performed by a qualified laboratory to CAN/CSA-A23.2-15A.

2.1.2.2 **Ironstone Content**: To be performed by an approved facility to the Method for Ironstone Content Determination in Fine and Coarse Concrete Aggregates, which is available from the Engineering Services Section, Streets Engineering Branch, Transportation Department. Do not use aggregate until the corresponding results have been reviewed by the Engineer. Ironstone content in coarse aggregate shall not exceed 1.0% by mass of the total coarse sample (retained on the 5 mm sieve and larger), and in fine aggregate shall not exceed 1.5% by mass of the total dry, unwashed fine aggregate sample (passing the 5 mm sieve to that retained on the 2.5 mm sieve). Any concrete supplied with aggregate exceeding the specified ironstone content will be rejected, and shall be removed by the Contractor as directed by the Engineer.

2.1.3 **Water:** To **Section 03055** Portland Cement Concrete

2.1.4 **Fly Ash:** For Class A,B,and C concrete no replacement of the specified minimum cement content with fly ash from the commencement of the construction season to May 15 and after September 30 unless permitted by the City Engineer.

2.1.5 **Sulfate Resistant Concrete:** Concrete using Type HS (High sulfate-resistant hydraulic cement) cement shall not be placed after September 30, for Class A, B, and C concrete.

2.1.6 **Curing compound:** to ASTM C309, Type 2, class B, white pigmented, resin based, liquid membrane-forming compound.

2.1.7 **Surface Sealant**: to AT B388, Type 1b Penetrating Sealers for Traffic Bearing Surfaces, outdoor Exposure where relative moisture content is ≤ 70%. Silane type sealants are not to be used for this application.

2.1.8 **Preformed Joint Filler:** to ASTM D1751.

2.1.9 **Joint Sealant:** to ASTM D1190, Sika 2c or approved equivalent.

2.1.10 **Forms:** To **Section 03100** Section 03100 Concrete Forms and Accessories.

2.1.11 **Reinforcement:** To **Section 03210** Section 03210 Reinforcing Steel.

2.2 MIX DESIGN

2.2.1 Mix design criteria for each class of concrete:

Spring and Fall Mixes

Class	Minimum 28 Day Compressive Strength (MPa)	Slump (mm)	Entrained Air Limits (% by volume)	Maximum Aggregate Size (mm)	Maximum Water to Cementing Materials Ratio (by mass)	Minimum Portland Cement Content (kg/m^3)	Cement Type
A	30	60 ± 20	5.5 - 8.0	20	0.45	335	GU*
B	30	60 ± 20	5.5 - 8.0	20	0.45	335	GU*
C	30	60 ± 20	> 5.5	20	0.45	335	GU*
D	30	100 ± 30	5.5 - 8.0	20	0.45	335	HS*
E	30	80 ± 20	5.5 - 8.0	20	0.45	300	HS*

Summer Mixes

Class	Minimum 28 Day Compressive Strength (MPa)	Slump (mm)	Entrained Air Limits (% by volume)	Maximum Aggregate Size (mm)	Maximum Water to Cementing Materials Ratio (by mass)	Minimum Portland Cement Content (kg/m^3)	Cement Type
A	30	60 ± 20	5.5 - 8.0	20	0.45	302	GU*
B	30	60 ± 20	5.5 - 8.0	20	0.45	302	GU*
C	30	60 ± 20	> 5.5	20	0.45	302	GU*
D	30	80 ± 20	5.5 - 8.0	20	0.45	335	HS*
E	30	80 ± 20	5.5 - 8.0	20	0.45	300	HS*

* Note: GUb and HSb cements can be used only upon approval of the Engineer

2.2.1.1 Class C concrete: shall attain the minimum compressive strength corresponding to the percentage of entrained air in the plastic concrete as follows.

Air Content (%)	Minimum 28 Day Compressive Strength (MPa)
5.5 to 5.9	30.0
6.0 to 8.0	42 - (2 * Air Content)
greater than 8.0	26.0

2.2.1.2 **High Early Strength Concrete:** For special situations or conditions the Engineer may require that the specified 28 day compressive strength be met in 7 days.

2.2.1.3 If any class of concrete is to be placed by pumping, the specified slump and air content shall be met at the point of pump discharge. Samples for testing will be obtained at the point of pump discharge.

2.2.1.4 For class C extruded parapet retaining walls and New Jersey Barriers the mix shall contain 0.6kg of synthetic micro fibres or approved equivalent per m^3 of concrete.

2.2.1.5 For class E concrete the following mix conditions shall apply:

A minimum ratio of supplementary cementitious materials to total mass of cementitious materials of 0.15, and

A minimum sand content of 45% by total weight of aggregate.

2.2.2 **Application of concrete classes:**

Class A: One course exposed pavements, commercial and residential alley crossings.

Class B: Unexposed pavement base.

Class C: All exposed road associated works including curb and gutter, sidewalks, walkways, private crossings, swales, medians, New Jersey barriers and parapet walls.

Class D: Structural pile foundations.

Class E: Exposed retaining walls.

2.2.3 **Seasonal concrete mix requirements:**

Spring Mixes

From the commencement of the construction season to May 15, or as directed by the City: no replacement of the minimum cement content with fly ash (clause 2.1.4) is permitted.

Summer Mixes

From May 16 to September 30: no more than 10% of the specified minimum cement content may be replaced with fly ash.

Fall Mixes

From October 1 to October 15: no replacement of the minimum cement content with fly ash is permitted (clause 2.1.4) and type HS cement may not be used (clause 2.1.5).

Cold Weather Mixes

From October 16 to the end of the construction season, or as defined by the Engineer: meet the requirements for cold weather concrete in clause 2.2.4.

2.2.4 **Cold weather concrete:** All classes of concrete placed after October 15 shall attain a minimum compressive strength of 27.0 MPa in 7 days and shall be provided with cold-weather protection to clause 7.4.2.5.3, CAN/CSA A23.1. High early strength concrete (as defined in clause 2.2.1.2) shall attain a minimum compressive strength of 30.0 MPa in 7 days and shall be provided with cold weather protection to clause 7.4.2.5.3, CAN/CSA A23.1 (type 2 curing). This cold weather protection must be adequate to maintain concrete surface temperatures at a minimum of 10º C for a period of 7 days following placement.

2.2.5 **For slipformed (machine placed) concrete, limit slump as follows:**
20 ± 10 mm for curb, curb and gutter and New Jersey barrier, and
30 ± 10 mm for walk, monolithic walk and pavement.

2.2.6 Type HE or Type HS cement may be substituted for Type GU cement, except as limited in clause 2.1.5.

2.2.7 Class A, C and E concrete may be subjected to air-void examination.

2.2.8 Concrete mix designs shall be prepared by a CSA approved laboratory, or by a concrete supplier with the capability and a facility approved by the City.

2.2.9 If requested, the supplier shall provide evidence that proportions in the mix design will produce concrete of the quality specified. Include strength tests on trial mixes made under plant conditions.

2.2.10 Concrete production may not proceed until the City has approved the applicable mix design.

3. EXECUTION

3.1 PLACING

3.1.1 Place concrete to **Section 03055**

3.1.2 Section 03055 Portland Cement Concrete.

3.2 FINISHING

3.2.1 Finish concrete to **Section 03055**

3.2.2 Section 03055 Portland Cement Concrete, and as supplemented below:

3.2.3 **Brush or Broom Finish:** Use a brush or a broom with nylon bristles that can form surface grooves no deeper than 3 mm. Remove excess water from the bristles before brushing. Brush in the designated direction.

3.3 JOINTS

3.3.1 Construct joints as required in each type of construction to the following standards as applicable.

3.3.2 **Crack-Control Joints:** intended to control the location of shrinkage cracks in hardening concrete. Construct joints to the indicated dimensions, spacing, and pattern by any of the following methods:

3.3.2.1 Formed Joint: Form the groove by inserting a metal or fibre strip, or polyethylene film into the plastic concrete. Finish the edges to a 6 mm radius. Remove the insert immediately after the initial set of the concrete. Seal the joint with a specified sealant.

3.3.2.2 Tooled Joint: Hand form the groove using a jointing tool with a thin metal blade to impress a plane of weakness into the plastic concrete. Finish the edges to a 6 mm radius. Seal the joint with a specified sealant.

3.3.2.3 Sawed Joint: Cut the groove with a concrete saw as soon as the concrete surface has hardened sufficiently to resist raveling as the cut is made, but before shrinkage cracks form in the concrete. The Contractor is responsible for the proper timing of the saw cut. Immediately flush the saw cut clean with water. Once the joint surfaces are dry, seal the joint with a specified sealant.

3.3.3 **Isolation Joint:** required where concrete is placed adjacent to an immovable structure or where indicated on the Drawings. Construct the joint by sawing or forming to create a clean break through the full cross-section of the concrete member. Make the joint wide enough to permit a snug fit for the pre-formed joint filler. Alternatively, place the pre-formed joint filler against the structure and pour the concrete against the pre-formed joint filler.

3.3.4 **Construction Joint:** required between concrete pours or for joining new concrete to existing work. Construct the joint with a keyway, dowels or tie bars as detailed on the drawings or as directed by the Engineer. Finish edges to a 6 mm radius. Vertically trim the existing concrete by sawing at least 50 mm deep and breaking. Leave the joint form in place until the concrete has set, then remove the joint form without damaging the concrete.

3.4 PROTECTION AND CURING

3.4.1 Protect freshly placed concrete from freezing, premature drying, temperature extremes, adverse weather conditions, and physical disturbance to clause 7.4, CAN/CSA-A23.1, and as supplemented below.

3.4.2 **Cold Weather Protection:** Concrete shall be protected from freezing for a minimum of 4 days after placement or for the time necessary to achieve 75% of the specified 28-day compressive strength.

3.4.3 **Membrane Curing:** Cure exposed concrete surfaces using a specified curing compound applied with a pressurized spray nozzle. Curing compound shall be applied immediately after final finishing and cover the entire exposed surface with an unbroken and uniform film at a rate depending on surface roughness but not less than 1 litre per 4 m^2 of surface. Membrane curing will not be required when the maximum daily air temperature for the 72 hours following placement of the concrete is not expected to be greater than 5º C.

3.4.4 **Moist Curing:** Use where specified or directed by the Engineer. After the concrete has set, maintain exposed surfaces continuously moist using wet burlap or polyethylene film in contact with the concrete for a minimum of 7 consecutive days after placement when Type GU or Type HS cement is used, or a minimum of 3 consecutive days when Type HE cement is used.

3.4.5 **Surface Sealant:** An approved sealing solution shall be sprayed on all exposed concrete surfaces in accordance with the manufacturers recommendations. The concrete shall be dry and swept clean prior to the application of the sealant.

3.5 FIELD QUALITY ASSURANCE

3.5.1 The contractor and the concrete supplier shall assist the field technician in obtaining samples for quality assurance testing**.**

3.4.2 The contractor shall suspend pouring operations after sampling until the results of the field quality tests are known.

3.5.2 Inadequate Protection and Curing

For concrete where the surface temperature is measured to be below 0**º** C the concrete may be accepted subject to a pay factor according to Table 03060.1.

TIME AFTER PLACEMENT THAT CONCRETE TEMPERATURE DROPS BELOW 0º C	PAY FACTOR (% of Contract Price)
> 96 hours	100.0
72 to 96 hours	80.0
48 to 72 hours	70.0
< 48 hours	Remove and Replace

TABLE 03060.1 COLD WEATHER PROTECTION PAY FACTORS

3.5.3 Deficient Slump

For any load of concrete, if the measured slump is outside the specified limits, a check test is taken on another portion of the load, or a retest is done if retempering with water is permitted by the Engineer. If the second test fails, the Engineer may reject that load of concrete including removal of the portion already poured.

3.5.4 Deficient Air Content

3.5.4.1 For any load of concrete, if the tested air content is outside the specified limits, the Engineer will require one of the following:

Air content between 5.0% and 5.5%: Concrete poured from the load shall be removed and the rest of the load shall be discarded. However, the Contractor may elect at the Contractor's risk to pour the rest of the load provided that within 40 days of placement, the Contractor submits to the Engineer proof that the load of concrete meets the required spacing factor as determined from air void examination performed by a qualified laboratory to clause 3.5.4.3, failing which the Contractor shall remove and replace all concrete represented by the failed test.

Air content below 5.0%: Concrete poured from the load shall be removed and the rest of the load shall be discarded.

Air content above 8.0%: Except for class C concrete, concrete poured from the load shall be removed and the rest of the load discarded. For class C concrete where high early strength is not specified, the concrete will be accepted if the specified 28 day strength is met.

3.5.4.2 If the measured air content is below the specified minimum air content, then the contractor may elect to retemper with air entraining admixtures to Section 3055 - Portland Cement Concrete, clause 3.2.6.

3.5.4.3 When Air Void Examination Is Required

The quality assurance laboratory will drill cores from the hardened concrete for air void examination to Section 03055 **Portland Cement Concrete**, clause 1.4.7, at a frequency of at least one core for each 2 000 m of local and collector sidewalk, curb and gutter or monolithic walk, curb and gutter, or as requested by the City for arterial, industrial or commercial roadways or small residential subdivisions.

3.5.4.4 Where concrete has been rejected and is to be removed for not meeting the spacing factor requirement in Section 03055 **Portland Cement Concrete**, clause 1.4.7, the Contractor at the Contractor's expense shall prove that the concrete left in place at both ends of the removal meets the specified spacing factor by air void examination to be performed by a qualified laboratory to Section 03055 **Portland Cement Concrete**. The test results shall be submitted to the Engineer.

3.5.5 Deficient Strength

Concrete work for roadways represented by a strength test result which is less than specified may be accepted subject to a pay factor according to Table 03060.2. If strength deficiencies persist, the Engineer will require changes in the concrete mix design for the remainder of the work.

CYLINDER STRENGTH (% of Specified Strength)	PAY FACTOR (% of Contract Price)
97.0	100.0
96.0	99.2
95.0	98.2
94.0	96.9
93.0	95.4
92.0	93.6
91.0	91.7
90.0	89.4
89.0	86.7
88.0	83.5
87.0	79.7
86.0	75.5
85.0	70.0
Under 85.0	No Payment

TABLE 03060.2 CONCRETE STRENGTH PAY FACTORS

3.5.5.1 Optional core strength test:

The Contractor has the option at the Contractor's expense of providing evidence of strength by coring and testing to CAN/CSA-A23.2-14C moisture conditioned, by a qualified laboratory within 7 days of a failed 28-day cylinder test or within 3 days of a failed 7-day cylinder test. Three cores shall be drilled from the hardened concrete represented by the failed cylinder strength tests at locations approved by the Engineer.

The average strength of the 3 cores shall equal 100% of the specified cylinder strength; otherwise, the concrete will be subject to the pay factors of Table 03060.2 on the basis of the cylinder strength tests.

3.5.5.2 Optional core strength test results shall be submitted to the Engineer with a copy to the Engineering Services Section, Transportation Department

END OF SECTION

1. GENERAL

1.1 SECTION INCLUDES

1.1.1 Requirements for the construction of Ultra-thin Whitetopping of existing asphalt pavement.

1.1.2 Additional requirements for concrete mix design, quality control, quality assurance, and placement for pavement and associated structures.

1.2 RELATED SECTIONS

1.2.1 Section 02961 – Pavement Cold Milling

1.2.2 Section 03055 - Portland Cement Concrete

1.2.3 Section 03100 - Concrete Forms and Accessories

1.2.4 Section 03210 - Reinforcing Steel

1.3 SUBMITTALS

1.3.1 Submit to the Engineering Services Section a mix design for each designated class of concrete at least 14 days prior to initial concrete work and when there is a change in materials, sources or proportions.

1.3.2 Submit a complete petrographic analysis of the aggregate proposed for use with the concrete mix design.

1.3.3 Submit the results of ironstone determination to the Engineering Services Section at least once per week.

1.3.4 Submit test results on concrete with fly ash with the mix design.

1.3.5 Optional core strength test results shall be submitted to the Engineer with a copy to the Engineering Services Section.

1.4 QUALITY ASSURANCE

1.4.1 To Section 03055 – Portland Cement Concrete.

1.5 QUALITY CONTROL

1.5.1 The supplier shall conduct a quality control program that will ensure their concrete product meets the specifications. The supplier shall provide test results, if requested by the Engineer. The quality control program should be conducted at the plant with corresponding spot checks at the jobsite. Construction sites are not to be used as reactionary quality control points by the supplier to deficiencies in the supplied product through excessive or continuous retempering of the mix.

1.5.2 A technician certified by CSA or ACI shall perform quality control testing initiated by the supplier.

2. PRODUCTS

2.1 MATERIALS

2.1.1 Portland Cement: To Section 03055 – Portland Cement Concrete.

2.1.2 Aggregates: To Section 03055 – Portland Cement Concrete, and as supplemented below:

2.1.2.1 Petrographic Analysis: To be performed by a qualified laboratory to the “Procedures for the Petrographic Analysis of Coarse and Fine Aggregate (Ontario)”, which is available from the Engineering Services Section, Streets Engineering Branch, Transportation and Streets Department.

2.1.2.2 Ironstone Content: To be performed by an approved facility to the Method for Ironstone Content Determination in Fine and Coarse Concrete Aggregates, which is available from the Engineering Services Section, Streets Engineering Branch, Transportation and Streets Department. Do not use aggregate until the Engineer has reviewed the corresponding results. Ironstone content in coarse aggregate shall not exceed 1.0% by mass of the total coarse sample (retained on the 5 mm sieve and up), and in fine aggregate shall not exceed 1.5% by mass of the total fine sample (passing the 5 mm sieve to that retained on the 2.5 mm sieve). Any concrete supplied with aggregates exceeding the specified ironstone content will be rejected, and shall be removed by the Contractor as directed by the Engineer.

2.1.3 Water: To 1.2.2 Section 03055 - Portland Cement Concrete

2.1.4 Fly Ash: For Class A, B, and c concrete not more than 10% of the specified minimum cement content may be replaced with fly ash from May 15 until September 30 unless not permitted by the City Engineer.

2.1.5 Sulfate Resistant Concrete: Concrete utilizing Type HS (**High sulphate-resistant hydraulic cement**) cement shall not be placed after September 30, for Class A, B, and C concrete.

2.1.6 Curing compound: to ASTM C309, type 2, class B, white pigmented, resin based, liquid membrane-forming compound.

2.1.7 Synthetic Fibers: to ASTM C1116. Fibers must provide a residual strength of at least 0.6 Mpa as measured by ASTM C 1399.

2.1.8 Preformed Joint Filler: to ASTM D1751.

2.1.9 Joint Sealant: to ASTM D1190, hot-poured elastic type.

2.1.10 Forms: To Section 03100 – Concrete Forms and Accessories.

2.1.11 Reinforcement: To Section 03210 – Reinforcing Steel.

2.2 MIX DESIGN

2.2.1 For Ultra-thin Whitetopping the concrete mix shall be designed to meet the following performance criteria:

- CSA A23.1 1-94 Table 8 Class C1 Exposure
- Maximum Water/cementing materials ratio: 0.40
- Air Content 6.0 +/- 1%

- Minimum Compressive Strength:
  20 Mpa at 2 days
  35 Mpa at 28 days
- Slump 70 **+/-** 20mm
- 7 kg/m^3 Synthetic Fiber
- Minimum toughness Performance Level lll at 7 days to ASTM C1018.

2.2.1.1 If the above class of concrete is to be placed by pumping, the specified slump and air limits shall be met at pump discharge.

2.2.2 Seasonal concrete mix requirements:

Spring Mixes – from the commencement of the construction season to May 15 or as defined by the Engineer
No replacement of the minimum cement content with fly ash (clause 2.1.4) is permitted.

Summer Mixes – May 16 to September 30
No more than 10% of the specified minimum cement content may be replaced with fly ash.

Fall Mixes – October 1 to October 15
No replacement of the minimum cement content with fly ash is permitted (clause 2.1.4) and Type HS cement can not be used (clause 2.1.5).

Cold Weather Mixes – October 16 to the end of the construction season, or as defined by the Engineer
Meet the requirements for cold weather concrete in clause 2.2.4.

2.2.3 Cold weather concrete:

2.2.3.1 All Concrete placed after October 15 shall attain a compressive strength of 27.0 MPa in 7 days and shall be provided with cold-weather protection in accordance with clause 21.2.3.4, CAN/CSA-A23.1-00.

2.2.3.2 High early strength concrete (as defined in section 2.2.1.1) placed after October 15 shall attain a compressive strength of 30.0 Mpa in 7 days and shall be provided with cold-weather protection in accordance with clause 21.2.3.4, CAN/CSA-A23.1-00.

2.2.3.3 Protection as described in Clause 21.2.3, CAN/CSA A23.1 –00 shall be adequate to maintain concrete surface temperatures at a minimum of 10 ^{o}C for a period of 7 days following placement..

2.2.4 For slipformed (machine placed) concrete, limit slump as follows:
20 ± 10 mm for curb, curb and gutter and New Jersey barrier, and
30 ± 10 mm for walk, monolithic walk and pavement.

2.2.5. Type 30 or Type 50 cement may be substituted for Type 10 cement, except as defined in clause 2.1.5.

2.2.6 Class A, C and E concrete may be subjected to air-void examination.

2.2.7 Concrete mix designs shall be performed by a qualified laboratory, or by a concrete supplier with the capability and a facility approved by the Engineer.

2.2.8 If requested, provide evidence that proportions in the mix design will produce concrete of the quality specified. Include strength tests on trial mixes made under plant conditions.

2.2.9 Concrete production may not proceed until the City Engineer has approved the applicable mix design.

3. EXECUTION

3.1 ASPHALT SURFACE PREPARATION

3.1.1 Mill existing asphalt surface to the depth indicated on the project drawings to Section 02961 – Pavement Cold Milling.

3.1.2 Sawcut the longitudinal and transverse edges of the scarified asphalt to provide a vertical face.

3.1.3 Mechanically sweep the roadway clean of all loose or foreign material (i.e. dirt in a subsidence, grass along a gutter face, grindings, etc.). The Contractor shall dispose of all sweepings.

3.1.4 Water and air blasé the surface of the roadway clean of all loose or foreign material.

3.2 FORMWORK

3.2.1 Set, align and brace forms to Section 03100 - Concrete Forms and Accessories.

3.2.2 Apply form release agent to inside face of forms prior to placement of the concrete. Do not apply form release agent to the prepared asphalt surface.

3.3 PLACING FIXED FORM PAVEMENT

3.3.1 Deposit concrete directly from the transporting equipment onto the prepared dry asphalt surface.

3.3.2 Do not place concrete when the asphalt surface temperature is less than 0^{o} C.

3.3.3 Deposit the concrete between forms to a uniform height.

3.3.4 Vibrate concrete to remove voids and air pockets. Do not move the concrete horizontally with the vibrator.

3.3.5 Strike off concrete between forms using a form riding paving machine or vibrating screed. Vibrate the surface of the concrete at a frequency of no less than 3500 vibrations/minute.

3.4 PLACING SLIPFORM PAVEMENT

3.4.1 Slipform paving equipment can be used. Furnish machines capable of spreading, consolidating, screeding and finishing concrete in one pass.

3.4.2 Deposit concrete in accordance with Sections 3.3.1 and 3.3.2.

3.4.3 Produce a dense and homogeneous concrete overlay requiring minimal hand finishing by vibrating the surface of the concrete with a pan vibrator operating at a frequency of no less than 3500 vibrations/minute.

3.5 FINISHING

3.5.1 Finish concrete to Section 03055 – Portland Cement Concrete, and as supplemented below:

3.5.2 **Tine Finish:** Tine the surface in the transverse direction to a depth of 3 to 6 mm and individual tine width of 2.5 to 3.5 mm. Space tines randomly at a minimum spacing of 13 mm apart, a maximum spacing of 38 mm apart, with no more than 50% of the tines apart by more than 25 mm.

3.6 JOINTS

3.6.1 Construct joints at a minimum 1.2-meter spacing as required in each type of construction to the following standards as applicable.

3.6.1.1 The minimum angle between any two intersecting joints shall be 80 degrees.

3.6.1.2 Joints shall intersect the pavement free edges at a 90-degree angle and shall extend straight for a minimum of 0.3 m from the pavement edge.

3.6.1.3 Align joints of adjacent panels.

3.6.1.4 Minimum joint depth shall be 25 mm or one-fourth of the Ultra-thin Whitetopping thickness.

3.6.2 **Crack-Control Joints:** intended to control the location of shrinkage cracks in hardening concrete. Construct joints to the indicated dimensions, spacing, and pattern by sawcutting of the fresh concrete

3.6.2.1 Sawed Joint: Cut the groove with a concrete saw as soon as the concrete surface has hardened sufficiently to resist raveling as the cut is made, but before shrinkage cracks form in the concrete. The Contractor is responsible for the proper timing of the saw cut. Immediately flush the saw cut clean with water.

3.6.3 **Isolation Joint:** required where concrete is placed adjacent to an immovable structure or where indicated on the Drawings. Construct the joint by sawing or forming to create a clean break through the full cross-section of the concrete member. Make the joint wide enough to permit a snug fit for the pre-formed joint filler. Alternatively, place the pre-formed joint filler against the structure and pour the concrete against the pre-formed joint filler.

3.6.4 **Construction Joint:** required between concrete pours or for joining new concrete to existing work. Construct the joint with a keyway, dowels or tie bars as detailed on the drawings or as directed by the Engineer. Finish edges to a 6-mm radius. Vertically trim the existing concrete by sawing at least 50 mm deep and breaking. Leave the joint form in place until the concrete has set, then remove the joint form without damaging the concrete.

3.7 PROTECTION AND CURING

3.7.1 Protect freshly placed concrete from premature drying, temperature extremes, adverse weather conditions, and physical disturbance to clause 21, CAN/CSA-A23.1, and as supplemented below:

3.7.2 **Moist Curing:** Use where specified or directed by the Engineer. After the concrete has set, maintain exposed surfaces continuously moist using wet burlap or polyethylene film in contact with the concrete for a minimum of 48 consecutive hours after placing.

3.8 OPENING TO TRAFFIC

3.8.1 Open the pavement to vehicular traffic after the concrete compressive strength exceeds 20.7 Mpa or when accepted for opening to traffic.

3.9 FIELD QUALITY CONTROL

3.9.1 The contractor and the concrete supplier shall assist the field technician in obtaining samples for quality assurance testing**.**

3.4.2 The contractor shall suspend pouring operations after sampling until the results of the field quality tests are known.

3.9.3 Deficient Slump

For any load of concrete, if the measured slump is outside the specified limits, a check test is taken on another portion of the load, or a retest is done if retempering with water is permitted by the Engineer. If the second test fails, the Engineer may reject that load of concrete including removal of the portion already poured.

3.9.4 Deficient Air Content

3.9.4.1 For any load concrete, if the tested air content is outside the specified limits, the Engineer will require one of the following:

Air content below 5.0%: Concrete poured from the load shall be removed and the rest of the load shall be discarded.

Air content above 7.0%: Concrete poured from the load shall be removed and the rest of the load discarded.

3.9.4.2 If the measured air content is below the specified minimum air content, then the contractor may elect to retemper with air entraining agents in accordance with Section 03055 - Portland Cement Concrete, clause 3.2.6.

3.9.4.3 When Air Void Examination Is Required

The quality assurance laboratory will drill cores from the hardened concrete for air void examination to 1.2.2 Section 03055 - Portland Cement **Concrete**, clause 1.4.6, at a frequency of at least one core for each 2 000 m of residential and collector sidewalk, curb and gutter or monolithic walk, curb and gutter, or as requested by the city for arterial, industrial or commercial streets or small residential subdivisions.

3.9.4.4 Where concrete has been rejected and is to be removed for not meeting the spacing factor requirement in 1.2.2 Section 03055 - Portland Cement **Concrete**, clause 1.4.6, the Contractor at the Contractor's expense shall prove that the concrete left in place at both ends of the removal meets the specified spacing factor by air void examination to be performed by a qualified laboratory to 1.2.2 Section 03055 - Portland Cement **Concrete**. The test results shall be submitted to the Engineer.

3.9.5 Deficient Strength

Concrete work for roadways represented by a strength test result which is less than specified may be accepted subject to a pay factor according to Table 03060.1. If strength deficiencies persist, the Engineer will require changes in the concrete mix design for the remainder of the work.

CYLINDER STRENGTH (% of Specified Strength)	PAY FACTOR (% of Contract Price)
97.0	100.0
96.0	99.2
95.0	98.2
94.0	96.9
93.0	95.4
92.0	93.6
91.0	91.7
90.0	89.4
89.0	86.7
88.0	83.5
87.0	79.7

86.0	75.5
85.0	70.0
Under 85.0	No Payment

TABLE 03060.1 CONCRETE STRENGTH PAY FACTORS

3.9.5.1 Optional core strength test:

The Contractor has the option at the Contractor's expense of providing evidence of strength by coring and testing to CAN/CSA-A23.2-14C by a qualified laboratory within 7 days of a failed 28-day cylinder test or within 3 days of a failed 7-day cylinder test. Three cores shall be drilled from the hardened concrete represented by the failed cylinder strength tests at locations approved by the Engineer.

The average strength of the 3 cores shall equal 100% of the specified cylinder strength; otherwise, the concrete will be subject to the pay factors of Table 03060.1 on the basis of the cylinder strength tests alone.

No reduction in the specified 28-day strength for cold weather or air content will be applied to the core strength test results when high early strength concrete is specified.

1. GENERAL

1.1 SCOPE

Supply of all labour, materials and equipment to complete the concrete formwork and falsework, including slipforming required for the work as indicated on the drawings or specified herein.

1.2 RELATED SECTIONS

Reinforcing Steel	Section 03210
Concrete for Water and Drainage Structures	Section 03310

1.3 QUALITY ASSURANCE

1.3.1 At least one person thoroughly familiar with the type of material being installed, the referenced standards and the requirements of this section shall direct this portion of the Work.

1.3.2 Supply, erect and dismantle concrete formwork and falsework in accordance with CSA-A23.1-04 except where specified elsewhere.

1.3.3 The design of all formwork, falsework, scaffolding, shoring, etc. shall be the responsibility of the Contractor.

1.3.4 Supply, erect and dismantle falsework in accordance with CSA-S269.1 except where specified elsewhere.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Formwork Materials:** comply with CAN/CSA-S269.3, plain reusable pre-coated plywood sheets or formed steel panels.

2.1.2 **Falsework Materials:** comply with CSA-S269.1.

2.1.3 **Form Ties:** use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in the concrete surface.

2.1.4 **Form Release Agent:** chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.

2.1.5 **Void Forms:** expanded polystyrene ‘Frost Cushion” by Beaver Plastics, or equal.

2.1.6 **Form Stripping Agent:** colourless mineral oil, free of kerosene, with viscosity between 15 to 24 mm^2/s at 40°C, flashpoint minimum 150°C, open cup.

2.1.7 All other materials, not specifically described but required for proper completion of concrete formwork, falsework, scaffolding, or shoring shall be as selected by the Contractor, subject to the advance approval of the Engineer.

2.1.8 **Slipform Equipment:** of a design suitable to the type of work being constructed, for use with vibrators, and capable of uniformly extruding, spreading, shaping, and consolidating fresh concrete to produce a dense homogeneous mass with surfaces requiring a minimum of hand finishing; self-propelled and capable of automatically controlling alignment and grade from taut wires or string lines.

3. EXECUTION

3.1 FABRICATION AND ERECTION

3.1.1 Verify lines, levels and centres before proceeding with formwork and falsework, and ensure dimensions agree with drawings.

3.1.2 Obtain Engineer’s approval for use of earth forms.

3.1.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

3.1.4 Fabricate and erect falsework in accordance with CSA-S269.1.

3.1.5 Do not place shores and mud sills on frozen ground.

3.1.6 Provide site drainage to prevent washout of soil supporting mud sills and shores.

3.1.7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1-04

3.1.8 Align form joints and make watertight. Keep form joints to a minimum.

3.1.9 Use 25 mm chamfer strips on external corners and 25 mm fillets at interior corners of concrete members, unless specified otherwise.

3.1.10 Form chases, slots, openings, drips, recesses and expansion and control joints as indicated.

3.1.11 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

3.2 SLIPFORMING

3.2.1 Set and maintain grade line by establishing taut string line or wire, based on Engineer's survey control datum.

3.2.2 Provide stable support for travelling slipform machine. Protect adjacent work and repair if damaged.

3.2.3 Coordinate concrete delivery and placing to ensure uniform progress of slipform machine without stoppage. If machine is stopped for any cause, immediately stop vibrating and tamping elements.

3.2.4 Maintain proper slump to ensure slipformed concrete does not sag.

3.2.5 Slipformed surfaces shall be smooth, dense, and free of pockets and honeycomb. Apply a minimum of hand finishing to correct minor irregularities.

3.3 FORM REMOVAL

3.3.1 Review the proper timing of form removal with the Engineer in all cases.

3.3.2 Loosen all wall or beam side forms within the first 24 hours after placing for the purpose of spraying water between the concrete and the forms. Strip wall and column forms within 48 hours to facilitate finishing.

3.3.3 Remove underside of slab or beam forms only after 28 days, or after concrete has attained a minimum of 75% of the specified 28 day strength, with results indicated by field cured test cylinders, and only as approved by the Engineer.

3.3.4 Re-shoring to remove forms will be permitted provided it is in accordance with CSA-S269.1.

3.4 CONSTRUCTION JOINTS

3.4.1 Prior to commencing construction, the Engineer shall approve, in writing, the locations of all construction joints required for construction but not shown on the drawings.

3.4.2 Construct joints in accordance with the details shown on the drawings.

3.4.3 Roughen all formed construction joints to expose the aggregate of the hardened concrete. Method of roughening to remove laitence to be approved by the Engineer. Alternatively, apply a suitable retardant to the forms of the construction joint and remove retarded surface mortar with low pressure jets of water or stiff brushes.

3.4.4 No vertical construction joints will be allowed within 3 m of wall intersections without prior written approval from the Engineer.

3.4.5 Limit the length of any single wall pour to a maximum of 18 m and allow a minimum of seven days before placing any adjoining sections.

1. GENERAL

1.1 SCOPE

Supply of all labour, materials and equipment to complete the reinforcing steel required for the work, as indicated on the drawings or specified herein.

1.2 RELATED SECTIONS

Concrete for Water and Drainage Structures	Section 03310
Concrete Forms and Accessories	Section 03100

1.3 QUALITY ASSURANCE

1.3.1 At least one person thoroughly familiar with the type of material being installed, the referenced standards and the requirements of this section shall direct this portion of the Work.

1.3.2 Install steel reinforcement in accordance with CSA-A23.1 and CSA-W186.

1.3.3 Upon request, provide the Engineer with a certified copy of mill test report of the proposed reinforcing steel, showing physical and chemical analysis, a minimum of 2 weeks prior to ordering of reinforcing steel, or as necessary to facilitate a review.

1.3.4 Upon request, inform the Engineer of proposed source of material to be supplied.

1.4 SUBMITTALS

1.4.1 Submit shop drawings, including placing of reinforcement.

1.4.2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacing, location of reinforcement and any mechanical splices (only if approved by the Engineer), with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacing and locations of chairs, spacers and hangers.

1.4.3 Prepare reinforcement drawings in accordance with the Reinforcing Steel Manual of Standard Practice - by the Reinforcing Steel Institute of Canada, or ACI 315 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

1.4.4 Detail lap lengths and bar development lengths to CSA-A23.3.

1.4.5 Locate laps in co-ordination with the location of construction joints.

1.4.6 If in the opinion of the Engineer, the drawings are inadequate or inaccurately prepared, revise and resubmit all shop drawings.

2. PRODUCTS

2.1 MATERIALS

2.1.1 **Reinforcing Steel:** billet steel, Grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise. Weldable low alloy steel deformed bars to CAN/CSA-G30.18.

2.1.2 **Tie Bars:** to CSA-G30.18 grade 300, billet-steel, deformed bars, uncoated; and also to ASTM D3963 for epoxy-coated.

2.1.3 **Steel Dowels:** to CSA-G30.18, clean, straight, free from flattened or burred ends, uncoated and also to ASTM D3963 for epoxy-coated.

2.1.4 **Cold-Drawn Steel Wire:** to CSA-G30.3M, uncoated; to ASTM D3963 for epoxy coated.

2.1.5 **Welded Steel Wire Fabric:** to CSA-G30.5M, uncoated; to ASTM D3963 for epoxy coated.

2.1.6 **Chairs, bolsters, bar supports, spacers:** adequate for strength and support of reinforcing and live loads during construction conditions.

2.1.7 **Tie Wire:** Cold-drawn annealed steel to CSA-G30.3.

2.1.8 **Epoxy Coating:** to ASTM A775/A775M.

2.1.9 **Galvanizing:** to CAN/CSA-G164.

2.1.10 **Plain Round Bars:** to CSA-G40.21.

2.1.11 All other materials, not specifically described but required for a complete and proper installation of concrete reinforcement, shall be as selected by the Contractor and be subject to the approval of the Engineer.

2.1.12 Supplementary cementing materials and their use to CAN/CSA-A3000.

2.2 FABRICATION

2.2.1 Fabricate reinforcing steel in accordance with CSA-A23.1, ACI 315, unless otherwise stated.

2.2.2 Obtain Engineer's approval for locations of reinforcement splices other than those shown on placing drawings.

2.2.3 Upon approval of Engineer, weld reinforcement in accordance with CSA-W186.

2.2.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.2.5 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

3. EXECUTION

3.1 FIELD BENDING

3.1.1 Do not field bend or field weld reinforcement except where indicated or authorized by the Engineer.

3.1.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

3.1.3 Replace bars that develop cracks or splits.

3.2 PLACING REINFORCEMENT

3.2.1 Place reinforcing steel as indicated on approved drawings and in accordance with CSA-A23.1.

3.2.2 Place sufficient chairs, and supports to adequately maintain the position of the reinforcing steel during placement of concrete, to within tolerances specified in the referenced CSA/CAN guidelines. Use tie wire to prevent the moving or dislodging of reinforcing steel during placement of the concrete.

3.2.3 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.

3.2.4 Prior to placing concrete, obtain the Engineer's approval of reinforcing material placement.

3.2.5 Ensure cover to reinforcement is maintained during concrete pour.

3.2.6 Reinforcing steel, anchor bolts, or other required inserts shall not be inserted into concrete during placement.

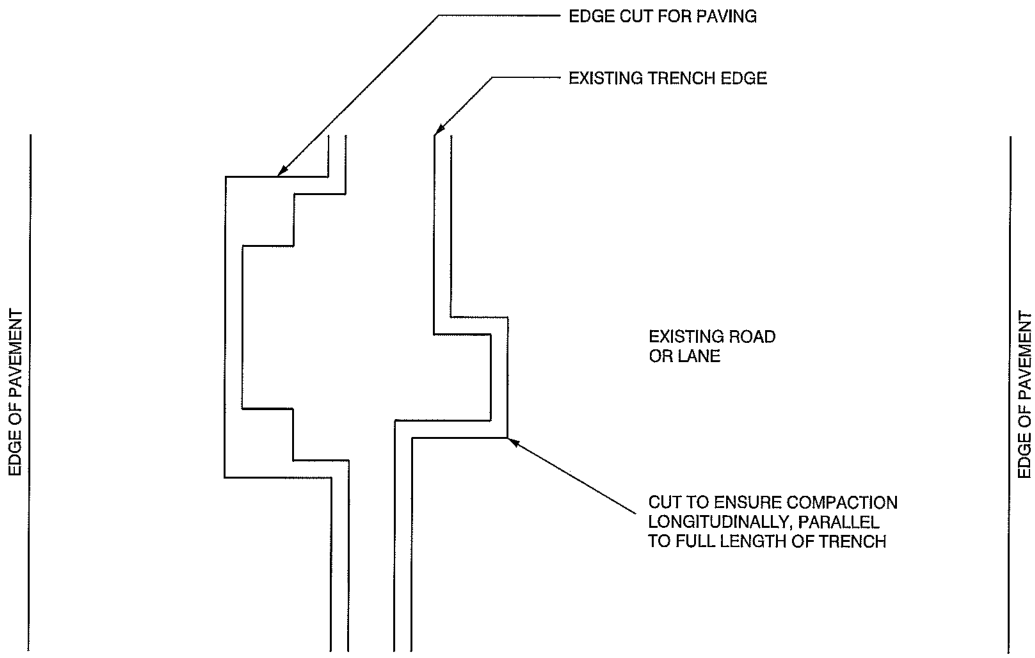
3.3 FIELD TOUCH-UP

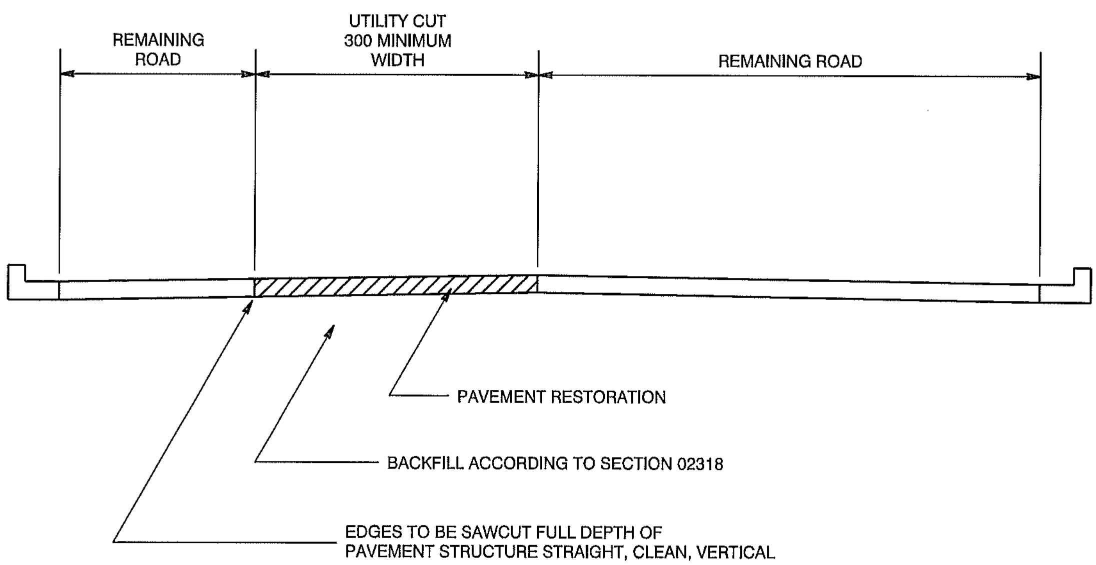
Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

UTILITY CUT RESTORATION

STANDARD DETAILS

SECTION 1000





NOTES:

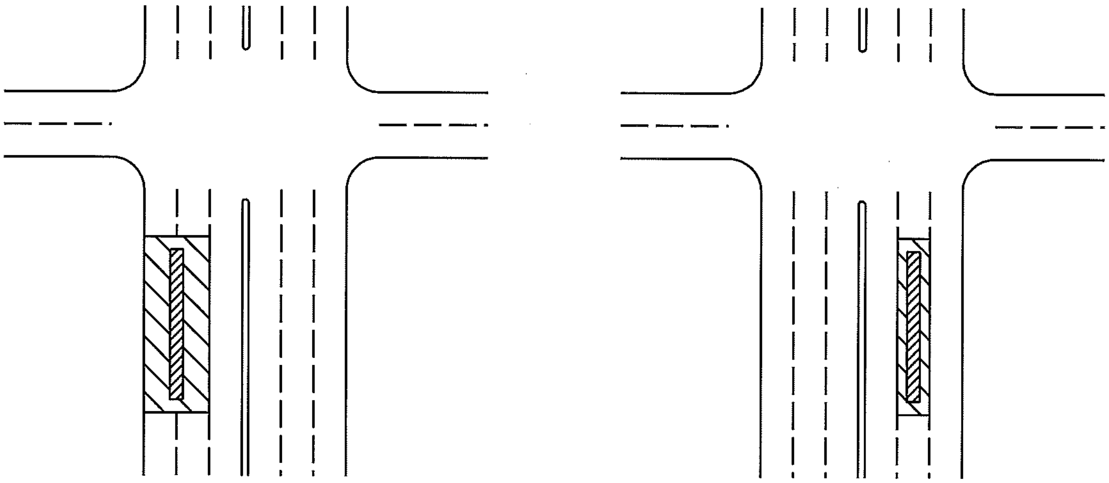
1. REMOVE AND REPLACE PAVEMENT STRUCTURE TO EDGE OF PAVEMENT (TO LIP OF GUTTER) WHEN WIDTH OF REMAINING ROAD < 1.5m.
2. REFER TO SECTION 02965 - UTILITY CUT RESTORATION.

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

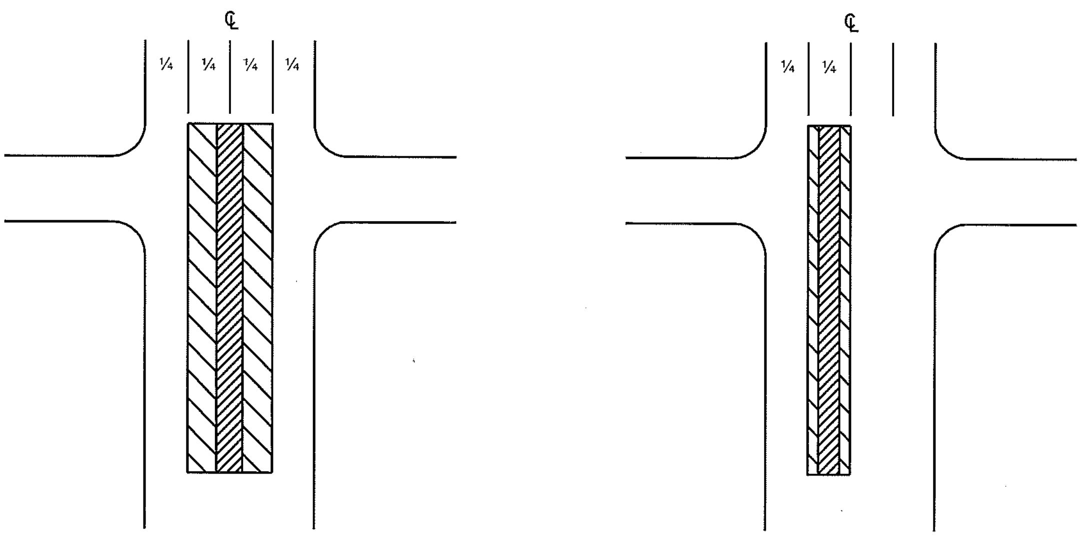
THE CITY OF Edmonton
STANDARD DRAWING

PAVEMENT RESTORATION AFTER UTILITY CUT

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			1000
Scale: N.T.S.	Checked By:			



ROAD SURFACE WITH LANE MARKINGS



ROAD SURFACE WITH NO LANE MARKINGS

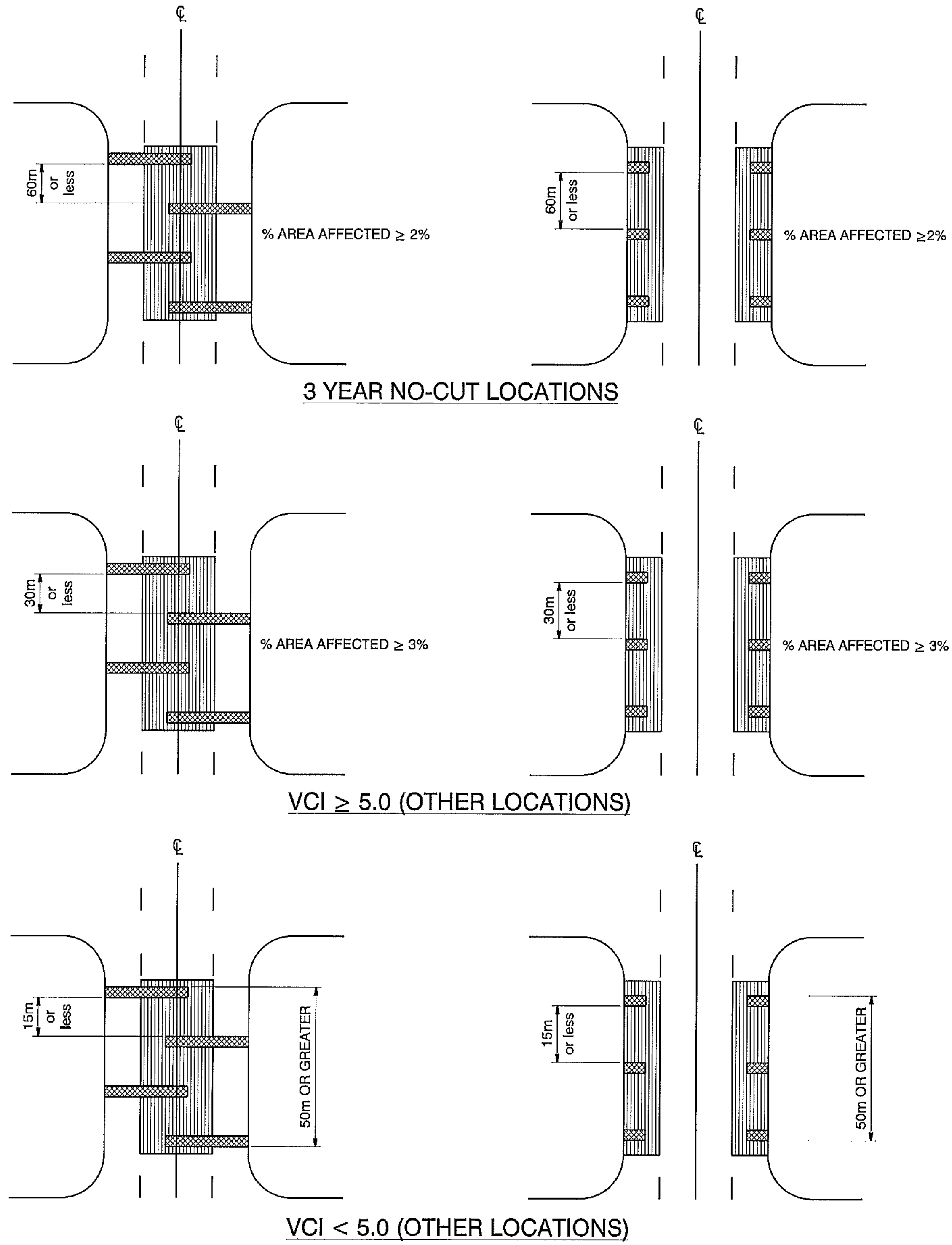
LEGEND

- PAVEMENT EDGE
- LANE MARKING
- UTILITY CUT
- OVERLAY

THE CITY OF Edmonton
STANDARD DRAWING

ROAD SURFACE RESTORATION AFTER UTILITY CUT

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 1010
Scale: N.T.S.	Checked By:		–	



LEGEND

CURB & GUTTER / EDGE OF PAVEMENT

UTILITY RESTORATION AREA

REPAIR AREA

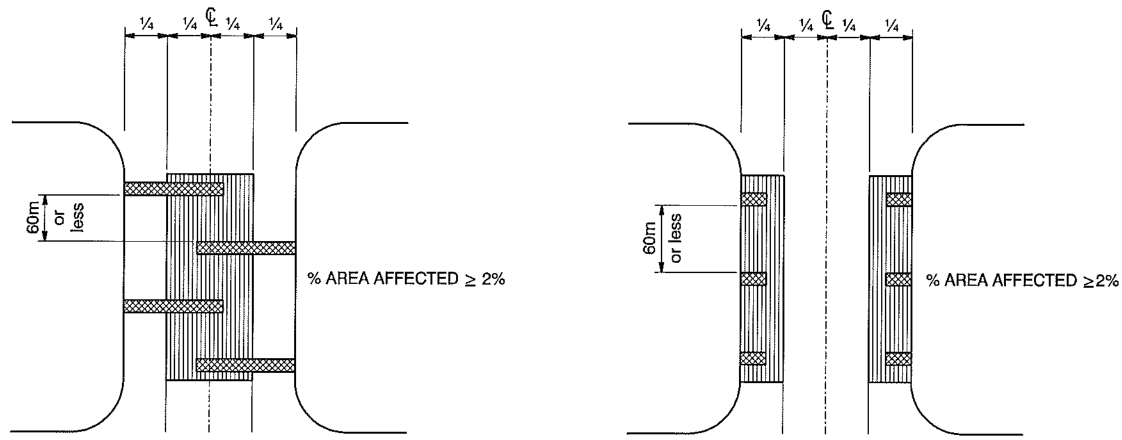
$$\% \text{ AREA AFFECTED} = \frac{\text{TOTAL REPAIR AREA}}{\text{UTILITY RESTORATION AREA}} \times 100$$

THE CITY OF Edmonton

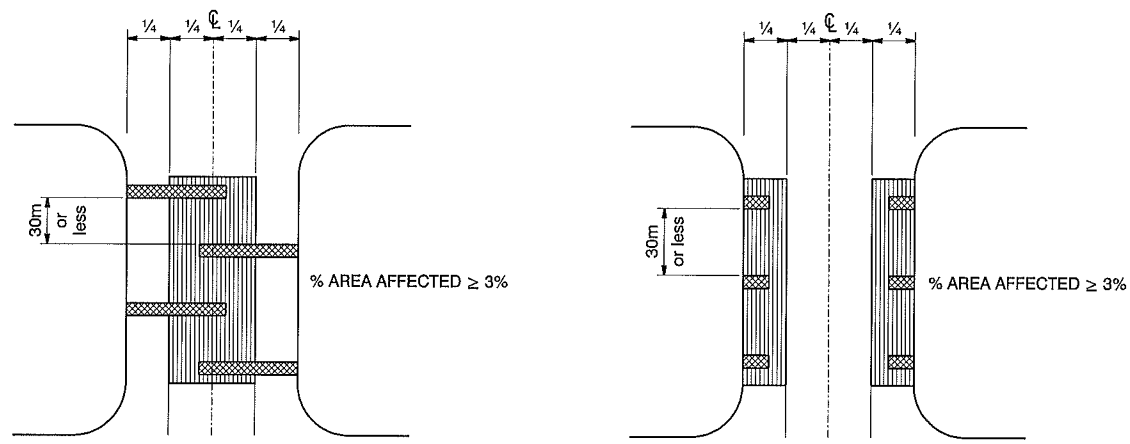
STANDARD DRAWING

TRANSVERSE CUT RESTORATION ARTERIAL ROAD

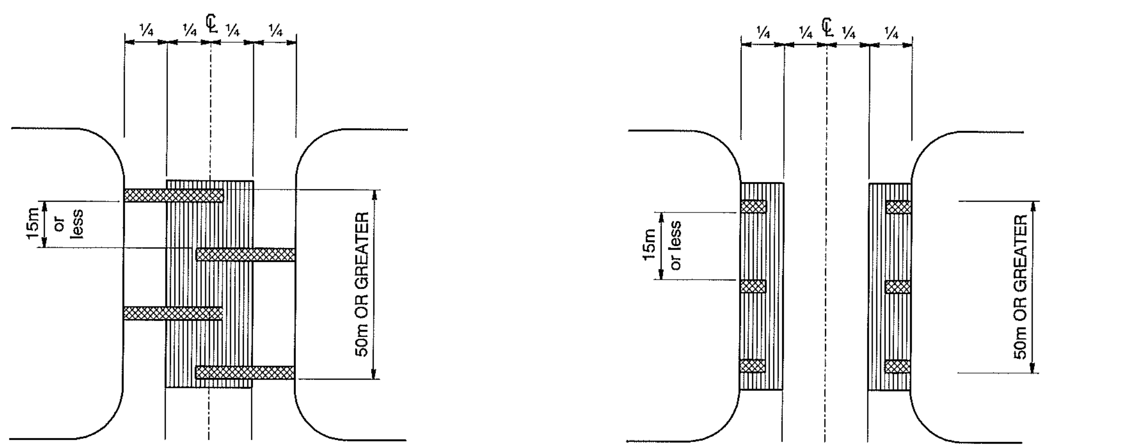
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 1020
Scale: NTS	Checked By:			



3 YEAR NO-CUT LOCATIONS



VCI ≥ 5.0 (OTHER LOCATIONS)



VCI < 5.0 (OTHER LOCATIONS)

LEGEND

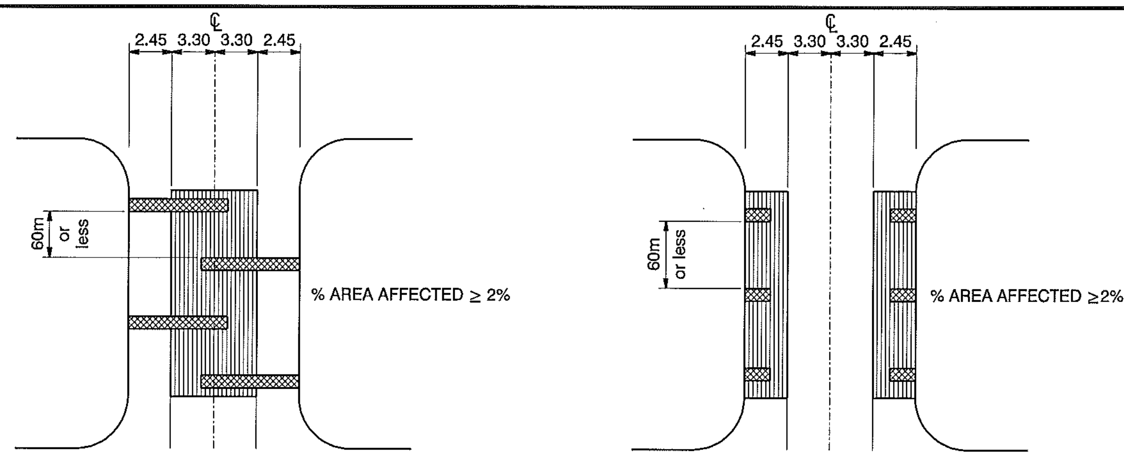
- CURB & GUTTER / EDGE OF PAVEMENT
- UTILITY RESTORATION AREA
- REPAIR AREA

$$\% \text{ AREA AFFECTED} = \frac{\text{TOTAL REPAIR AREA}}{\text{UTILITY RESTORATION AREA}} \times 100$$

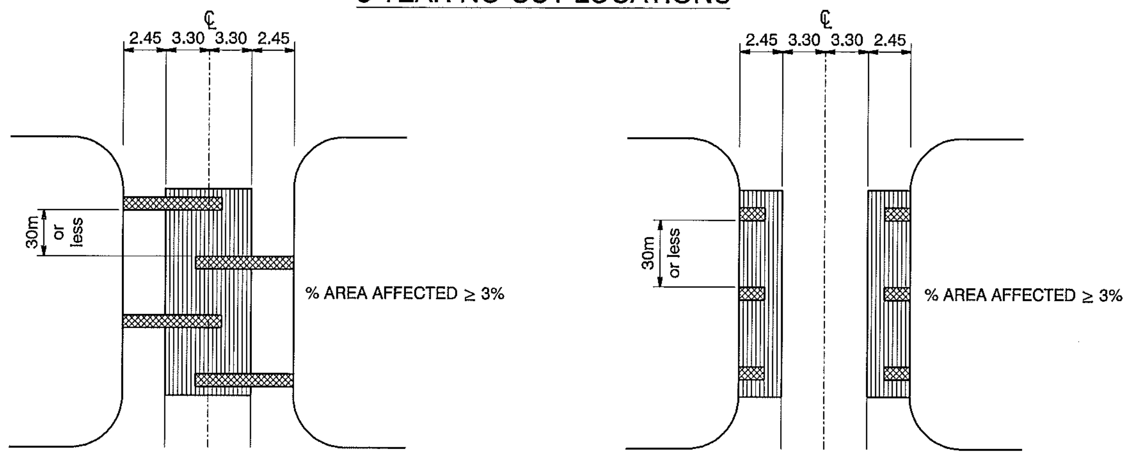
THE CITY OF Edmonton
STANDARD DRAWING

TRANSVERSE CUT RESTORATION
14.5m COLLECTOR ROAD

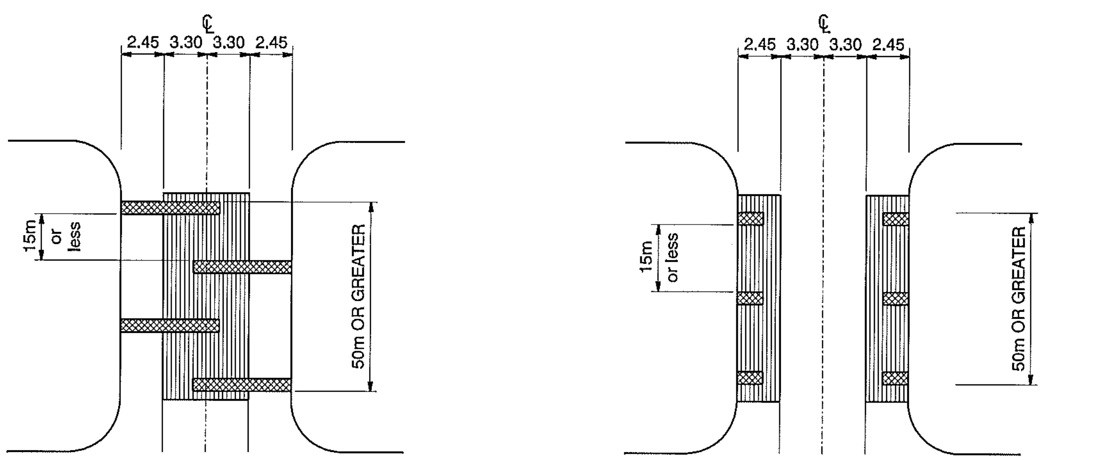
Date Approved: FEB.,2011	Drawn By: JW	Approved	Revision #	Drawing # 1021
Scale: NTS	Checked By:			



3 YEAR NO-CUT LOCATIONS



VCI ≥ 5.0 (OTHER LOCATIONS)



VCI < 5.0 (OTHER LOCATIONS)

LEGEND

CURB & GUTTER / EDGE OF PAVEMENT

UTILITY RESTORATION AREA

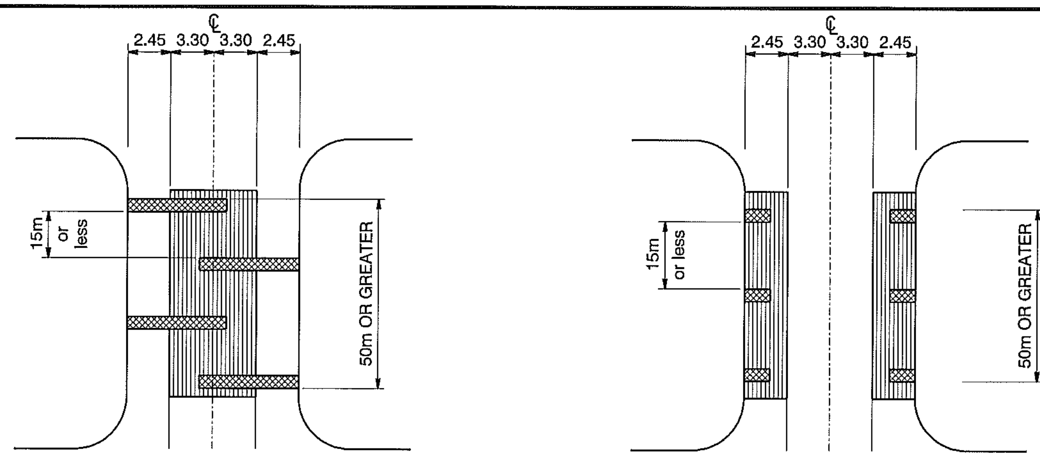
REPAIR AREA

$$\text{\% AREA AFFECTED} = \frac{\text{TOTAL REPAIR AREA}}{\text{UTILITY RESTORATION AREA}} \times 100$$

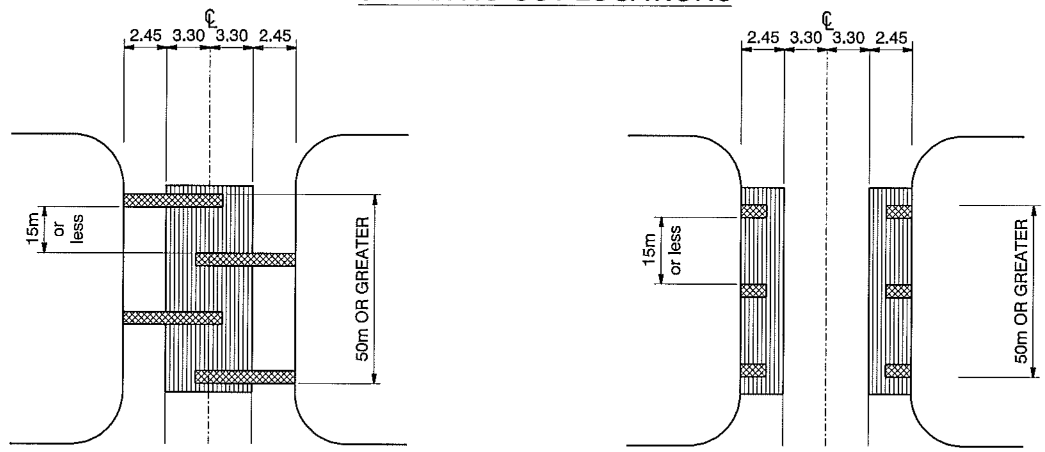
THE CITY OF Edmonton
STANDARD DRAWING

TRANSVERSE CUT RESTORATION
11.5m COLLECTOR ROAD

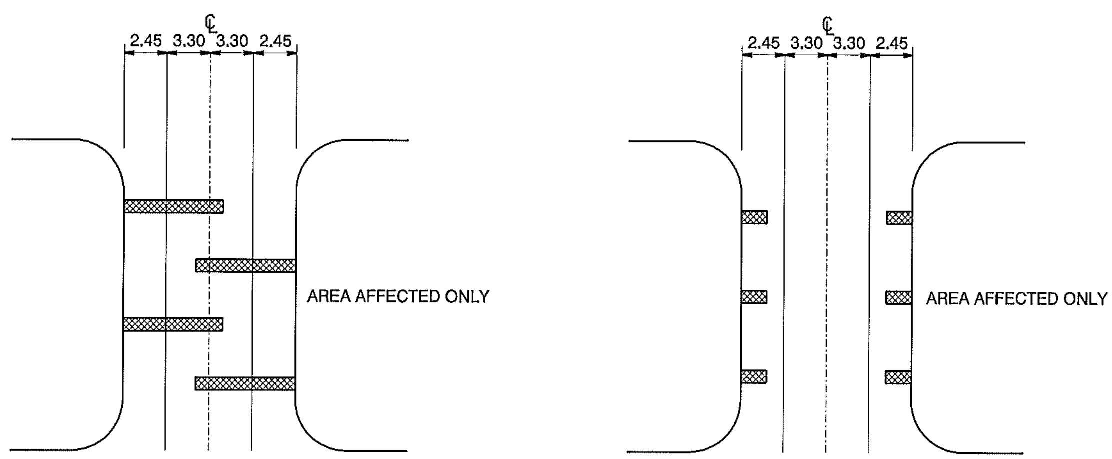
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 1022
Scale: NTS	Checked By:			



3 YEAR NO-CUT LOCATIONS



VCI $\geq$ 5.0 (OTHER LOCATIONS)



VCI < 5.0 (OTHER LOCATIONS)

LEGEND

- CURB & GUTTER / EDGE OF PAVEMENT
- UTILITY RESTORATION AREA
- REPAIR AREA

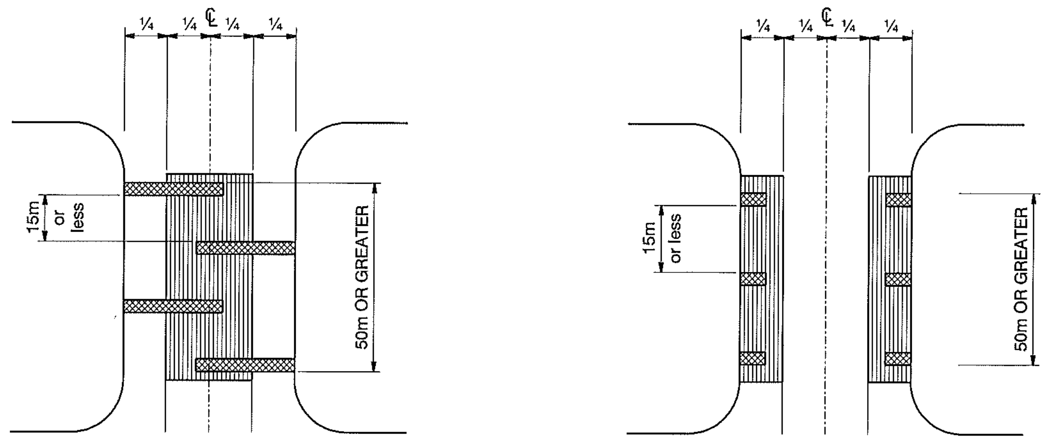
$$\% \text{ AREA AFFECTED} = \frac{\text{TOTAL REPAIR AREA}}{\text{UTILITY RESTORATION AREA}} \times 100$$

THE CITY OF Edmonton

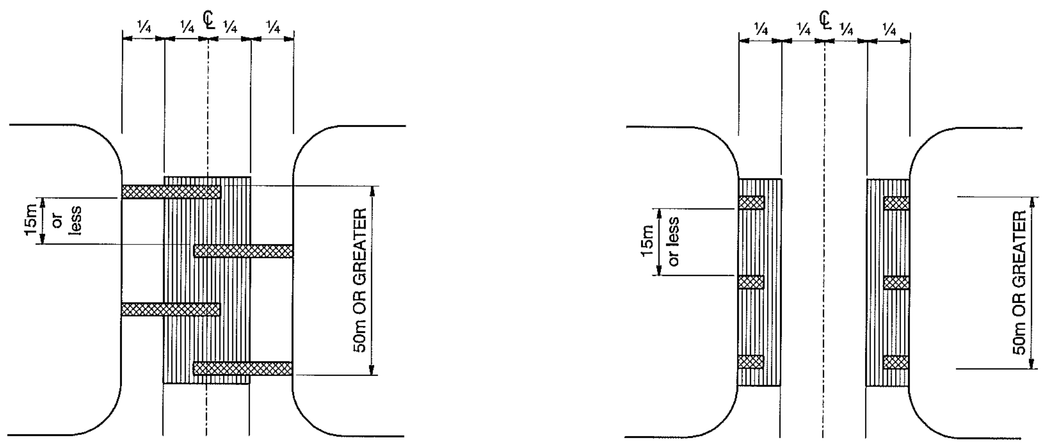
STANDARD DRAWING

TRANSVERSE CUT RESTORATION LOCAL INDUSTRIAL ROAD

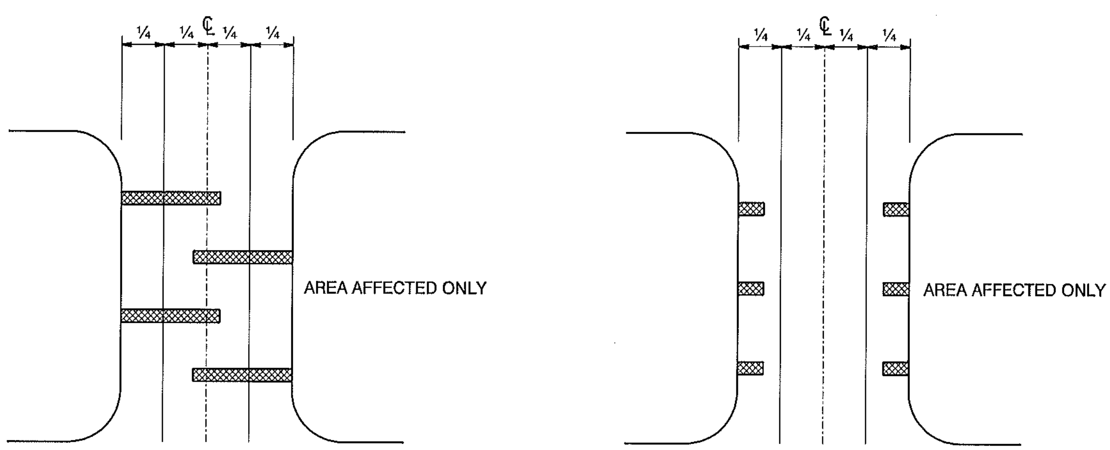
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 1023
Scale: NTS	Checked By:			



3 YEAR NO-CUT LOCATIONS



VCI ≥ 5.0 (OTHER LOCATIONS)



VCI < 5.0 (OTHER LOCATIONS)

LEGEND

CURB & GUTTER / EDGE OF PAVEMENT

UTILITY RESTORATION AREA

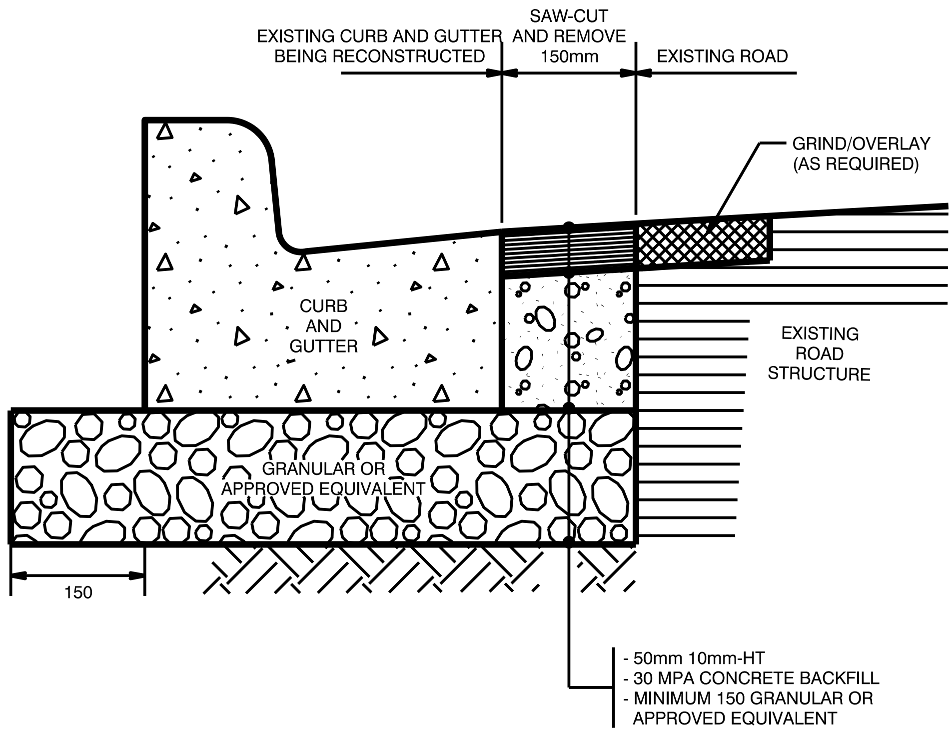
REPAIR AREA

$$\% \text{ AREA AFFECTED} = \frac{\text{TOTAL REPAIR AREA}}{\text{UTILITY RESTORATION AREA}} \times 100$$

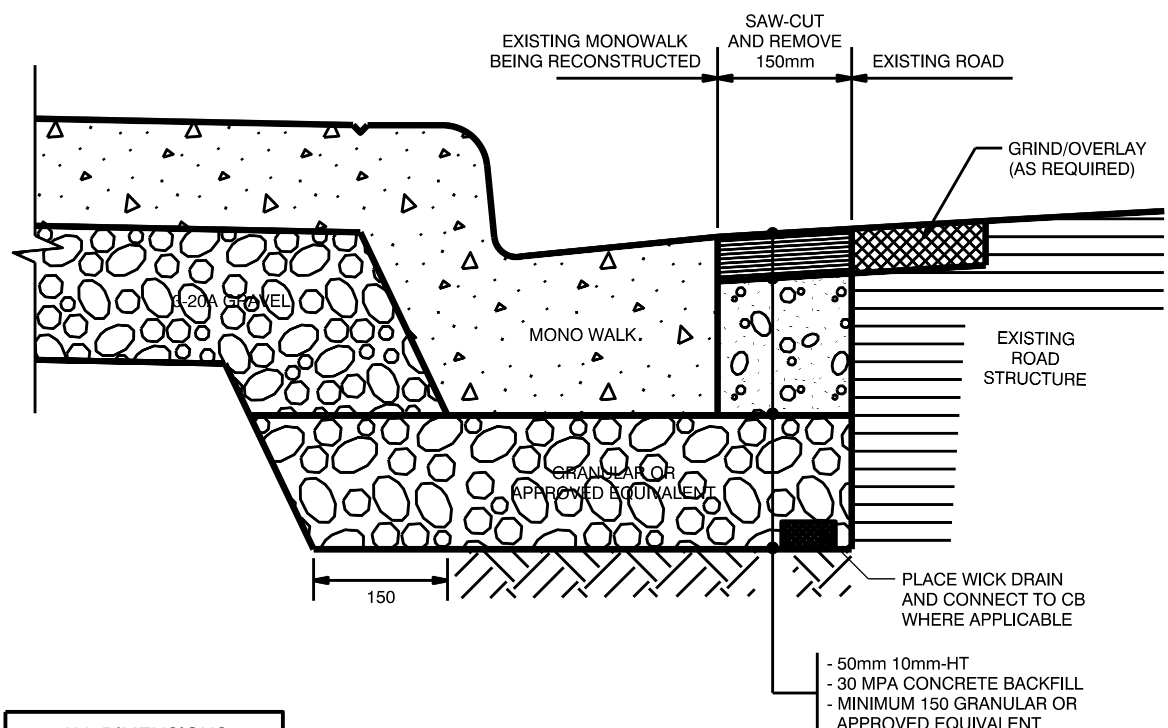
THE CITY OF Edmonton
STANDARD DRAWING

TRANSVERSE CUT RESTORATION
LOCAL RESIDENTIAL ROAD

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 1024
Scale: NTS	Checked By:			



CURB AND GUTTER REPLACEMENT



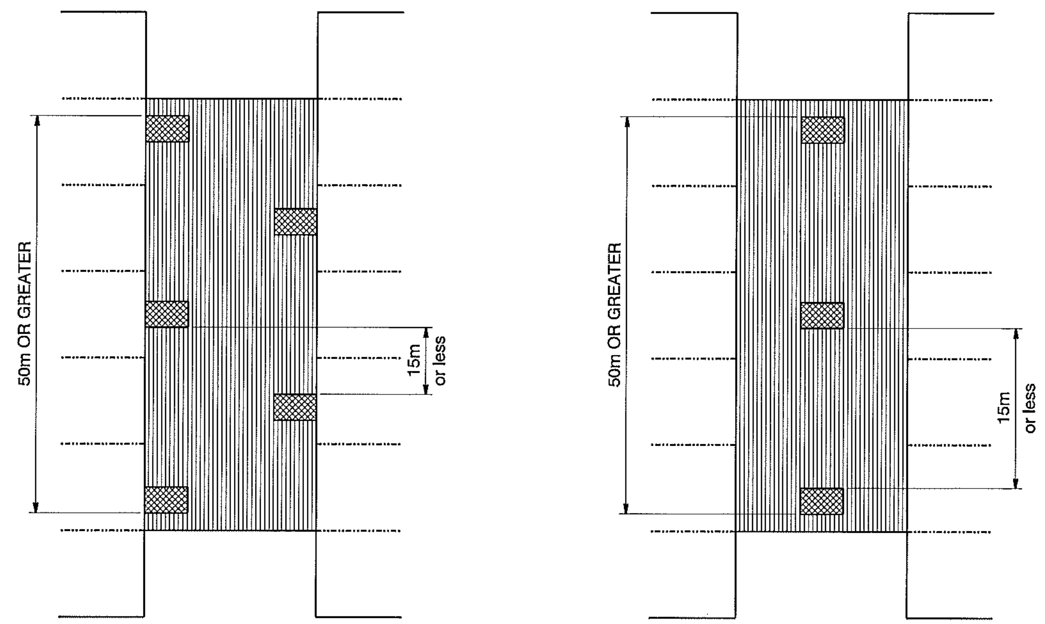
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

MONOWALK REPLACEMENT

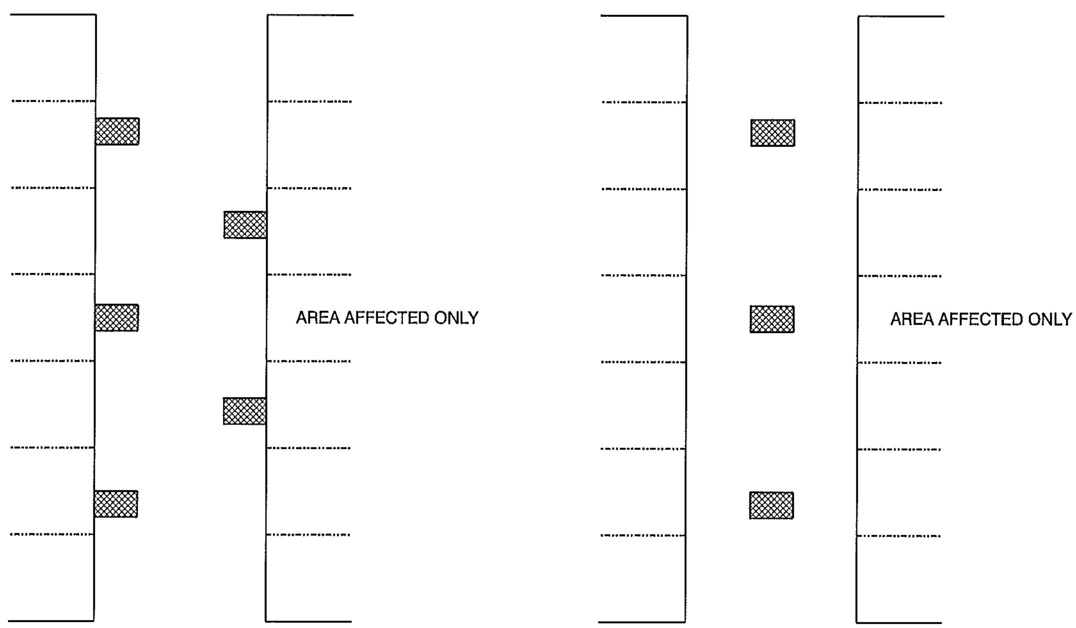
THE CITY OF Edmonton
STANDARD DRAWING

CURB AND GUTTER / MONOWALK REPLACEMENT - SAWCUT DETAILS

Date Approved: FEB., 2015	Drawn By: JW	Approved Rhonda Toohey	Revision #	Drawing # 1030
Scale: NTS	Checked By: MP		–	



3 YEAR NO-CUT LOCATIONS AND VCI ≥ 5.0 (OTHER LOCATIONS)



VCI < 5.0 (OTHER LOCATIONS)

LEGEND

- CURB & GUTTER / FENCE LINE
- PROPERTY LINE
- UTILITY RESTORATION AREA
- REPAIR AREA

$$\% \text{ AREA AFFECTED} = \frac{\text{TOTAL REPAIR AREA}}{\text{UTILITY RESTORATION AREA}} \times 100$$

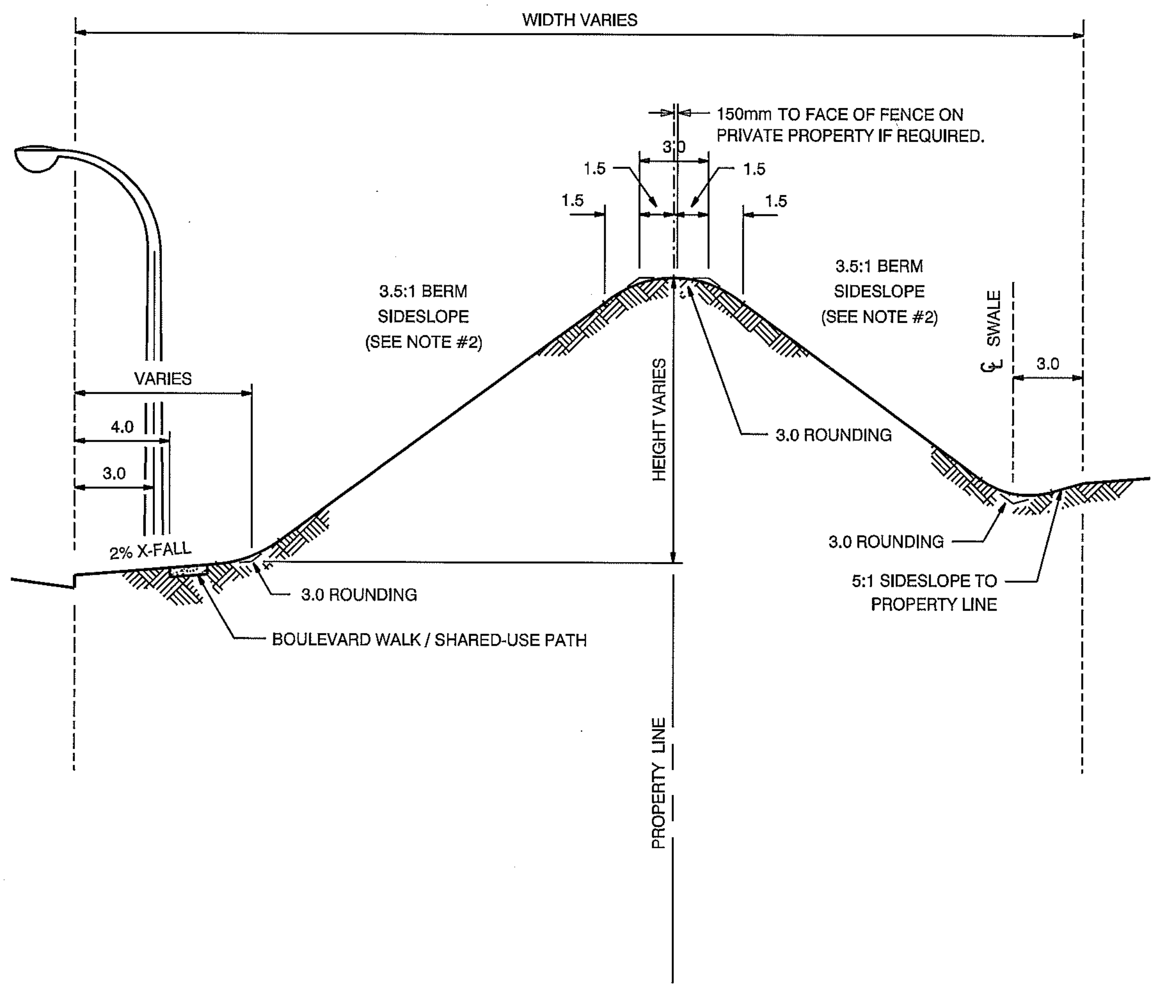
THE CITY OF Edmonton
STANDARD DRAWING

TRANSVERSE CUT RESTORATION
ALLEYS

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 1025
Scale: NTS	Checked By:			

CROSS-SECTIONS
STANDARD DETAILS

SECTION 2000



NOTES:

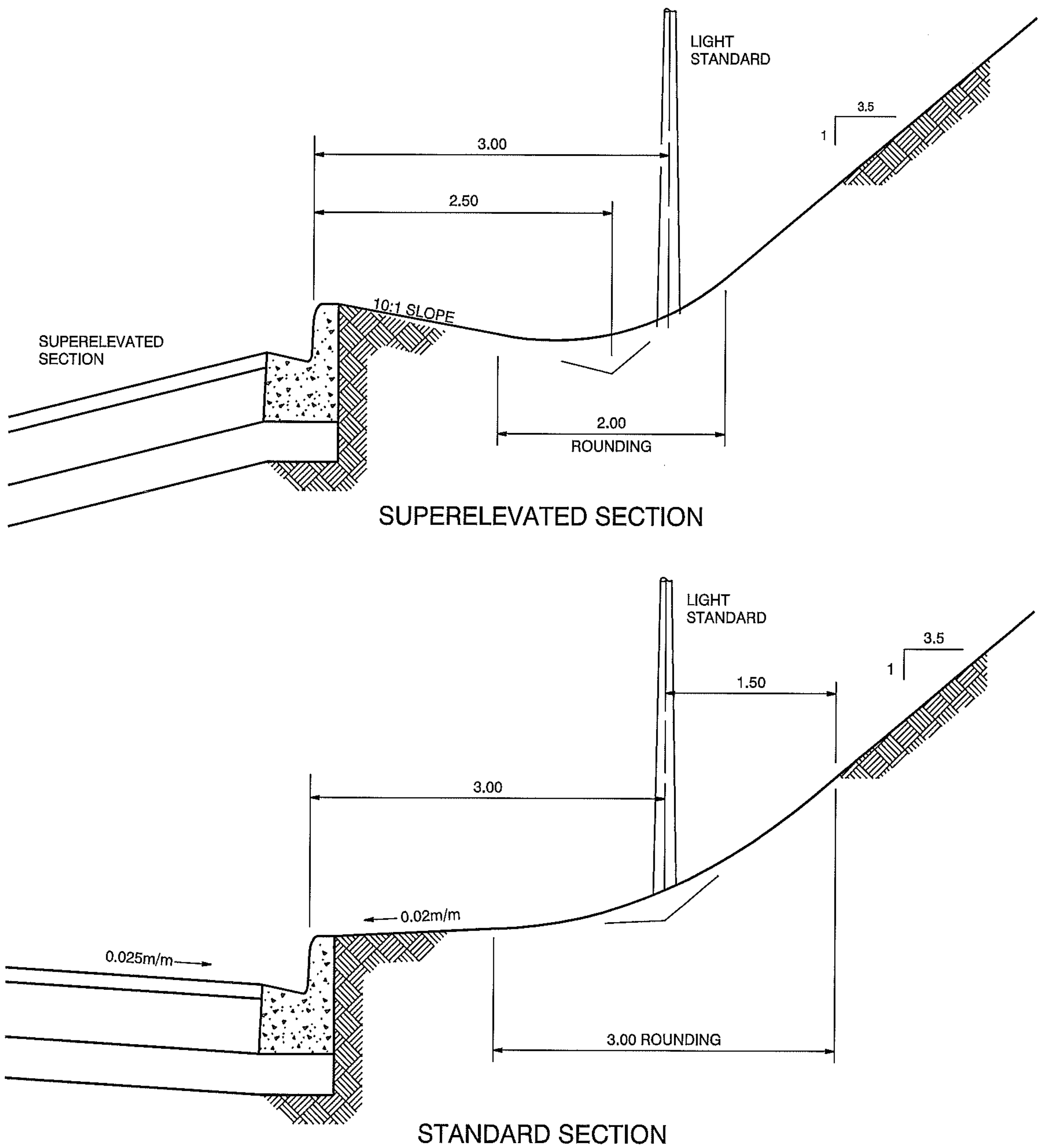
1. THE ABOVE DIAGRAM INDICATES THE DESIRABLE BERM FORMAT FOR MAXIMUM HEIGHT OF BERM.
2. BERM SIDESLOPE MINIMUM IS 3:1, SUBJECT TO APPROVAL BY CITY OF EDMONTON PARKS BRANCH, ASSET MANAGEMENT & PUBLIC WORKS DEPT.

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

TYPICAL BERM SECTION

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			2000
Scale: N.T.S.	Checked By:			

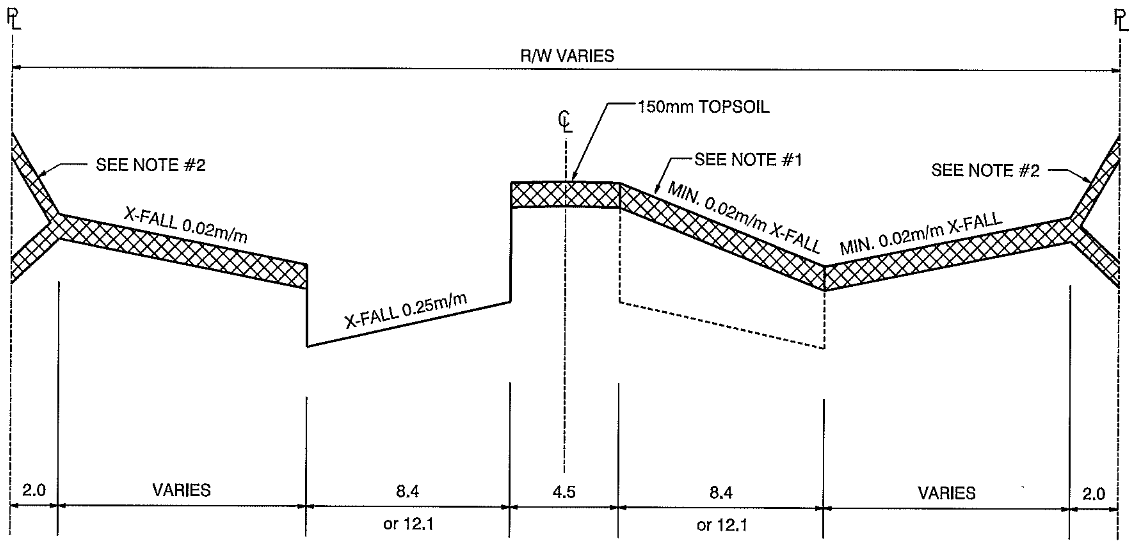


ALL DIMENSIONS
IN METRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

BOULEVARD GRADING STANDARD

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			2010
Scale: N.T.S.	Checked By:		–	



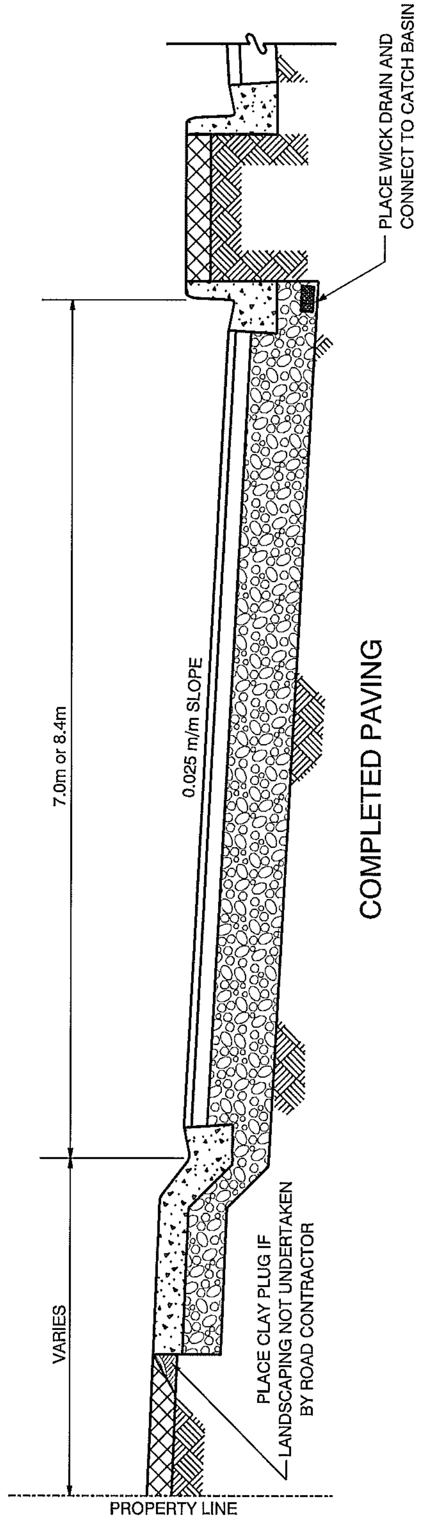
NOTES:

1. WHERE ONLY ONE HALF OF THE ARTERIAL ROADWAY IS TO BE CONSTRUCTED AND THE COMPLETE RIGHT OF WAY EXISTS, THE UNCONSTRUCTED PORTION SHALL BE GRADED TO THIS LINE AND DRAINAGE INSTALLED.
2. GRADE TO MEET THE EXISTING GROUND. IF THE CUT IS IN EXCESS OF 2.0 METRES SPECIAL GRADES WILL BE SET.

THE CITY OF Edmonton
STANDARD DRAWING

STAGED ARTERIAL GRADING REQUIREMENTS

Date Approved: FEB., 2010	Drawn By: JW	Approved	Revision #	Drawing # 2020
Scale: N.T.S.	Checked By:		–	



NOTES:

1. PAVEMENT STRUCTURE TO BE APPROVED BY CITY OF EDMONTON.
2. X-FALL TO BE MEASURED FROM LIP OF GUTTER.
3. 7.0m FOR FLANKAGE ON R-1 LOTS.
4. 8.4m FOR FRONTING ON R-1 LOTS.

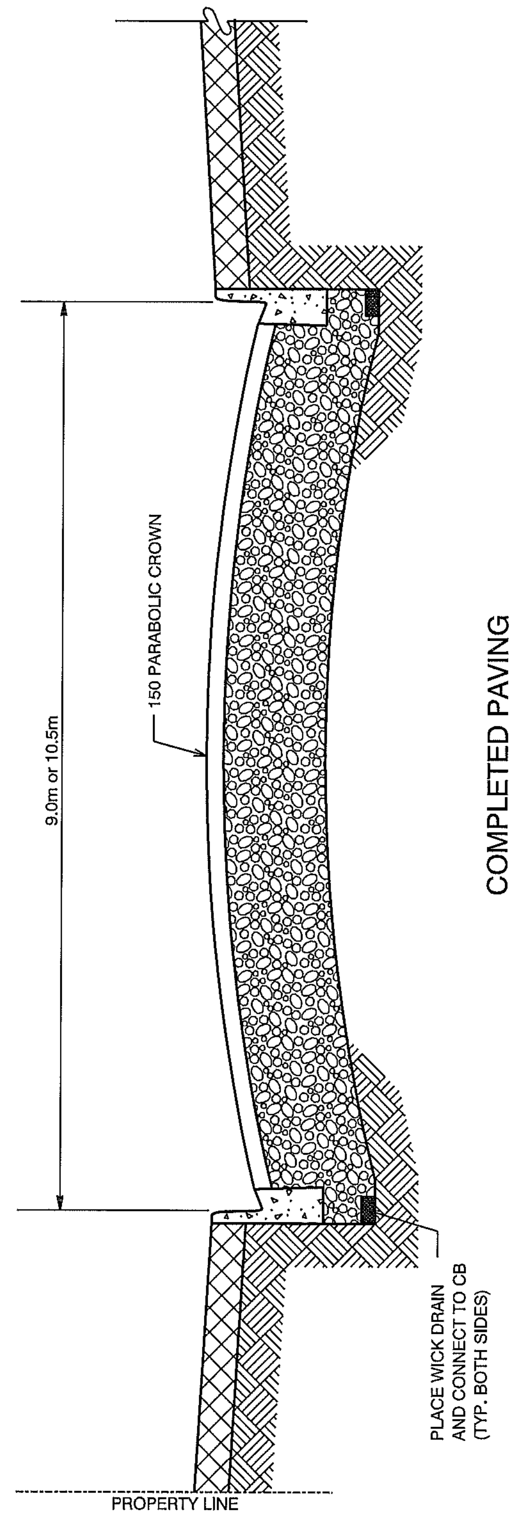
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

TAC CLASSIFICATION U.L.U. 50

THE CITY OF Edmonton
STANDARD DRAWING

RESIDENTIAL SERVICE ROAD

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2030
Scale: NTS	Checked By:			



NOTES:

1. PAVEMENT STRUCTURE TO BE APPROVED BY CITY OF EDMONTON.
2. X-FALL TO BE MEASURED FROM LIP OF GUTTER.
3. 9.0m FOR FLANKAGE LOTS.
4. 10.5m FOR FRONTING ON LOTS.

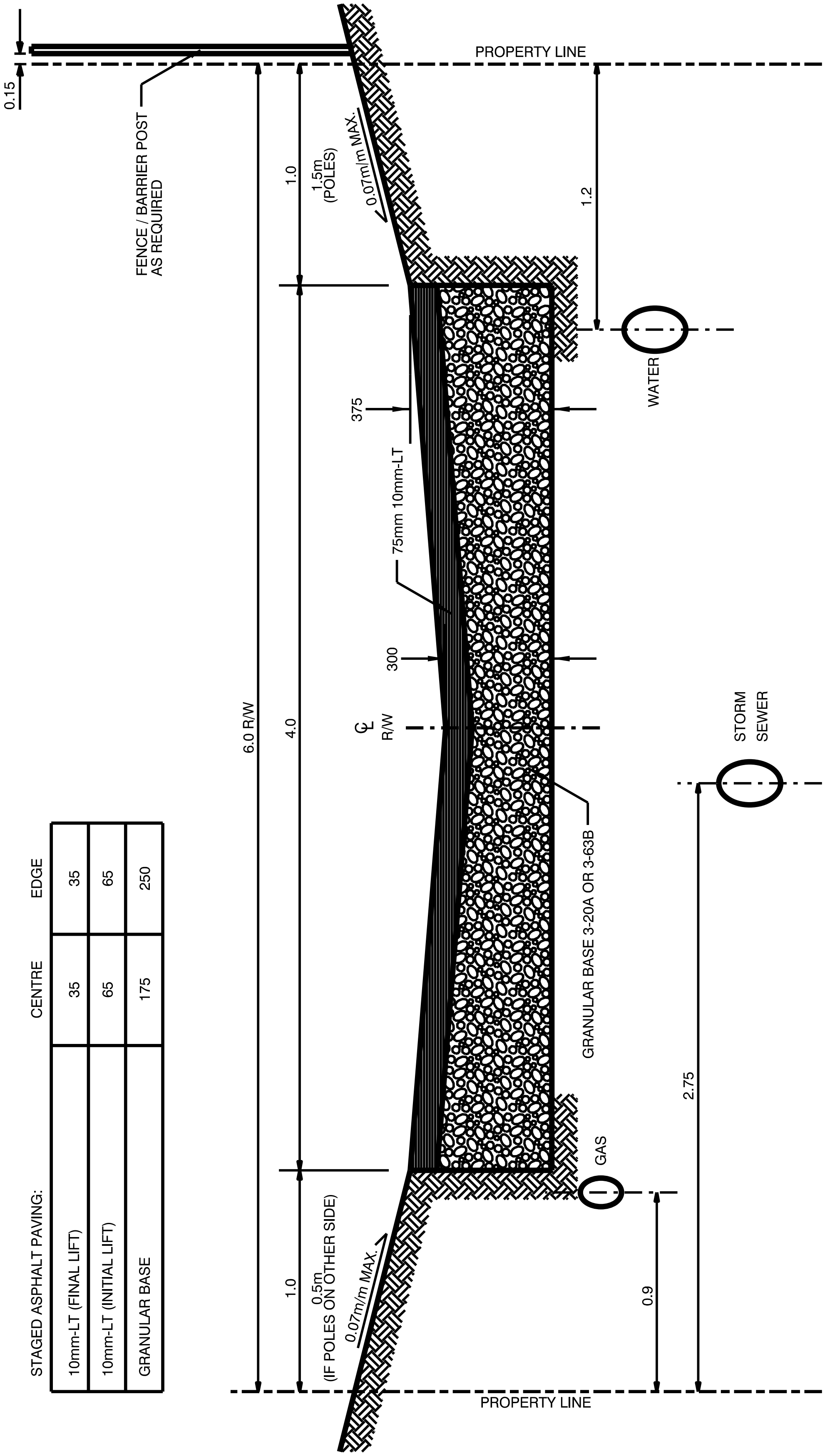
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

TAC CLASSIFICATION U.L.U. 50

THE CITY OF Edmonton
STANDARD DRAWING

INDUSTRIAL SERVICE ROAD

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2031
Scale: NTS	Checked By:			



ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

STAGED ASPHALT PAVING:	CENTRE	EDGE
10mm-LT (FINAL LIFT)	35	35
10mm-LT (INITIAL LIFT)	65	65
GRANULAR BASE	175	250

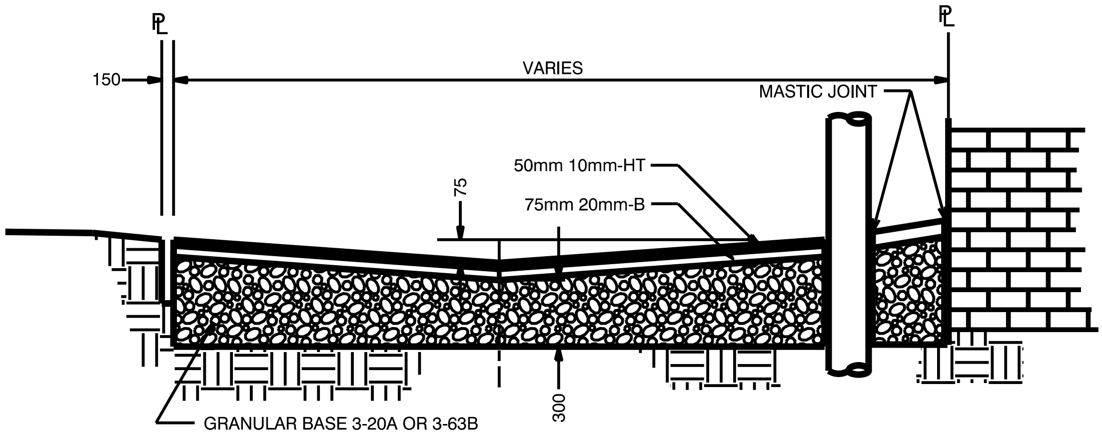
NOTES:

1. REDUCE CENTRELINE "V" TO 50mm AT TIE-IN TO BACK OF BOULEVARD WALK TO FACILITATE DRAINAGE AS REQUIRED.
2. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m.
3. EDGES OF PAVEMENT TO BE WARPED TO FIT DRIVEWAYS.
4. ALLEY IS CENTERED IN R/W UNLESS THERE ARE POLES.
5. STAGED ASPHALT PAVING WILL BE REQUIRED IF MULITPLE UTILITIES ARE INSTALLED WITHIN THE 4.0m PAVED AREA.

THE CITY OF Edmonton
STANDARD DRAWING

4.0m RESIDENTIAL ALLEY

Date Approved: FEB., 2015	Drawn By: JW	Approved Rhonda Toohey	Revision #	Drawing # 2040
Scale: NTS	Checked By: MP			



STRUCTURE:	TYPE	CENTRE	EDGE
ASPHALT		125	125
GRAVEL	3-20A	300	375
ALTERNATIVE STRUCTURE	3-63B	300	375

NOTES:

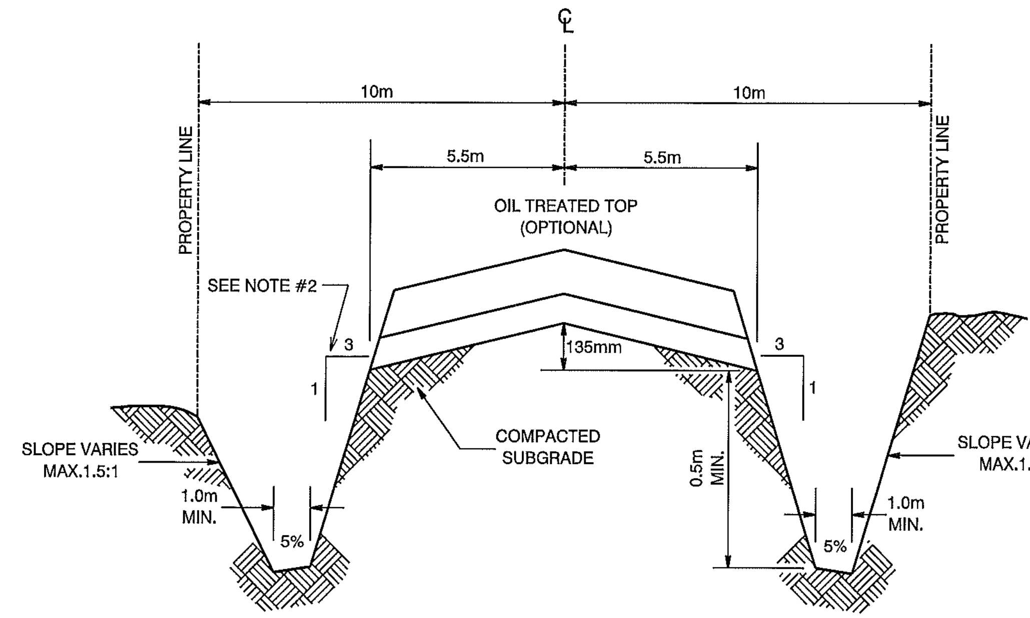
1. REDUCE CENTRELINE "V" TO 50mm AT TIE-IN TO BACK OF BOULEVARD WALK TO FACILITATE DRAINAGE AS REQUIRED.
2. IN ALLEY CONSTRUCTION, THE SAG POINT MAY BE OFF CENTERED AND/ OR THE CROSS-FALL VARIED TO MATCH EXISTING GRADES ALONG THE ALLEY EDGES.
3. EXCAVATION LIMITS TO BE AS SHOWN ABOVE.

THE CITY OF Edmonton

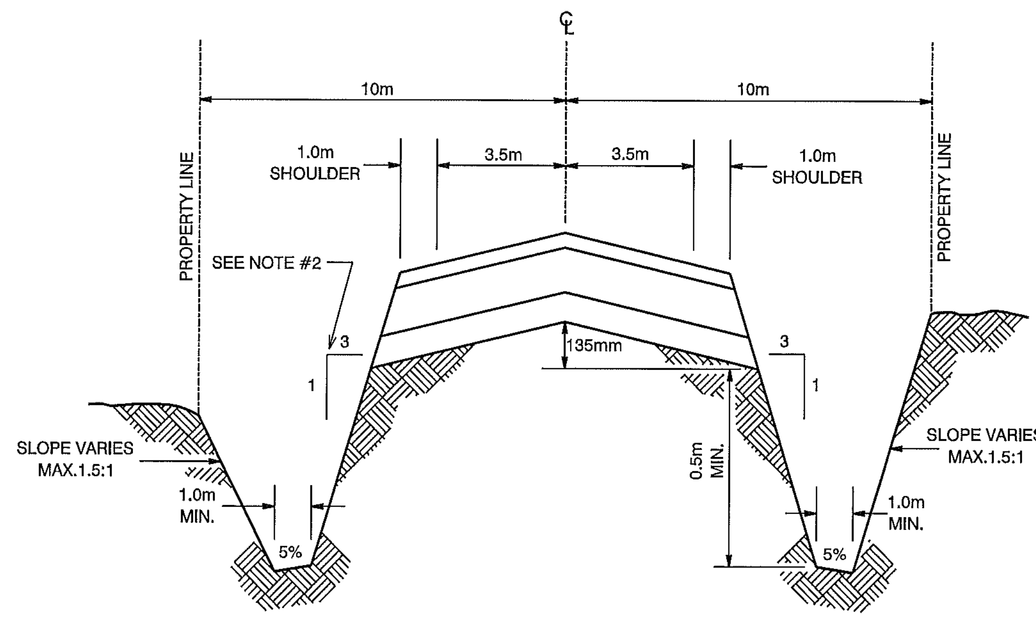
STANDARD DRAWING

6.0m COMMERCIAL ALLEY

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2015	JW	Rhonda Toohey		2041
Scale: NTS	Checked By: MP			



INTERIM SECTION



PAVED SECTION

NOTES:

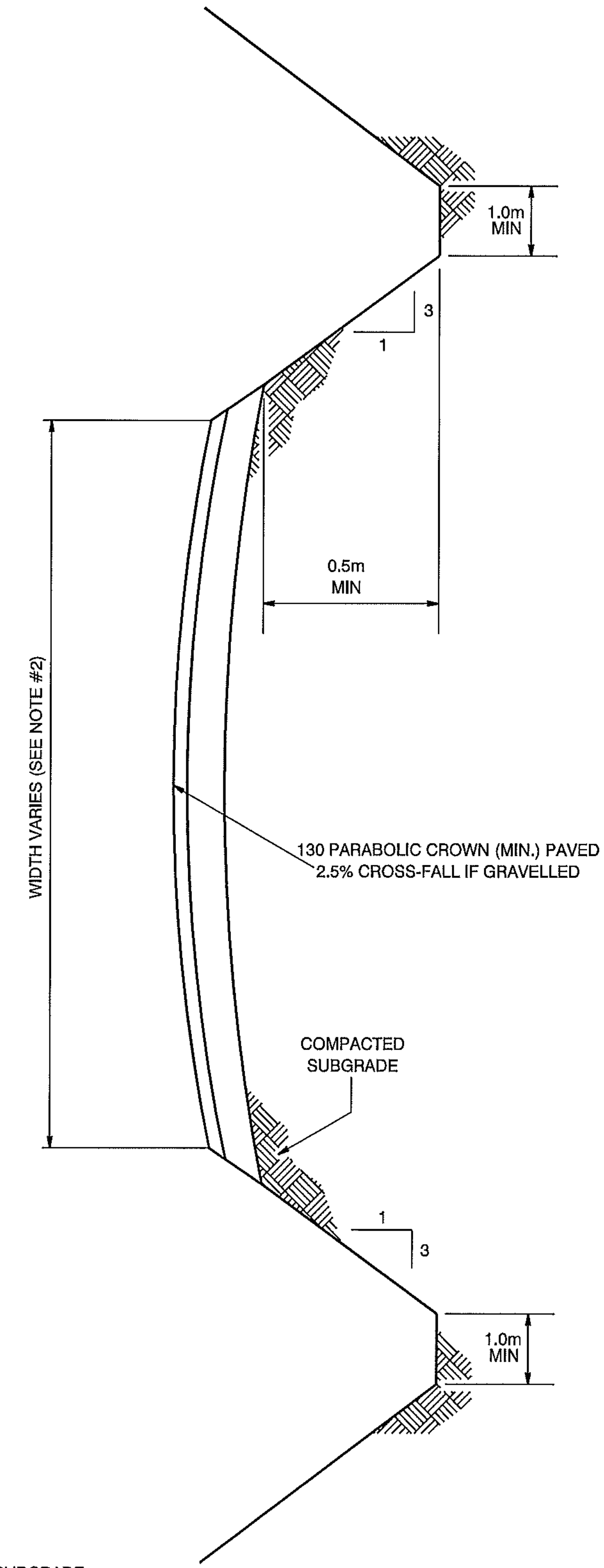
1. ENGINEERING FABRIC TO BE PLACED BETWEEN SUBGRADE AND WHEN A WET SUBGRADE IS ENCOUNTERED, AS DIRECTED BY THE ENGINEER.
2. SIDESLOPE DEPENDS ON DESIGN SPEED AND TRAFFIC VOLUME, REFER TO TAC GUIDELINES.

TAC CLASSIFICATION R.L.U. 50

THE CITY OF Edmonton
STANDARD DRAWING

9.0m RURAL LOCAL/ COLLECTOR ROADWAY

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2050
Scale: NTS	Checked By:			



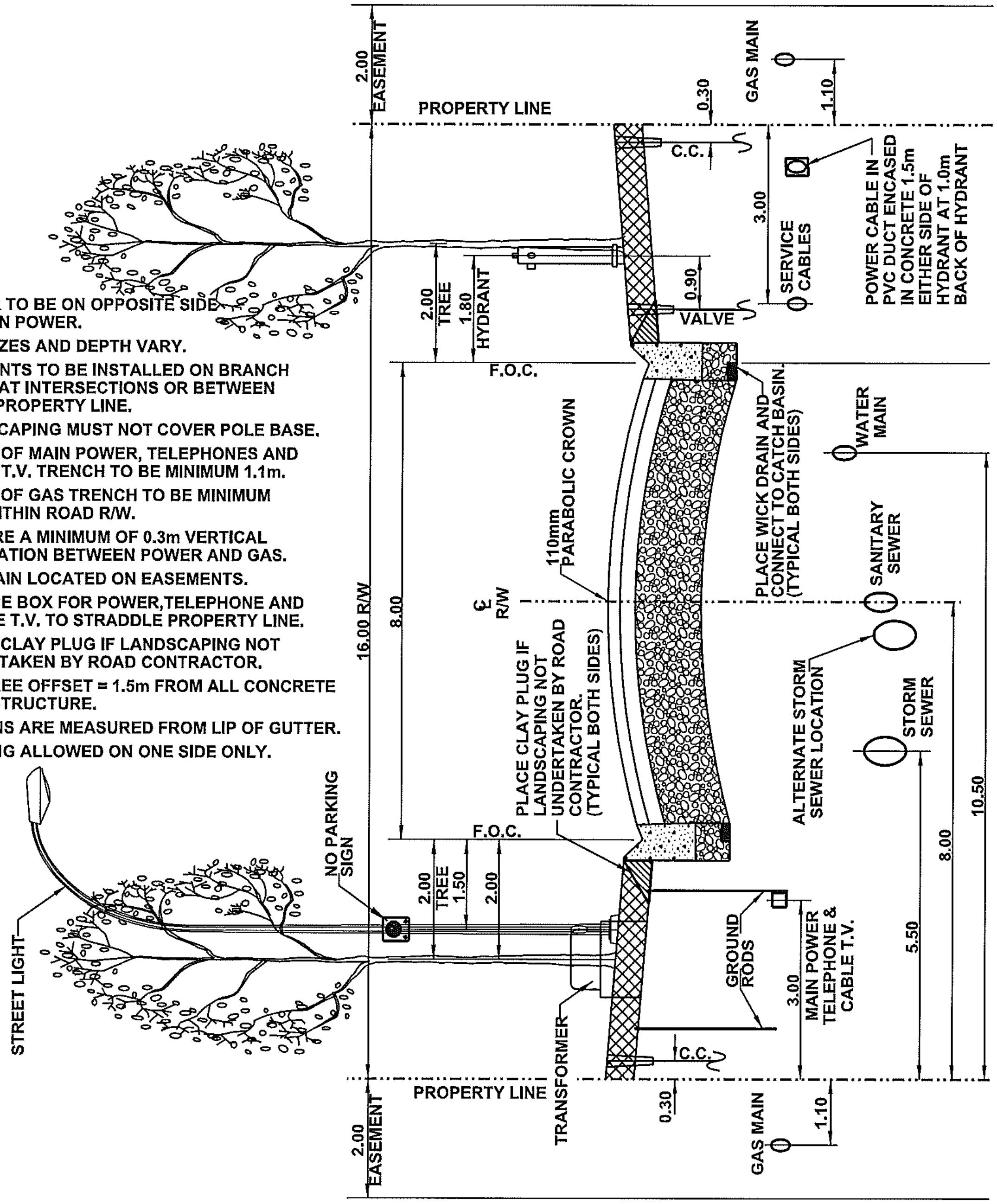
NOTES:

1. GEOTEXTILE FABRIC TO BE PLACED ON SUBGRADE, AS DIRECTED BY THE ENGINEER.
2. MINIMUM WIDTH FOR TWO-LANE OPERATIONS IS 6.0m FOR TEMPORARY ACCESS AND 7.0m FOR DETOUR ROAD.
3. MINIMUM WIDTH FOR ONE-LANE OPERATIONS IS 3.0m FOR TEMPORARY ACCESS AND 3.5m FOR DETOUR ROAD.

THE CITY OF Edmonton
STANDARD DRAWING

TEMPORARY ACCESS / DETOUR ROAD

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2060
Scale: NTS	Checked By:			



NOTES:
1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. GAS MAIN LOCATED ON EASEMENTS.
9. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
10. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
11. MIN. TREE OFFSET = 1.5m FROM ALL CONCRETE INFRASTRUCTURE.
12. CROWNS ARE MEASURED FROM LIP OF GUTTER.
13. PARKING ALLOWED ON ONE SIDE ONLY.

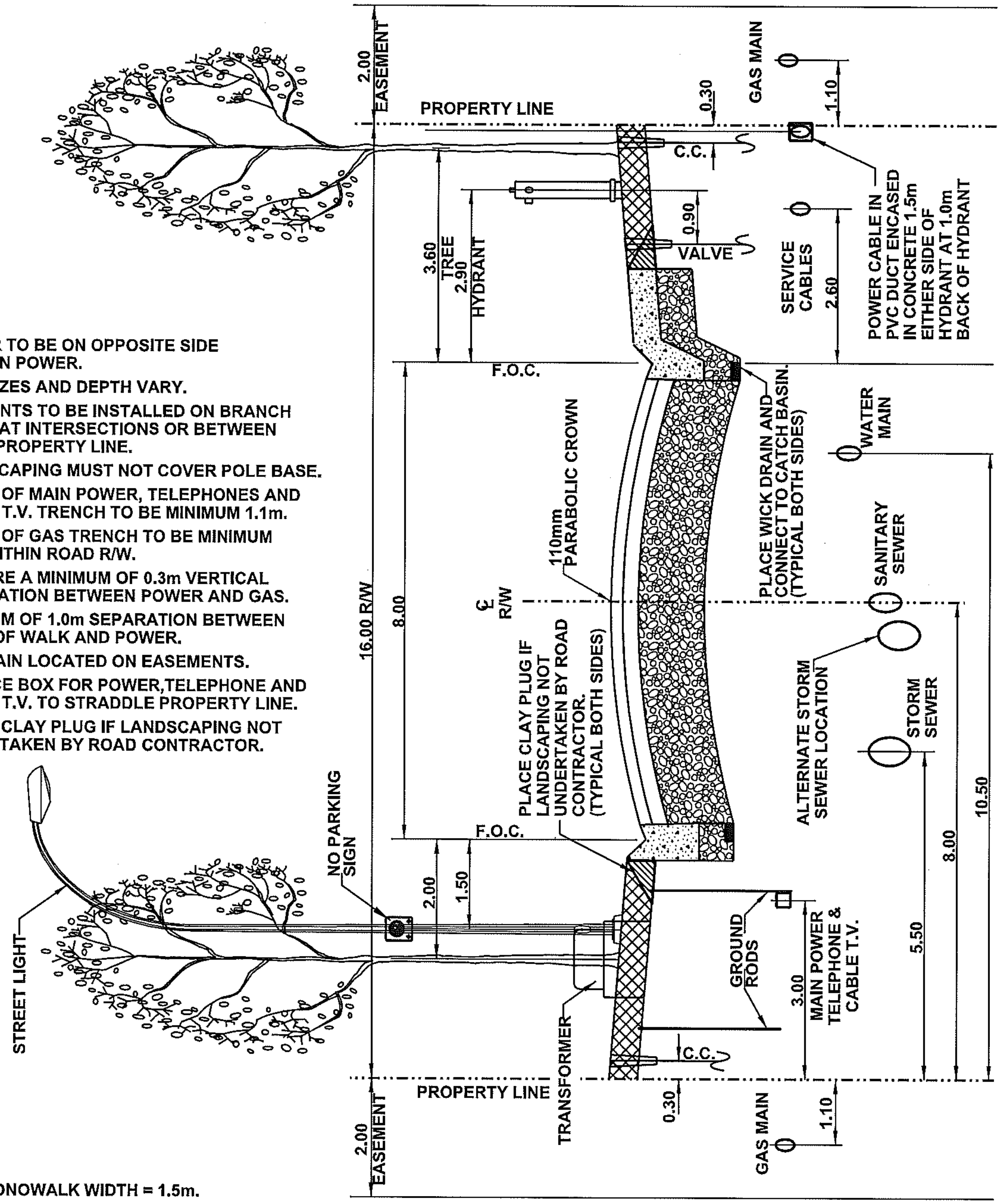
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION U.L.U. 60

THE CITY OF Edmonton
STANDARD DRAWING

8.0m URBAN LOCAL RESIDENTIAL (NO WALK) - 16m R/W

Date Approved: FEB., 2011	Drawn By: KLB	Approved	Revision #	Drawing # 2100
Scale: N.T.S.	Checked By:			



NOTES:
1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. MIN. MONOWALK WIDTH = 1.5m.
13. MIN. TREE OFFSET = 1.5m FROM ALL CONCRETE INFRASTRUCTURE.
14. MONOLITHIC SIDEWALK CURB AND GUTTER ON ONE SIDE ONLY UNLESS OTHERWISE SPECIFIED.
15. CROWNS ARE MEASURED FROM LIP OF GUTTER.
16. PARKING ALLOWED ON WALK SIDE ONLY.

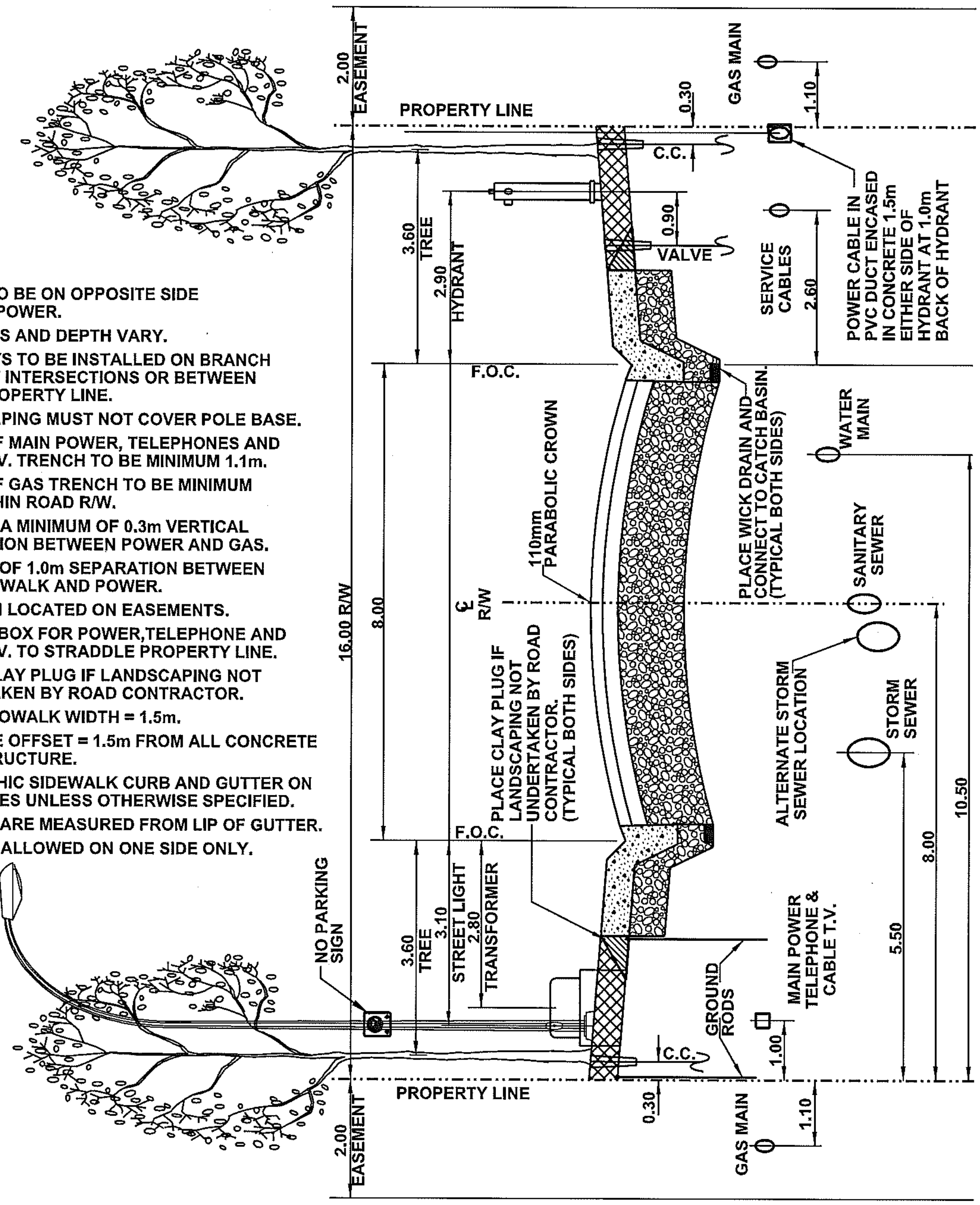
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION U.L.U. 60

THE CITY OF Edmonton
STANDARD DRAWING

8.0m URBAN LOCAL RESIDENTIAL (MONO WALK 1 SIDE ONLY) - 16m R/W

Date Approved: FEB., 2011	Drawn By: KLB	Approved:	Revision #	Drawing # 2110
Scale: N.T.S.	Checked By:			



NOTES:
1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. MIN. MONOWALK WIDTH = 1.5m.
13. MIN. TREE OFFSET = 1.5m FROM ALL CONCRETE INFRASTRUCTURE.
14. MONOLITHIC SIDEWALK CURB AND GUTTER ON BOTH SIDES UNLESS OTHERWISE SPECIFIED.
16. CROWNS ARE MEASURED FROM LIP OF GUTTER.
17. PARKING ALLOWED ON ONE SIDE ONLY.

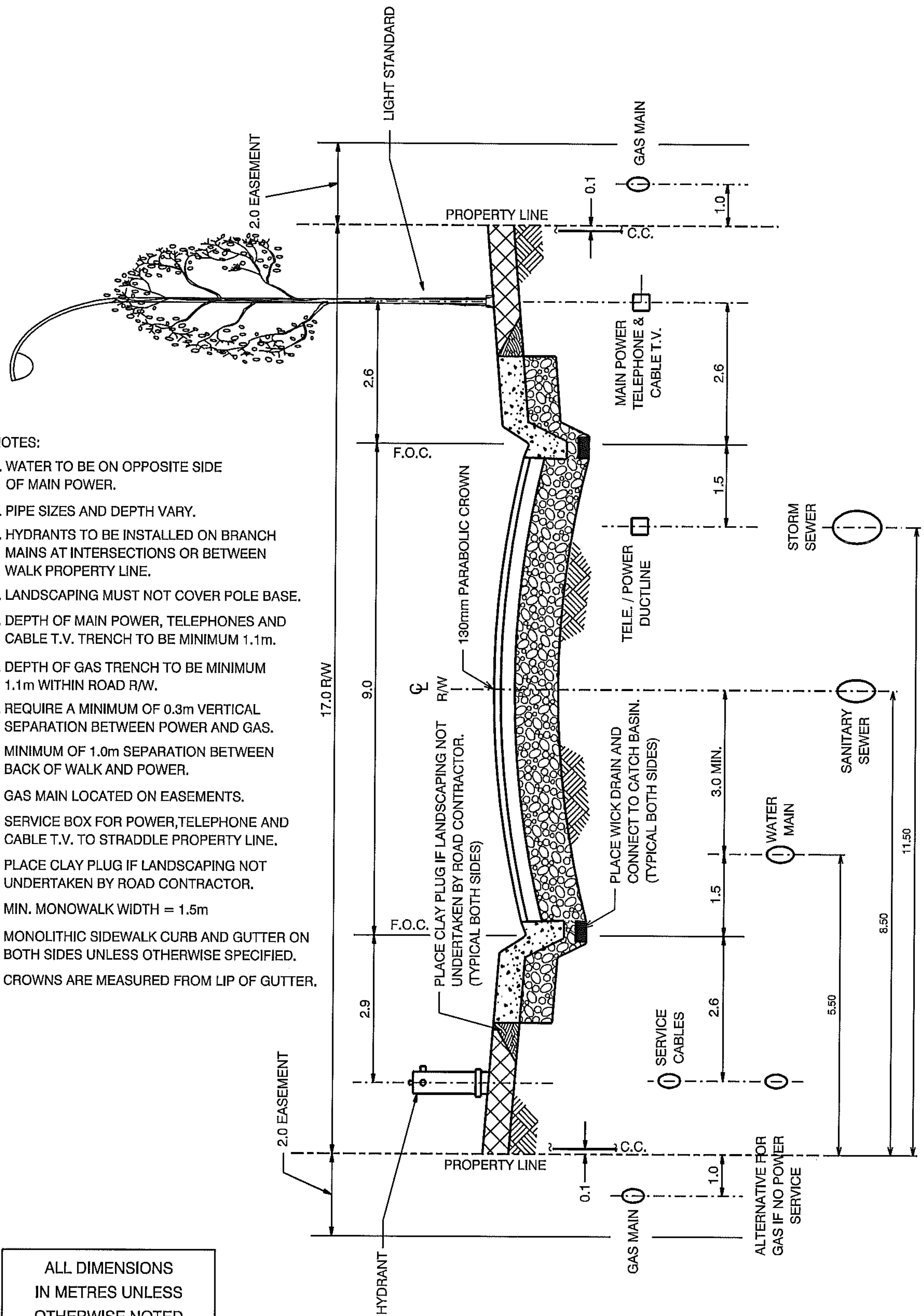
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION U.L.U. 60

THE CITY OF **Edmonton**
STANDARD DRAWING

8.0m URBAN LOCAL RESIDENTIAL (MONO WALK BOTH SIDES) - 16m R/W

Date Approved: FEB., 2011	Drawn By: KLB	Approved	Revision #	Drawing # 2120
Scale: N.T.S.	Checked By:			



NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. MIN. MONOWALK WIDTH = 1.5m
13. MONOLITHIC SIDEWALK CURB AND GUTTER ON BOTH SIDES UNLESS OTHERWISE SPECIFIED.
14. CROWNS ARE MEASURED FROM LIP OF GUTTER.

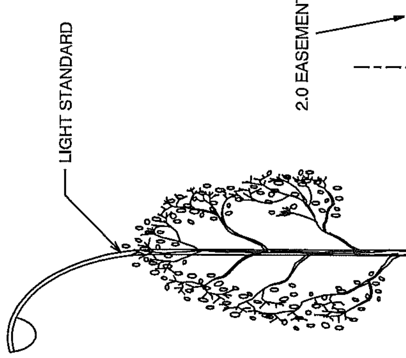
ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

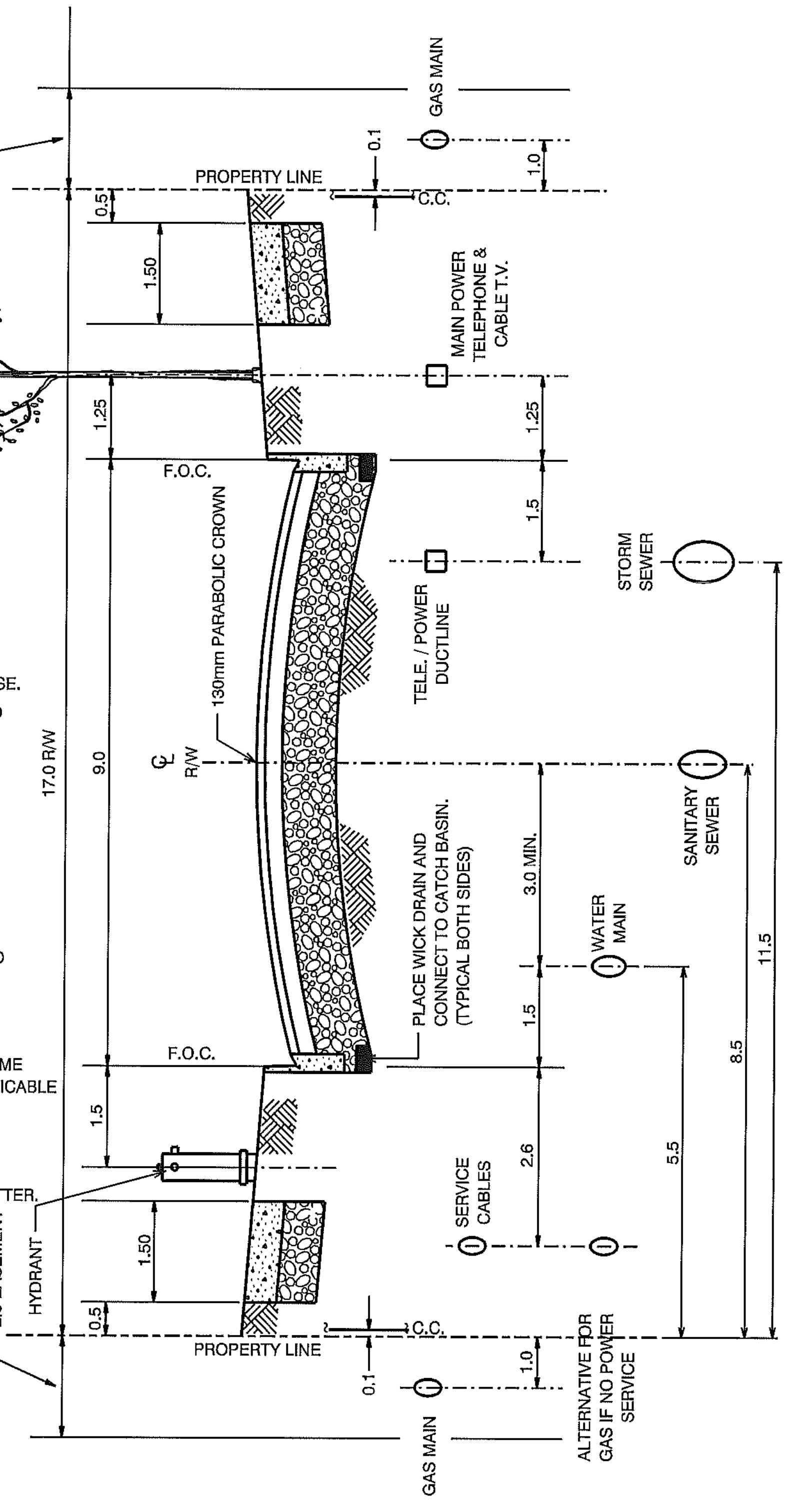
TAC CLASSIFICATION ULU 60

THE CITY OF Edmonton
STANDARD DRAWING

9.0m URBAN LOCAL RESIDENTIAL (MONO WALK) -17m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2200
Scale: NTS	Checked By:			





NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. MIN. TREE OFFSET = BOULEVARD WALK SAME ALIGNMENT AS STREET LIGHT WHERE APPLICABLE OR 1.5m FROM CURB FACE (NO WALK).
13. SIDEWALK ON BOTH SIDES UNLESS OTHERWISE SPECIFIED.
14. CROWNS ARE MEASURED FROM LIP OF GUTTER.

ALL DIMENSIONS
IN METRES UNLESS
OTHERWISE NOTED

TAC CLASSIFICATION ULU 60

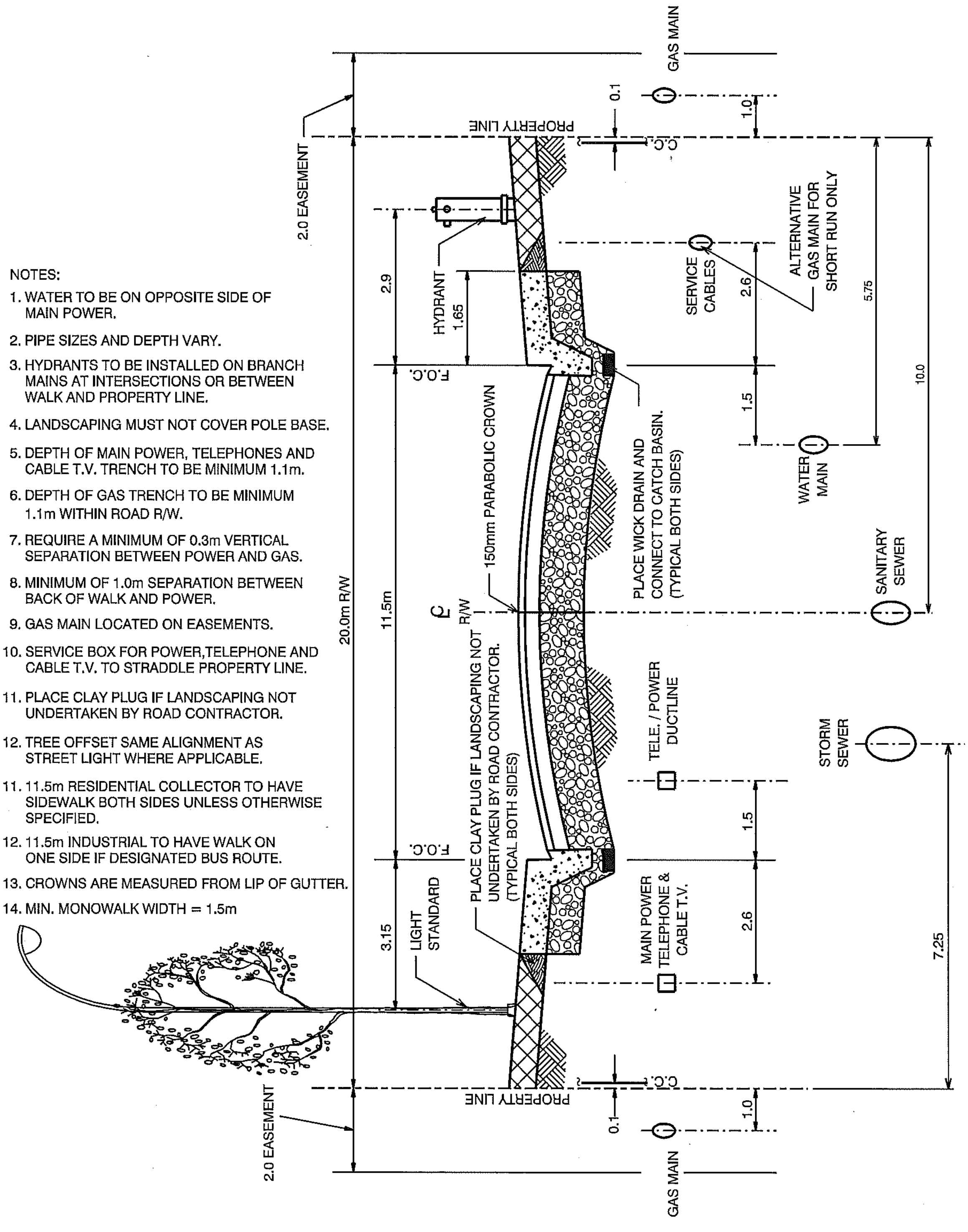
THE CITY OF Edmonton
STANDARD DRAWING

9.0m URBAN LOCAL RESIDENTIAL (BOULEVARD WALK) - 17m R/W

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			2210
Scale: NTS	Checked By:			

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. TREE OFFSET SAME ALIGNMENT AS STREET LIGHT WHERE APPLICABLE.
11. 11.5m RESIDENTIAL COLLECTOR TO HAVE SIDEWALK BOTH SIDES UNLESS OTHERWISE SPECIFIED.
12. 11.5m INDUSTRIAL TO HAVE WALK ON ONE SIDE IF DESIGNATED BUS ROUTE.
13. CROWNS ARE MEASURED FROM LIP OF GUTTER.
14. MIN. MONOWALK WIDTH = 1.5m

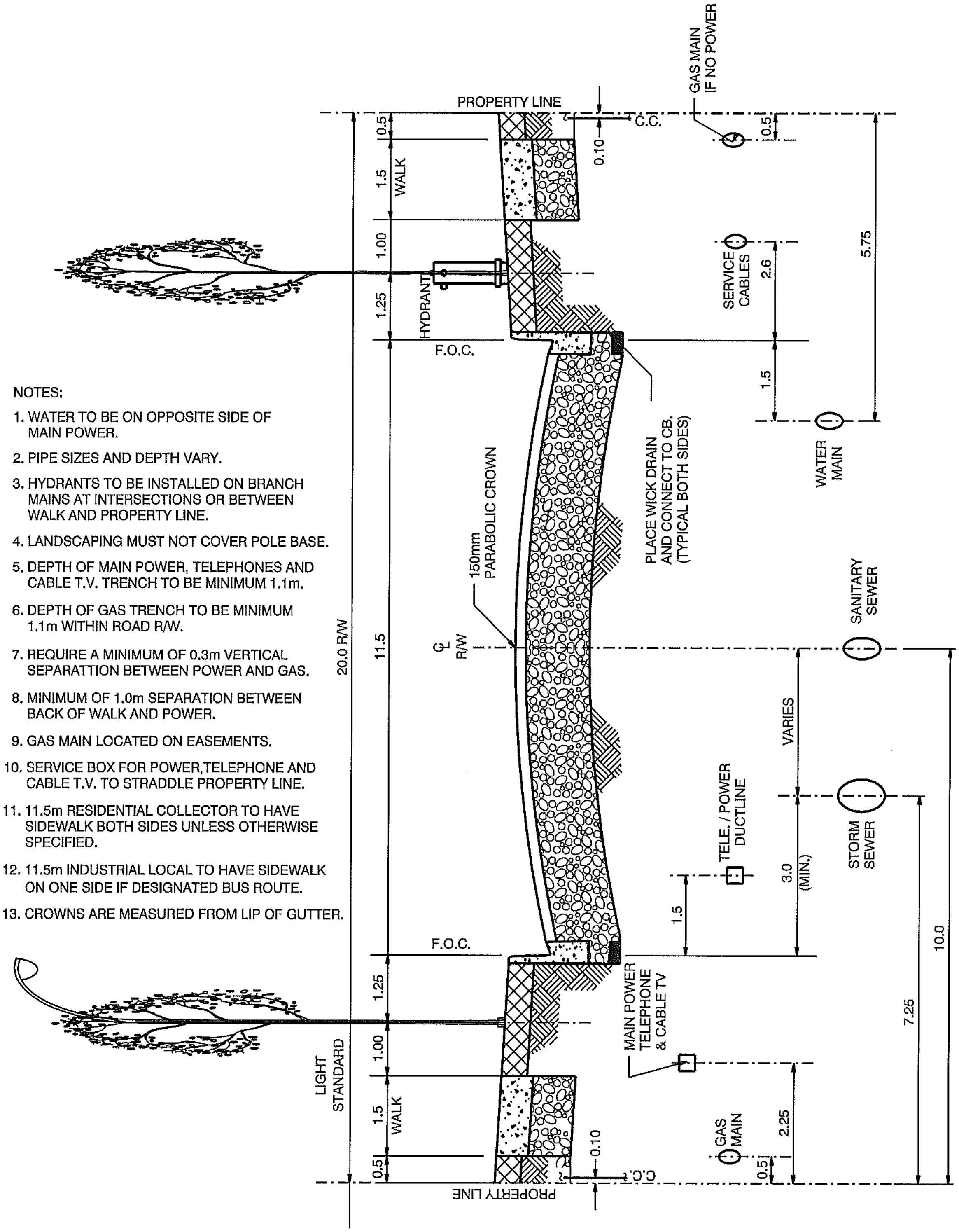


TAC CLASSIFICATION U.L.U. 60

Edmonton (THE CITY OF)
STANDARD DRAWING

11.5m URBAN COLLECTOR / INDUSTRIAL LOCAL (MONO WALK) - 20m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2300
Scale: NTS	Checked By:			



NOTES:

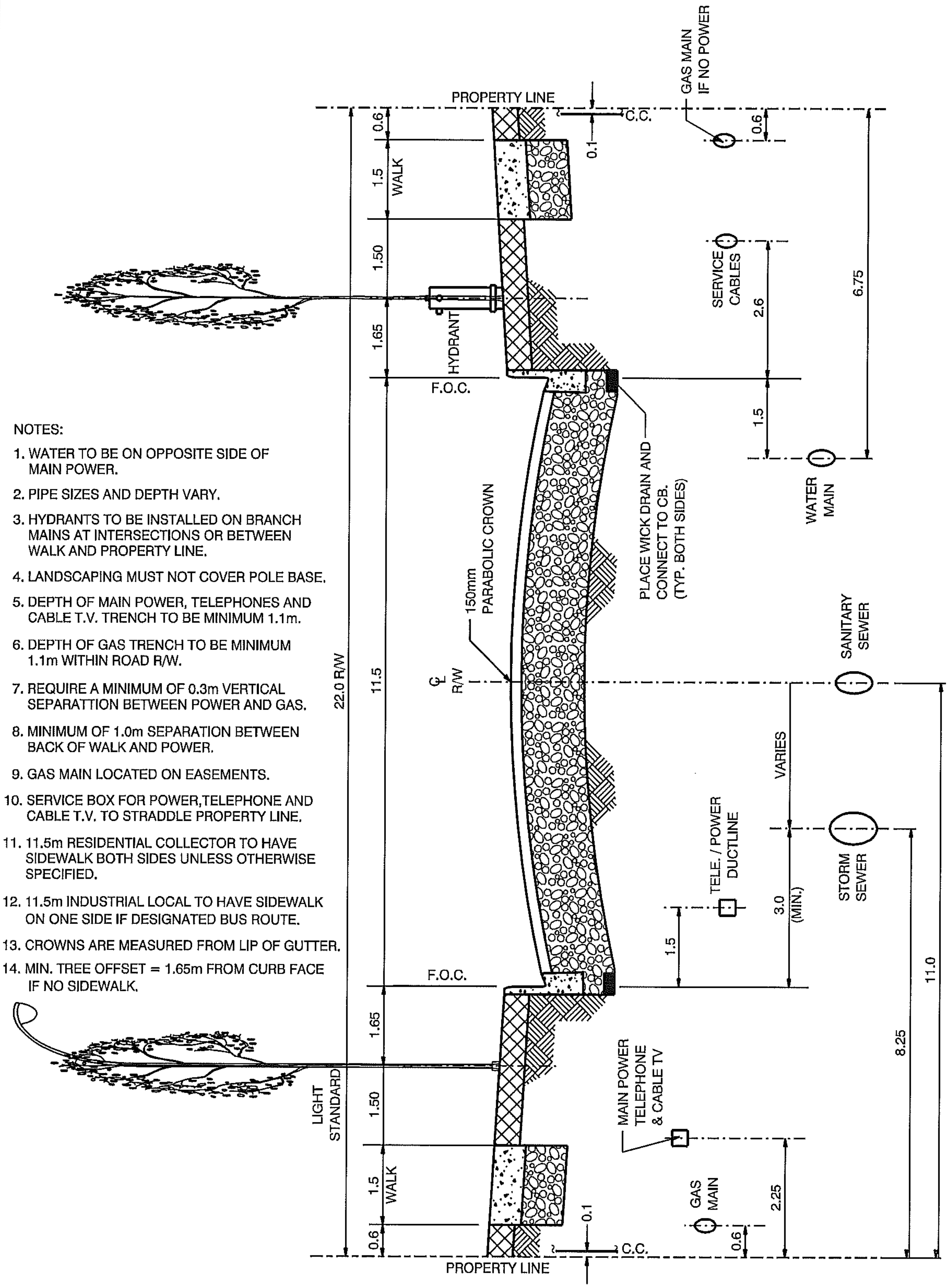
1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATTION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. 11.5m RESIDENTIAL COLLECTOR TO HAVE SIDEWALK BOTH SIDES UNLESS OTHERWISE SPECIFIED.
12. 11.5m INDUSTRIAL LOCAL TO HAVE SIDEWALK ON ONE SIDE IF DESIGNATED BUS ROUTE.
13. CROWNS ARE MEASURED FROM LIP OF GUTTER.

TAC CLASSIFICATION U.L.U. 60

THE CITY OF Edmonton
STANDARD DRAWING

11.5m URBAN RESIDENTIAL COLLECTOR / INDUSTRIAL LOCAL (BOULEVARD WALK) - 20m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2310
Scale: NTS	Checked By:			



NOTES:

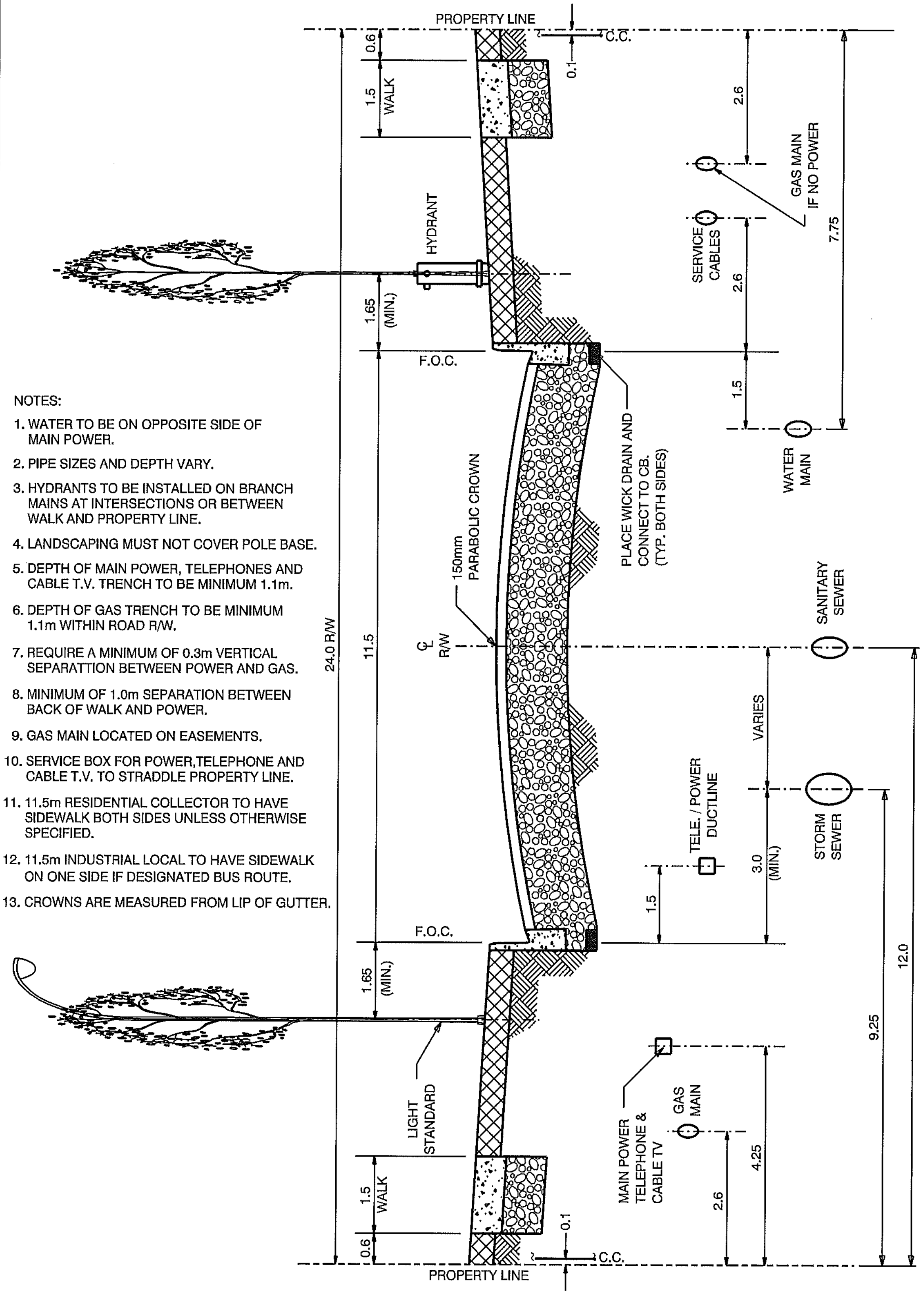
1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATTION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. 11.5m RESIDENTIAL COLLECTOR TO HAVE SIDEWALK BOTH SIDES UNLESS OTHERWISE SPECIFIED.
12. 11.5m INDUSTRIAL LOCAL TO HAVE SIDEWALK ON ONE SIDE IF DESIGNATED BUS ROUTE.
13. CROWNS ARE MEASURED FROM LIP OF GUTTER.
14. MIN. TREE OFFSET = 1.65m FROM CURB FACE IF NO SIDEWALK.

TAC CLASSIFICATION U.L.U. 60

THE CITY OF Edmonton
STANDARD DRAWING

11.5m URBAN RESIDENTIAL COLLECTOR / INDUSTRIAL LOCAL (BOULEVARD WALK) - 22m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2320
Scale: NTS	Checked By:			



NOTES:

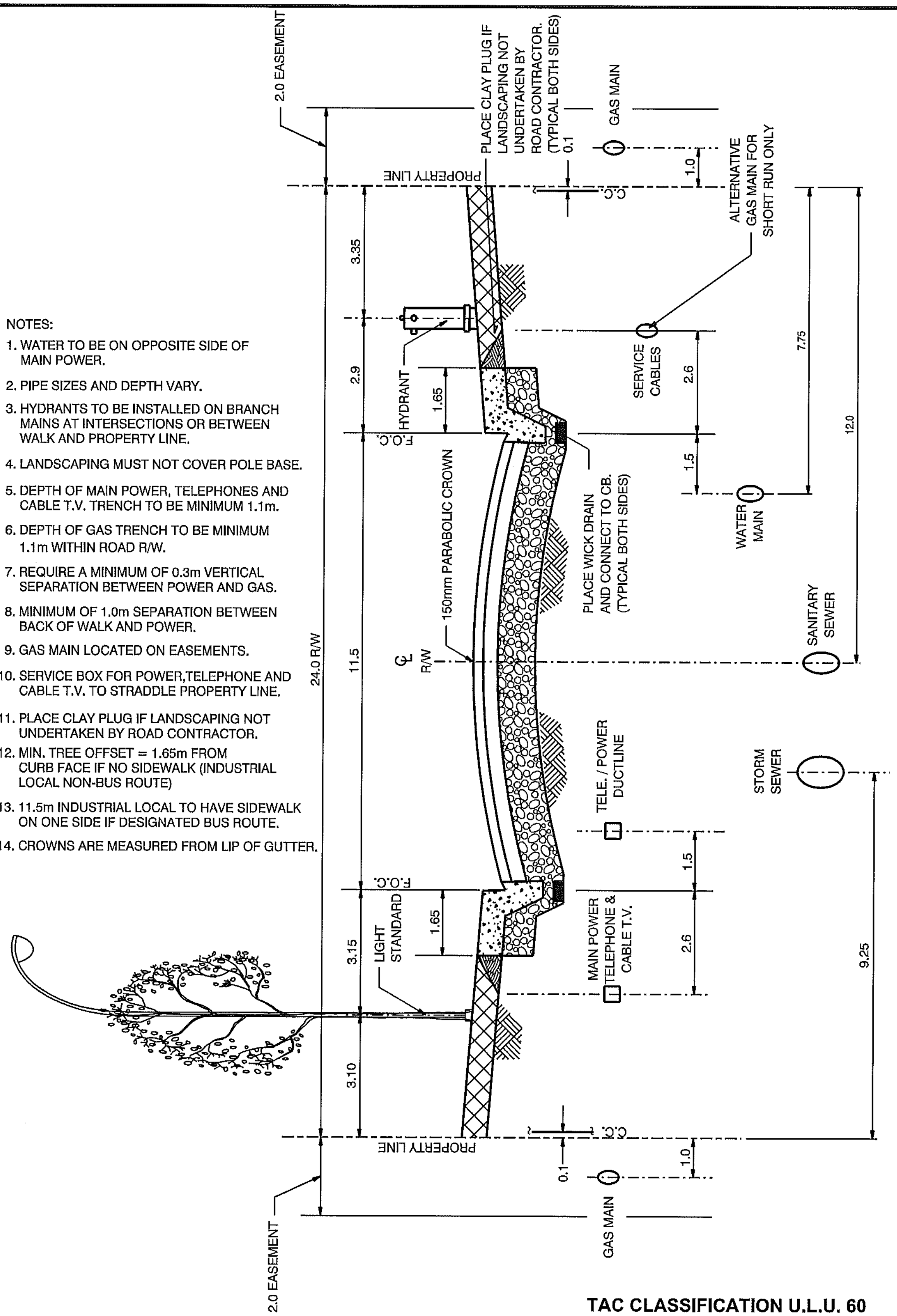
1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATTION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. 11.5m RESIDENTIAL COLLECTOR TO HAVE SIDEWALK BOTH SIDES UNLESS OTHERWISE SPECIFIED.
12. 11.5m INDUSTRIAL LOCAL TO HAVE SIDEWALK ON ONE SIDE IF DESIGNATED BUS ROUTE.
13. CROWNS ARE MEASURED FROM LIP OF GUTTER.

TAC CLASSIFICATION U.L.U. 60

THE CITY OF Edmonton
STANDARD DRAWING

11.5m URBAN RESIDENTIAL COLLECTOR /
INDUSTRIAL LOCAL (BOULEVARD WALK) - 24m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2330
Scale: NTS	Checked By:			



NOTES:

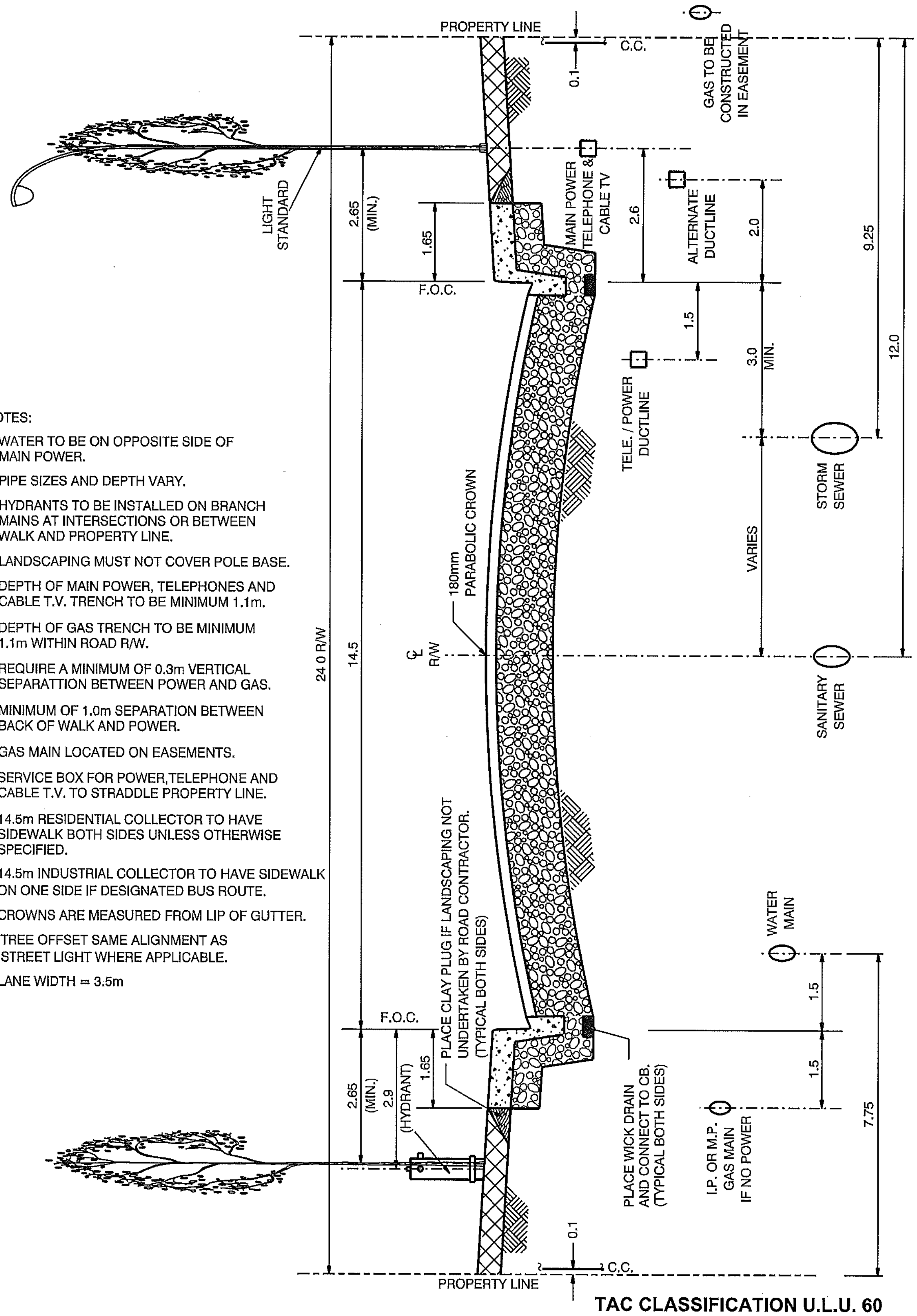
1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. MIN. TREE OFFSET = 1.65m FROM CURB FACE IF NO SIDEWALK (INDUSTRIAL LOCAL NON-BUS ROUTE)
13. 11.5m INDUSTRIAL LOCAL TO HAVE SIDEWALK ON ONE SIDE IF DESIGNATED BUS ROUTE.
14. CROWNS ARE MEASURED FROM LIP OF GUTTER.

TAC CLASSIFICATION U.L.U. 60

THE CITY OF Edmonton
STANDARD DRAWING

11.5m URBAN RESIDENTIAL COLLECTOR / INDUSTRIAL LOCAL (MONO WALK) - 24m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2340
Scale: NTS	Checked By:			



NOTES:

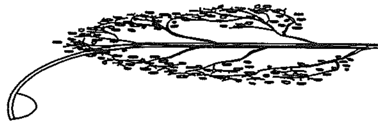
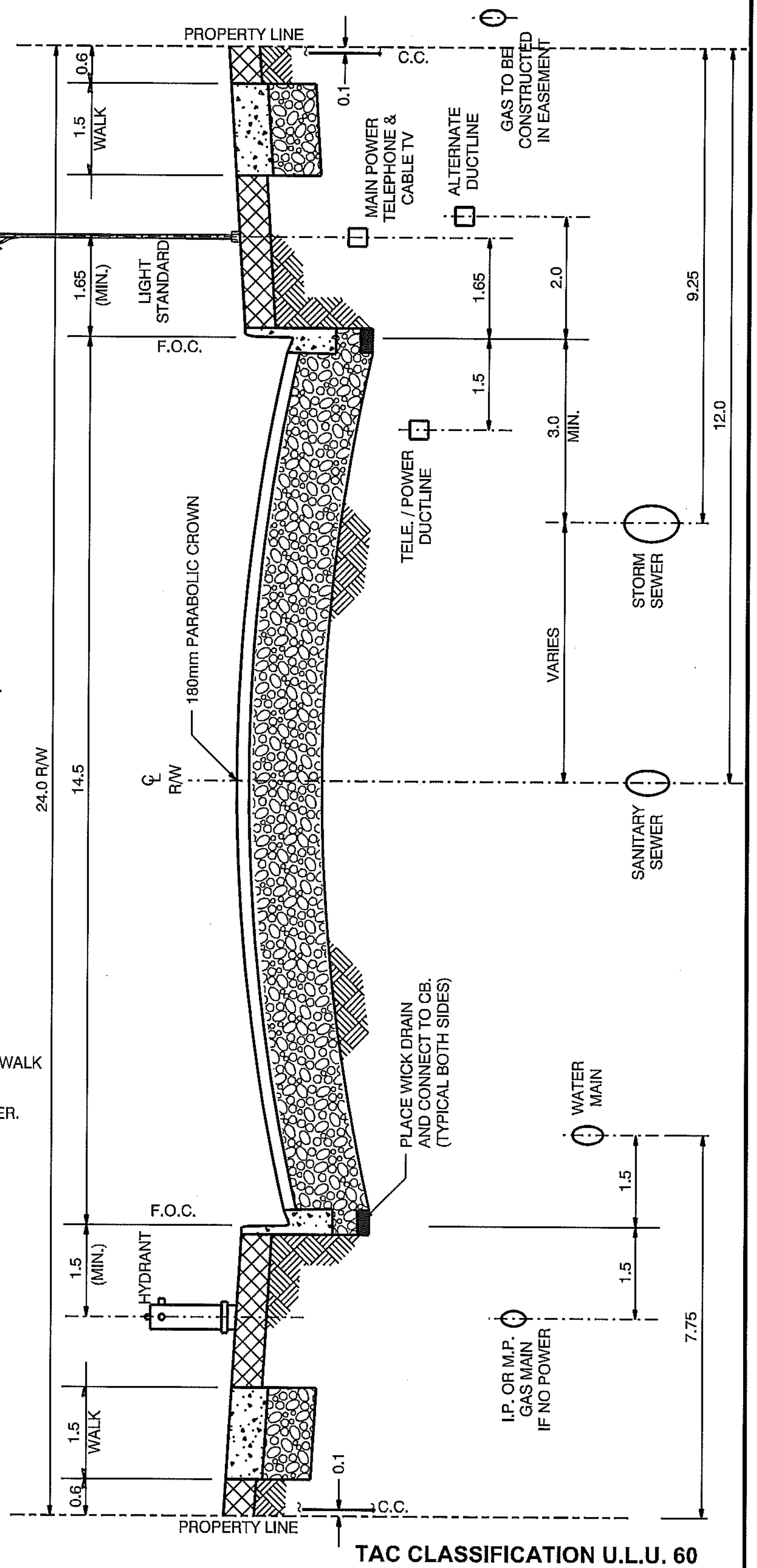
1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATTION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. 14.5m RESIDENTIAL COLLECTOR TO HAVE SIDEWALK BOTH SIDES UNLESS OTHERWISE SPECIFIED.
12. 14.5m INDUSTRIAL COLLECTOR TO HAVE SIDEWALK ON ONE SIDE IF DESIGNATED BUS ROUTE.
13. CROWNS ARE MEASURED FROM LIP OF GUTTER.
14. TREE OFFSET SAME ALIGNMENT AS STREET LIGHT WHERE APPLICABLE.
15. LANE WIDTH = 3.5m

TAC CLASSIFICATION U.L.U. 60

THE CITY OF Edmonton
STANDARD DRAWING

14.5m INDUSTRIAL COLLECTOR (MONO WALK) - 24m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2400
Scale: NTS	Checked By:			

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATTION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. 14.5m RESIDENTIAL COLLECTOR TO HAVE SIDEWALK BOTH SIDES UNLESS OTHERWISE SPECIFIED.
12. 14.5m INDUSTRIAL COLLECTOR TO HAVE SIDEWALK ON ONE SIDE IF DESIGNATED BUS ROUTE.
13. CROWNS ARE MEASURED FROM LIP OF GUTTER.
14. LANE WIDTH = 3.5m

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION U.L.U. 60

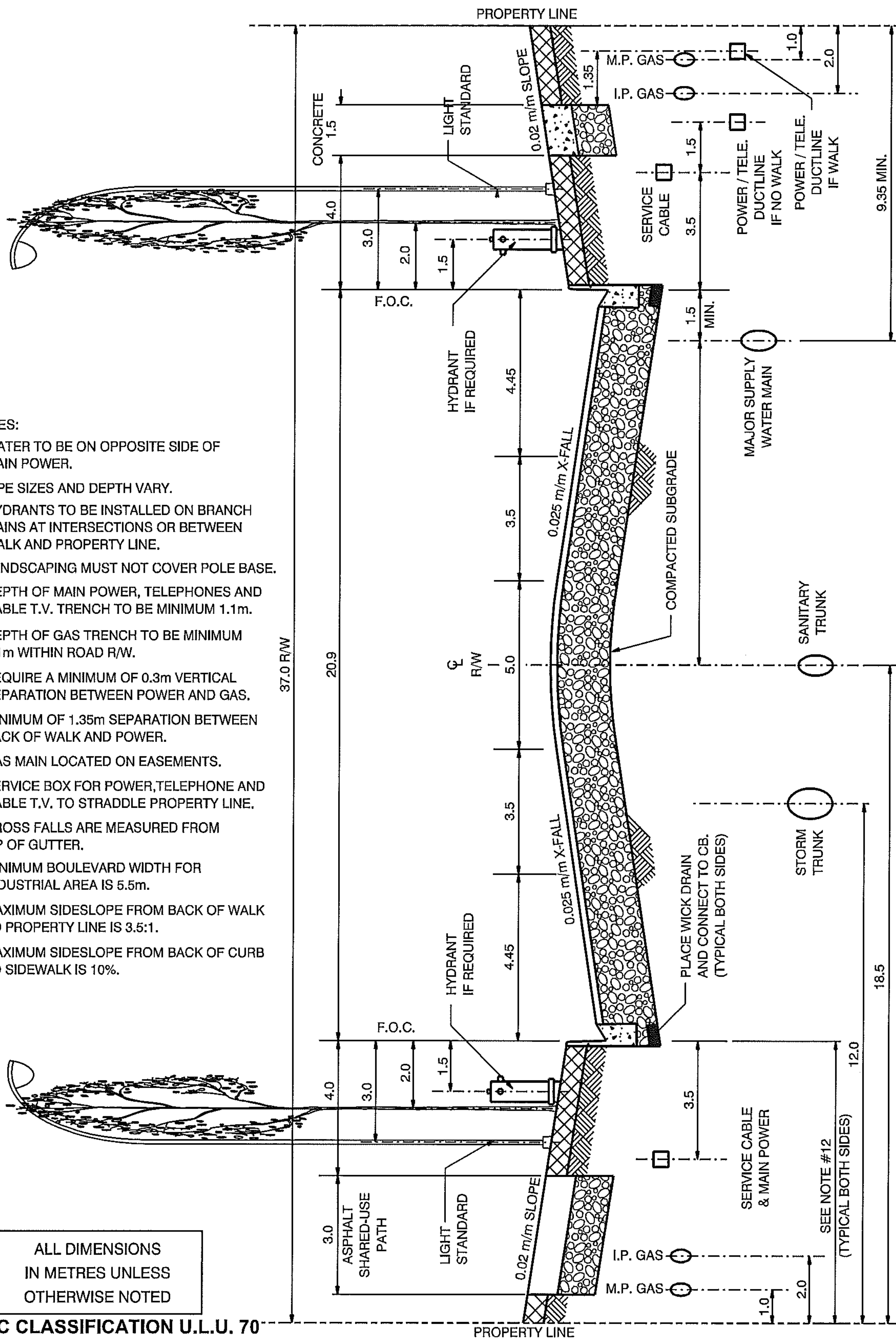
THE CITY OF Edmonton
STANDARD DRAWING

14.5m INDUSTRIAL COLLECTOR (BOULEVARD WALK) - 24m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2410
Scale: NTS	Checked By:			

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.35m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. CROSS FALLS ARE MEASURED FROM LIP OF GUTTER.
12. MINIMUM BOULEVARD WIDTH FOR INDUSTRIAL AREA IS 5.5m.
13. MAXIMUM SIDESLOPE FROM BACK OF WALK TO PROPERTY LINE IS 3.5:1.
14. MAXIMUM SIDESLOPE FROM BACK OF CURB TO SIDEWALK IS 10%.



ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

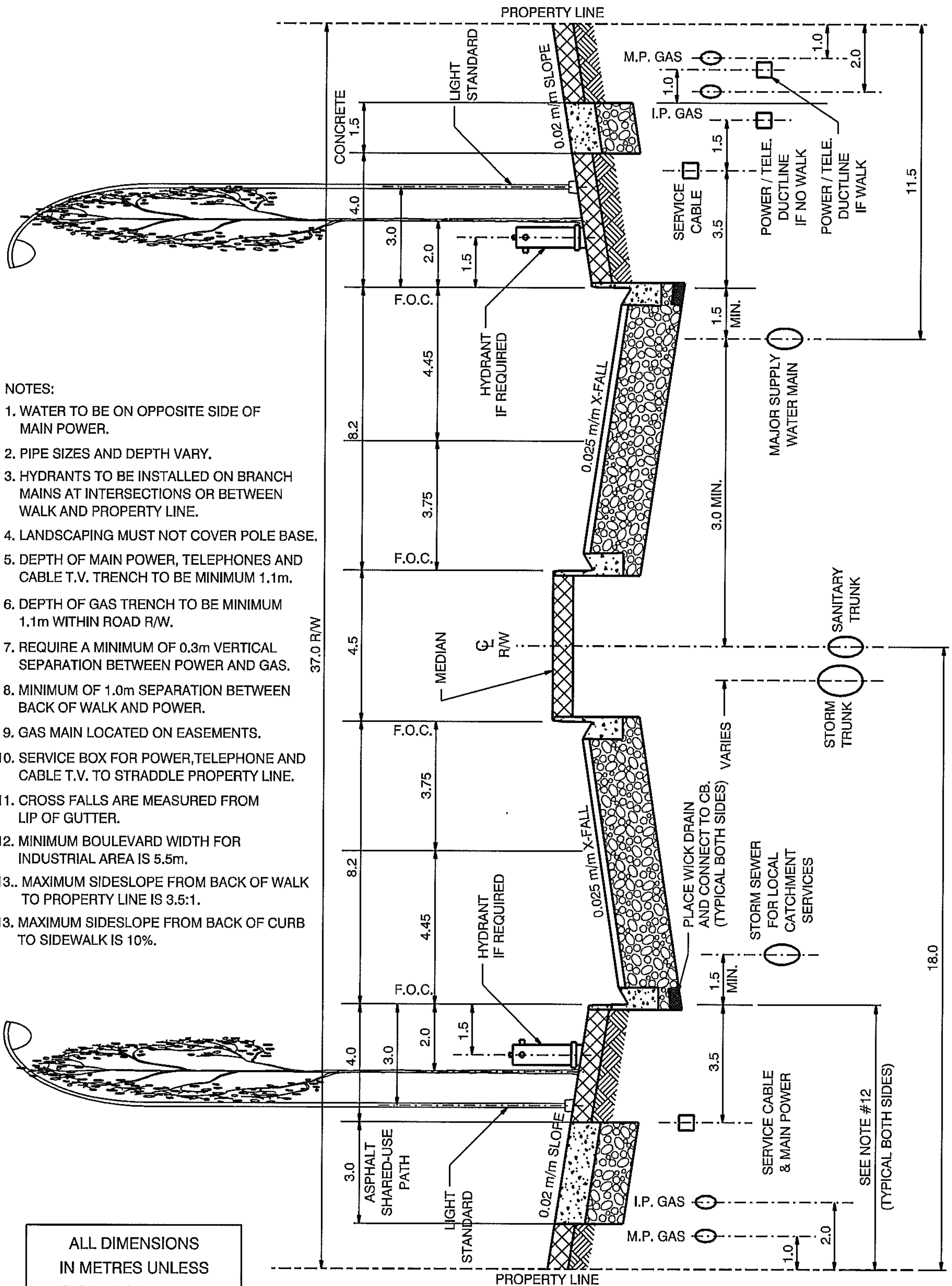
TAC CLASSIFICATION U.L.U. 70

THE CITY OF Edmonton

STANDARD DRAWING

5 LANE URBAN UNDIVIDED ARTERIAL - 37m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2500
Scale: NTS	Checked By:			



NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. CROSS FALLS ARE MEASURED FROM LIP OF GUTTER.
12. MINIMUM BOULEVARD WIDTH FOR INDUSTRIAL AREA IS 5.5m.
13.. MAXIMUM SIDESLOPE FROM BACK OF WALK TO PROPERTY LINE IS 3.5:1.
13. MAXIMUM SIDESLOPE FROM BACK OF CURB TO SIDEWALK IS 10%.

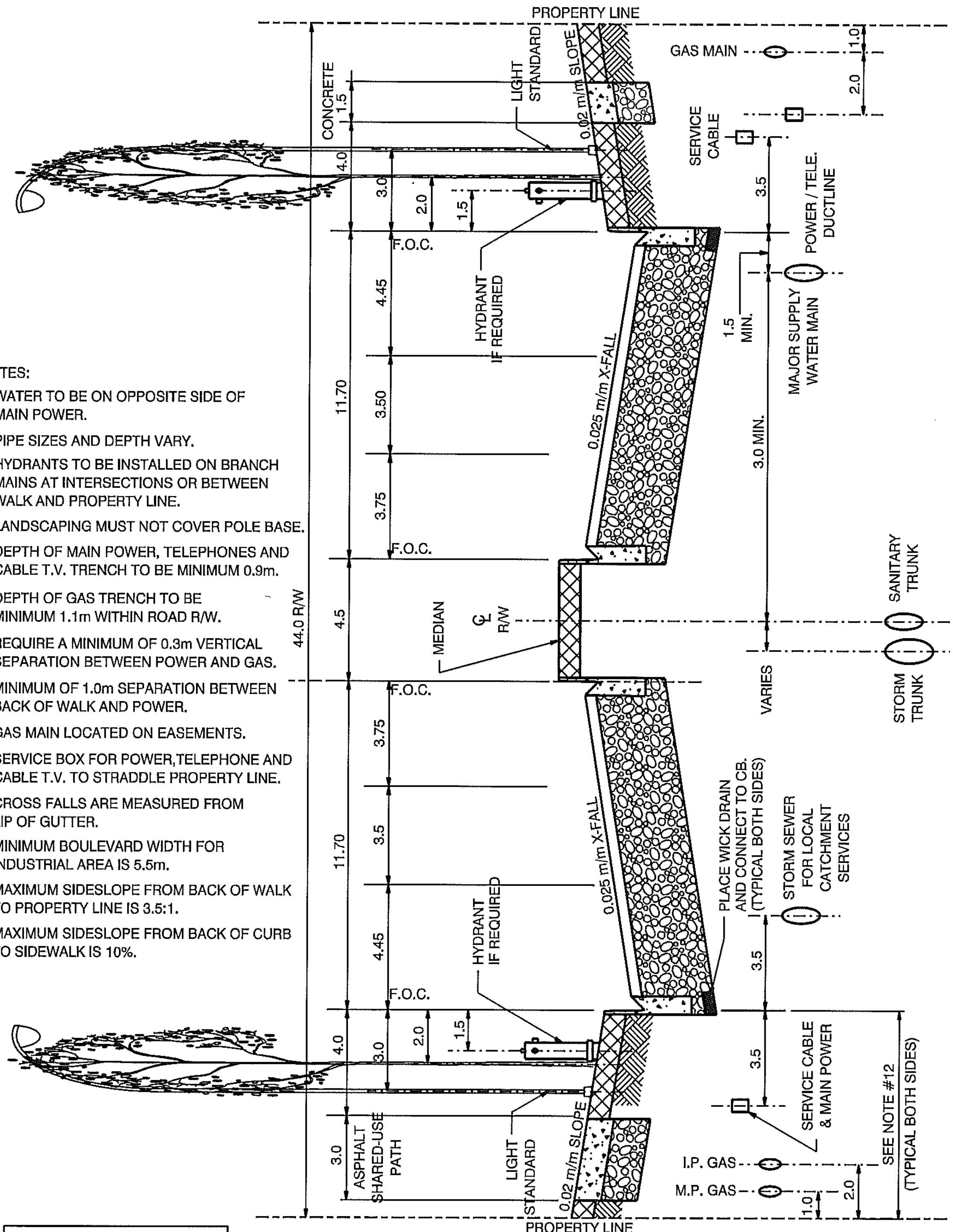
ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION U.L.U. 70

THE CITY OF Edmonton
STANDARD DRAWING

4 LANE URBAN DIVIDED ARTERIAL - 37m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2510
Scale: NTS	Checked By:			



NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 0.9m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. CROSS FALLS ARE MEASURED FROM LIP OF GUTTER.
12. MINIMUM BOULEVARD WIDTH FOR INDUSTRIAL AREA IS 5.5m.
13. MAXIMUM SIDESLOPE FROM BACK OF WALK TO PROPERTY LINE IS 3.5:1.
14. MAXIMUM SIDESLOPE FROM BACK OF CURB TO SIDEWALK IS 10%.

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

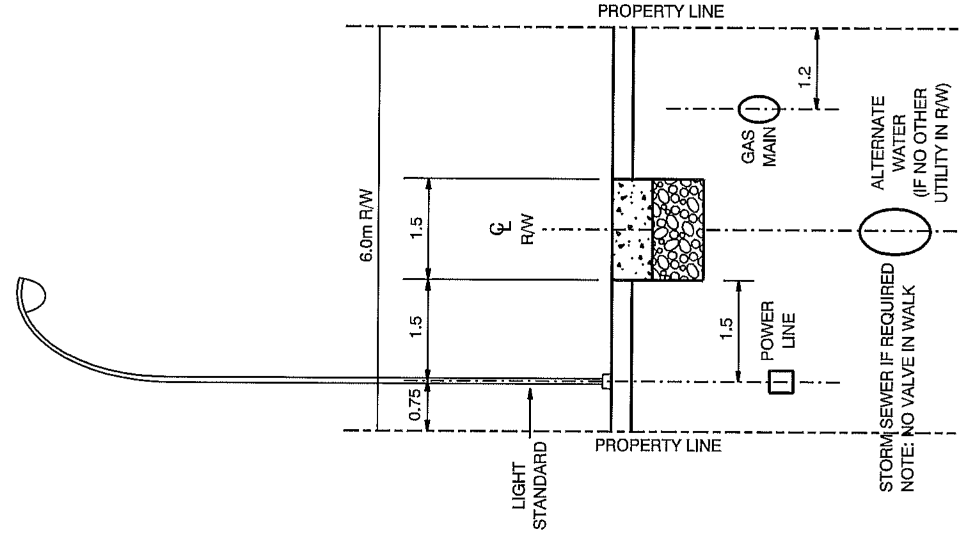
TAC CLASSIFICATION U.L.U. 70

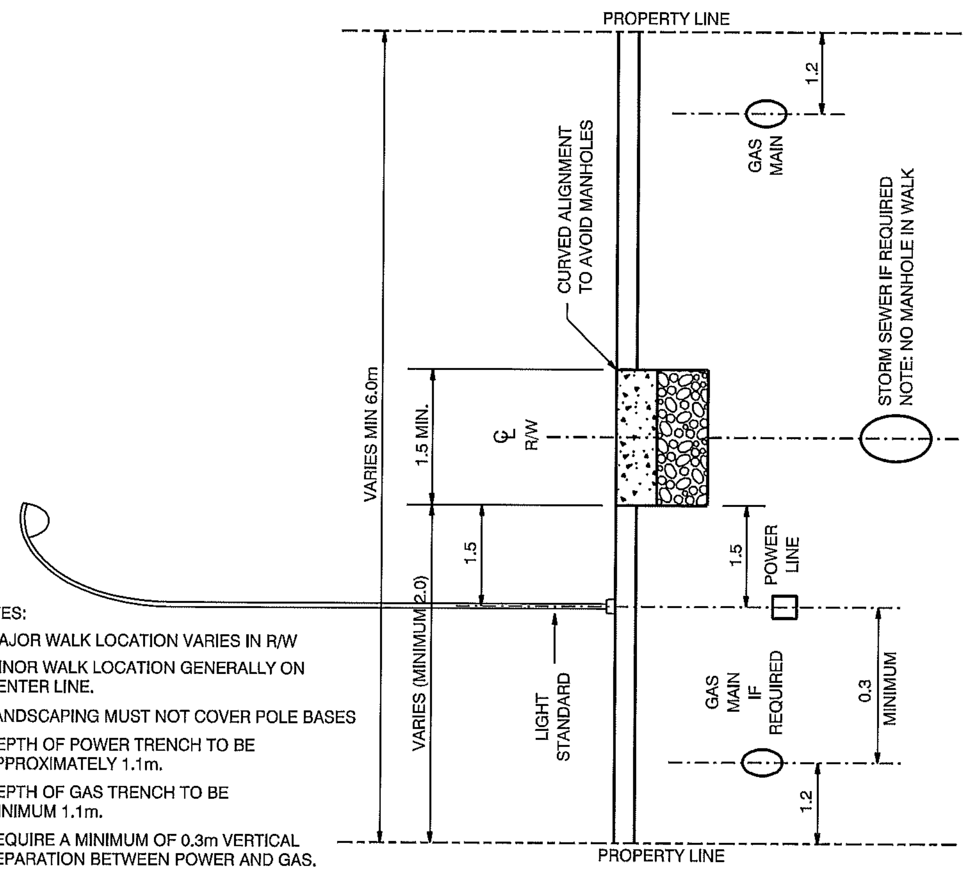
THE CITY OF Edmonton

STANDARD DRAWING

6 LANE URBAN DIVIDED ARTERIAL - 44m R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2520
Scale: NTS	Checked By:			





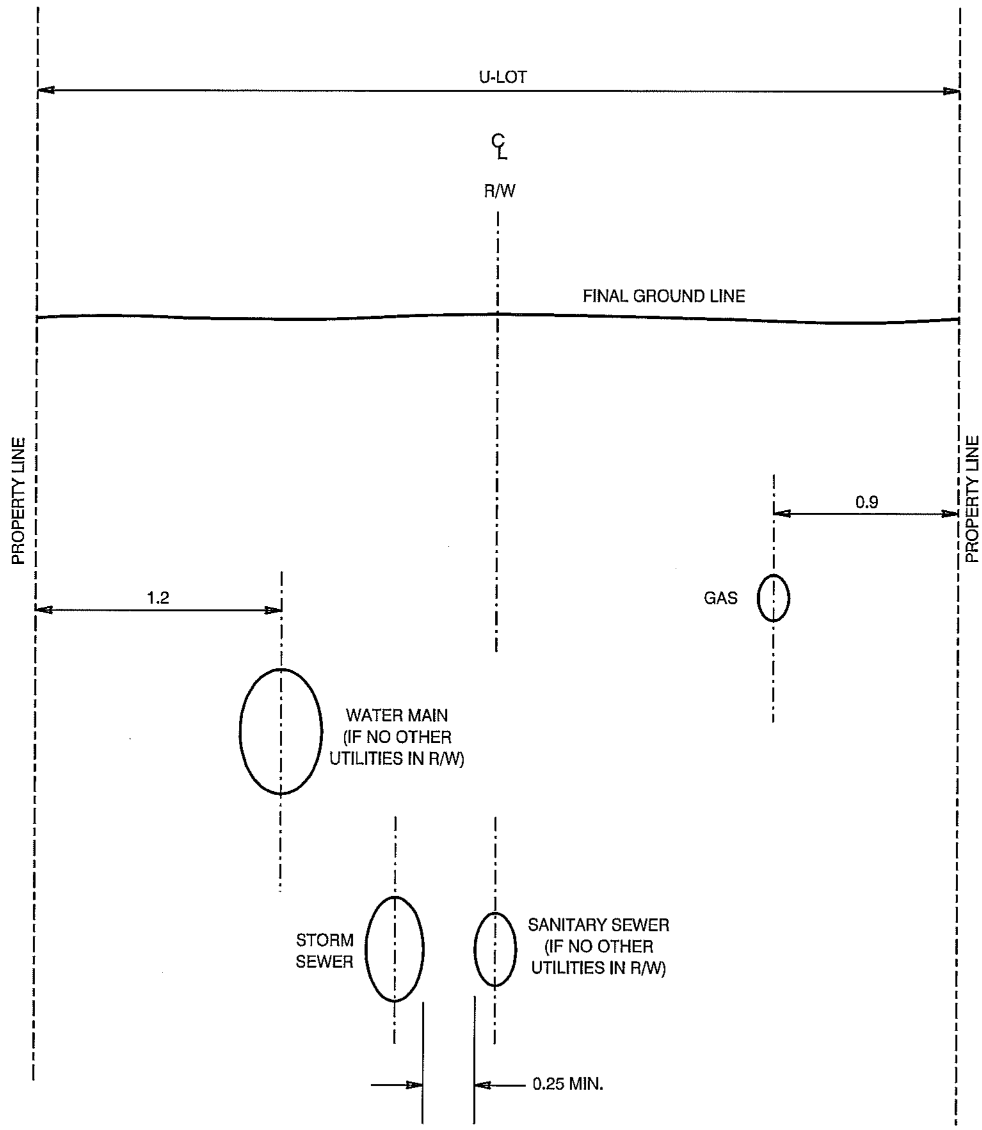
NOTES:

1. MAJOR WALK LOCATION VARIES IN R/W
2. MINOR WALK LOCATION GENERALLY ON CENTER LINE.
3. LANDSCAPING MUST NOT COVER POLE BASES
4. DEPTH OF POWER TRENCH TO BE APPROXIMATELY 1.1m.
5. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m.
6. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
7. REQUIRE MINIMUM 3.0m HORIZONTAL SEPARATION BETWEEN STORM SEWER AND POWER.

THE CITY OF Edmonton
STANDARD DRAWING

UTILITIES LOCATION PLAN WALKWAYS

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2600
Scale: NTS	Checked By:			



NOTES:

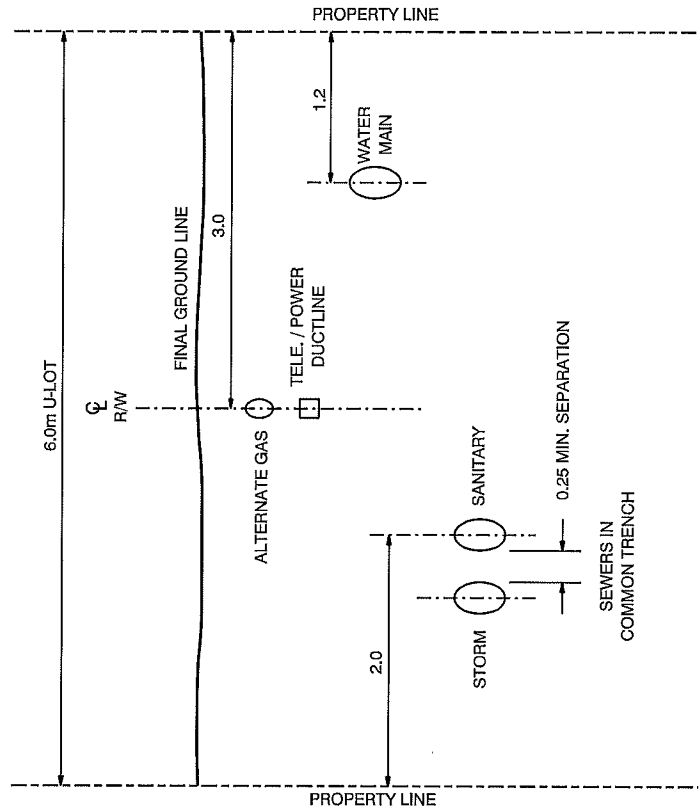
1. GAS, IF REQUIRED CAN BE LOCATED ACCORDING TO THE SITUATION.
2. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m.

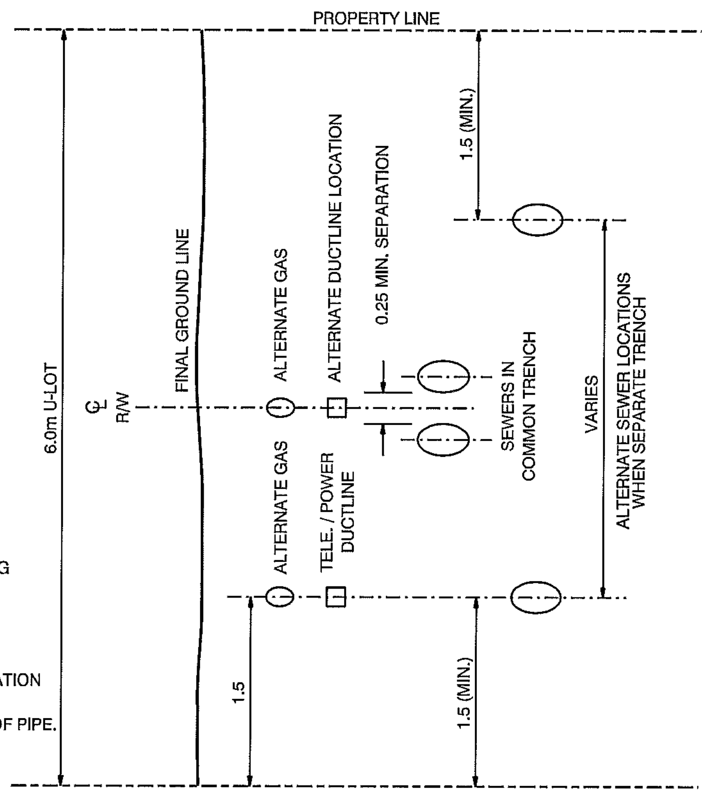
THE CITY OF Edmonton

STANDARD DRAWING

4.5m PUBLIC UTILITY LOTS

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2700
Scale: NTS	Checked By:			





NOTES:

1. GAS, IF REQUIRED CAN BE LOCATED ACCORDING TO THE SITUATION.
2. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m.
3. DEPTH OF TELEPHONE/POWER TRENCH TO BE APPROXIMATELY 0.9m.
4. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
5. IF OVER 1200mm PIPE 1.5 OFFSET TO OUTSIDE OF PIPE.

THE CITY OF Edmonton

STANDARD DRAWING

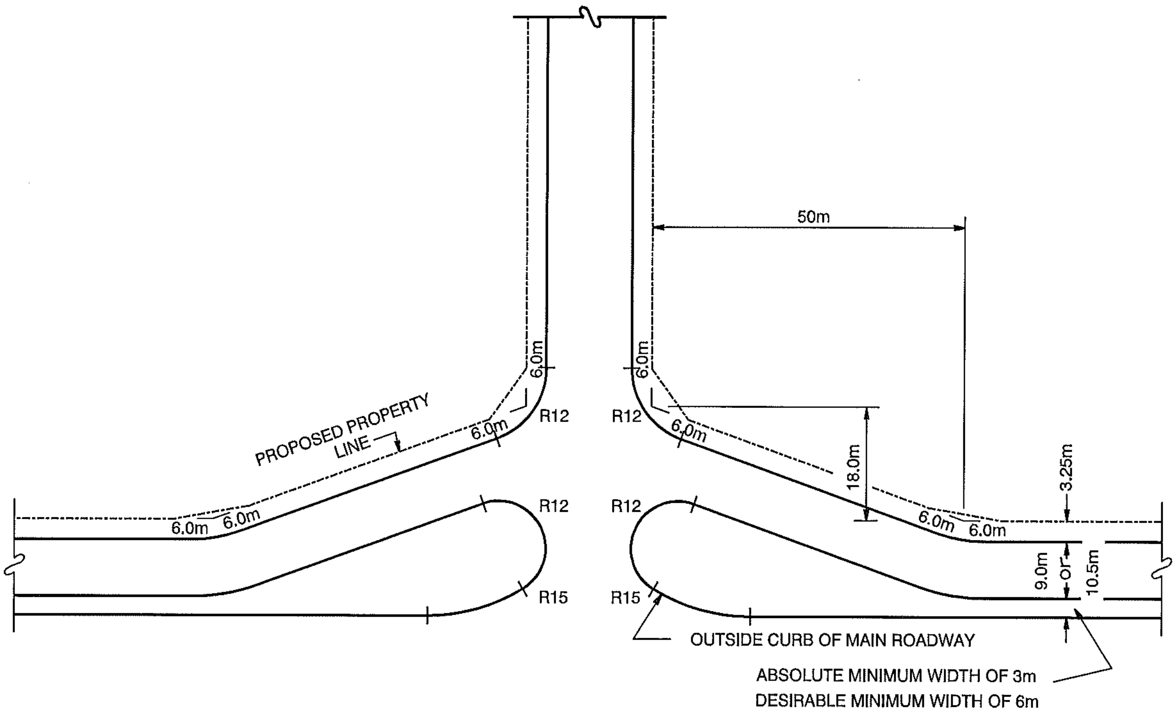
6.0m PUBLIC UTILITY LOTS

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 2710
Scale: NTS	Checked By:			

DESIGN DETAILS

STANDARD DETAILS

SECTION 3000



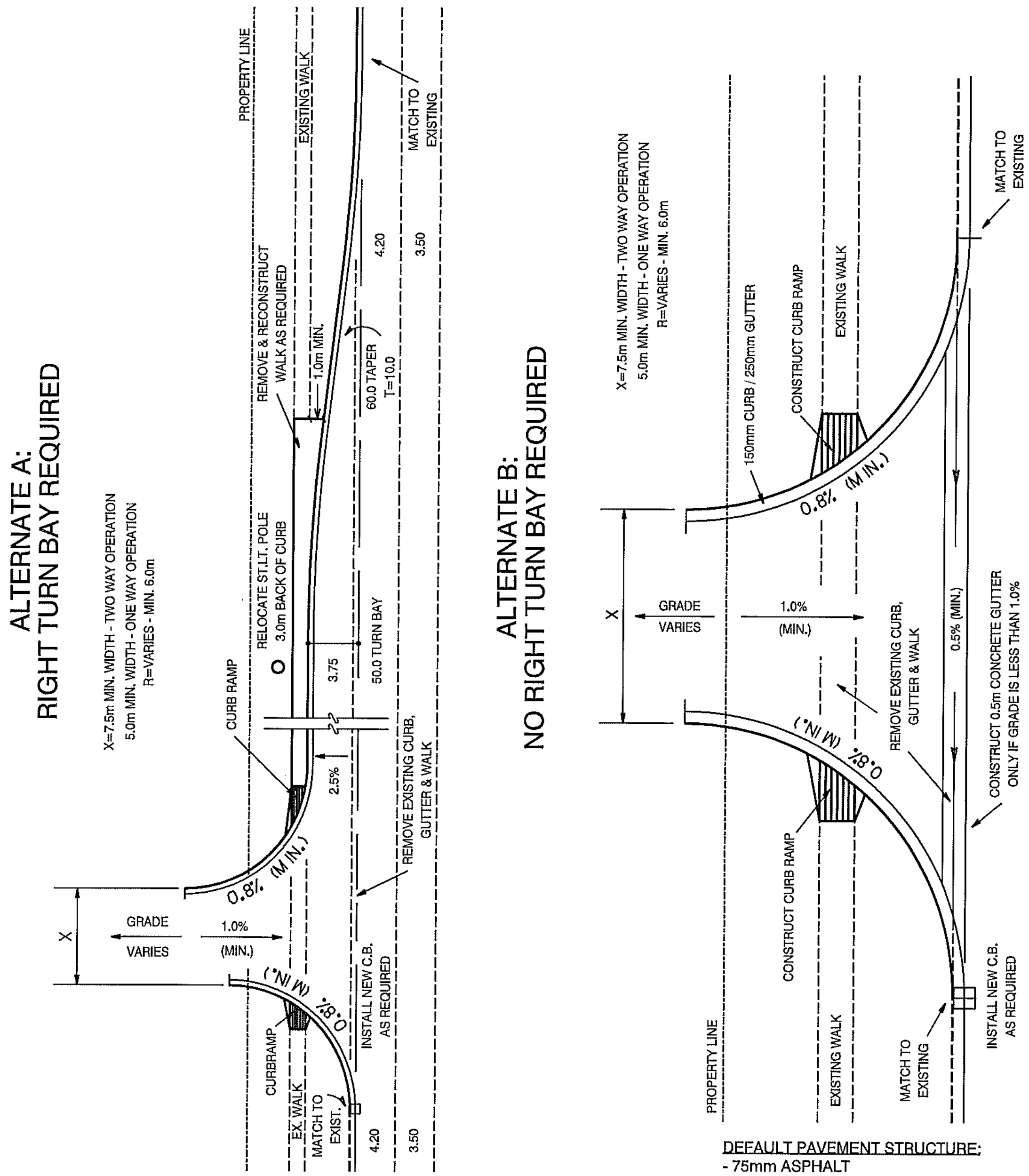
NOTES:

1. ILLUSTRATION BASED ON MINIMUM TURNING REQUIREMENTS OF WB-21 DESIGN VEHICLE.

THE CITY OF Edmonton
STANDARD DRAWING

INDUSTRIAL SERVICE ROAD "BULB" ENTRANCE

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 3000
Scale: N.T.S.	Checked By:		–	



DEFAULT PAVEMENT STRUCTURE:
- 75mm ASPHALT
- 150mm CONCRETE
- 150mm PLANT-MIX SOIL CEMENT
- 150mm SUBGRADE PREPARATION

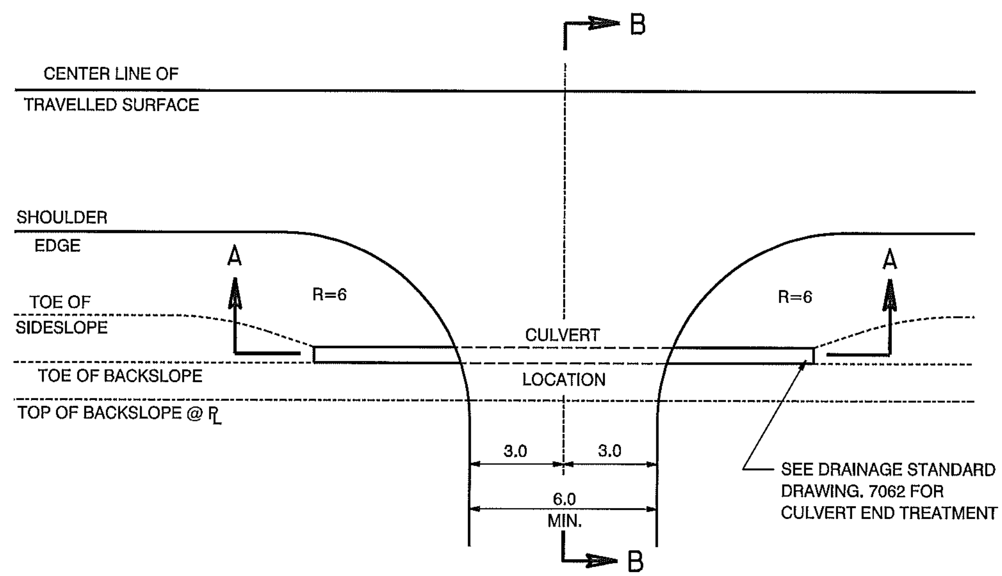
NOTES:
1. IF CONSTRUCTION IS TO BE UNDERTAKEN BY PRIVATE DEVELOPER, THEN A MUNICIPAL IMPROVEMENT AGREEMENT IS REQUIRED. CONTACT DEVELOPEMENT ENGINEERING, TRANSPORTATION DEPARTMENT.
2. ALL WORK TO CONFORM TO CITY SPECIFICATIONS.
3. RE-LANDSCAPE AS REQUIRED WITH SOD.
4. ALL DIMENSIONS ARE TO LIP OF GUTTER.

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

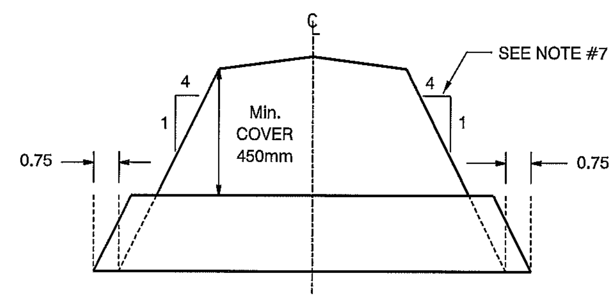
THE CITY OF Edmonton
STANDARD DRAWING

MAJOR COMMERCIAL ACCESS TYPICAL CURB RETURN FORMAT

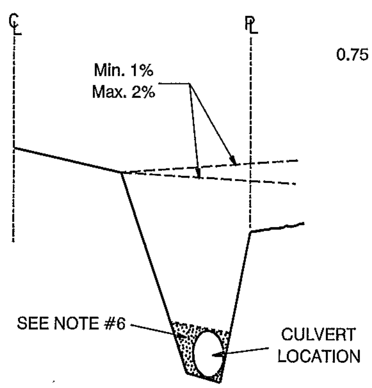
Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			3010
Scale: N.T.S.	Checked By:			



PLAN



SECTION A-A



SECTION B-B (N.T.S.)

DEFAULT PAVEMENT STRUCTURE:

- 100mm ASPHALT
- 200mm GRAVEL
- 150mm SUBGRADE PREPARATION
  (OR APPROVED EQUIVALENT)

NOTES:

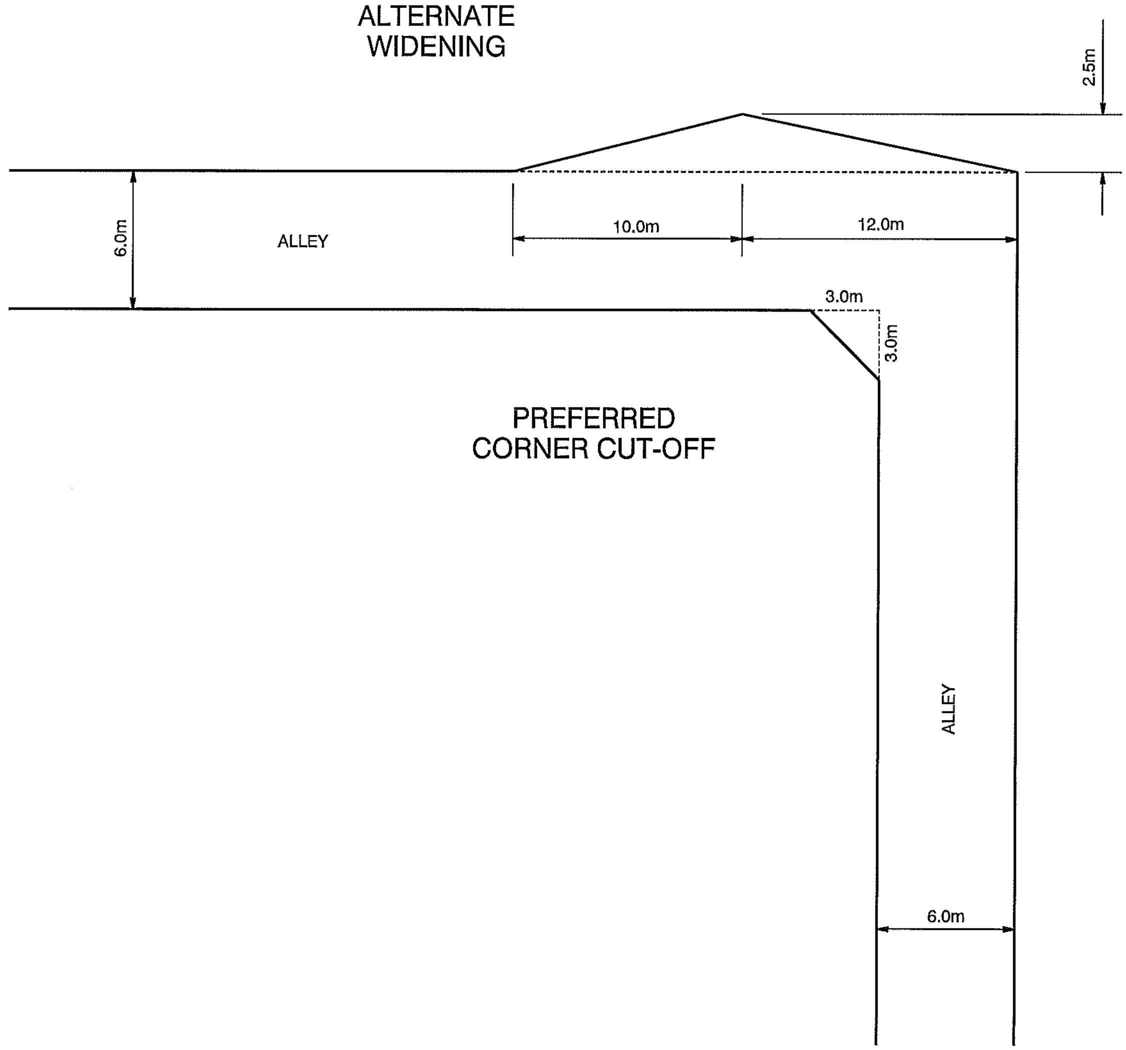
1. CULVERT MINIMUM DIAMETER 375mm C.M.P..
2. MINIMUM COVER 450mm.
3. CULVERT TO EXTEND 0.75m BEYOND TOE OF FILL.
4. CROSSING PERMIT REQUIRED FOR ACCESS CONSTRUCTION.
5. CULVERT CONSTRUCTION TO COMPLY WITH
   SPECIFICATIONS FOR CORRUGATED STEEL PIPE CROSSING.
6. SEE SPECIFICATIONS FOR COMPACTION AND BEDDING REQUIREMENTS.
7. SIDESLOPE DEPENDS ON DESIGN SPEED AND TRAFFIC VOLUME,
   REFER TO TAC GUIDELINES.

ALL DIMENSIONS
IN METRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

RURAL LOCAL ACCESS

Date Approved: FEB., 2011	Drawn By: JW	Approved Jody Hamel	Revision #	Drawing # 3020
Scale: N.T.S.	Checked By:			



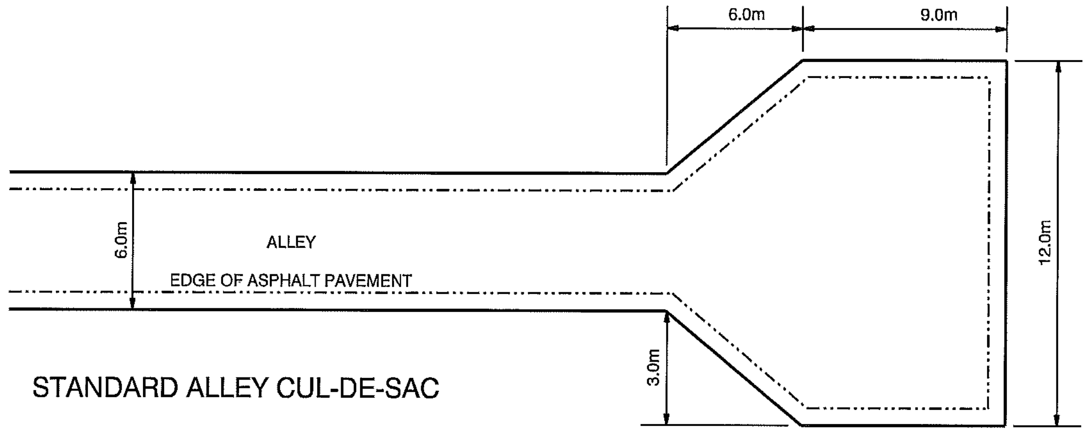
NOTES:

1. DESIGN VEHICLE - FRONT LOADING GARBAGE TRUCK.

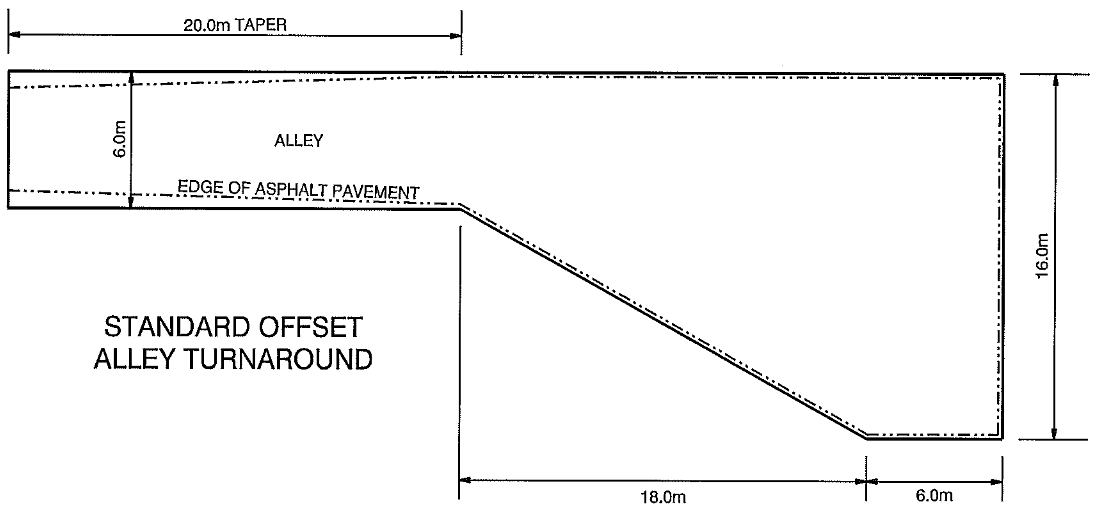
THE CITY OF Edmonton
STANDARD DRAWING

ALLEY WIDENING IN LIEU OF 3m X 3m CORNER CUT-OFF

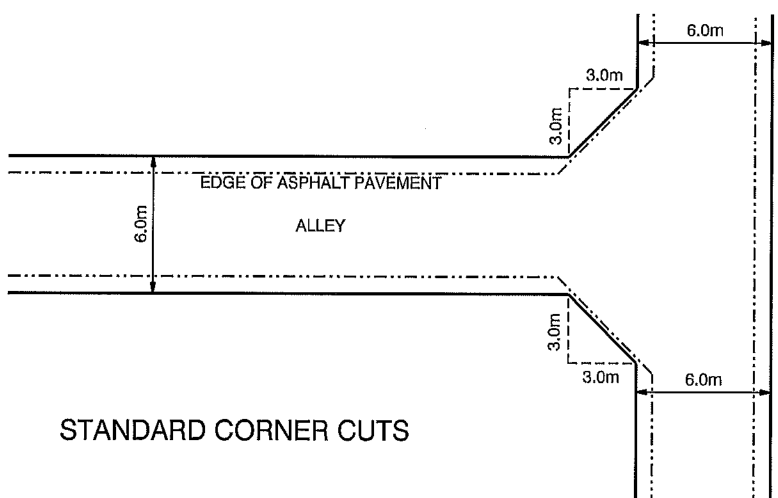
Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW	Jody Hancock		3030
Scale: N.T.S.	Checked By:			



STANDARD ALLEY CUL-DE-SAC



STANDARD OFFSET ALLEY TURNAROUND



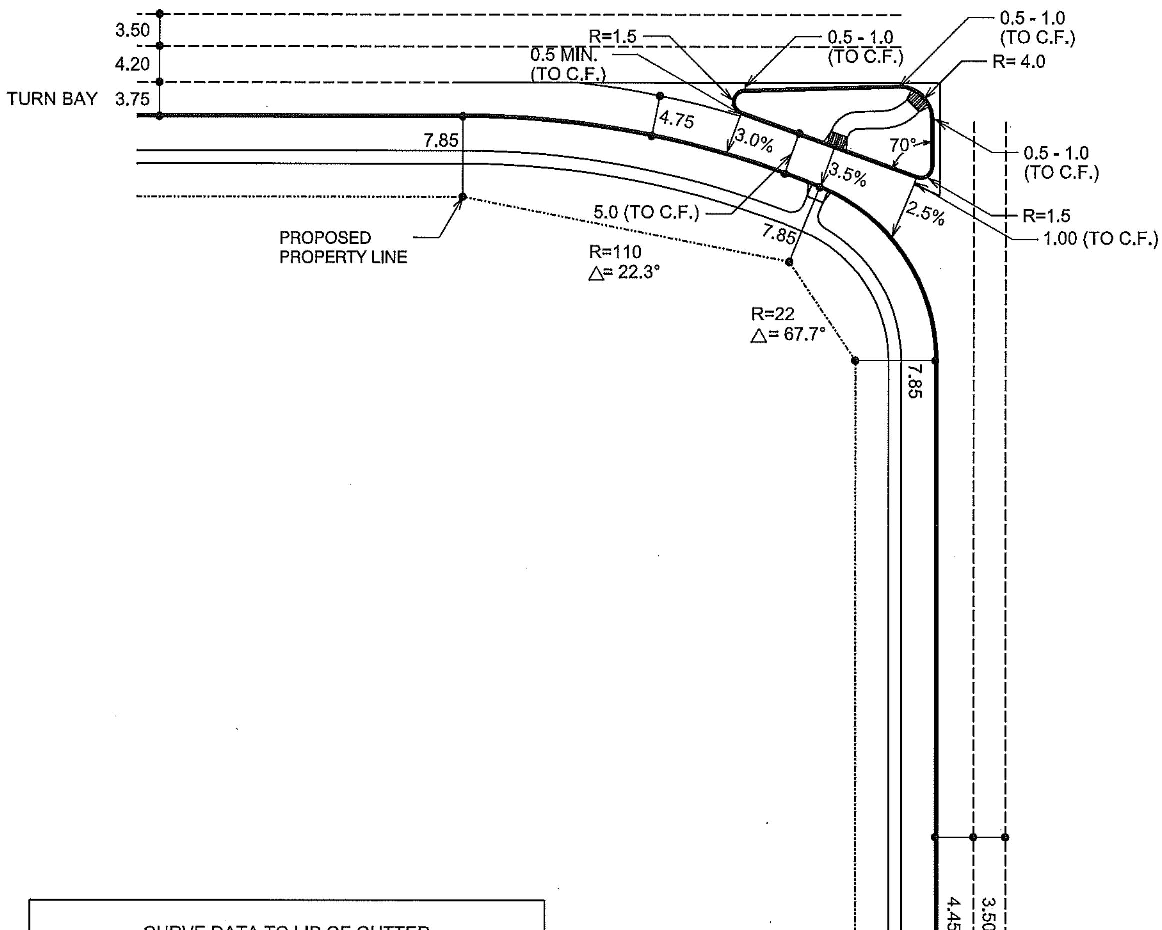
STANDARD CORNER CUTS

NOTES:
1. DESIGN VEHICLE - SU.

THE CITY OF Edmonton
STANDARD DRAWING

PUBLIC ALLEY CUL-DE-SAC AND CORNER CUTS

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 3040
Scale: N.T.S.	Checked By:			



CURVE DATA TO LIP OF GUTTER WHEN ANGLE = 90°		
R	110	22
△	22.3	67.7
TANGENT	21.682	14.755
LENGTH	42.816	25.994
LONG TANGENT = 55.394 SHORT TANGENT = 28.582		

NOTES:

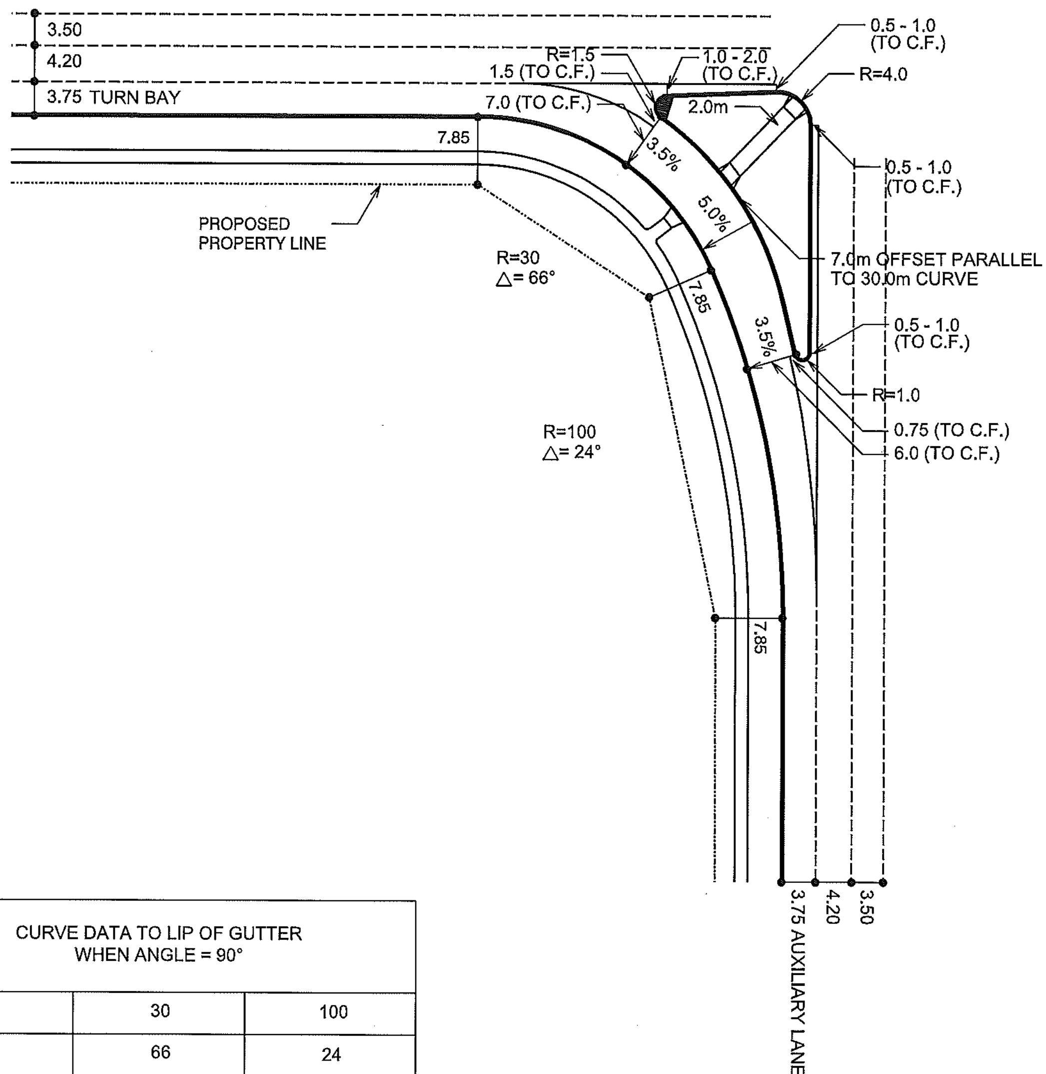
1. ALL RADII ARE TO LIP OF GUTTER.
2. PAVEMENT MARKING OFFSETS ARE TO CURB FACE.
3. THE ABOVE CURVE DATA IS APPLICABLE ONLY WITHIN A 10° DEFLECTION FROM 90°.
4. RIGHT TURN CUT-OFF TO BE REVIEWED / ADJUSTED TO ACCOMMODATE DESIGN TRUCK CLASSIFICATION (WB21).

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

RIGHT TURN STANDARD - ARTERIAL TO ARTERIAL - CHANNELIZED HIGH ENTRY ANGLE (YIELD CONDITION)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 3100
Scale: N.T.S.	Checked By:			



CURVE DATA TO LIP OF GUTTER WHEN ANGLE = 90°		
R	30	100
△	66	24
TANGENT	19.537	21.122
LENGTH	34.634	41.633
LONG TANGENT = 58.308 SHORT TANGENT = 35.979		

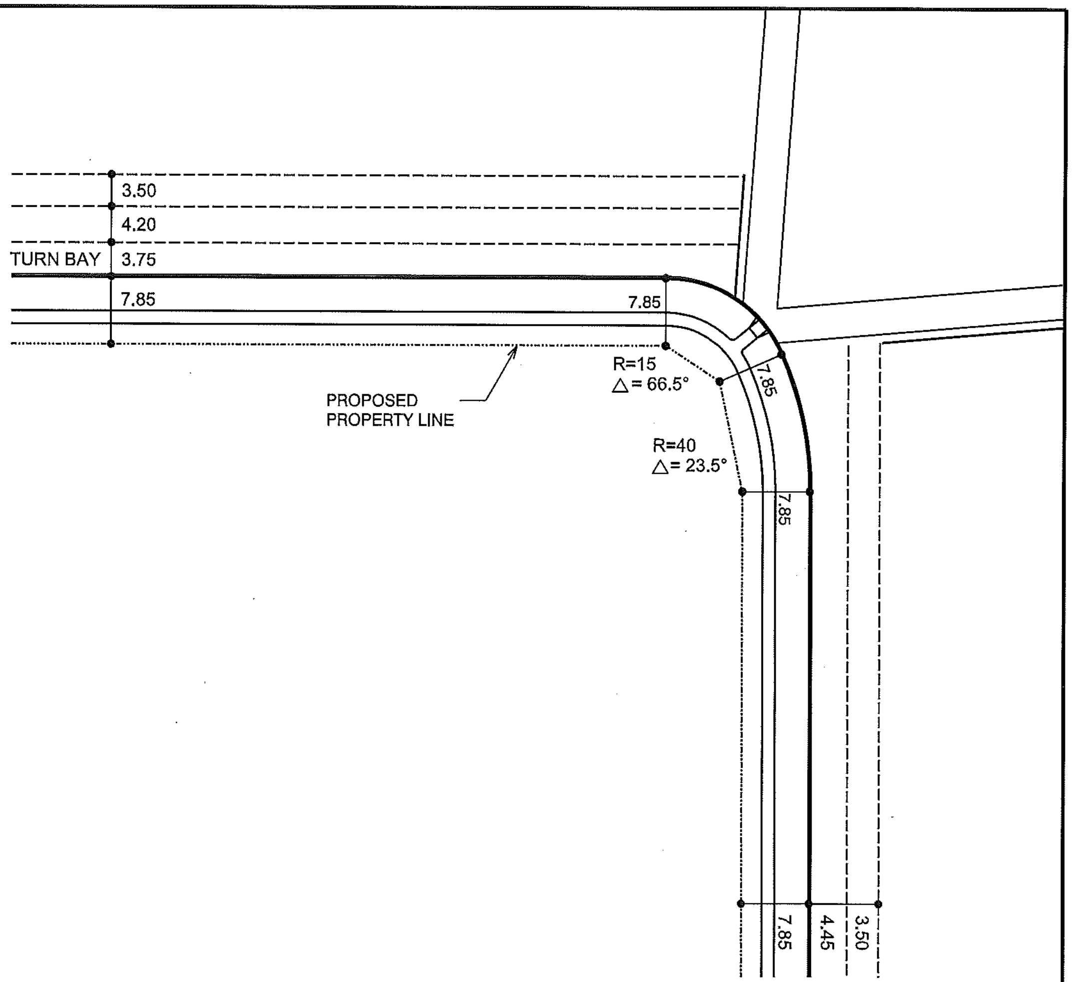
NOTES:
1. ALL RADII ARE TO LIP OF GUTTER.
2. PAVEMENT MARKING OFFSETS ARE TO CURB FACE.
3. THE ABOVE CURVE DATA IS APPLICABLE ONLY WITHIN A 10° DEFLECTION FROM 90°.
4. RIGHT TURN CUT-OFF TO BE REVIEWED / ADJUSTED TO ACCOMMODATE DESIGN TRUCK CLASSIFICATION (WB21).

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

RIGHT TURN STANDARD - ARTERIAL TO ARTERIAL- CHANNELIZED LOW EXIT ANGLE (FREE FLOW)

Date Approved: FEB., 2011	Drawn By: JW	Approved Jody Hand	Revision #	Drawing # 3110
Scale: N.T.S.	Checked By:			



CURVE DATA TO LIP OF GUTTER WHEN ANGLE = 90°		
R	15	40
△	66.5°	23.5°
TANGENT	9.808	8.372
LENGTH	17.373	16.505
LONG TANGENT = 25.026 SHORT TANGENT = 17.098		

NOTES:

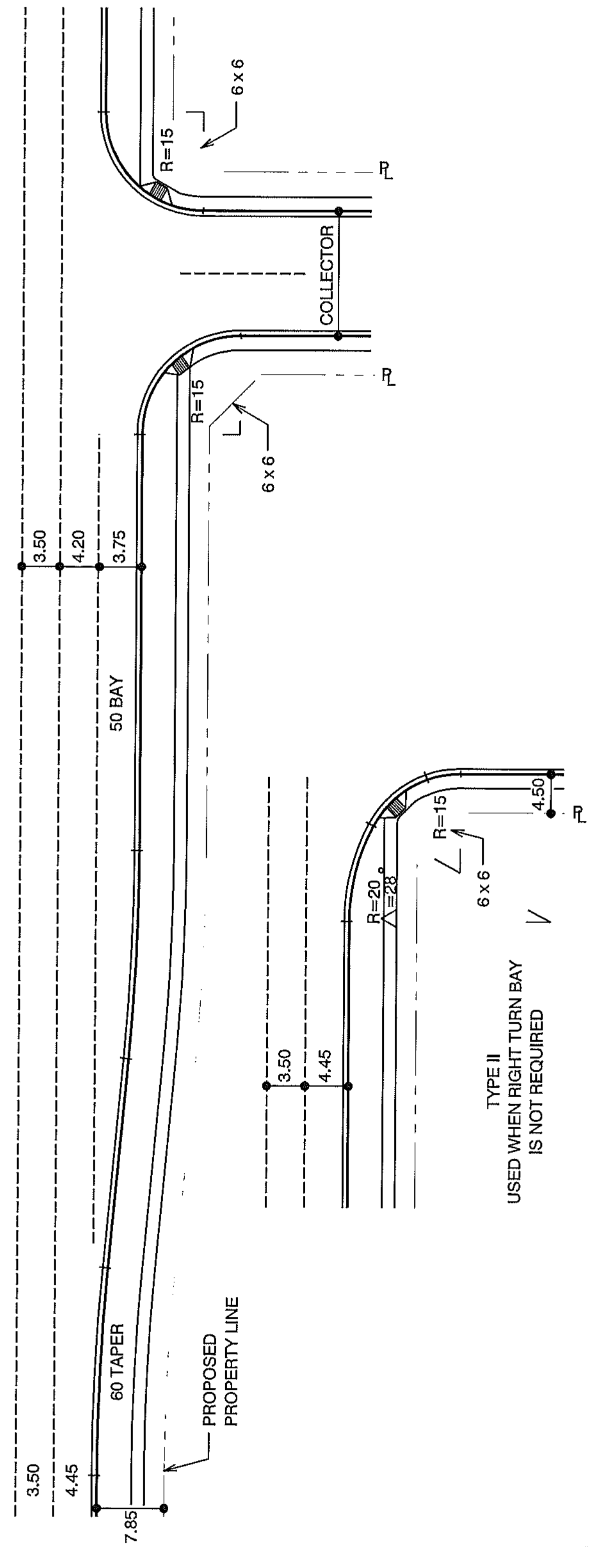
1. ALL RADII ARE TO LIP OF GUTTER.
2. PAVEMENT MARKING OFFSETS ARE TO CURB FACE.
3. THE ABOVE CURVE DATA IS APPLICABLE ONLY WITHIN A 10° DEFLECTION FROM 90°.
4. RIGHT TURN CUT-OFF TO BE REVIEWED / ADJUSTED TO ACCOMMODATE DESIGN TRUCK CLASSIFICATION (WB21).

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

RIGHT TURN STANDARD - ARTERIAL TO ARTERIAL - UNCHANNELIZED SIMPLE CURVE (STOP CONDITION)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 3120
Scale: N.T.S.	Checked By:			



NOTES:
1. ALL RADII ARE TO LIP OF GUTTER.
2. OFFSET DISTANCE ARE TO CURB FACE.
3. BAY LENGTH TO BE DETERMINED BY TRAFFIC VOLUME.
4. PROPERTY LINE REQUIREMENT WILL INCREASE IF BERM/FENCE IS REQUIRED.

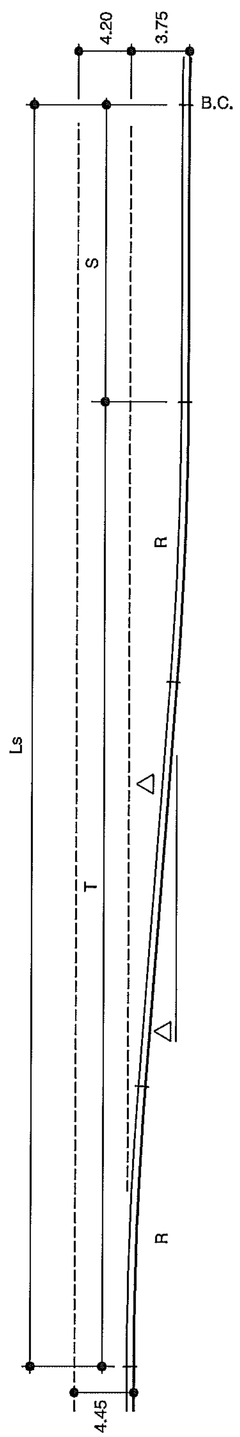
ALL DIMENSIONS
IN METRES UNLESS
OTHERWISE NOTED

MAIN LINE DESIGN SPEED 70 Km/hr.

THE CITY OF Edmonton
STANDARD DRAWING

RIGHT TURN BAY STANDARD
ARTERIAL TO COLLECTOR

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 3200
Scale: N.T.S.	Checked By:			



LEGEND:

T=TAPER
Ls=MINIMUM LENGTH
S=BAY LENGTH=Ls-T

RIGHT TURN BAY DATA					
DESIGN SPEED (km/h)	T	Ls MINIMUM	R	△	TAN.
60	60	90	216.68	5°17'	10
70	60	110	216.68	5°17'	10
80	70	130	270.64	4°14'	10

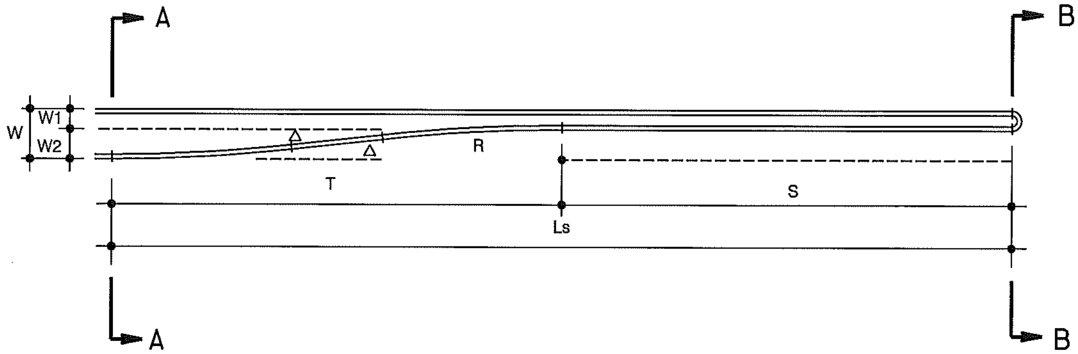
ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

NOTES:
1. ALL DIMENSIONS TO CURB FACE.

THE CITY OF Edmonton
STANDARD DRAWING

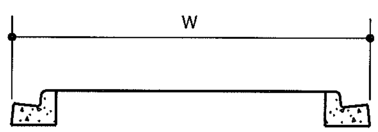
RIGHT TURN BAY STANDARD
ARTERIAL - ARTERIAL

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			3210
Scale: N.T.S.	Checked By:			

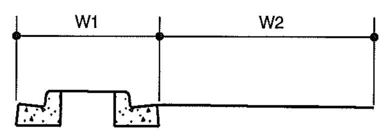


LEGEND:

T=TAPER
Ls=MINIMUM LENGTH
S=BAY LENGTH=Ls-T



SECTION A-A



SECTION B-B

LEFT TURN BAY DATA					
DESIGN SPEED (km/h)	T	Ls MINIMUM	R	△	TAN.
60	60	90	242.85	4°43'	10
70	60	110	242.85	4°43'	10
80	70	130	303.36	3°47'	10

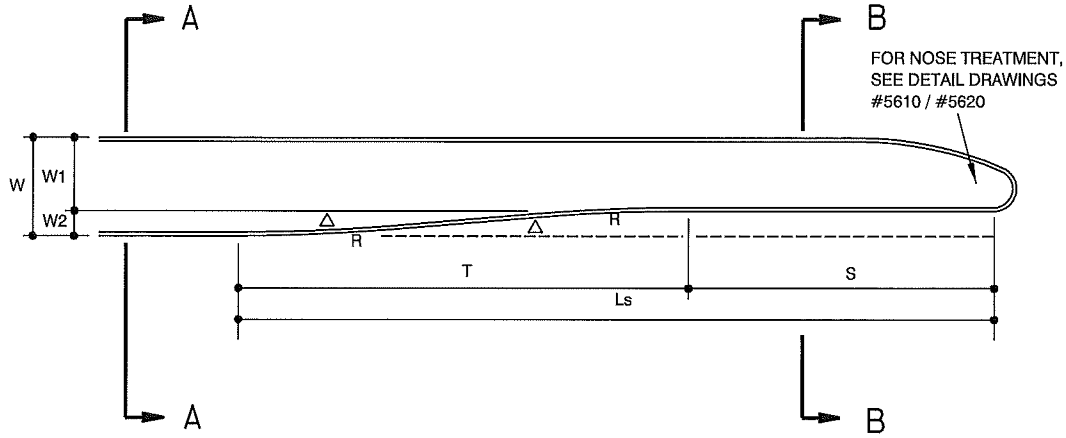
NARROW MEDIAN WIDTH			
0.25 GUTTER (RECOMMENDED)			
DES. WIDTH	W	W1	W2
	5.00	1.70	3.30

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

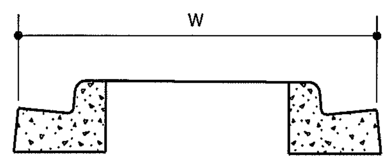
LEFT TURN BAY STANDARD (NARROW MEDIAN)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision # —	Drawing # 3300
Scale: N.T.S.	Checked By:			

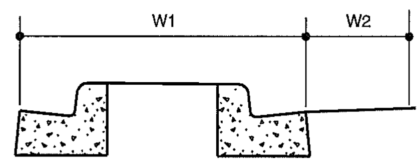


LEGEND:

T=TAPER
Ls=MINIMUM LENGTH
S=BAY LENGTH=Ls-T



SECTION A-A



SECTION B-B

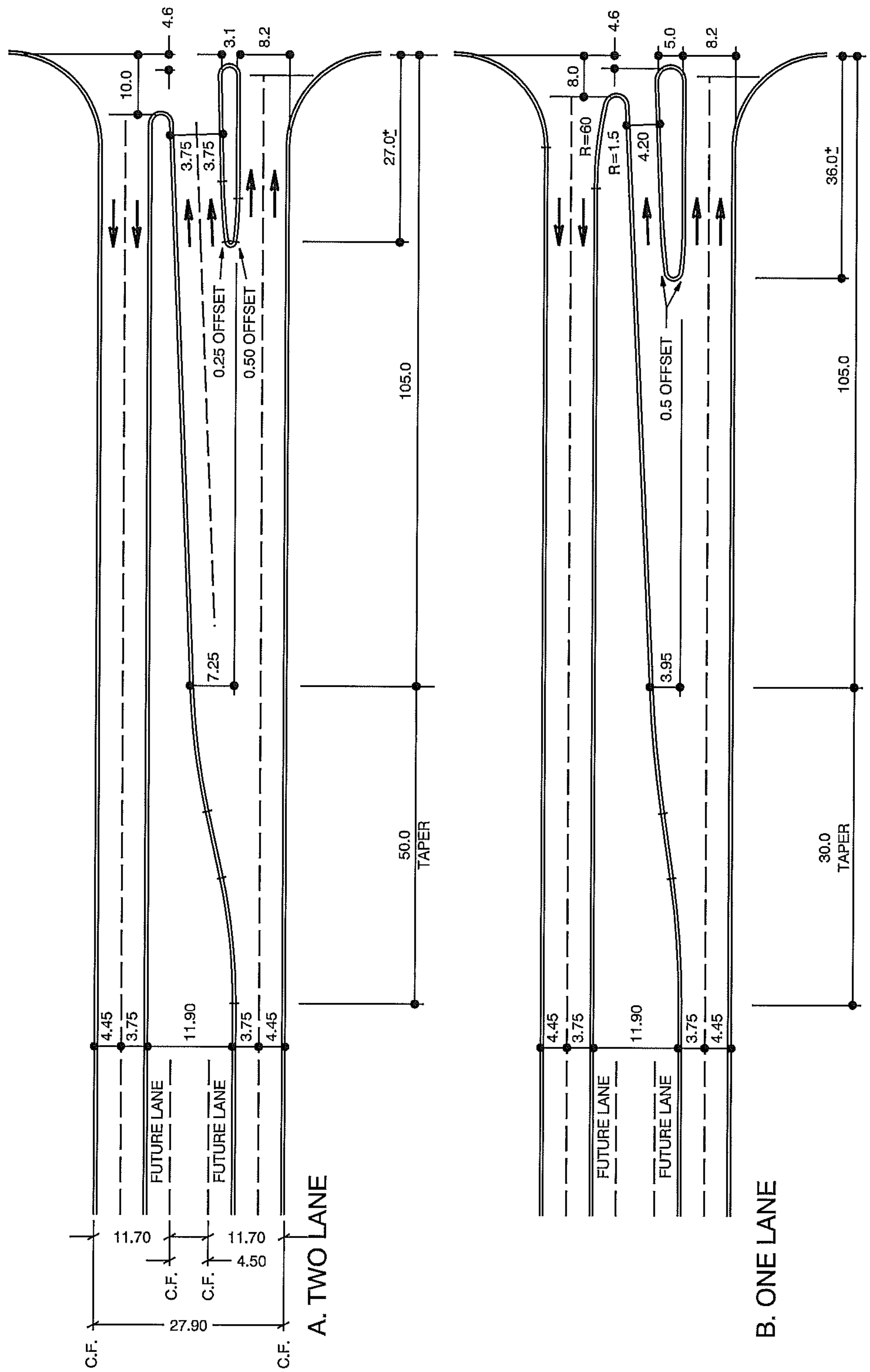
LEFT TURN BAY DATA					
DESIGN SPEED (km/h)	T	Ls MINIMUM	R	△	TAN.
60	60	90	242.85	4°43'	10
70	60	110	242.85	4°43'	10
80	70	130	303.36	3°47'	10

WIDE MEDIAN WIDTH			
0.25m GUTTER (STANDARD)			
DESIRABLE WIDTH	W	W1	W2
	12.4	9.1	3.30

THE CITY OF Edmonton
STANDARD DRAWING

LEFT TURN BAY STANDARD (WIDE MEDIAN)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 3310
Scale: N.T.S.	Checked By:			



ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

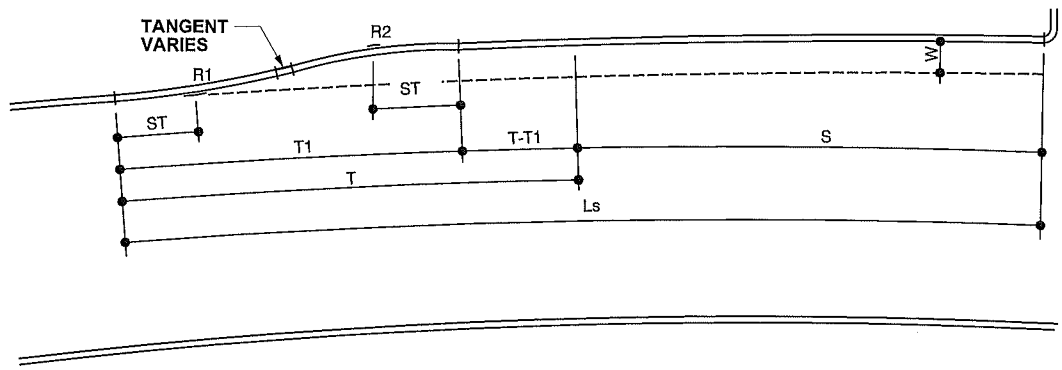
NOTES:

1. MEDIAN WIDTHS ARE BASED ON CURBED MEDIANS.
2. ALL NOSE LOCATIONS SHOULD BE CHECKED WITH TURNING VEHICLE TEMPLATES.
3. CONSTRUCT MEDIAN END TREATMENT (DRAWING #5610 / #5620) WHERE APPLICABLE.

THE CITY OF Edmonton
STANDARD DRAWING

LEFT TURN STANDARD (CHANNELIZED SLOT)

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			3320
Scale: N.T.S.	Checked By:		–	



LEGEND:

T=STANDARD TAPER LENGTH (60)
T1=ADJUSTED TAPER LENGTH (SEE CHART BELOW)
Ls=BAY LENGTH (STANDARD TAPER (60) PLUS S)
S=STORAGE BAY LENGTH (DETERMINED BY TRAFFIC VOLUME)
ST=SUB-TANGENT LENGTH (SEE CHART BELOW)
W=BAY WIDTH (SEE DWG. 4068 & DWG. 4070)

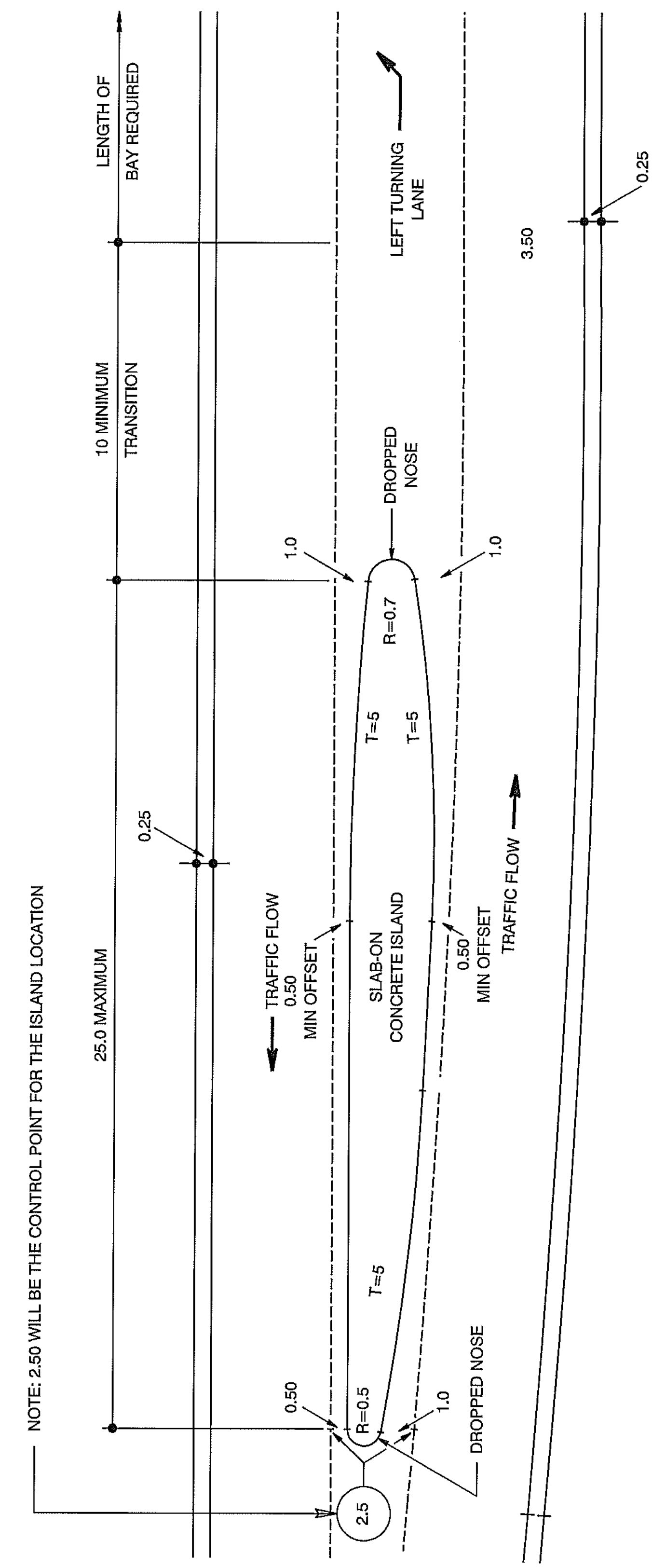
TURN BAY DATA					
DESIGN SPEED km/h	MAIN LINE CURVE DATA (RADIUS)	ADJUSTED TAPER 1	SUB-TANGENT	RADIUS 1	RADIUS 2
50 - 80	TAN TO 1165	STD.(DWG.4068)	10	VARIES	VARIES
50 - 80	1165 TO 580	35	7	VARIES	VARIES
50 - 70	580 TO 350	30	6	VARIES	VARIES
50 - 70	350 TO 250	25	5	VARIES	VARIES
50 - 60	250 TO 145	20	4	VARIES	VARIES

ALL DIMENSIONS
IN METRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

RIGHT AND LEFT TURN BAY STANDARD
CURVED MAINLINE

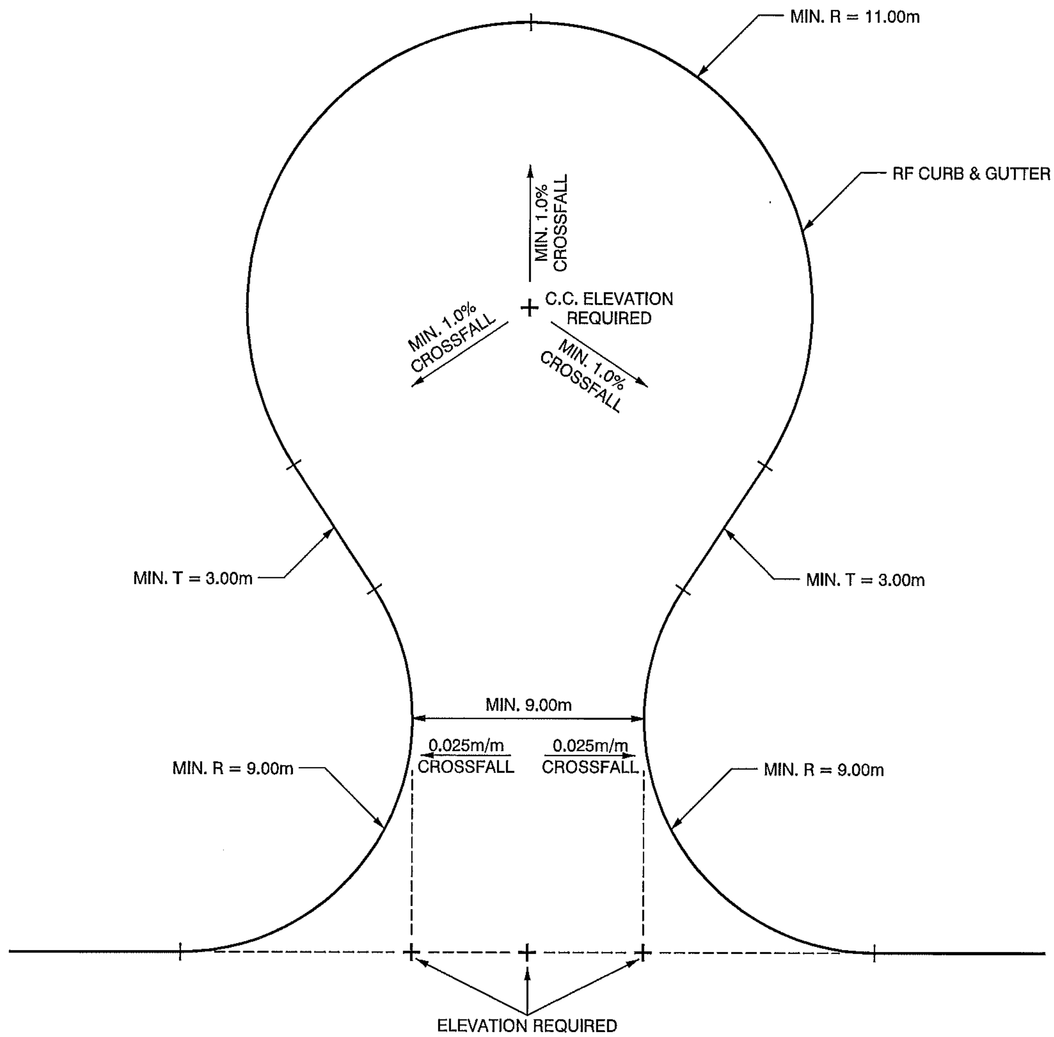
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 3350
Scale: N.T.S.	Checked By:		—	



THE CITY OF Edmonton
STANDARD DRAWING

ISLAND LAYOUT FOR INTRODUCTION OF CHANNELIZATION

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 3400
Scale: N.T.S.	Checked By:			

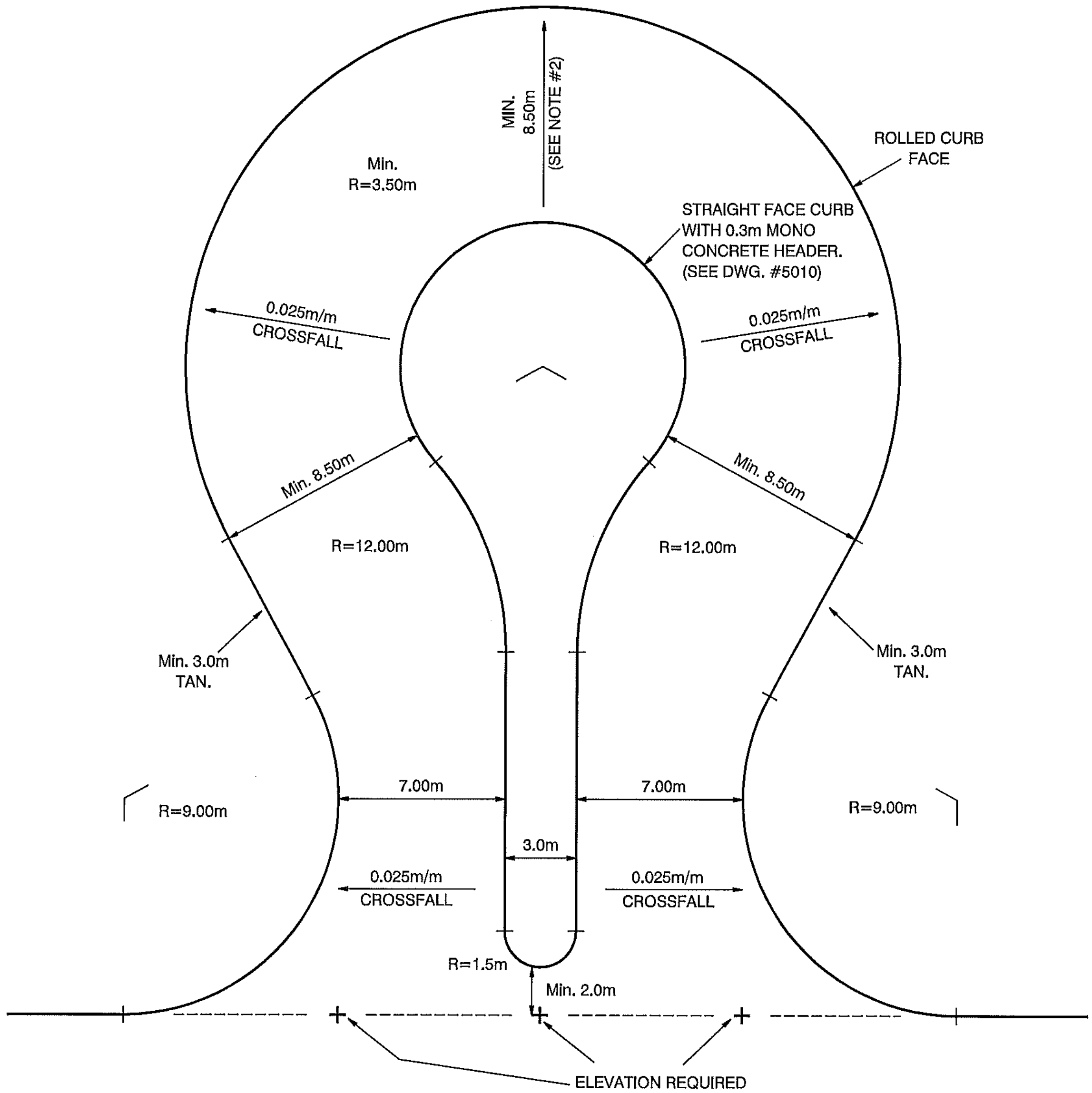


NOTES:
1. PROVIDE ELEVATION FOR ALL TICK MARKS SHOWN.
2. MIN. 1.0% LONGITUDINAL GRADE REQUIRED ALONG CUL-DE-SAC AND CURB RADII.

THE CITY OF Edmonton
STANDARD DRAWING

RESIDENTIAL CUL-DE-SAC (WITHOUT ISLAND)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 3500
Scale: N.T.S.	Checked By:			



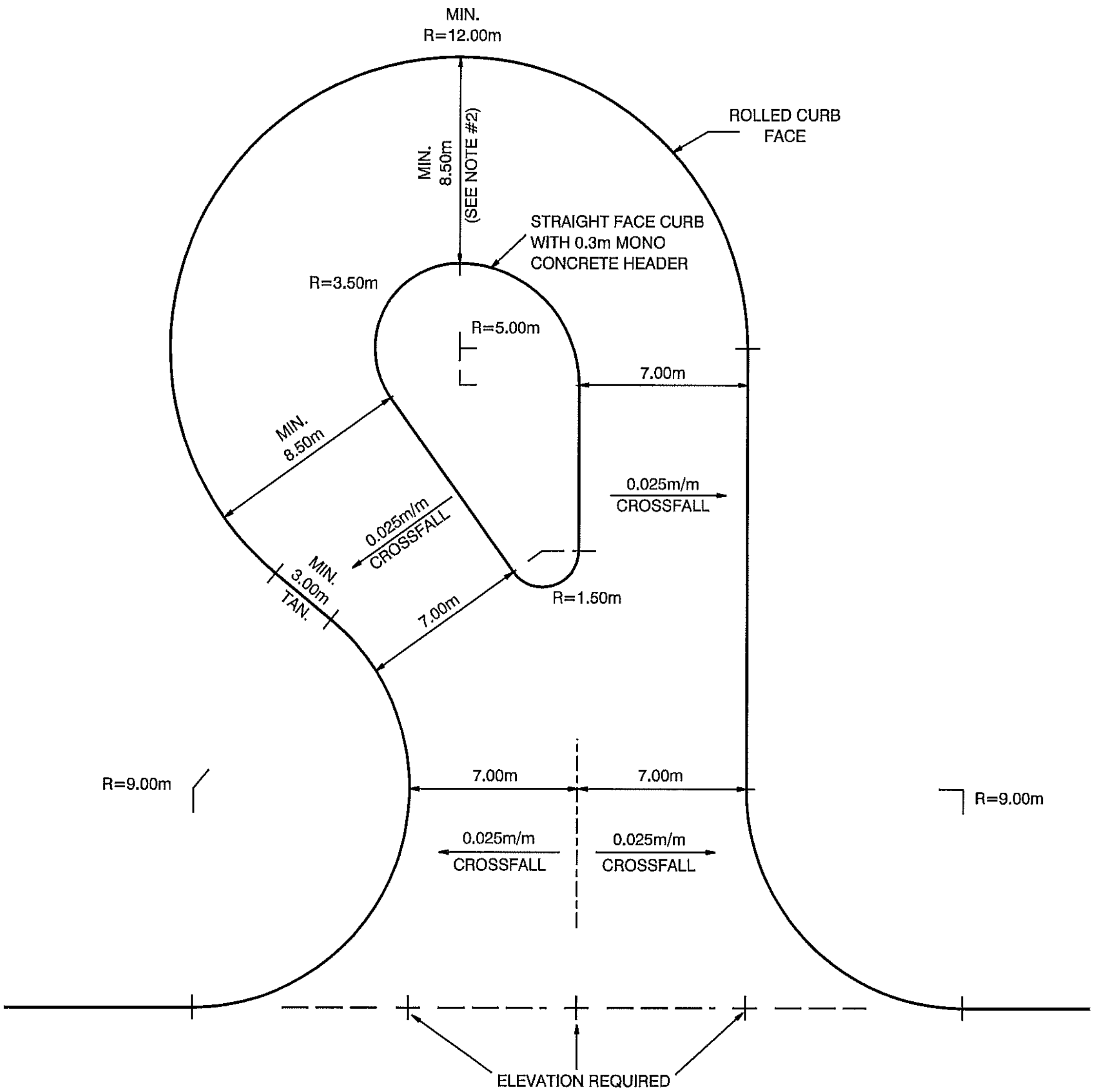
NOTES:

1. PROVISION ALLOTTED FOR PARALLEL PARKING AROUND 12.00m RADIUS. NO PARKING ON INSIDE.
2. CROSSFALL ON NOSE MAY BE REDUCED TO 0.01m/m (Min.) TO FACILITATE GRADES.

THE CITY OF Edmonton
STANDARD DRAWING

RESIDENTIAL CUL-DE-SAC ISLAND (CIRCULAR)

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			3510
Scale: N.T.S.	Checked By:		–	



NOTES:

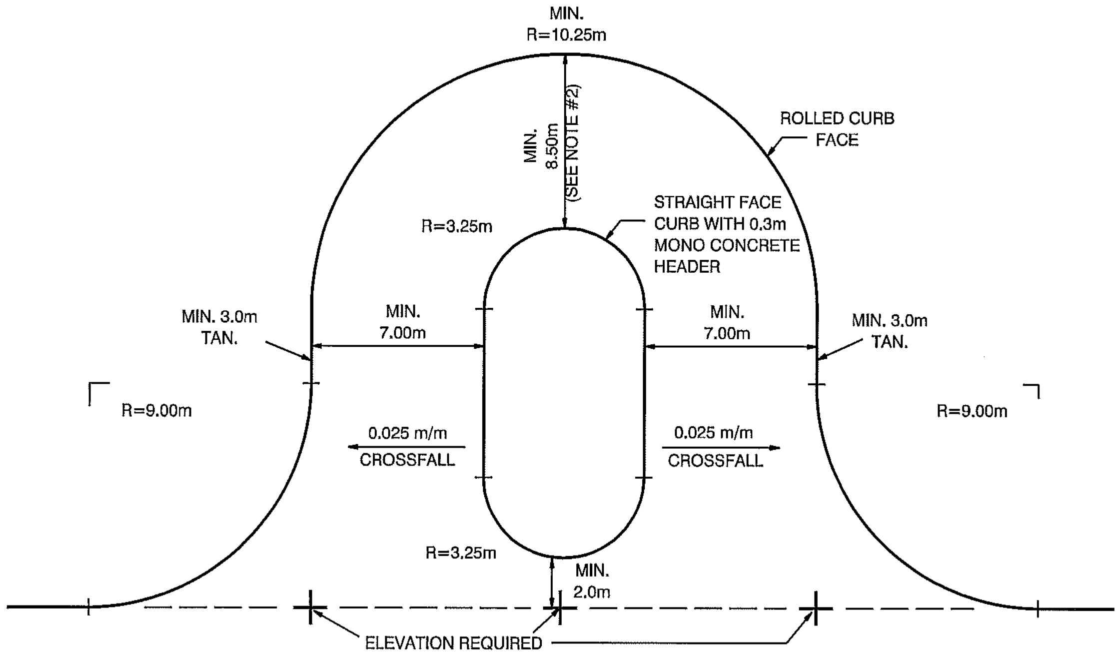
1. PROVISION ALLOTTED FOR PARALLEL PARKING AROUND 12.00m RADIUS. NO PARKING ON INSIDE.
2. CROSSFALL MAY BE REDUCED TO 0.01m/m TO FACILITATE GRADES.

THE CITY OF Edmonton

STANDARD DRAWING

RESIDENTIAL CUL-DE-SAC ISLAND (CIRCULAR OFFSET)

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			3520
Scale: N.T.S.	Checked By:		–	



NOTES:

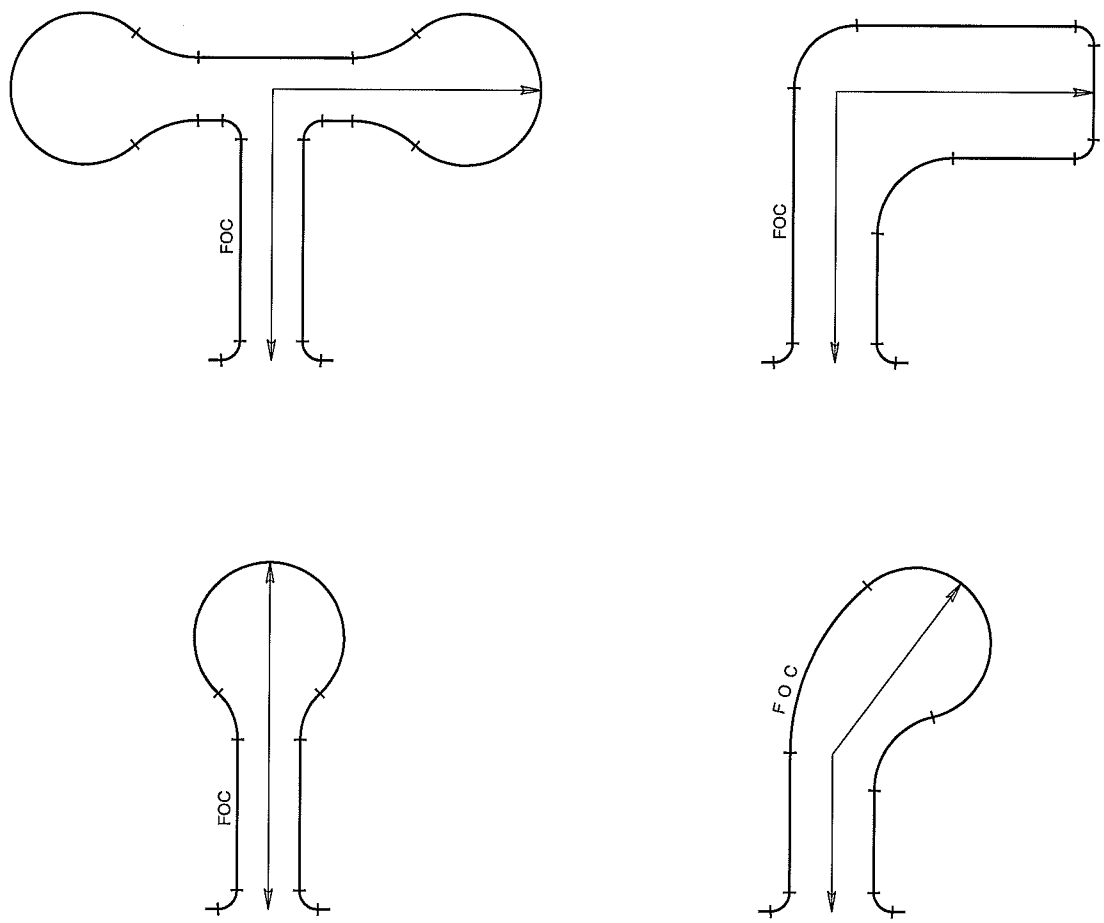
1. PROVISION ALLOTTED FOR PARALLEL PARKING AROUND 10.25m RADIUS. NO PARKING ON INSIDE.
2. CROSSFALL ON NOSE MAY BE REDUCED TO 0.01m/m (Min.) TO FACILITATE GRADES.

THE CITY OF Edmonton
STANDARD DRAWING

RESIDENTIAL CUL-DE-SAC ISLAND
(ELONGATED)

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			3530
Scale:	Checked By:			
N.T.S.			–	

POINTS FROM WHERE MEASUREMENTS ARE TO BE TAKEN TO DETERMINE SIDEWALK REQUIREMENTS FOR CULS-DE-SAC WITH NO WALKWAY CONNECTIONS.



NOTES:
WALKWAYS WILL BE REQUIRED IN CUL-DE-SAC AS DESCRIBED BELOW.

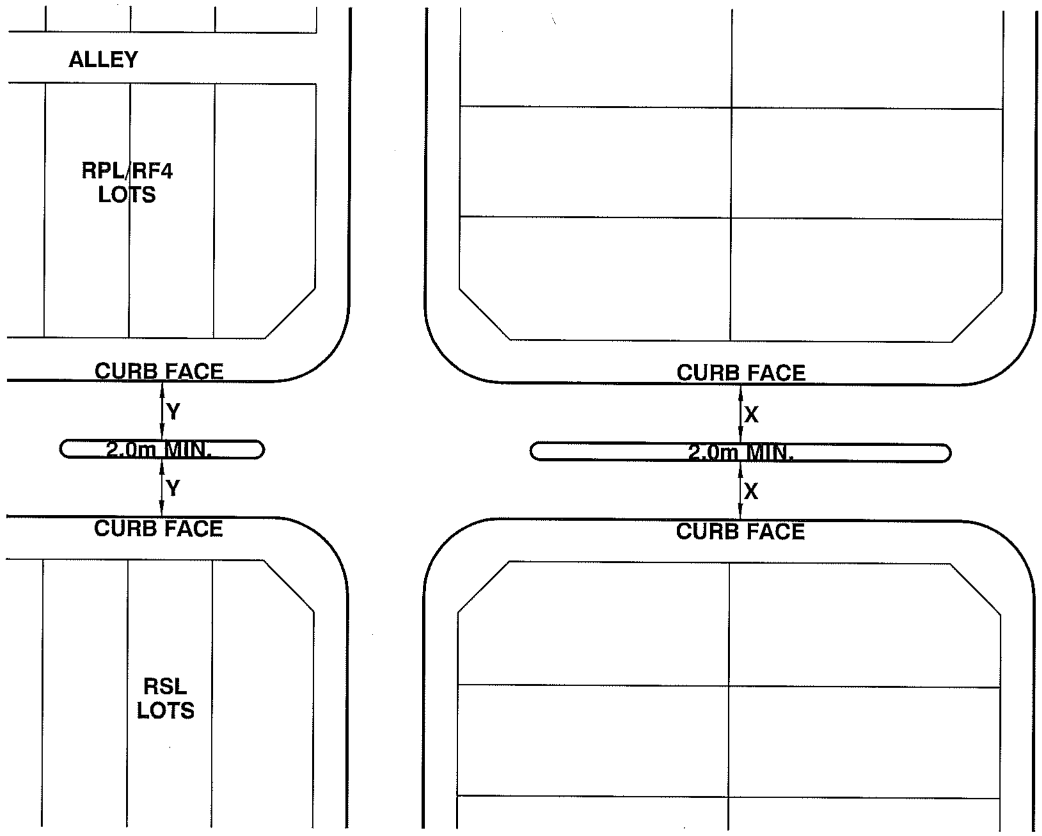
- CUL-DE-SAC WITH 10 OR FEWER LOTS FRONTING AND/OR FLANKING THE CUL-DE-SAC DOES NOT REQUIRE A SIDEWALK.
- CUL-DE-SAC WITH FEWER THAN 18 LOTS AND LESS THAN 120m ONLY REQUIRES A SIDEWALK ON ONE SIDE. (*)
- CUL-DE-SAC WITH 18 LOTS OR MORE FRONTING AND/OR FLANKING WILL REQUIRE A SIDEWALK ON BOTH SIDES.
- CUL-DE-SAC WITH A WALKWAY CONNECTION TO A WALK OR TRAIL SYSTEM WILL REQUIRE A SIDEWALK ON BOTH SIDES.

(*) SIDEWALK ON ONE-SIDE FOR APPLICATIONS >18 LOTS ARE DISCRETIONARY & REQUIRE FURTHER INFORMATION ON LAND USE / ZONING.

THE CITY OF Edmonton
STANDARD DRAWING

SIDEWALK REQUIREMENTS
CUL-DE-SAC

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			3540
Scale: N.T.S.	Checked By:			



ROAD TYPE	DIM.	MIN. WIDTH	COMMENT
LOCAL (FLANKING)	X	4.5m	PARKING BANNED
COLLECTOR (FLANKING)	X	6m	PARKING BANNED
COLLECTOR	Y	6m	PARKING BANNED
LOCAL	Y	7m	RPL/RF4/RSL LOTS

NOTES:

1. ALL DIMENSIONS ARE TO CURB FACE
2. COMMUNITY SERVICES MAY REQUIRE WIDER MEDIANS TO ACCOMMODATE LANDSCAPING.
3. MIN. WIDTH OF MEDIAN IS 2.0m. (3.0m WITH LANDSCAPING)
4. MEDIANS ARE NOT ALLOWED IN FRONT OF LOTS WITH FRONT DRIVEWAYS.

THE CITY OF Edmonton
STANDARD DRAWING

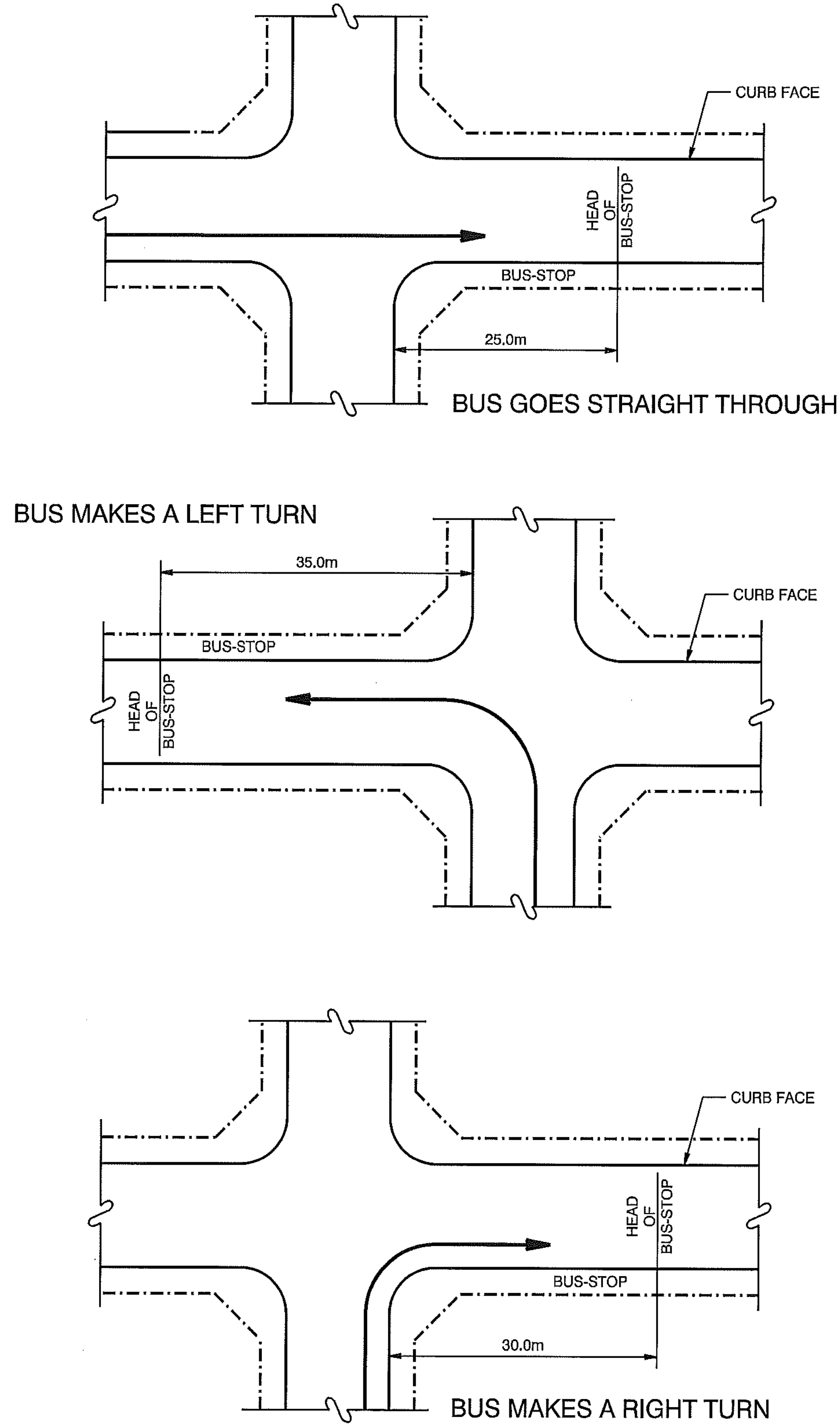
NEIGHBOURHOOD ENTRY MEDIAN

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 3600
Scale: NTS	Checked By:			

TRANSIT DETAILS

STANDARD DETAILS

SECTION 4000

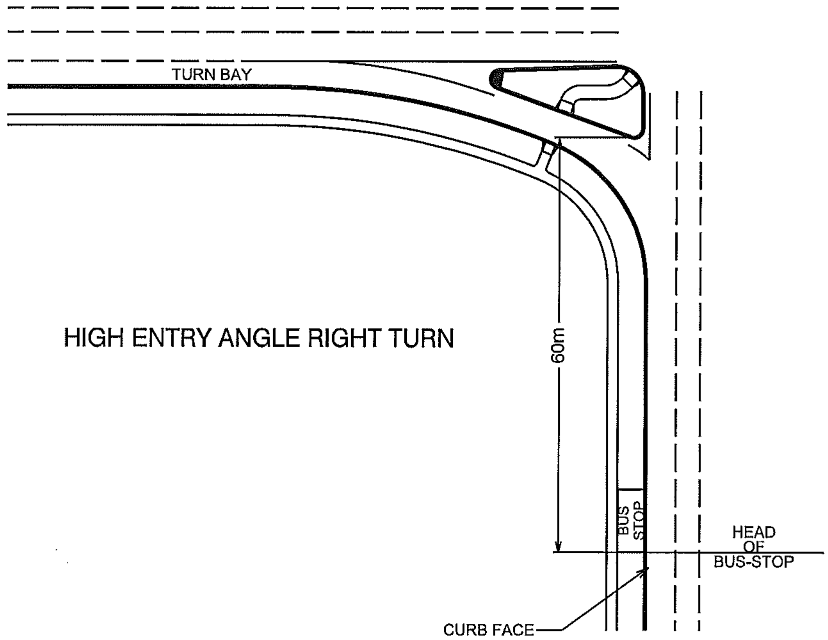


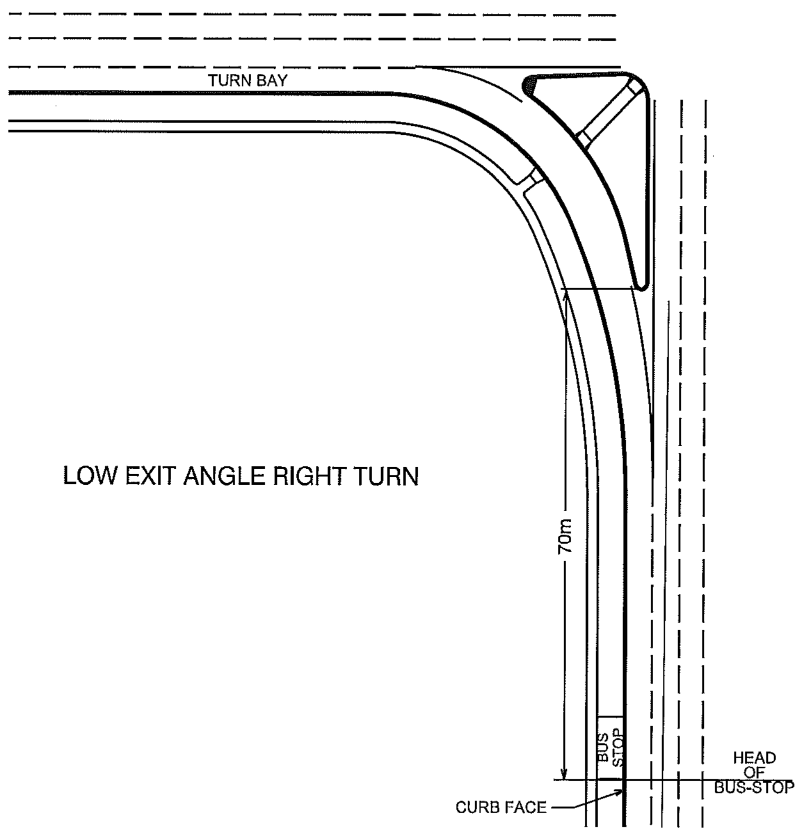
NOTES:
1. STRAIGHT FACE CURB REQUIRED AT BUS-STOP.

THE CITY OF Edmonton
STANDARD DRAWING

LOCATION OF BUS STOP (UNCHANNELIZED INTERSECTION)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 4000
Scale: NTS	Checked By:			

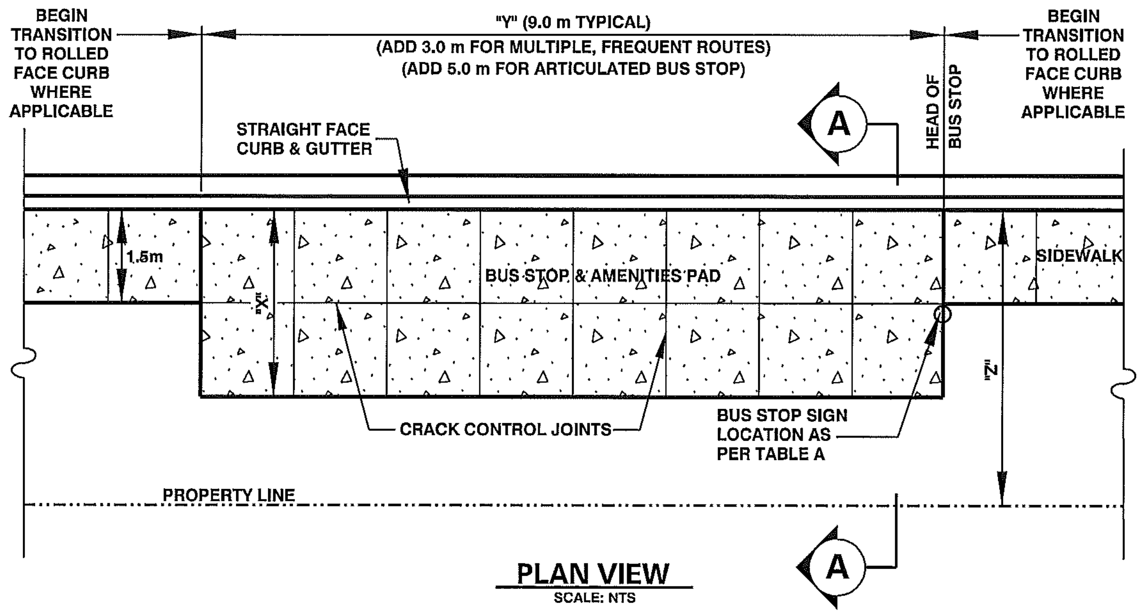




THE CITY OF Edmonton
STANDARD DRAWING

LOCATION OF BUS STOP (CHANNELIZED INTERSECTION)

Date Approved: FEB., 2011	Drawn By: KA	Approved	Revision #	Drawing # 4010
Scale: N.T.S.	Checked By:			



PLAN VIEW

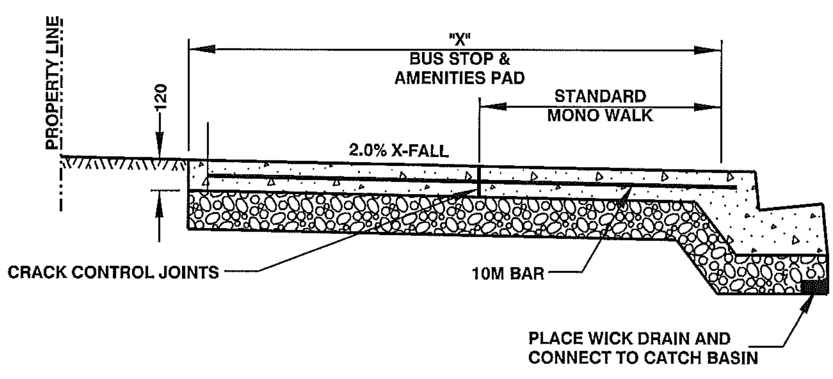
SCALE: NTS

NOTES:

1. PROVIDE A BUS STOP & AMENITIES PAD WITH WIDTH "X" AND LENGTH "Y" IN ACCORDANCE WITH THE DRAWING NOTES AND TABLE A (SEE BELOW). PROVIDE APPROPRIATE CRACK CONTROL JOINTS THROUGHOUT.
2. MAINTAIN MIN. 0.3m CLEARANCE BETWEEN PROPERTY LINE AND AMENITIES PAD.

TABLE A - BUS STOP & AMENITIES PAD SIZE

CONDITION	DISTANCE "Z" TO PROPERTY LINE	REQUIRED PAD WIDTH "X" (m)	REQUIRED PAD LENGTH "Y" (m)	BUS STOP SIGN LOCATION BEHIND SIDEWALK
OVER- CONSTRAINED	"Z" < 2.8m	2.1m	9.0	HEAD OF PAD
CONSTRAINED	2.8m <= "Z" < 3.9m	"Z"- 0.3m (MAX. 3.0m)	12.0	3m BACK FROM HEAD
NOT CONSTRAINED	"Z" > 3.9m	"Z"- 0.3m (MAX. 4.1m)	9.0	HEAD OF PAD



SECTION A-A

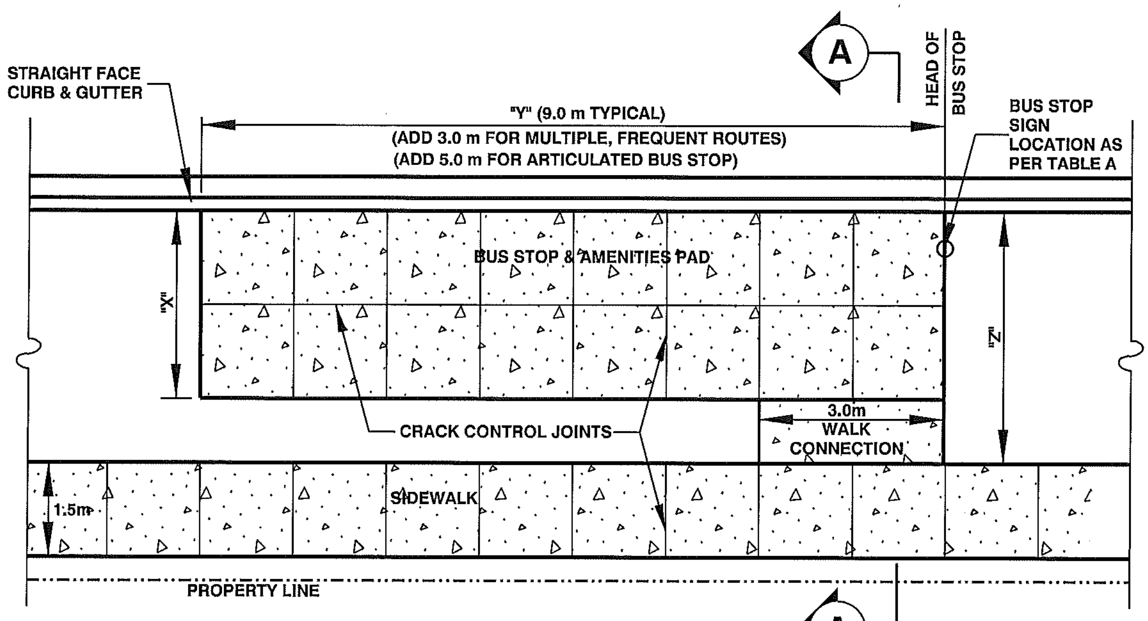
SCALE: NTS

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF **Edmonton**
STANDARD DRAWING

BUS STOP AND AMENITIES PAD - MONO WALK

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 4100
Scale: N.T.S.	Checked By:			



PLAN VIEW

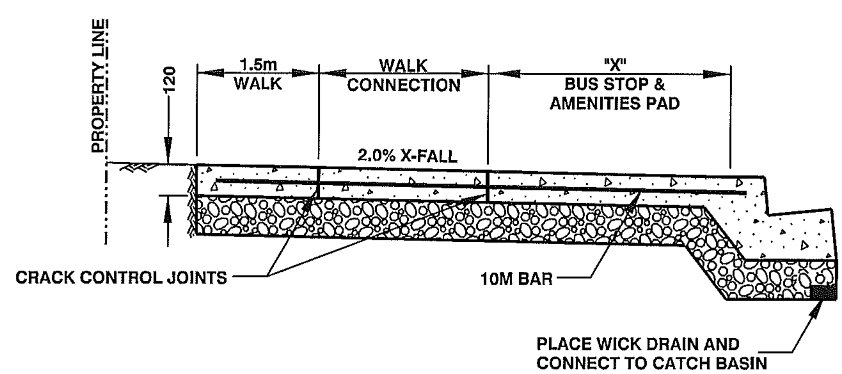
SCALE: NTS

NOTES:

1. PROVIDE A BUS STOP & AMENITIES PAD WITH WIDTH "X" AND LENGTH "Y" IN ACCORDANCE WITH THE DRAWING NOTES AND TABLE A (SEE BELOW). PROVIDE APPROPRIATE CRACK CONTROL JOINTS THROUGHOUT.
2. IF REQUIRED PAD WIDTH "X" IS LESS THAN 1.0m FROM SIDEWALK, POUR THE CONCRETE PAD TO THE SIDEWALK. OTHERWISE, PROVIDE A 3.0m WIDE WALK CONNECTION AT THE HEAD OF THE PAD.

TABLE A. BUS STOP & AMENITIES PAD SIZE

CONDITION	DISTANCE "Z" TO SIDEWALK	REQUIRED PAD WIDTH "X" (m)	REQUIRED PAD LENGTH "Y" (m)	BUS STOP SIGN LOCATION
OVER-CONSTRAINED	Z < 2.25m	NOT PERMISSIBLE	NOT PERMISSIBLE	NOT PERMISSIBLE
CONSTRAINED	2.25m <= "Z" < 3.6m	"X" = "Z"	12.0	3m BACK FROM HEAD
NOT CONSTRAINED	3.6m <= "Z"	"X" = "Z" (MAX 4.1m)	9.0	HEAD OF PAD



SECTION A-A

SCALE: NTS

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

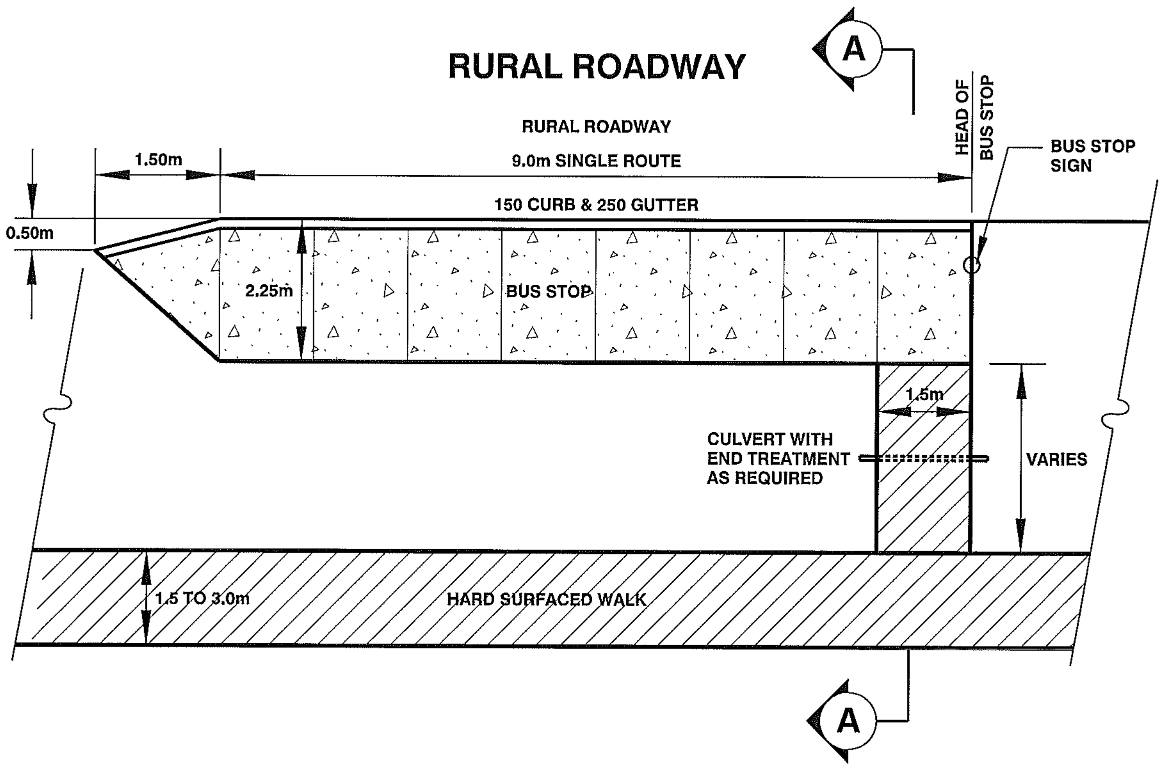
THE CITY OF Edmonton

STANDARD DRAWING

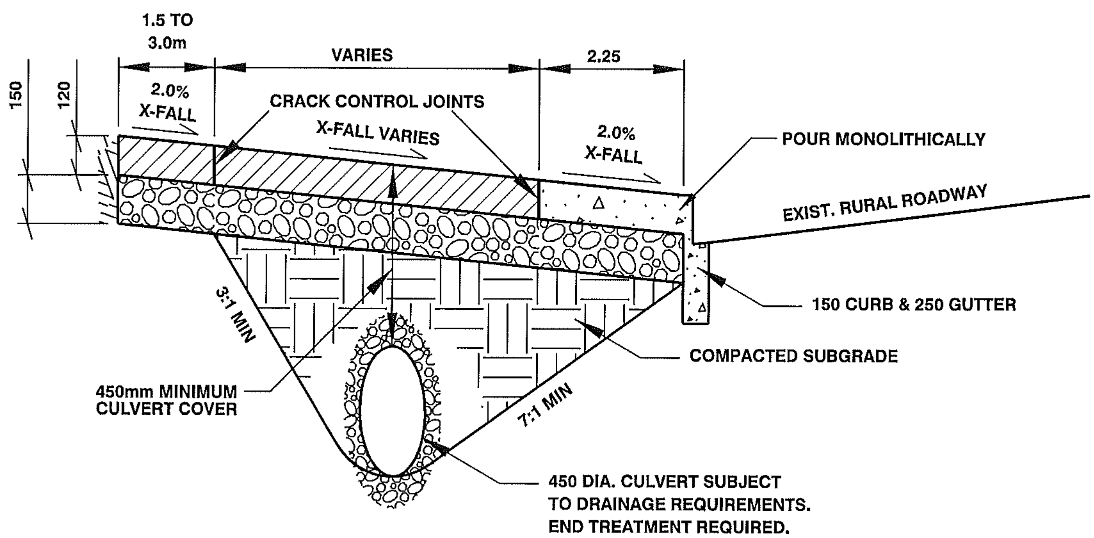
BUS STOP AND AMENITIES PAD - BOULEVARD WALK

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 4110
Scale: N.T.S.	Checked By:			

RURAL ROADWAY



PLAN VIEW
SCALE: NTS



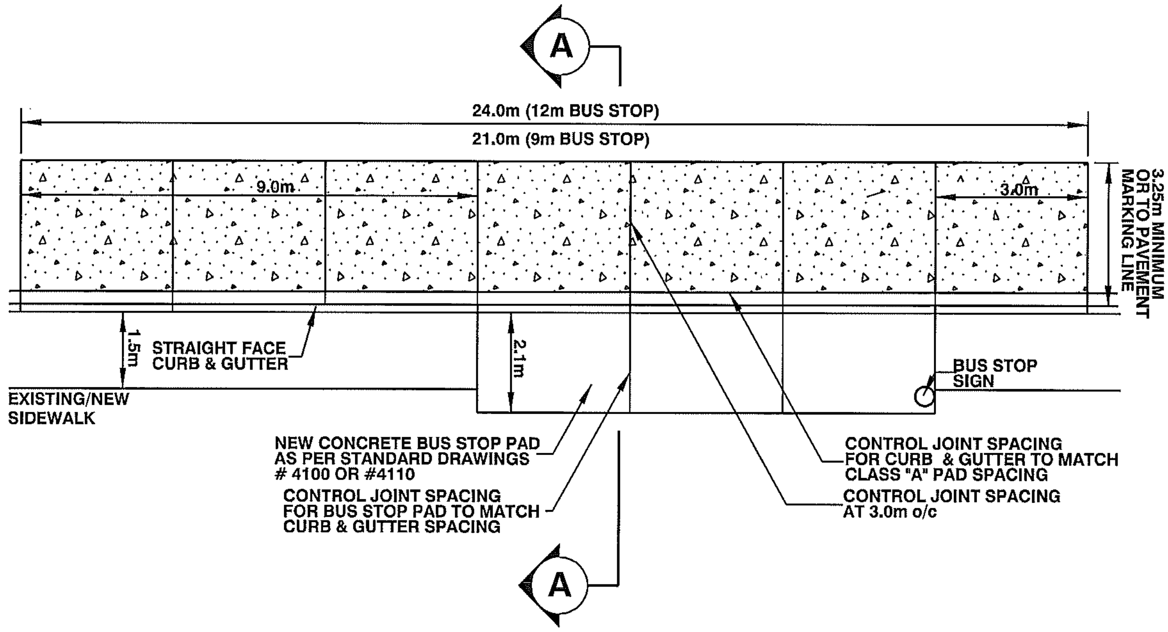
SECTION A-A
SCALE: NTS

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

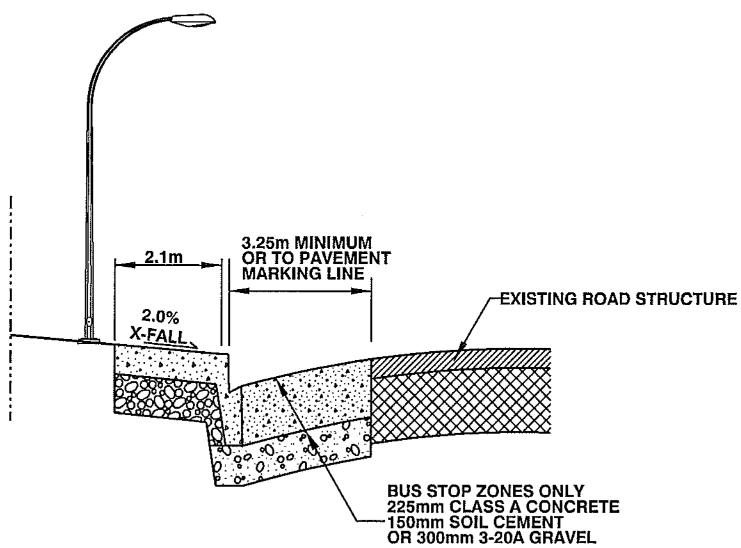
BUS STOP PAD - RURAL ROADWAY

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 4200
Scale: NTS	Checked By:			



PLAN VIEW

SCALE: NTS



SECTION A-A

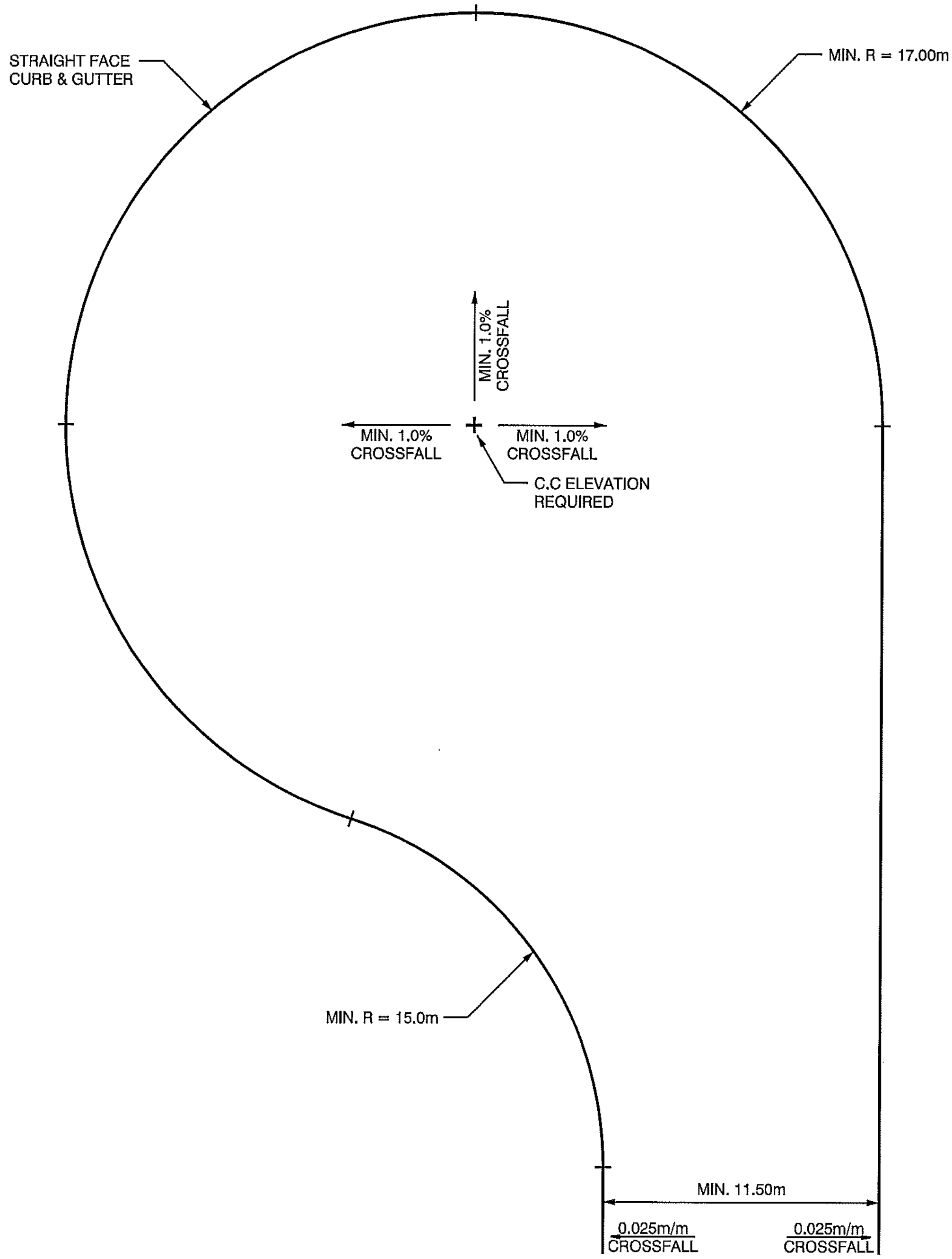
SCALE: NTS

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

CLASS A CONCRETE BUS STOP PAD (RETROFIT)

Date Approved: FEB., 2011	Drawn By: KLB	Approved	Revision #	Drawing # 4250
Scale: N.T.S.	Checked By:			

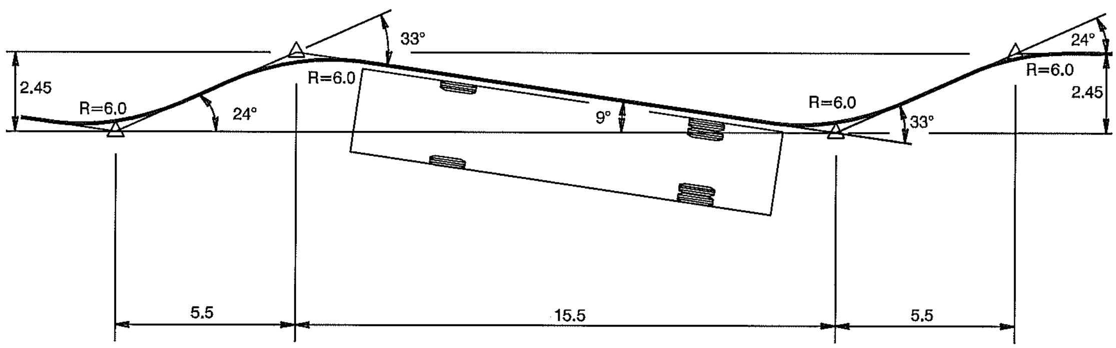


NOTES:
1. PROVIDE ELEVATION FOR ALL TICK MARKS SHOWN.
2. FOR TEMPORARY TURNAROUND WITH NO CURB AND GUTTER, PLACE MINI BARRIERS OR INSTALL BARRIER POSTS @ 1.5m ON CENTRE ALONG EDGE OF TURNAROUND.

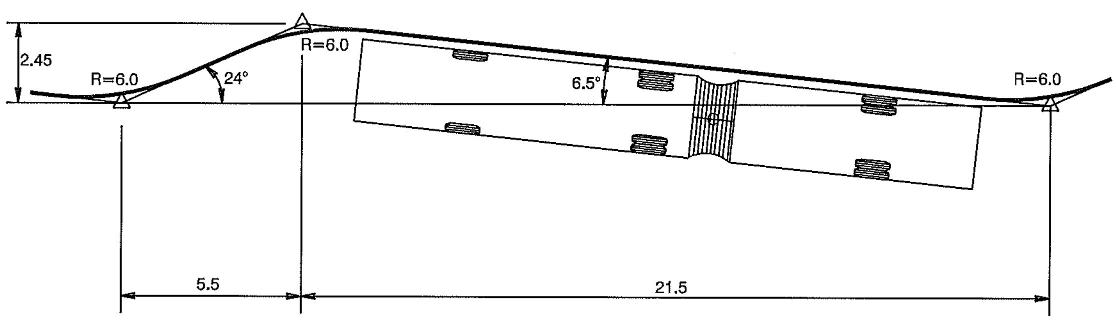
THE CITY OF Edmonton
STANDARD DRAWING

TRANSIT TURNAROUND (OFFSET)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 4300
Scale: N.T.S.	Checked By:		—	



STANDARD (12m) BUS SAWTOOTH TRANSIT BAY



ARTICULATED (18m) BUS SAWTOOTH TRANSIT BAY

NOTE:
CROSSWALKS SHALL BE ACCOMMODATED BY PROVIDING A 4.0m LENGTH OF STRAIGHT CURB BETWEEN CONSECUTIVE BAYS.

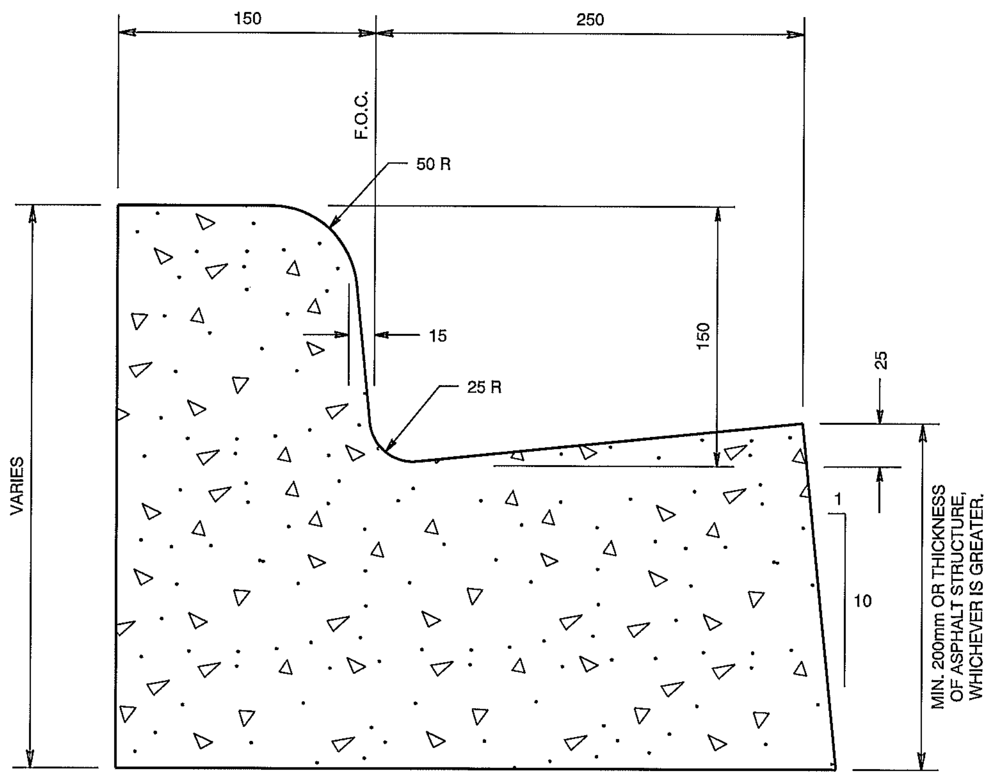
THE CITY OF Edmonton
STANDARD DRAWING

SAWTOOTH TRANSIT BAY - TRANSIT TERMINAL SITE

Date Approved: APRIL, 2011	Drawn By: KB	Approved	Revision #	Drawing # 4400
Scale: NTS	Checked By:			

CONSTRUCTION DETAILS
STANDARD DETAILS

SECTION 5000

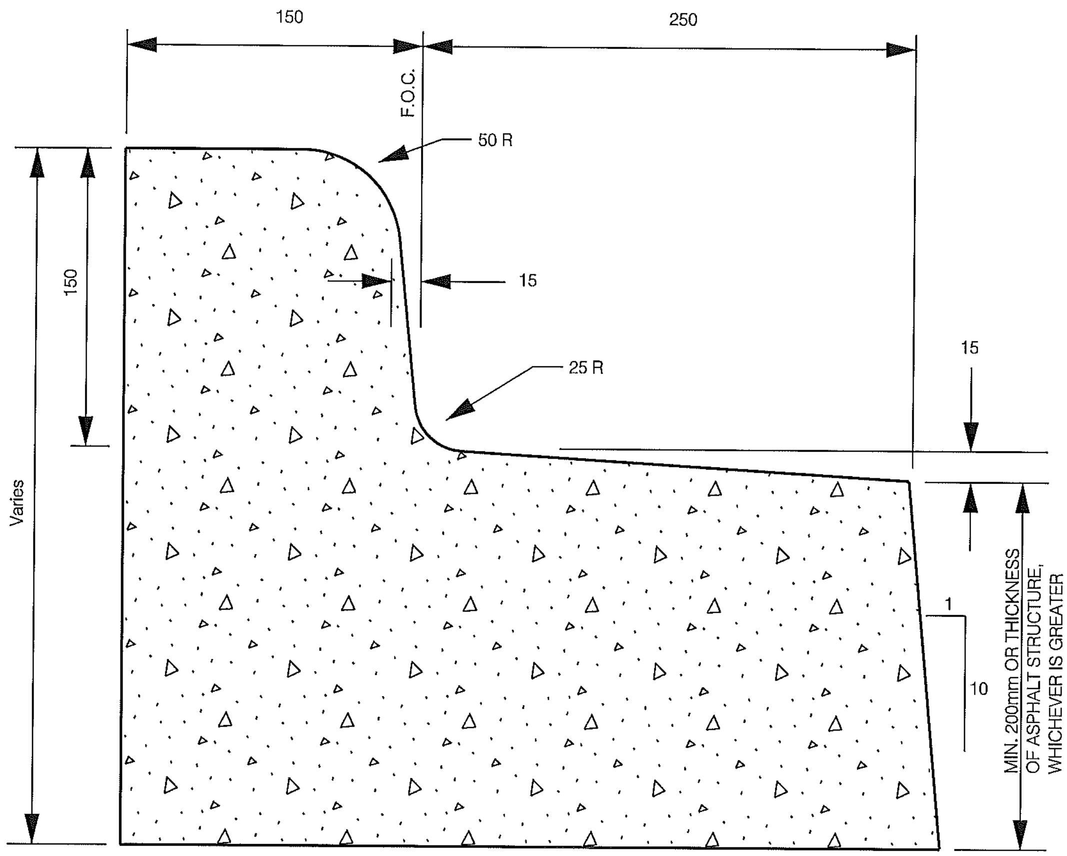


ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

150 CURB WITH 250 GUTTER

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5000
Scale: NTS	Checked By:		–	

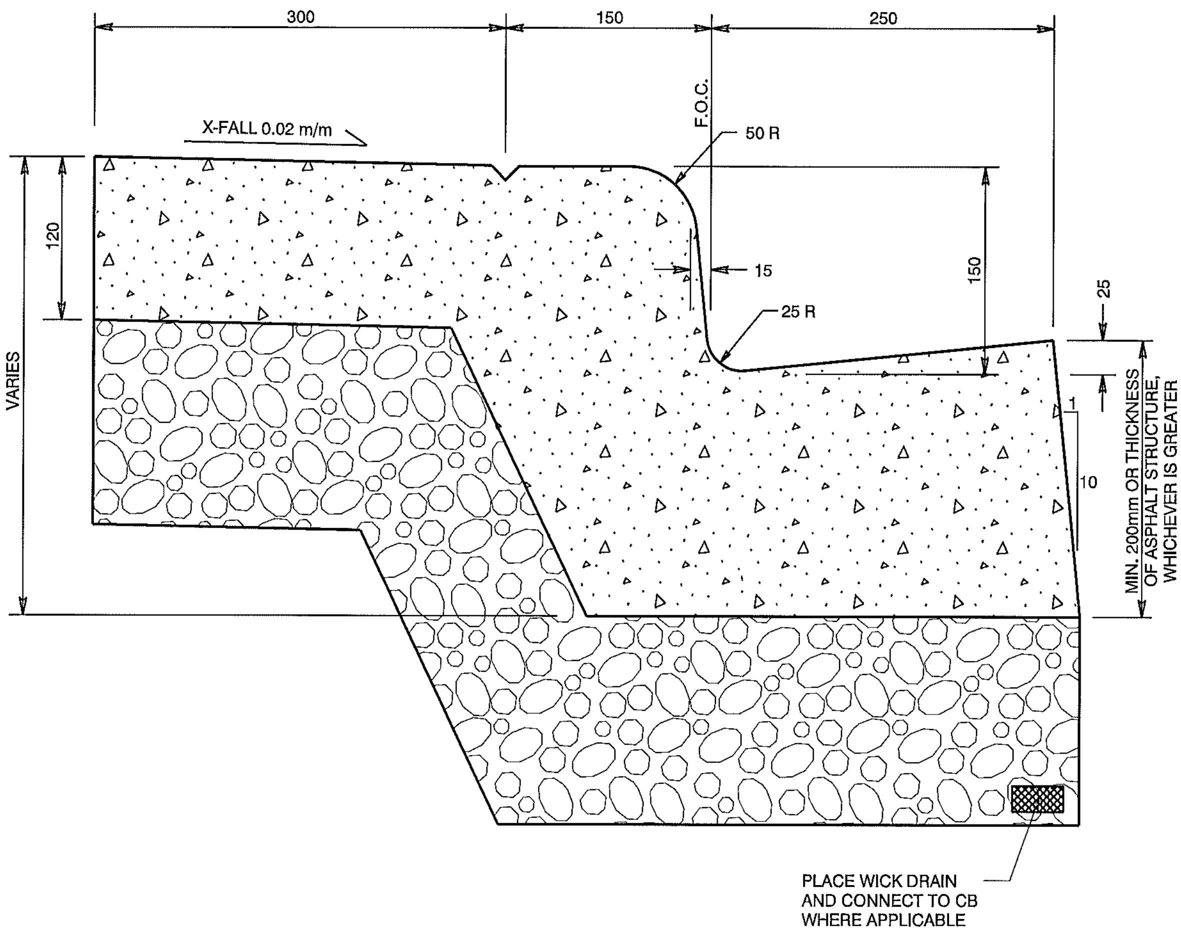


ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

150 CURB WITH REVERSE 250 GUTTER

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	GF			5001
Scale:	Checked By:			
N.T.S.				

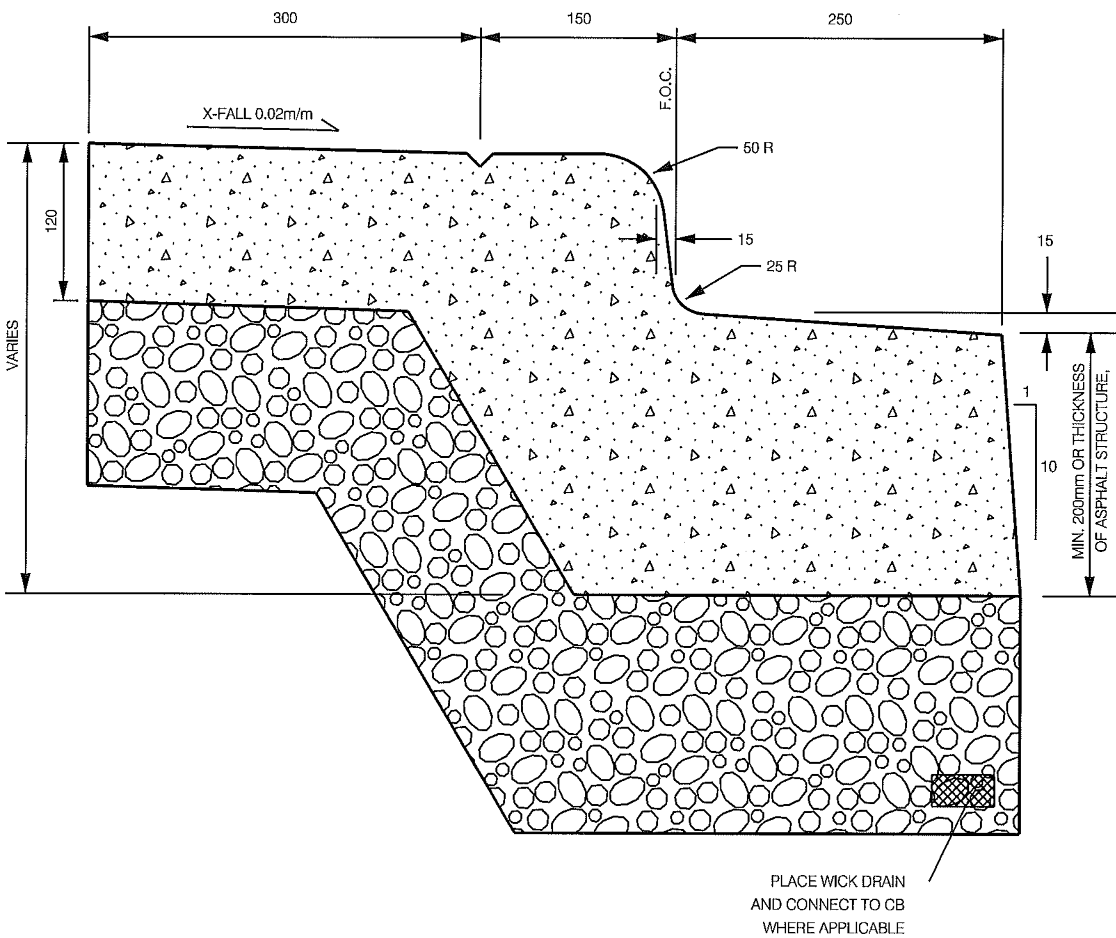


ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

150 CURB & 250 GUTTER WITH 300 MONO CONCRETE HEADER

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5010
Scale: NTS	Checked By:		—	

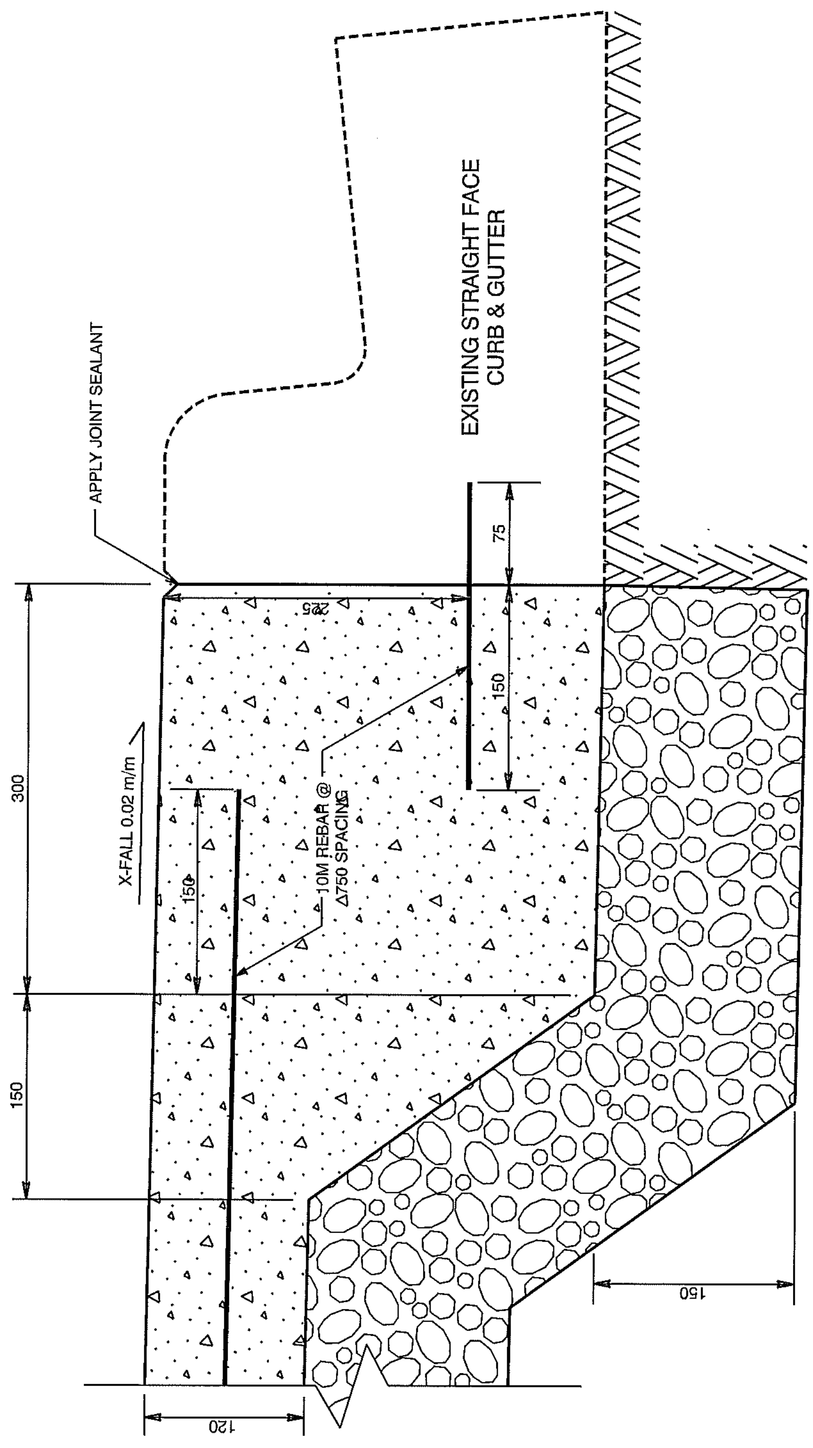


ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

150 CURB & 250 REVERSE GUTTER WITH MONO CONCRETE HEADER

Date Approved: FEB., 2011	Drawn By: GF	Approved	Revision #	Drawing # 5011
Scale: N.T.S.	Checked By:			



NOTES:

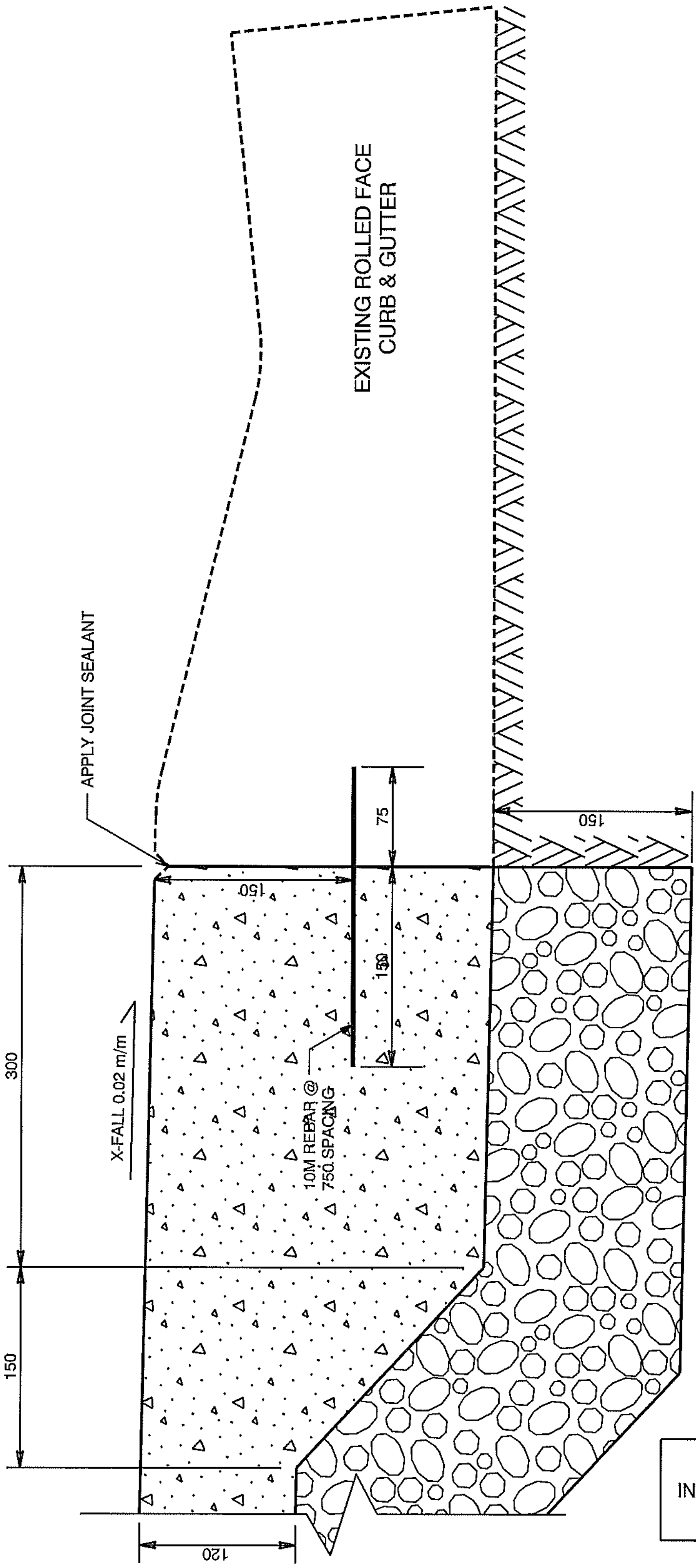
- ALL NEW CONSTRUCTION REQUIRES CURB LINE WALK AND BUS STOP PADS TO BE POURED MONOLITHCALLY WITH CURB AND GUTTER.
- THIS METHOD OF RETROFIT CONSTRUCTION CANNOT BE USED UNLESS AUTHORIZED BY THE CITY OF EDMONTON.

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

STRAIGHT FACE CONCRETE CURBLINE WALK / BUS STOP (RETROFIT)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5020
Scale: NTS	Checked By:		–	



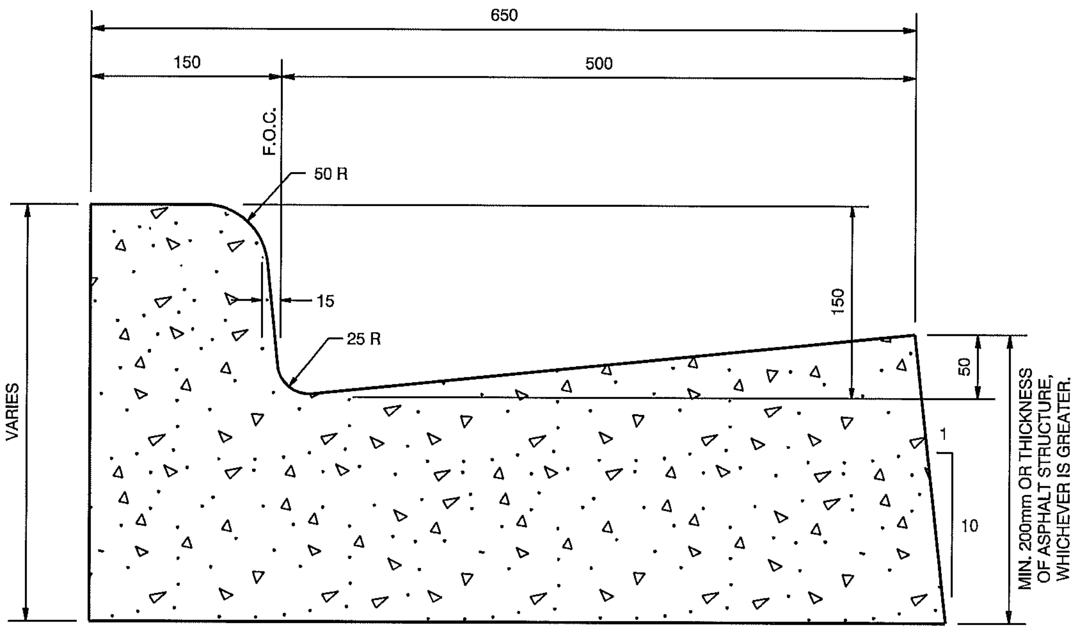
NOTES:
- ALL NEW CONSTRUCTION REQUIRES CURB LINE WALK AND BUS STOP PADS TO BE POURED MONOLITHCALLY WITH CURB AND GUTTER.
- THIS METHOD OF RETROFIT CONSTRUCTION CANNOT BE USED UNLESS AUTHORIZED BY THE CITY OF EDMONTON.

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

ROLL FACE CURBLINE WALK (RETROFIT)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5021
Scale: NTS	Checked By:		—	

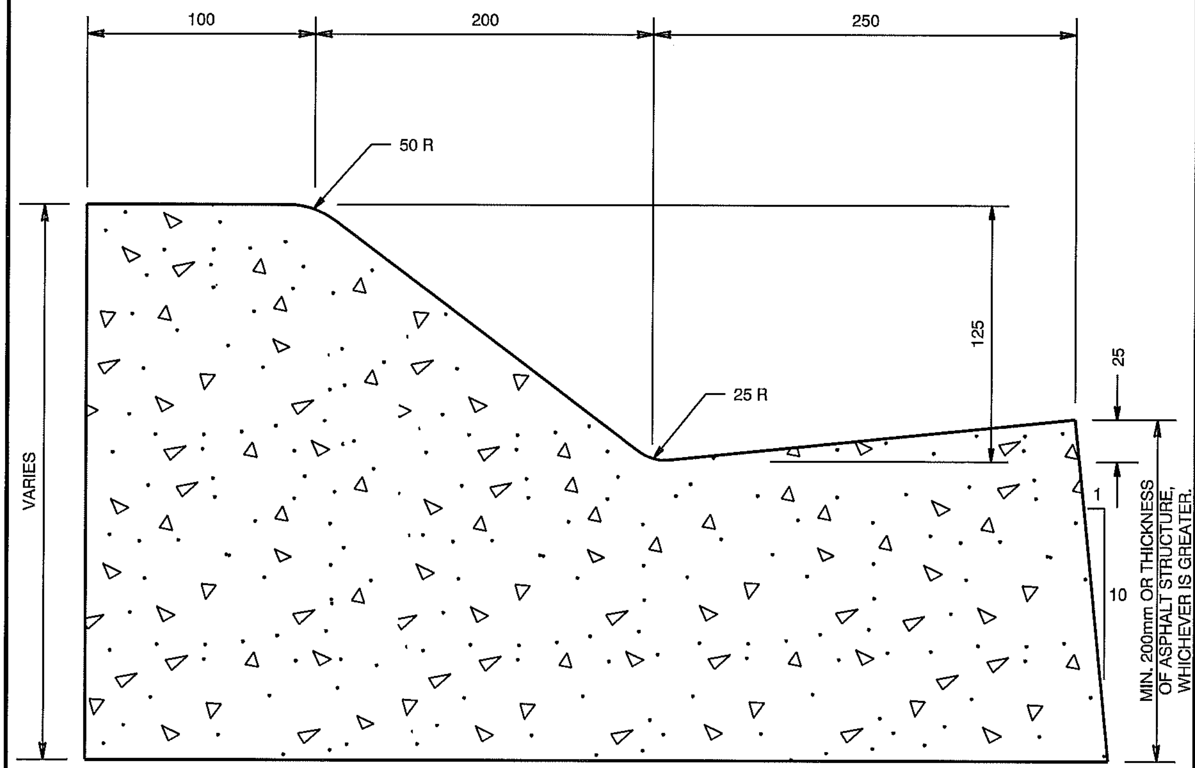


ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

150 CURB & 500 GUTTER (RETROFIT)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5022
Scale: N.T.S.	Checked By:		–	

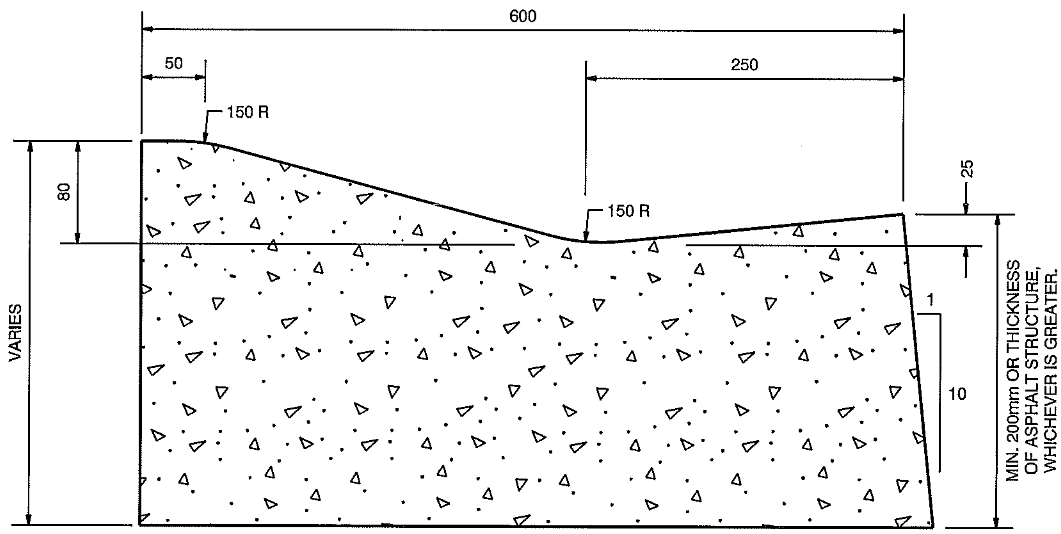


ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

125 SEMI-MOUNTABLE CURB & 250 GUTTER

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			5023
Scale: NTS	Checked By:			

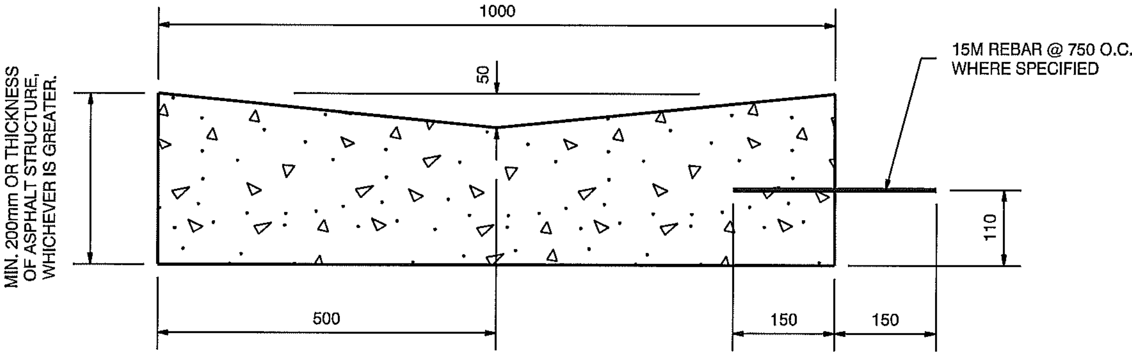


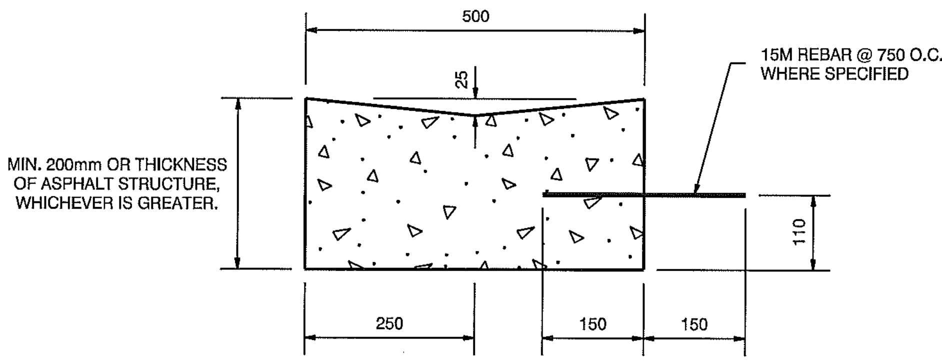
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

80 ROLL FACE CURB & 250 GUTTER

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW	Jody Ha[illegible]		5024
Scale: N.T.S.	Checked By: [illegible]			



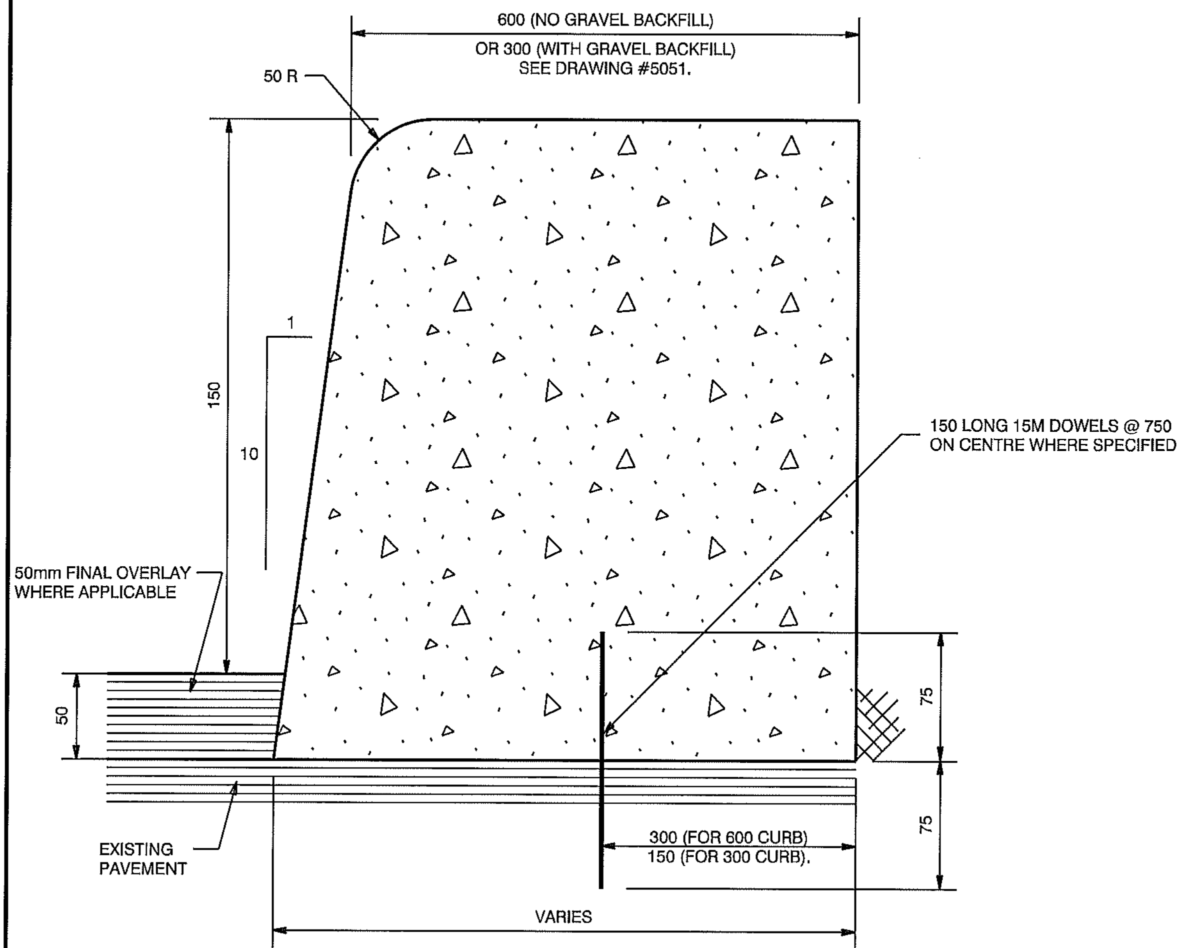


ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

500mm / 1000mm CONCRETE V-GUTTERS

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5030
Scale: N.T.S.	Checked By:			



ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

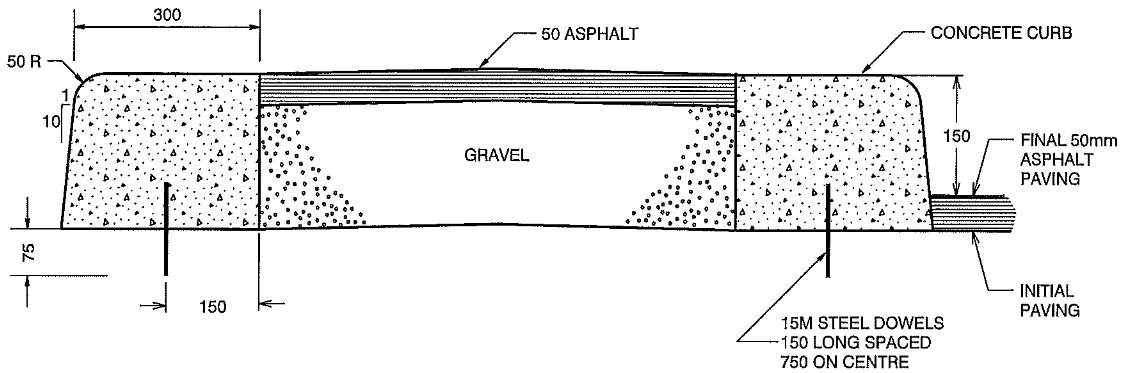
NOTES:

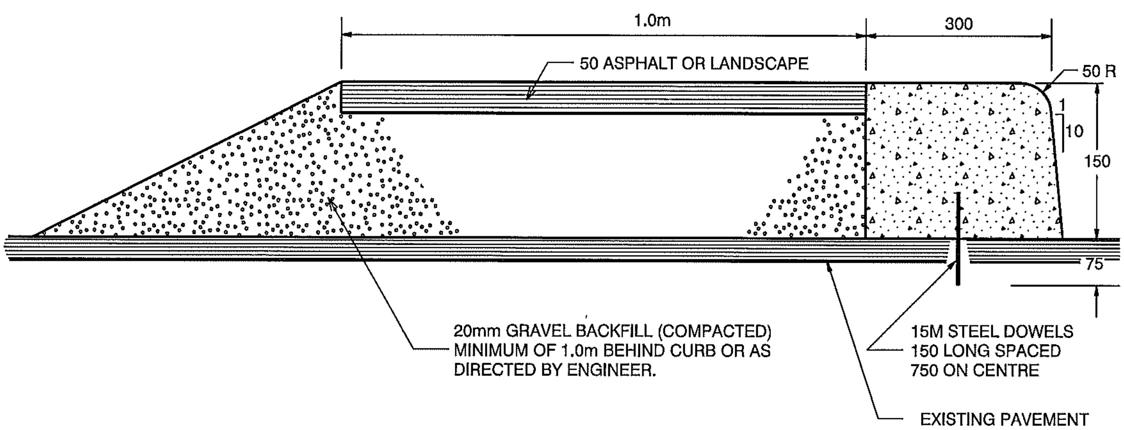
1. EXPOSED FACE OF CURB TO BE 150mm.

THE CITY OF Edmonton
STANDARD DRAWING

CONCRETE BARRIER CURB

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5040
Scale: NTS	Checked By:		–	





NOTES:

1. MAXIMUM EXPOSED FACE OR CURB TO BE 150mm.
2. INCREASE WIDTH OF CONCRETE CURB TO 600mm IF NO GRAVEL BACKFILL AND ASPHALT TOPPING.
3. CONCRETE CURB DETAIL SHOWN ON DRAWING #5040.

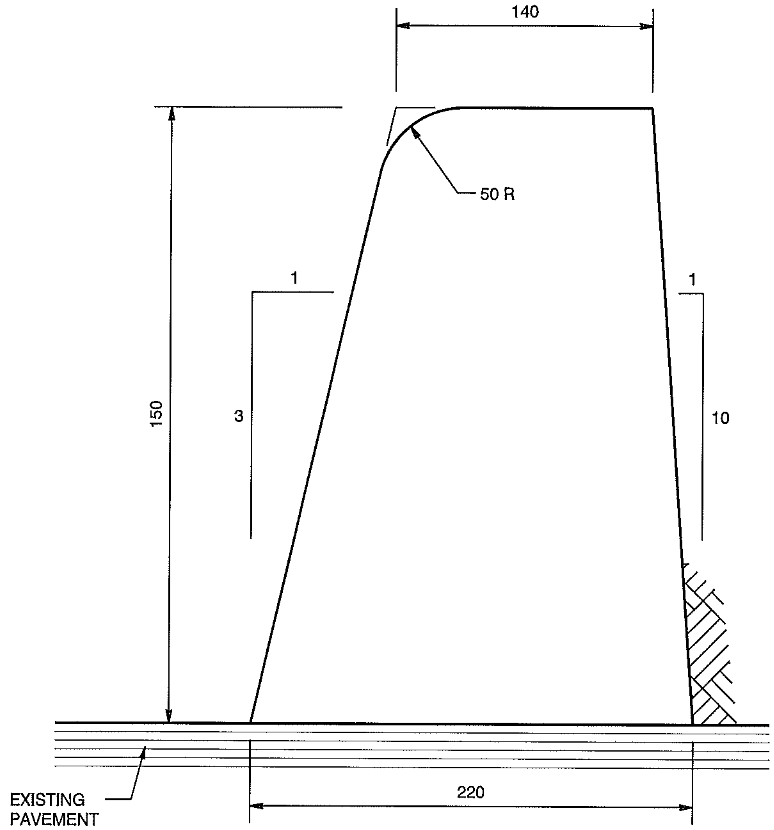
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton

STANDARD DRAWING

TEMPORARY SLAB-ON CONCRETE CURB

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5051
Scale: N.T.S.	Checked By:			

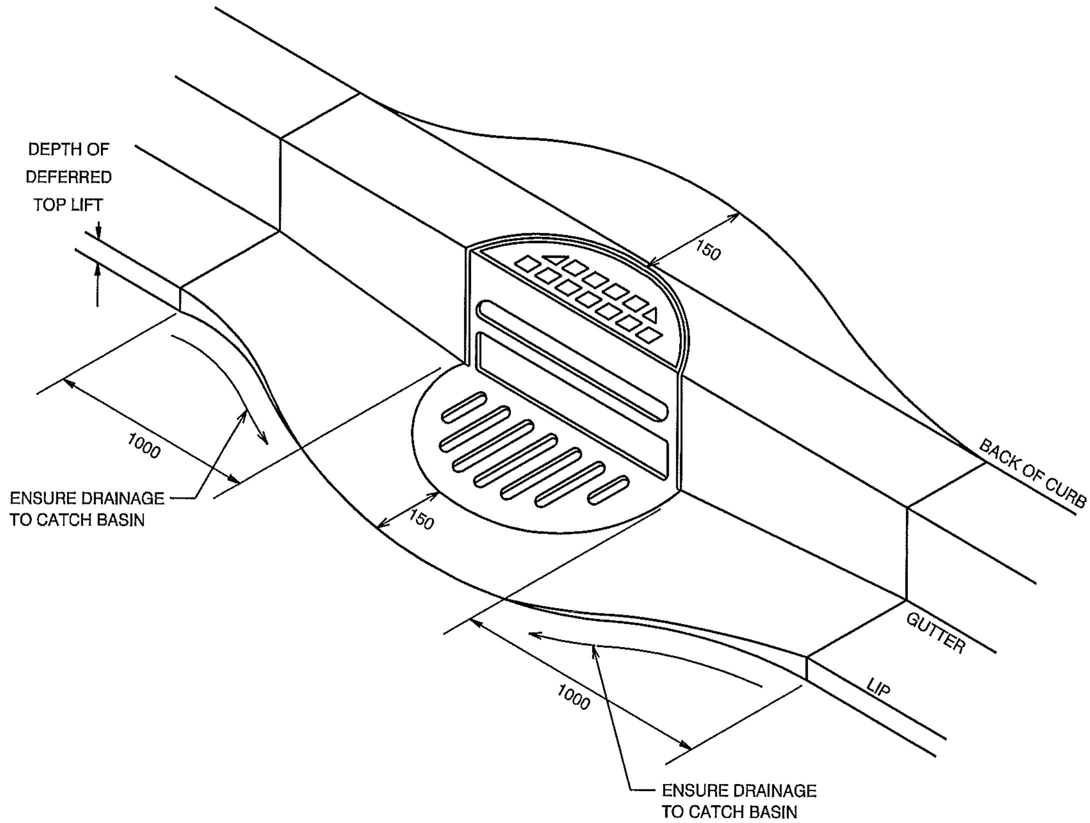


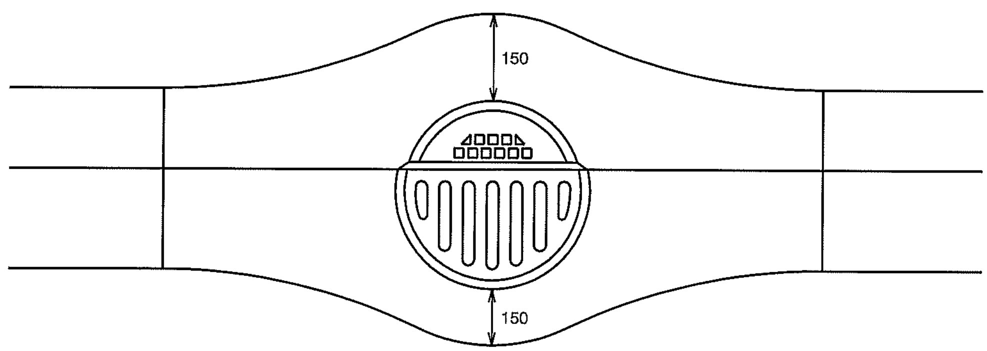
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF **Edmonton**
STANDARD DRAWING

TEMPORARY SLAB-ON ASPHALT CURB

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5052
Scale: N.T.S.	Checked By:		—	





PLAN VIEW

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

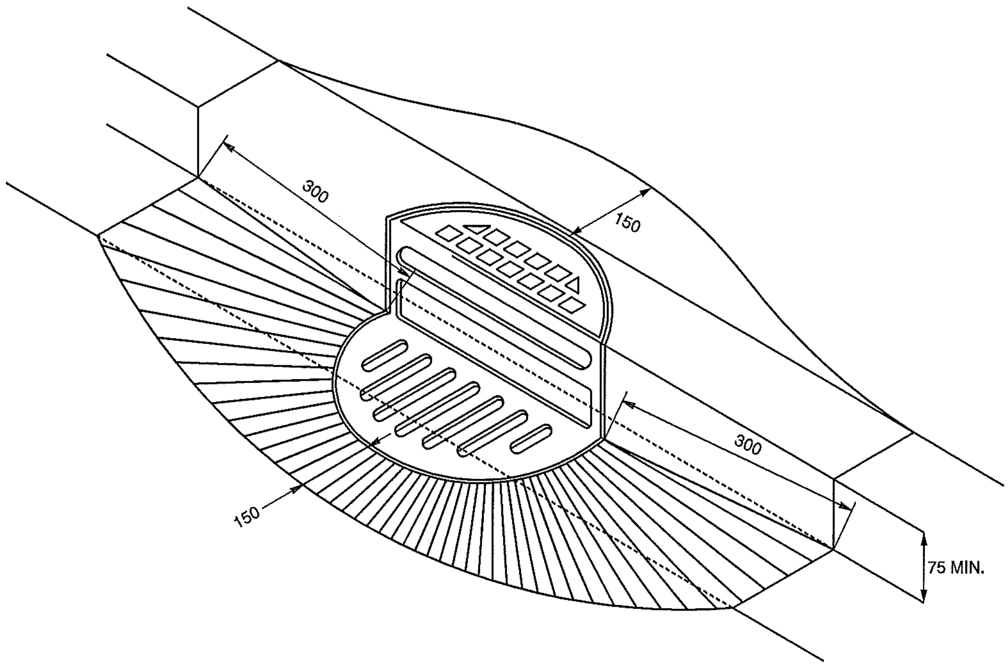
NOTES:

1. TYPICAL CURB AND GUTTER TREATMENT AT CATCH BASIN WHEN ASPHALT TOP LIFT IS DEFERRED. LOCATION TO BE DETERMINED BY ENGINEER.
2. MINIMUM 0.5% FOR 5.0m EACH DIRECTION ON SAG VERTICAL CURVE.

THE CITY OF Edmonton
STANDARD DRAWING

DEPRESSED CURB AND GUTTER FOR CATCH BASIN

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5060
Scale: N.T.S.	Checked By:			



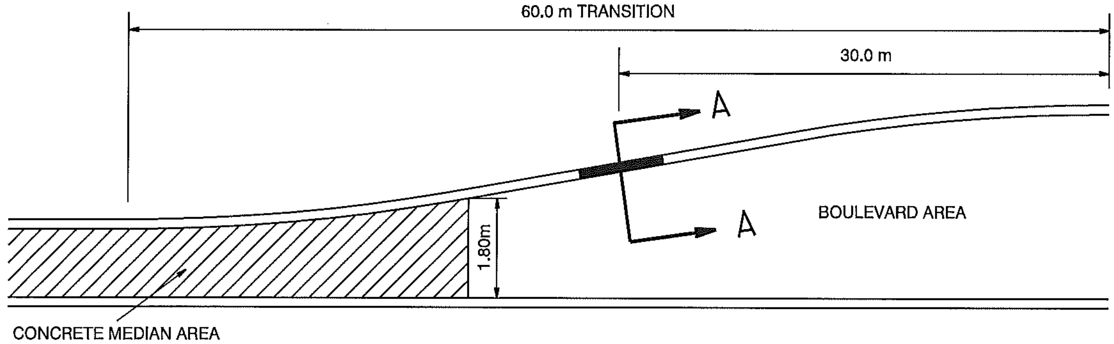
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

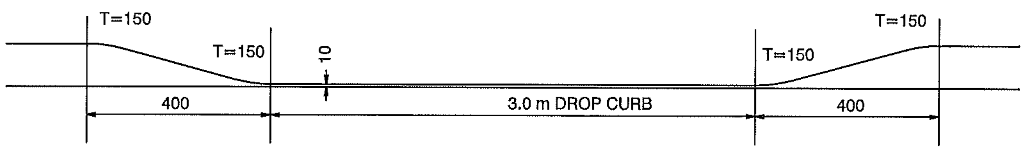
NOTES:
1. TYPICAL ASPHALT GRADING AROUND CATCH BASINS WITH 50mm OVERLAYS IN GUTTERS.

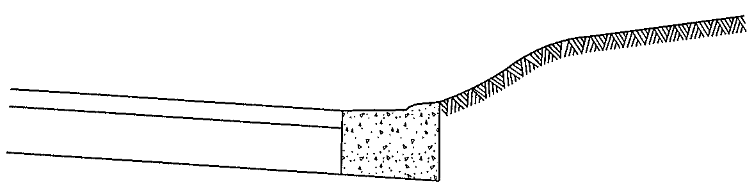
THE CITY OF Edmonton
STANDARD DRAWING

CATCH BASIN TREATMENT 50mm OVERLAY OF GUTTER

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			5061
Scale: N.T.S.	Checked By:		–	





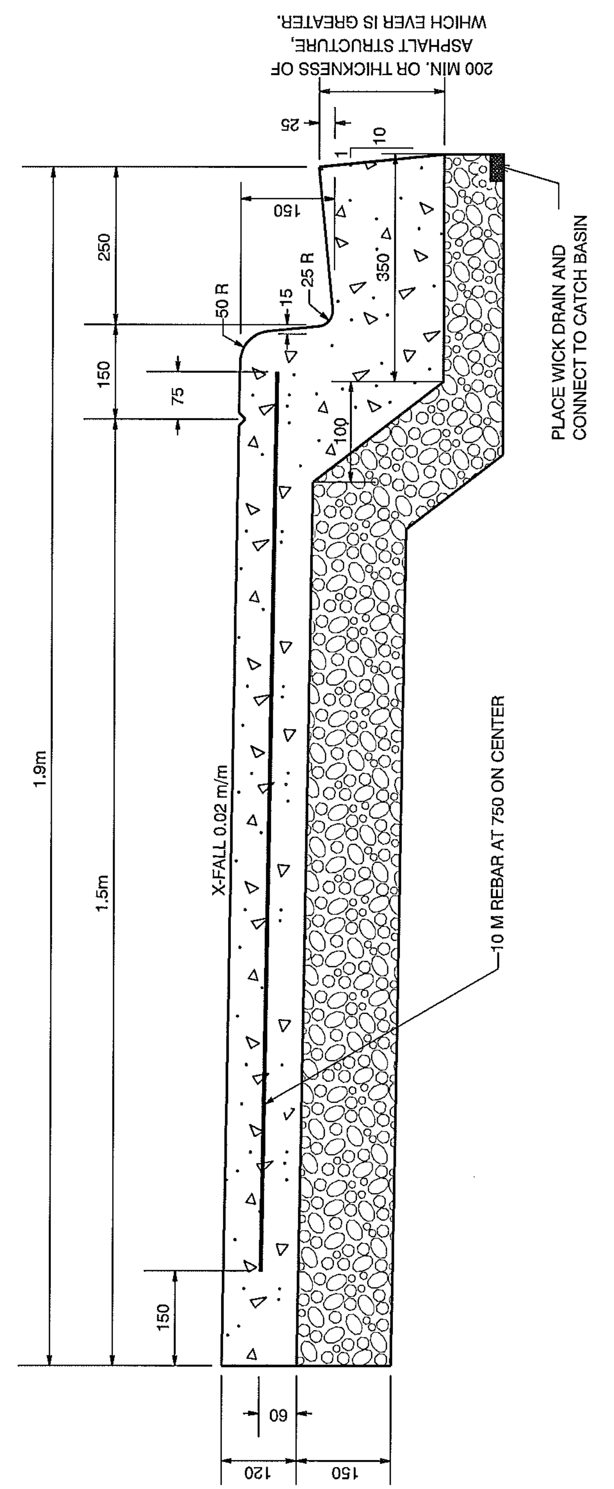


TYPICAL CROSS SECTION A-A

THE CITY OF Edmonton
STANDARD DRAWING

LAWN MOWER ACCESS TO MEDIAN

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5070
Scale: N.T.S.	Checked By:		—	

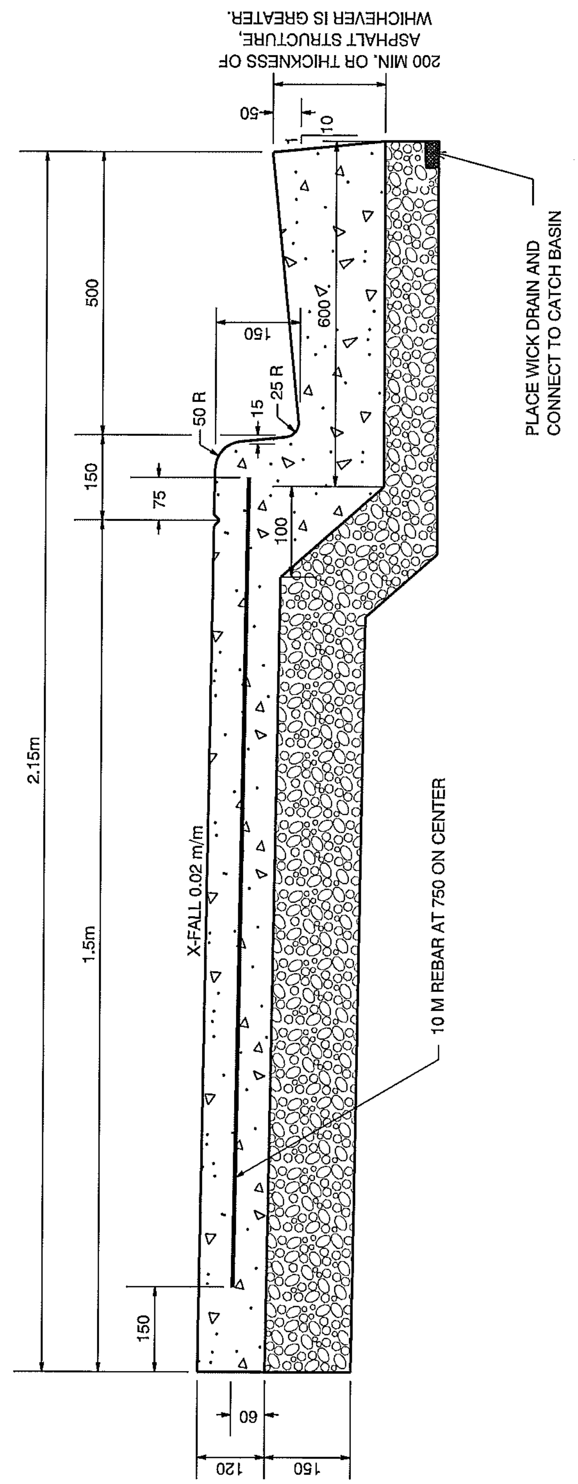


ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

1.5m MONOLITHIC WALK WITH 150 CURB AND 250 GUTTER

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			5100
Scale: N.T.S.	Checked By:			

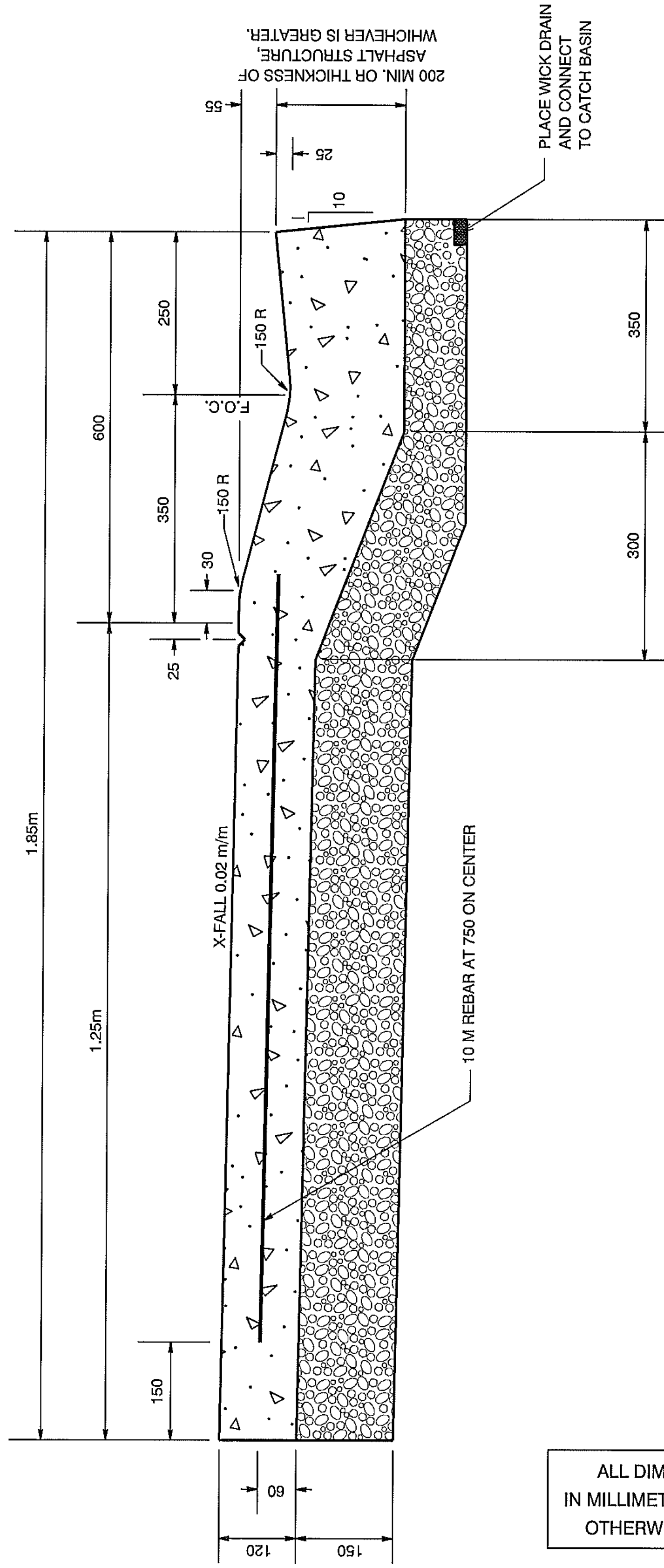


ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF **Edmonton**
STANDARD DRAWING

1.5m MONOLITHIC WALK WITH 150 CURB AND 500mm GUTTER (RETROFIT)

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			5110
Scale: N.T.S.	Checked By:			

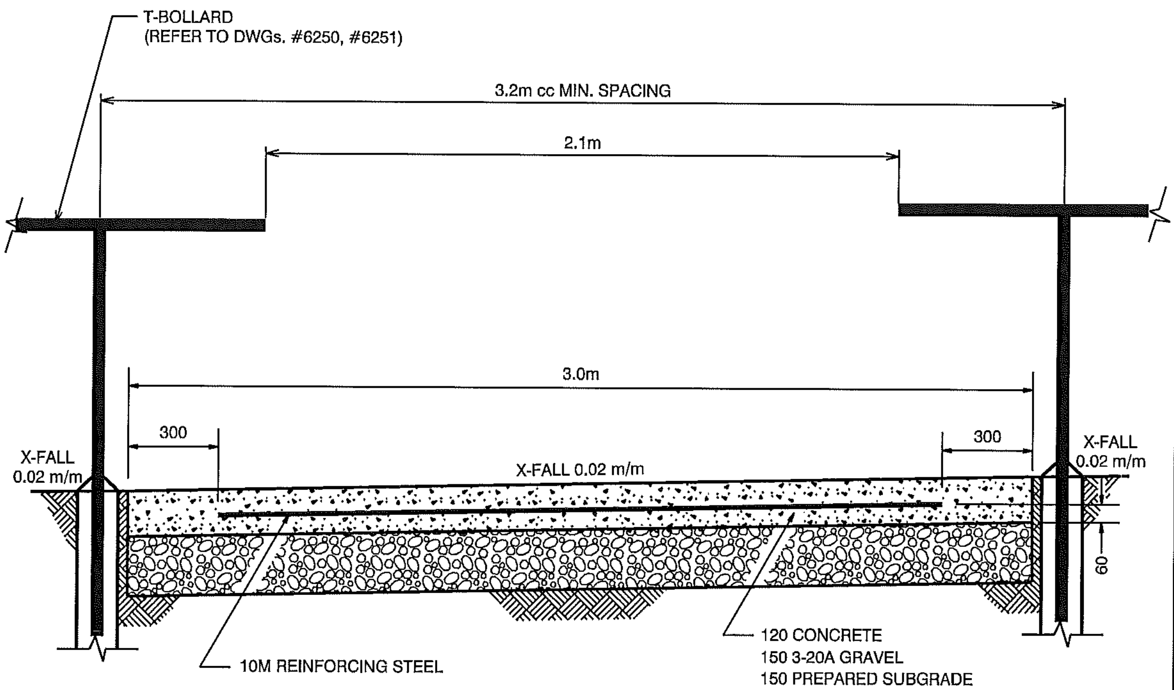


ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

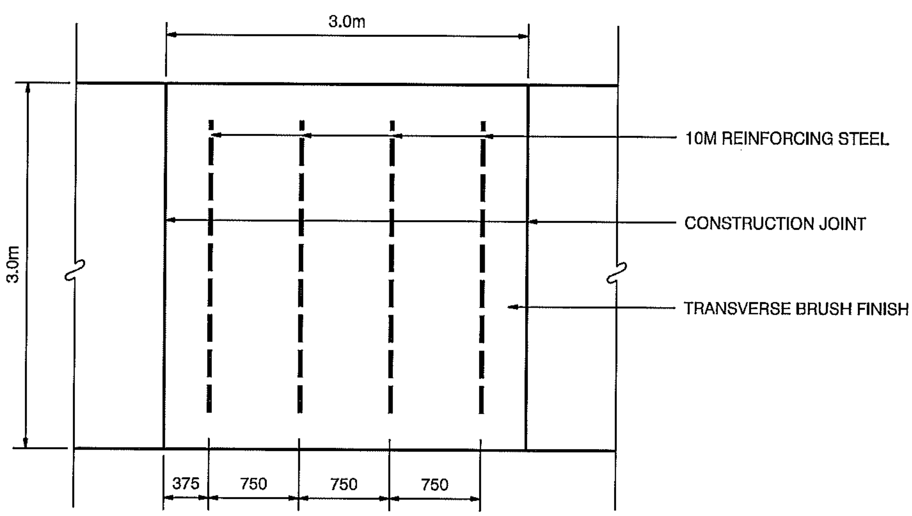
THE CITY OF **Edmonton**
STANDARD DRAWING

ROLL FACE MONOLITHIC WALK AND GUTTER

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5120
Scale: N.T.S.	Checked By:			



TYPICAL SECTION



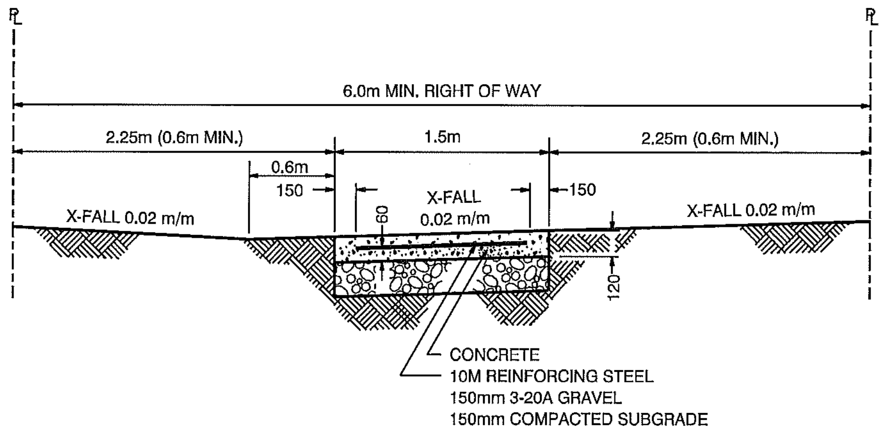
PLAN VIEW

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

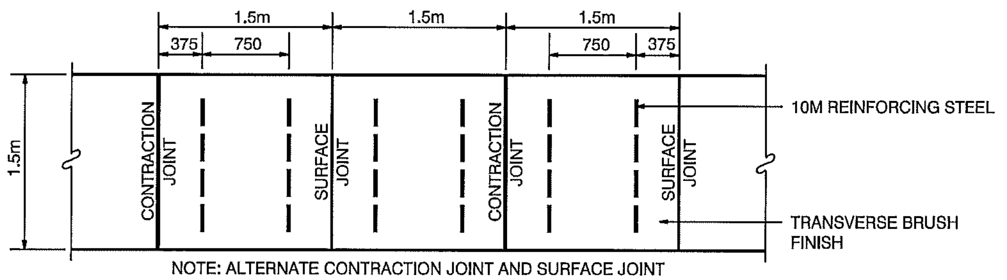
THE CITY OF Edmonton
STANDARD DRAWING

EMERGENCY ACCESS ROAD - CONCRETE

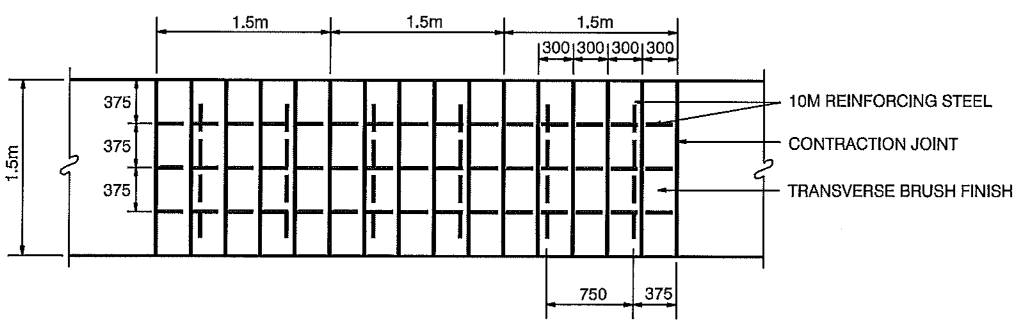
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5130
Scale: N.T.S.	Checked By:			



TYPICAL SECTION



TYPICAL PLAN VIEW



SPECIAL TREATMENT PLAN VIEW

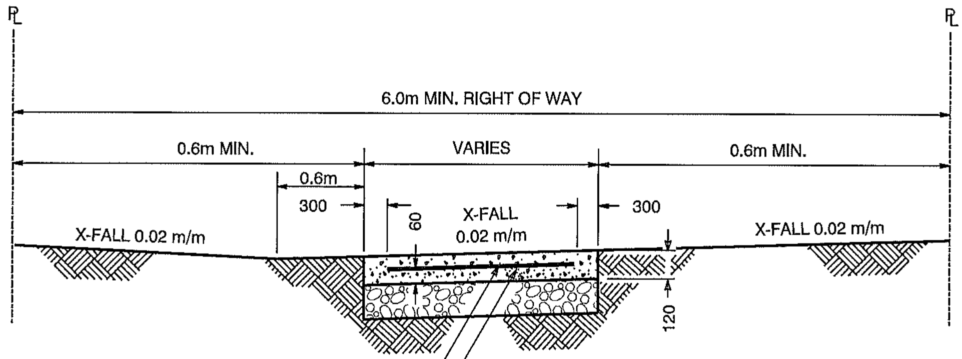
NOTES:
1. SPECIAL TREATMENT ADJACENT TO EXISTING TREES AS REQUESTED BY ENGINEER.
2. USE ALL CONTRACTION JOINTS WITHIN SPECIAL TREATMENT AREA.
3. LONGITUDINAL REBARS MUST BE CONTINUOUS AND TIED TO THE TRANSVERSE REBARS.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

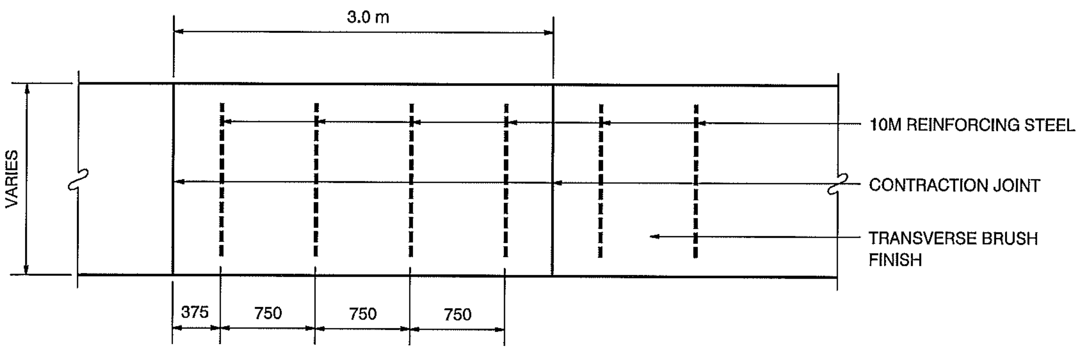
THE CITY OF Edmonton
STANDARD DRAWING

CONCRETE WALKWAY - 1.5m

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			5140
Scale: N.T.S.	Checked By:			



TYPICAL SECTION



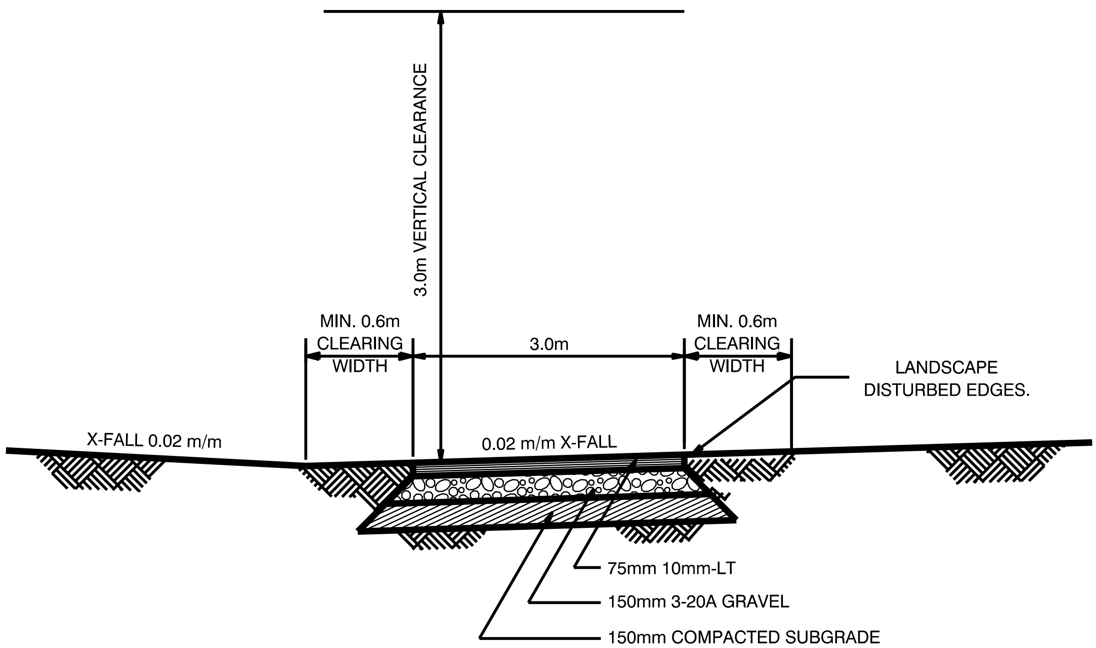
PLAN VIEW

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

CONCRETE WALKWAY GREATER THAN 1.5 m

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5150
Scale: N.T.S.	Checked By:		–	



TYPICAL SECTION

NOTE:

FOR 3.0m SHARED-PATH WIDTH,
A 100mm SOLID YELLOW CENTER
LINE IS REQUIRED AT THE DISCRETION
OF TRANSPORTATION DEPARTMENT.

ALTERNATE STRUCTURE:

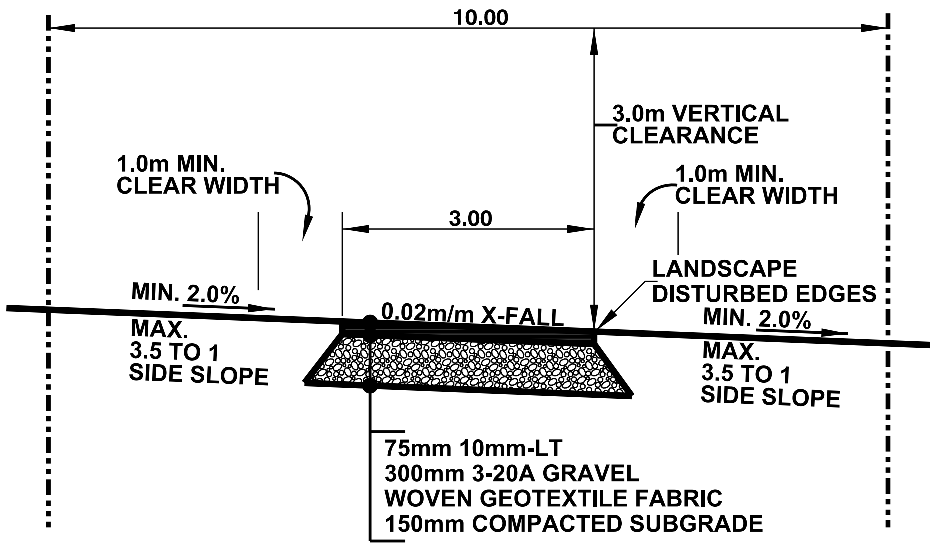
- 75mm 10mm-LT
- 300mm 3-20A GRAVEL ON WOVEN GEOTEXTILE FABRIC NILEX 2002 OR LAYFIELD LP200 OR EQUIVALENT EXTENDED UP EDGES OF GRAVEL ON NATIVE GROUND.

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

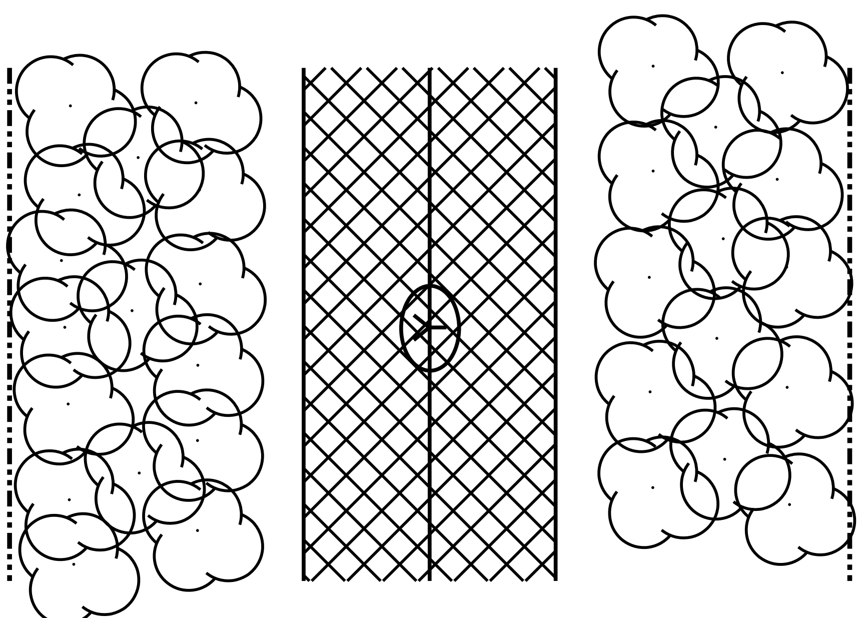
SHARED USE PATH

Date Approved: FEB, 2015	Drawn By: JW	Approved: Rhonda Toohey	Revision #	Drawing # 5160
Scale: N.T.S.	Checked By: MP			



TYPICAL CROSS SECTION

NOTE:
FOR SHARE-USE PATH WIDTH 3.0m
OR GREATER, A 100mm SOLID YELLOW
CENTER LINE IS REQUIRED AT DISCRETION
OF TRANSPORTATION DEPARTMENT.



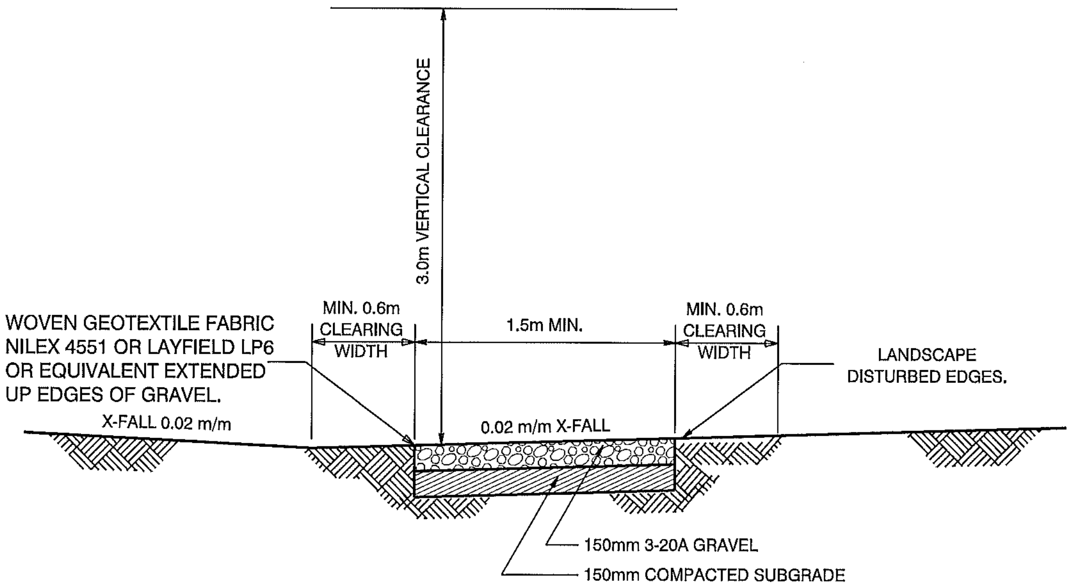
TYPICAL PLAN VIEW

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

TOP OF BANK TRAIL

Date Approved: FEB, 2015	Drawn By: KLB	Approved: Rhonda Toohey	Revision #	Drawing # 5165
Scale: N.T.S.	Checked By: MP			



TYPICAL SECTION

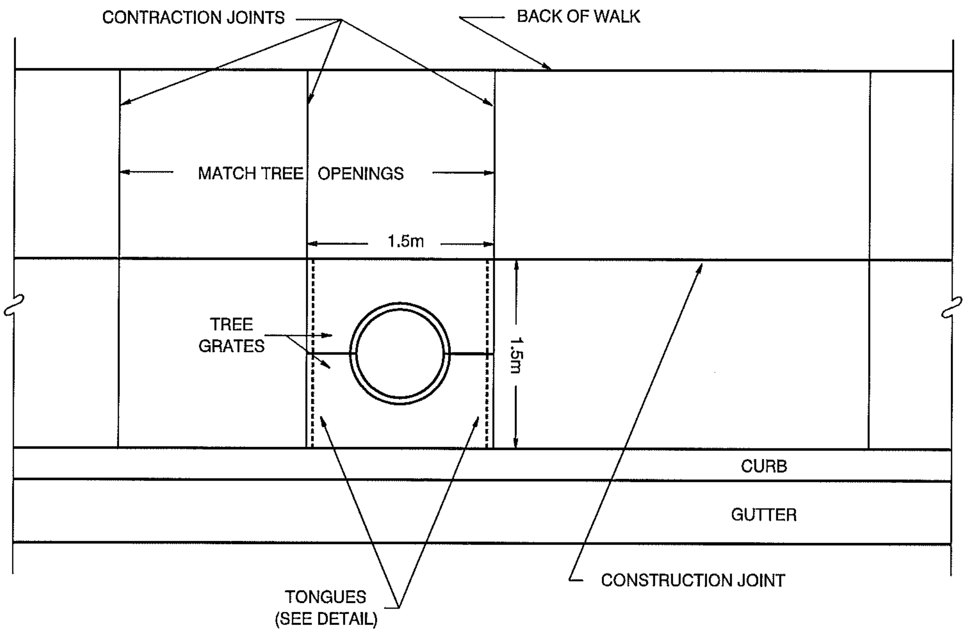
ALTERNATE STRUCTURE: - 300mm 3-20A GRAVEL WITH GEOTEXTILE NILEX 4551 OR LAYFIELD LP6 OR EQUIVALENT ON NATIVE GROUND.

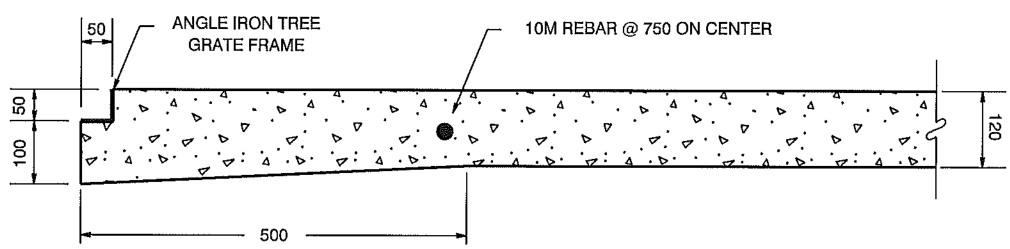
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

GRANULAR WALKWAY

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5170
Scale: N.T.S.	Checked By:		—	





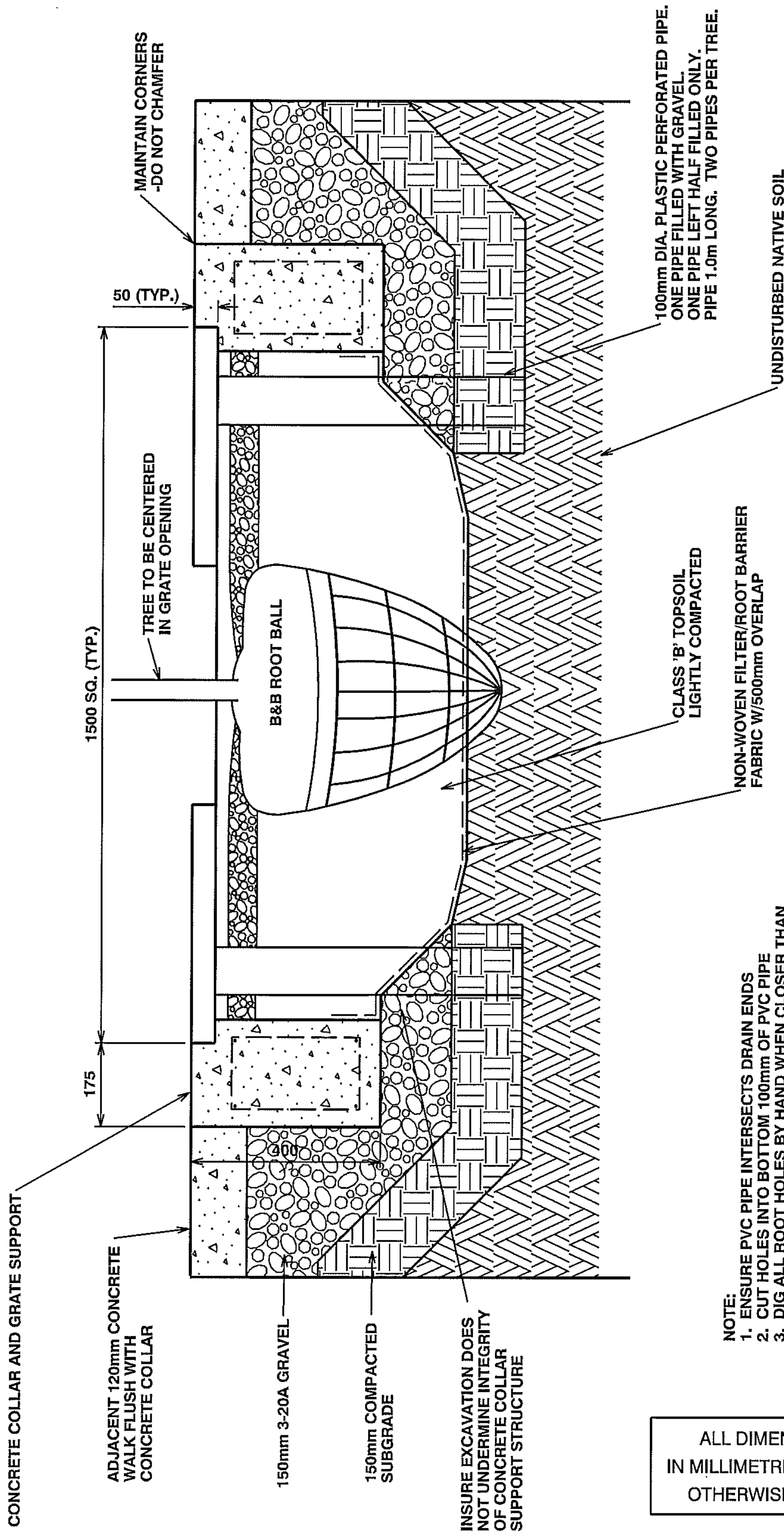
DETAIL OF TONGUE FOR
SUPPORT OF TREE GRATES

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

SIDEWALK CONSTRUCTION AT TREE OPENING

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5180
Scale: N.T.S.	Checked By:		—	



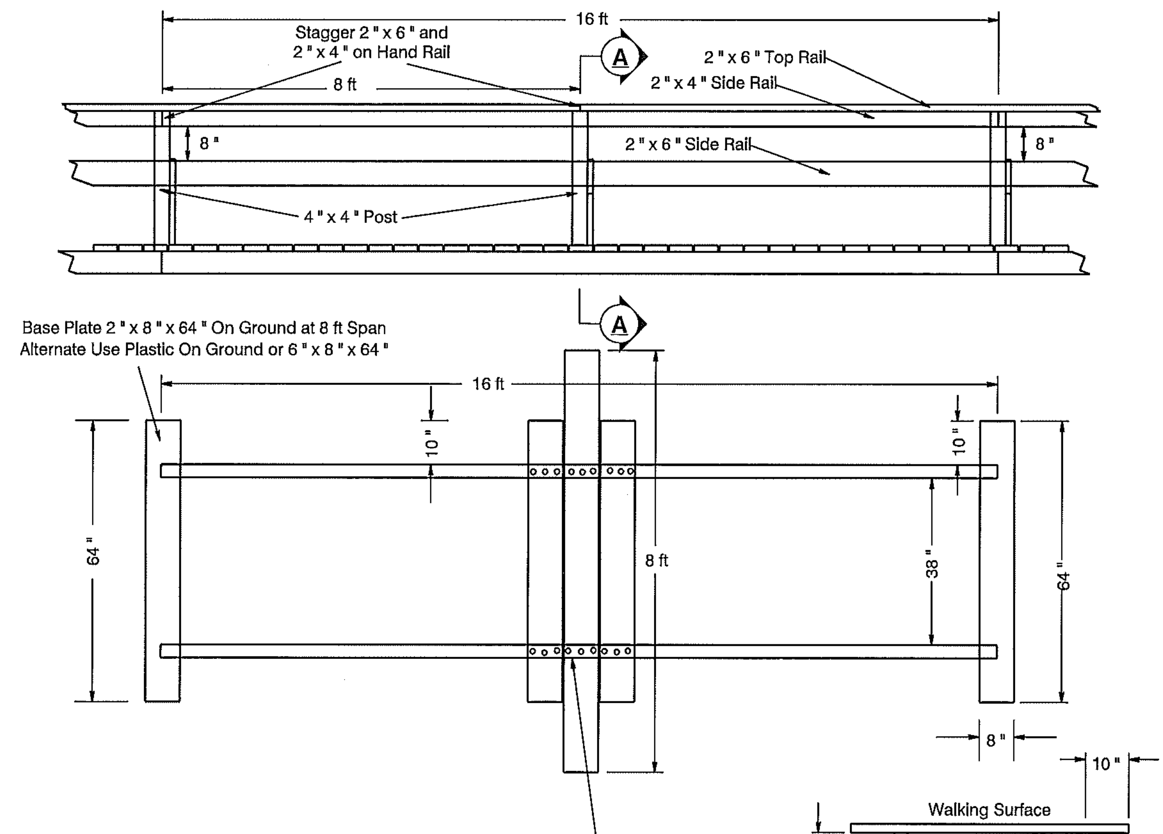
NOTE:
1. ENSURE PVC PIPE INTERSECTS DRAIN ENDS
2. CUT HOLES INTO BOTTOM 100mm OF PVC PIPE
3. DIG ALL ROOT HOLES BY HAND WHEN CLOSER THAN 1.0m TO U.G. POWER, TELEPHONE AND GAS ALIGNMENTS.

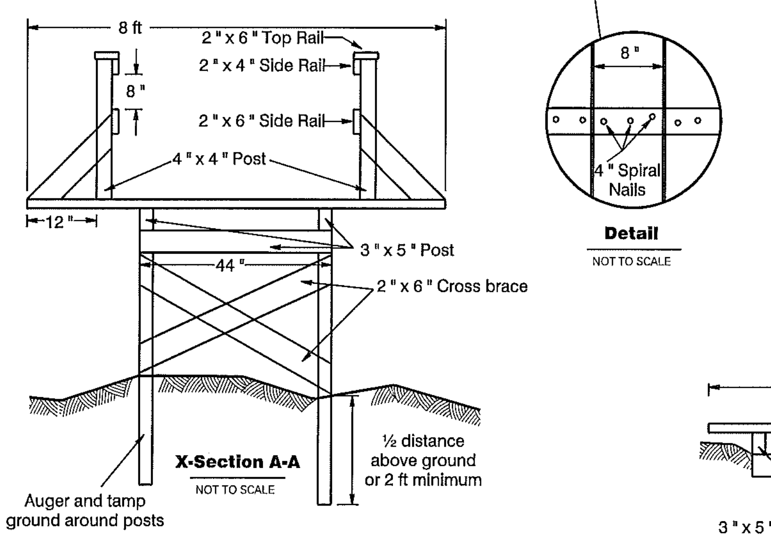
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

BOULEVARD TREE PIT DETAIL

Date Approved: FEB, 2011	Drawn By: KA	Approved	Revision #	Drawing # 5190
Scale: N.T.S.	Checked By:			



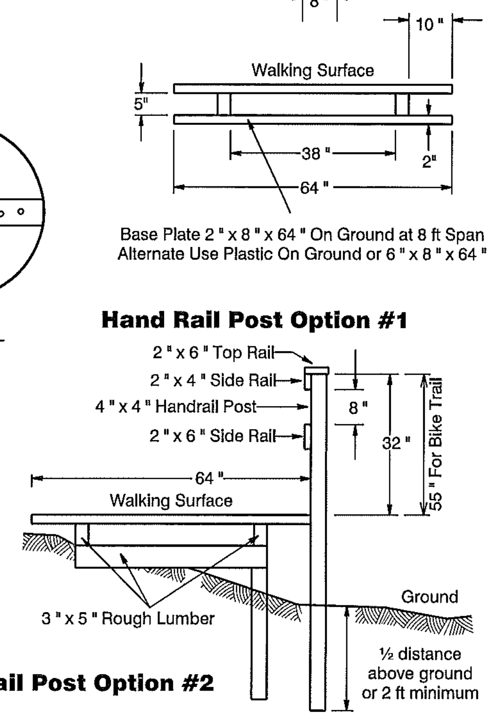


X-Section A-A

NOT TO SCALE

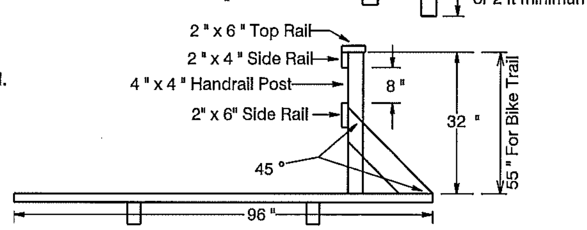
Detail

NOT TO SCALE



Hand Rail Post Option #1

Hand Rail Post Option #2



NOTES:

1. Stringers Are 3 " x 5 " x 16 ′ Rough Pressure Treated.
2. Base Plate:
   a: 2 " x 8 " x 64 " Rough Pressure Treated.
   b: 2⅜" x 5½" Plastic Wood"
   c: 6 " x 8 " x 64 " Pressure Treated.
3. Top Boards or Walking Surface 2 " x 8 " x 64 " Rough Pressure Treated.
4. Hand Rail:
   a: 2 " x 4 " x 16 ′ S/4/S Pressure Treated (Side Rail).
   b: 2 " x 6 " x 16 ′ S/4/S Pressure Treated (Top Rail).
   c: 4 " x 4 " x 32 " S/4/S Pressure Treated (Handrail Post).
5. Braces 2 " x 8 " Rough Pressure Treated Outlook to Hold Hand Rail.
6. Use 4 " Spiral Nails.
7. All Dimensions are Nominal Imperial Units to Correspond to Standard Lumber Sizes.

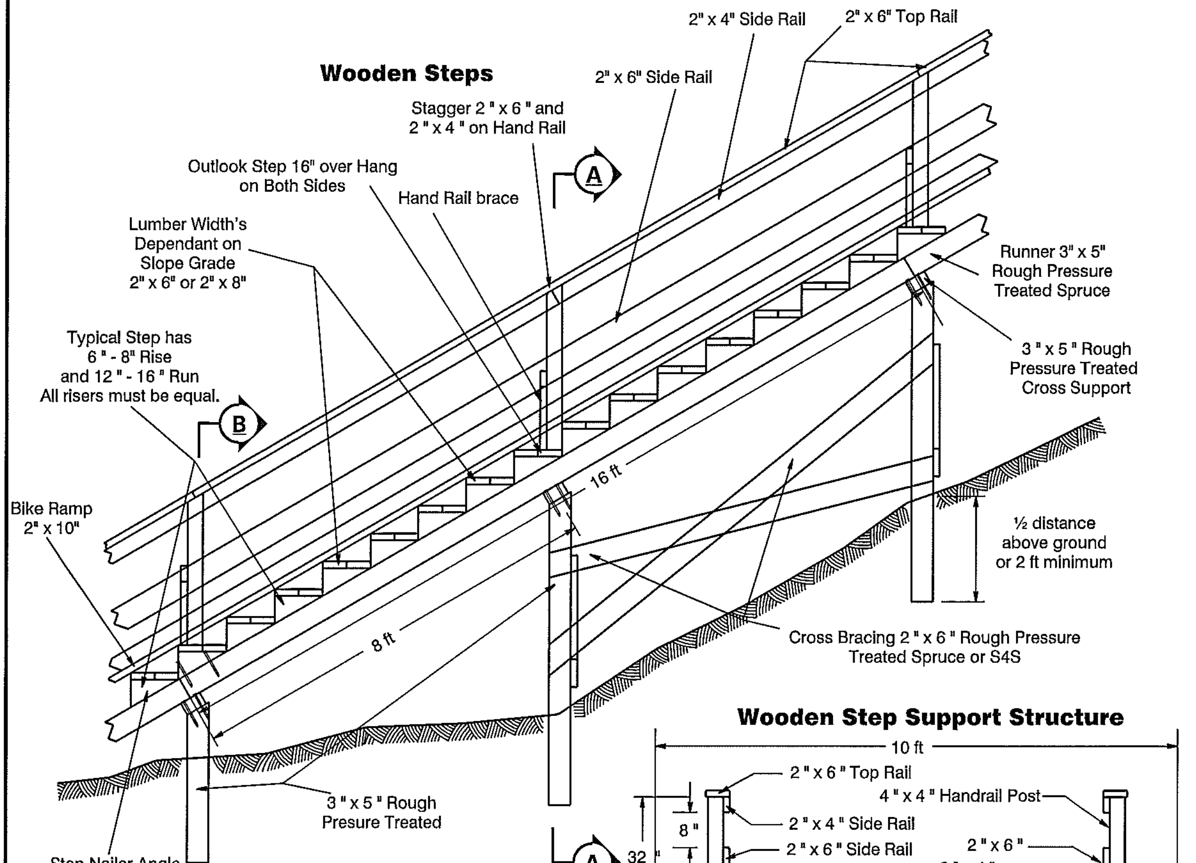
THE CITY OF Edmonton

STANDARD DRAWING

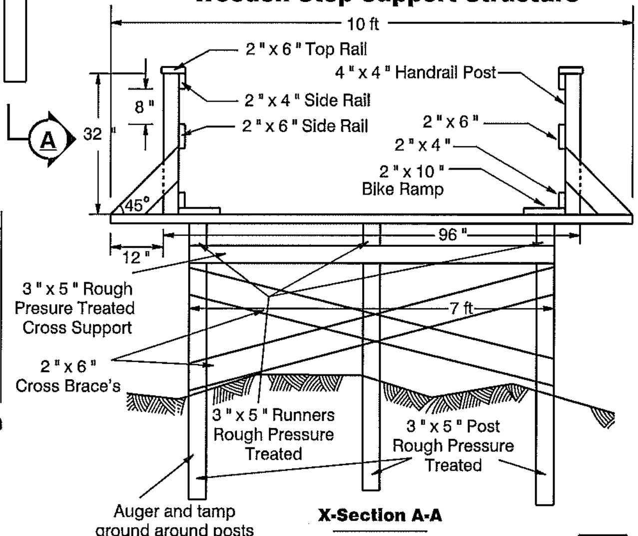
WOODEN WALK

Date Approved: FEB., 2011	Drawn By: JW	Approved:	Revision # ----	Drawing # 5200
Scale: NTS	Checked By:			

Wooden Steps



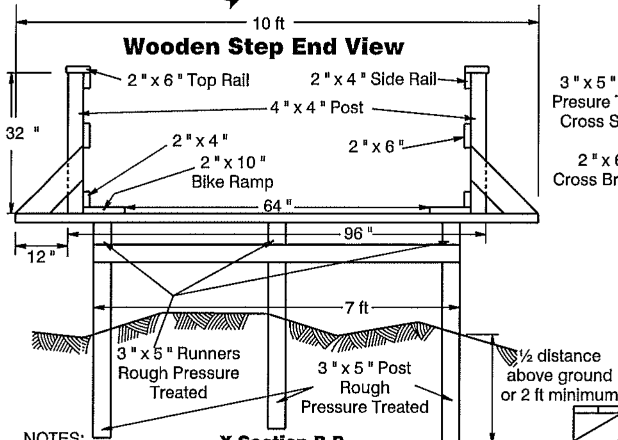
Wooden Step Support Structure



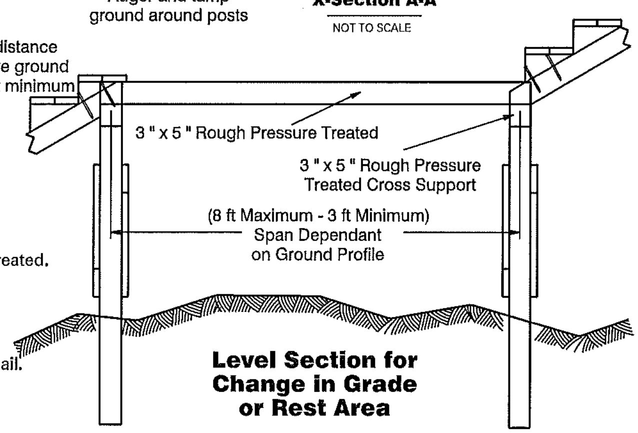
X-Section A-A

NOT TO SCALE

Wooden Step End View



X-Section B-B



Level Section for Change in Grade or Rest Area

NOTES:

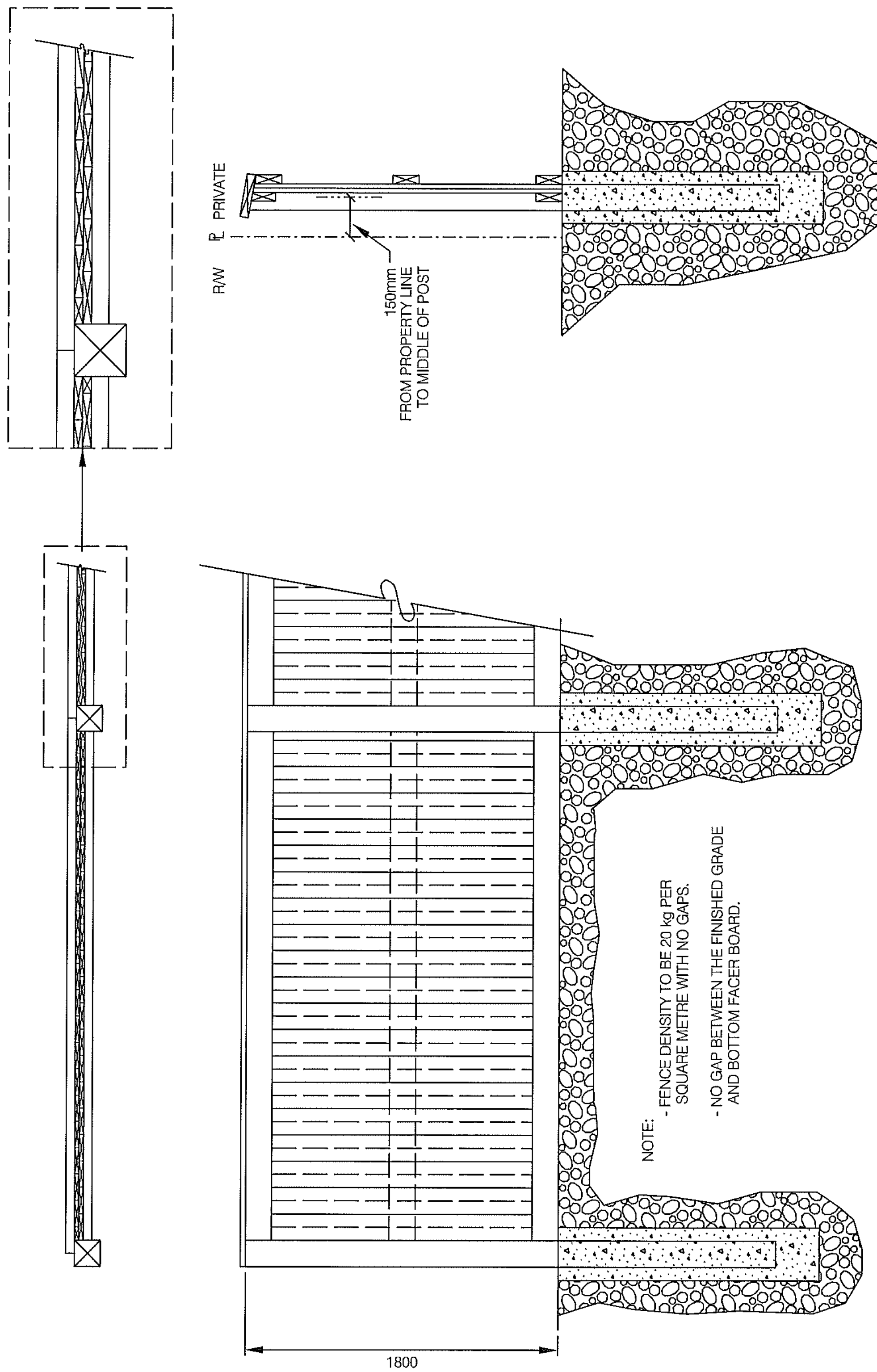
1. Stringers Are 3 " x 5 " x 16 ′ Rough Pressure Treated.
2. Base Plate:
   a: 2 " x 8 " x 64 " Rough Pressure Treated.
   b: 2⅜" x 5½" Plastic Wood"
   c: 6 " x 8 " x 64 " Pressure Treated.
3. Top Boards or Walking Surface 2 " x 8 " x 64 " Rough Pressure Treated.
4. Hand Rail:
   a: 2 " x 4 " x 16 ′ S/4/S Pressure Treated (Side Rail).
   b: 2 " x 6 " x 16 ′ S/4/S Pressure Treated (Top Rail).
   c: 4 " x 4 " x 32 " S/4/S Pressure Treated (Handrail Post).
5. Braces 2 " x 8 " Rough Pressure Treated Outlook to Hold Hand Rail.
6. Use 4 " Spiral Nails.
7. All Dimensions are nominal imperial units to correspond to standard lumber sizes.

THE CITY OF Edmonton

STANDARD DRAWING

WOODEN STAIRS AND SUPPORT STRUCTURE

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			5201
Scale: NTS	Checked By:			

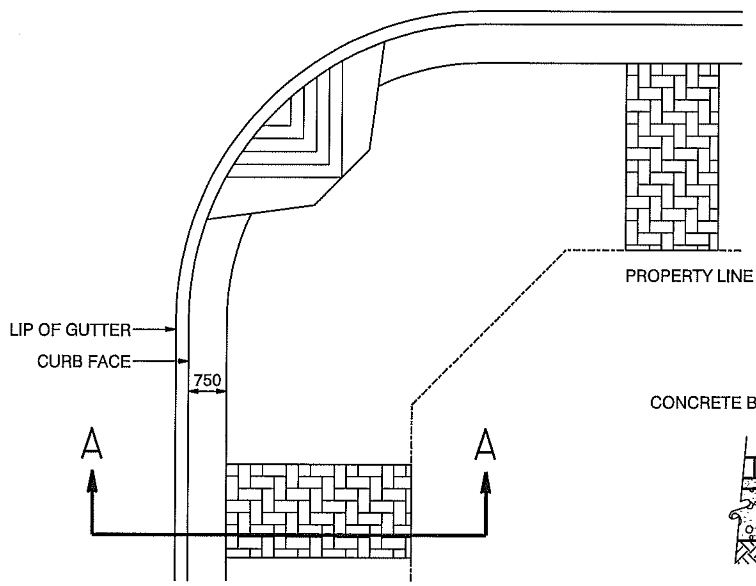


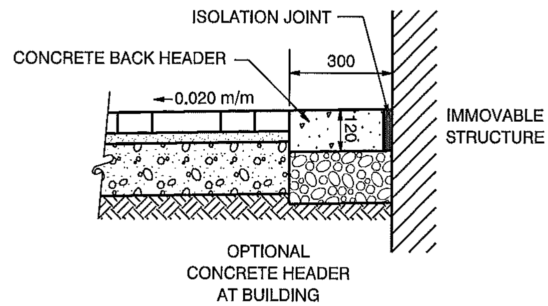
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

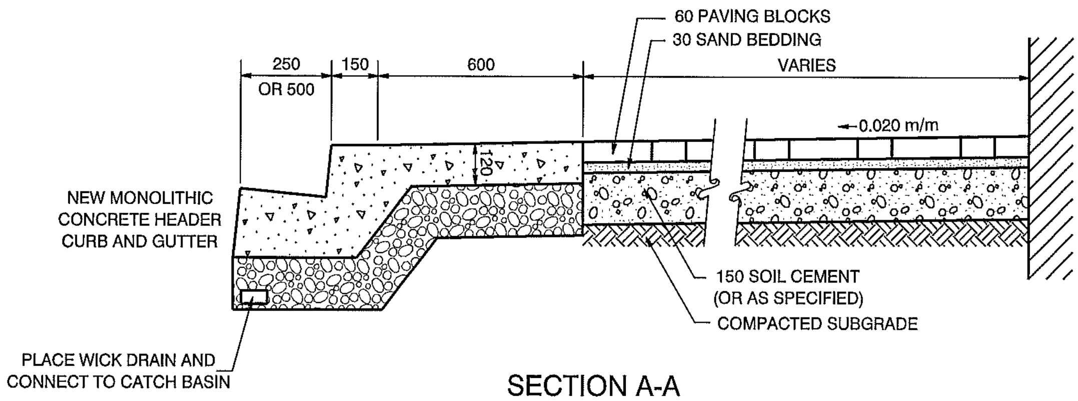
THE CITY OF Edmonton
STANDARD DRAWING

WOODEN NOISE ATTENUATION FENCE

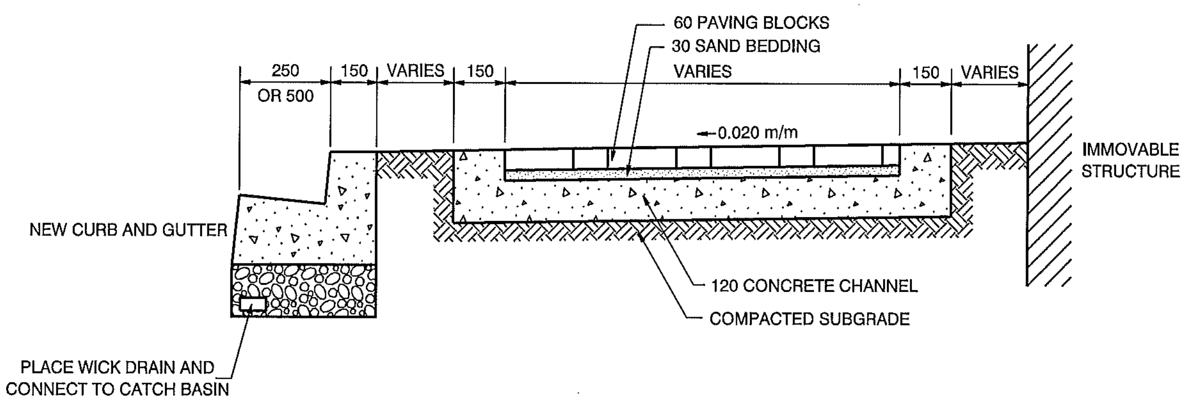
Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	GF			5205
Scale: N.T.S.	Checked By:			







SECTION A-A



BOULEVARD PAVING STONE CONCRETE CHANNEL

NOTES:

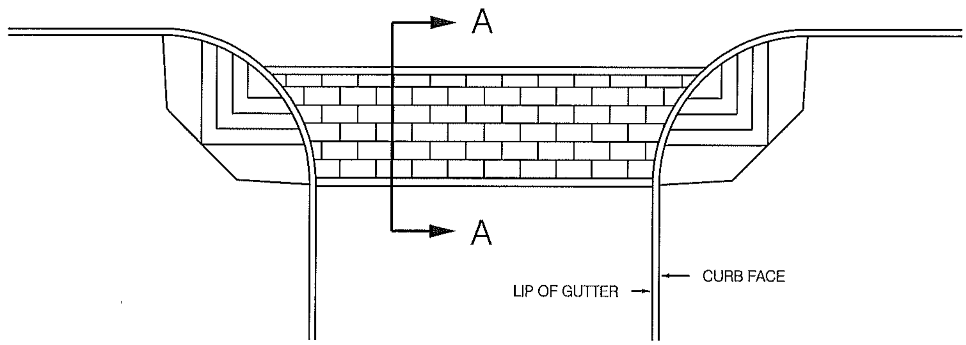
1. CURB, GUTTER AND 600mm MOUNTING SLAB POURED MONOLITHICALLY.
2. SIDEWALK X-SLOPE STANDARD 0.02m/m.
3. SIDEWALK X-SLOPE FOR RETROFITTING (1.0% MIN. - 4.0% MAX.).
4. CURB RAMP POURED MONOLITHICALLY.
5. SEE DRAWING #5510 FOR CURB RAMP TYPES.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

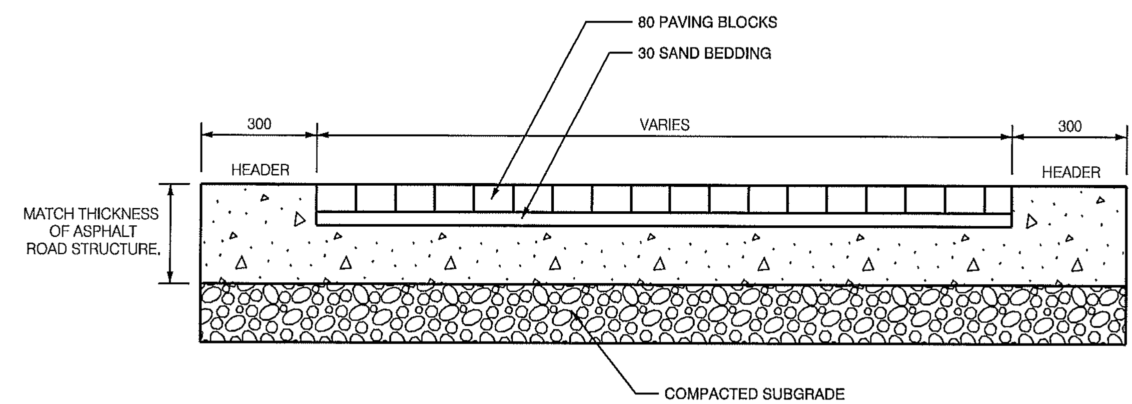
THE CITY OF Edmonton
STANDARD DRAWING

PAVING BRICK SIDEWALK CONSTRUCTION

Date Approved: FEB., 2011	Drawn By: JW	Approved:	Revision #	Drawing # 5210
Scale: N.T.S.	Checked By:		—	



SECTION A-A



NOTES:

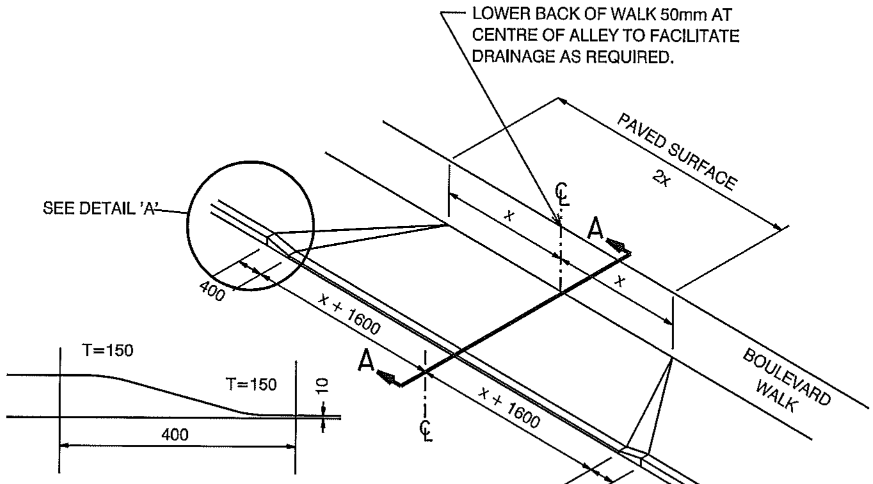
1. CROSSWALK WIDTH IS 4m, EXCEPT THE DOWNTOWN AREA WHICH IS 5m

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

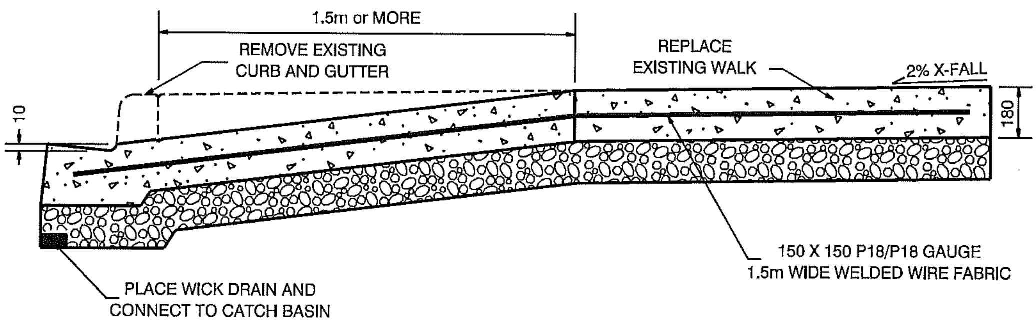
THE CITY OF Edmonton
STANDARD DRAWING

PAVING BRICK CROSSWALK CONSTRUCTION

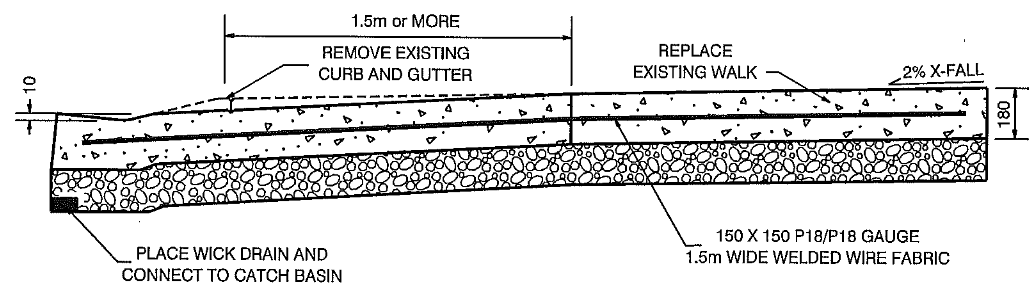
Date Approved: FEB., 2011	Drawn By: GF	Approved	Revision #	Drawing # 5215
Scale: N.T.S.	Checked By:			



DETAIL 'A'



SECTION A-A STRAIGHT FACE



SECTION A-A ROLLED FACE

NOTES:
1. MAXIMUM SLOPE 8% UNLESS OTHERWISE APPROVED BY ENGINEER.
2. CROSSING MUST BE POURED MONOLITHICALLY WITH CURB AND GUTTER.
3. ALTERNATIVE REINFORCING 10M REBAR ON A 300 mm GRID WITH 75 mm COVER FROM BOTTOM AND EDGE OF SLAB.

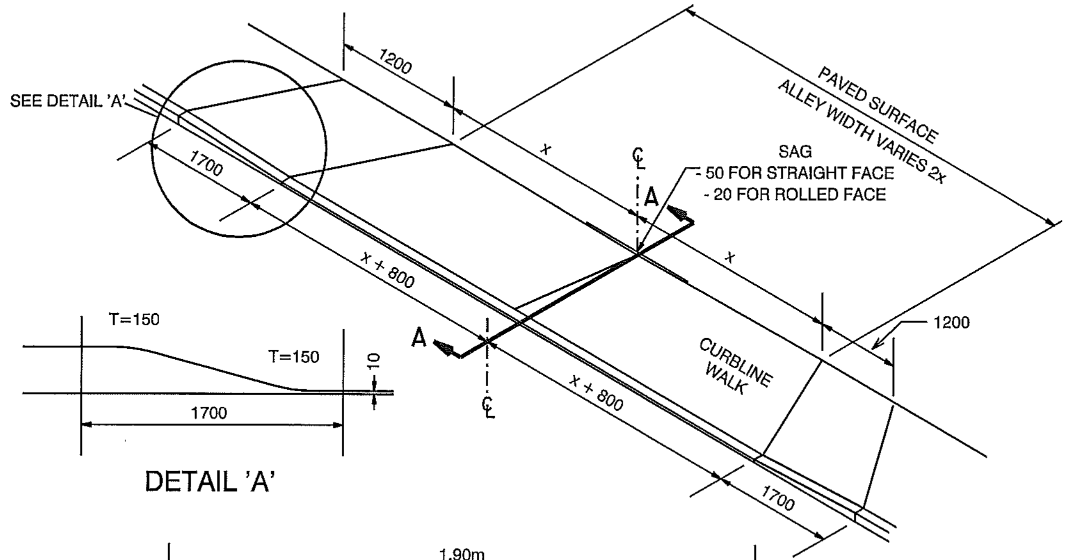
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

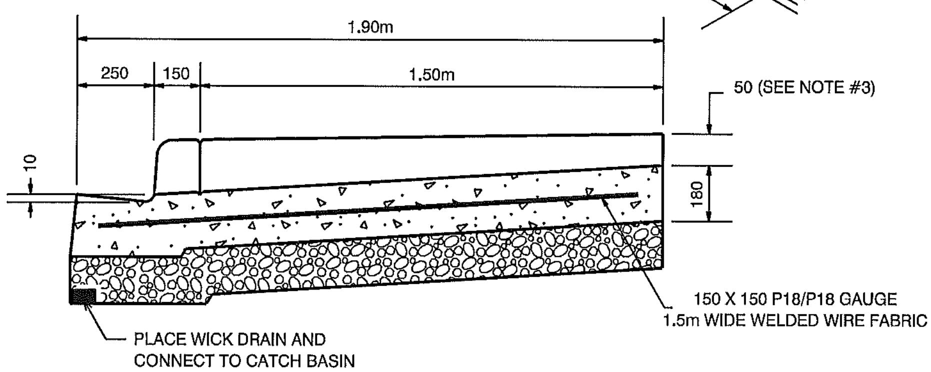
THE CITY OF Edmonton
STANDARD DRAWING

ALLEY CROSSING

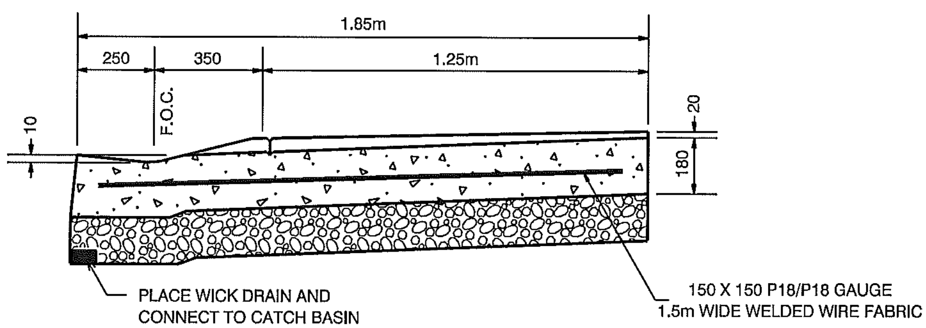
BOULEVARD WALK AND APRONS (BOULEVARD > 1.5)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5300
Scale: N.T.S.	Checked By:			





SECTION A-A STRAIGHT FACE



SECTION A-A ROLLED FACE

NOTES:
1. MAXIMUM SLOPE 8% UNLESS OTHERWISE APPROVED BY ENGINEER.
2. CROSSING MUST BE POURED MONOLITHICALLY WITH CURB AND GUTTER.
3. BACK OF CROSSING DROP FOR EXISTING 200mm CURBFACE IS 50mm.
4. ALTERNATIVE REINFORCING 10M REBAR ON A 300 mm GRID WITH 75 mm COVER FROM BOTTOM AND EDGE OF SLAB.

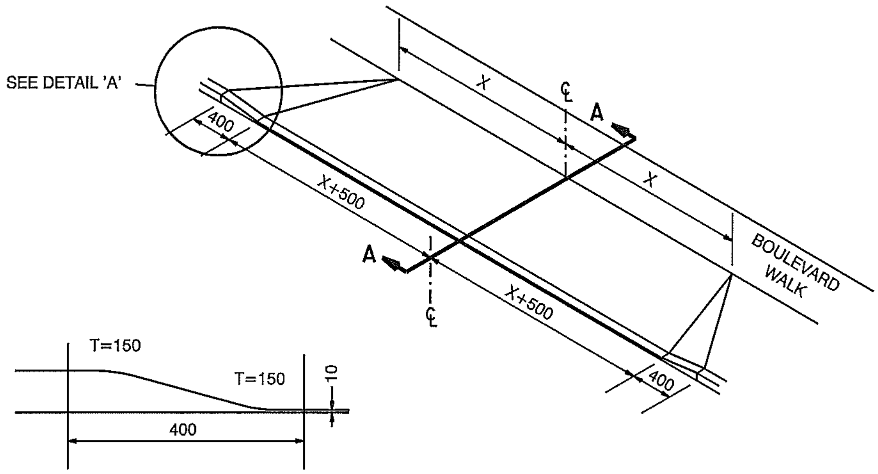
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton STANDARD DRAWING

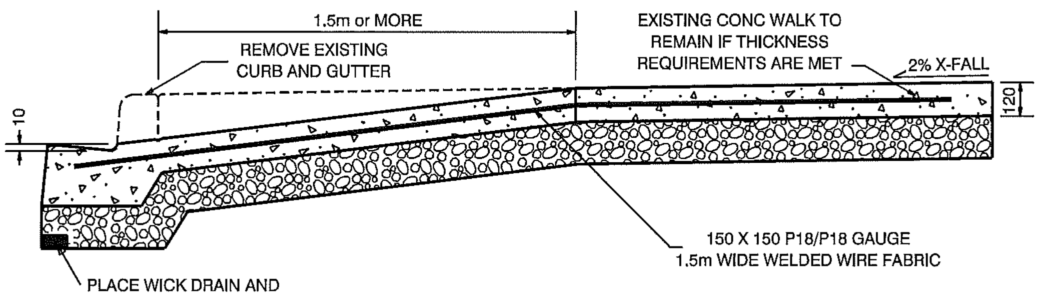
ALLEY CROSSING

MONO WALK AND BOULEVARD WALK (BOULEVARD < 1.5)

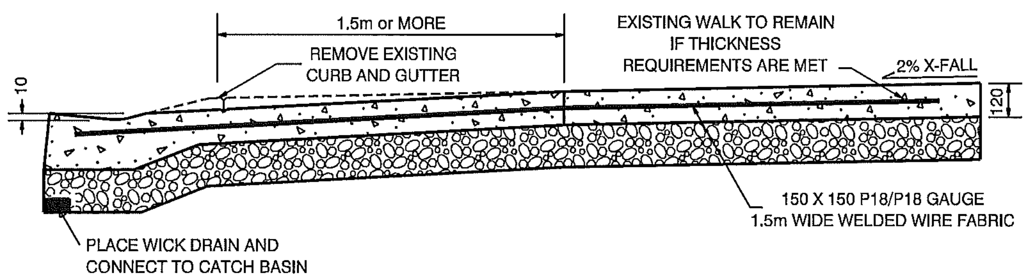
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5310
Scale: N.T.S.	Checked By:			



DETAIL 'A'



SECTION A-A STRAIGHT FACE



SECTION A-A ROLLED FACE

NOTES:
1. MAXIMUM SLOPE 8% UNLESS OTHERWISE APPROVED BY ENGINEER.
2. CROSSING MUST BE POURED MONOLITHICALLY WITH CURB AND GUTTER.
3. ALTERNATIVE REINFORCING 10M REBAR ON A 300 mm GRID WITH 75 mm COVER FROM BOTTOM AND EDGE OF SLAB.

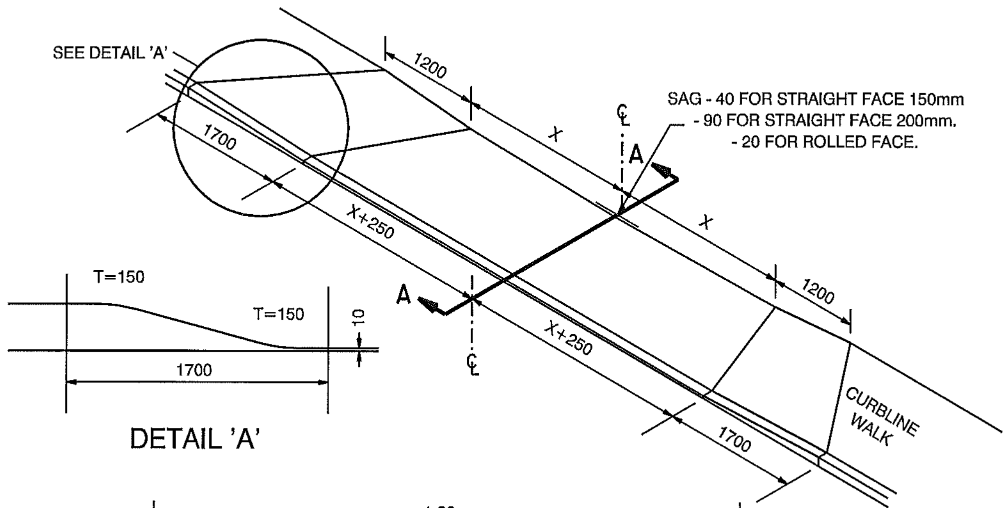
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

PRIVATE CROSSING

BOULEVARD WALK AND APRONS (BOULEVARD >1.5m)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5320
Scale: N.T.S.	Checked By:			



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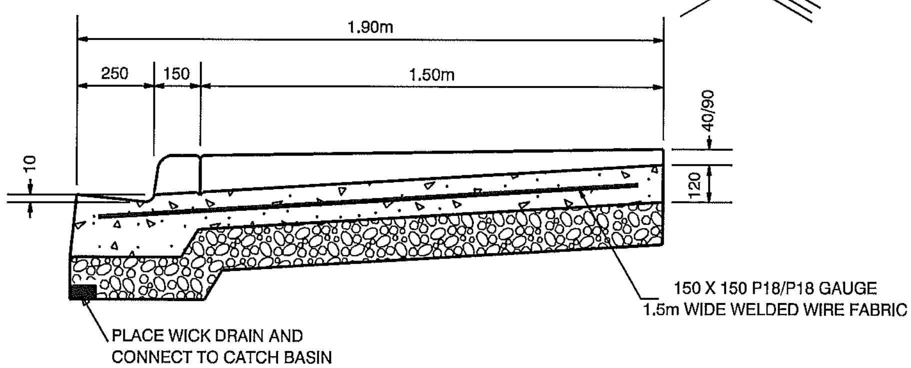
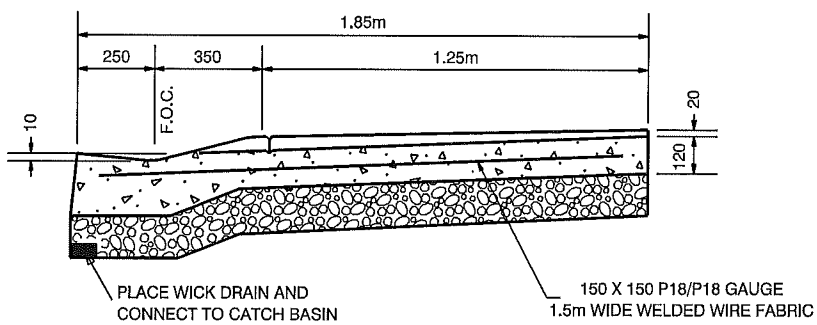


SECTION A-A STRAIGHT FACE



SECTION A-A ROLLED FACE

NOTES:
1. MAXIMUM SLOPE 8% UNLESS OTHERWISE APPROVED BY ENGINEER.
2. CROSSING MUST BE POURED MONOLITHICALLY WITH CURB AND GUTTER.
3. BACK OF CROSSING DROP FOR EXISTING 200mm CURBFACE IS 50mm.
4. ALTERNATIVE REINFORCING 10M REBAR ON A 300 mm GRID WITH 75 mm COVER FROM BOTTOM AND EDGE OF SLAB.

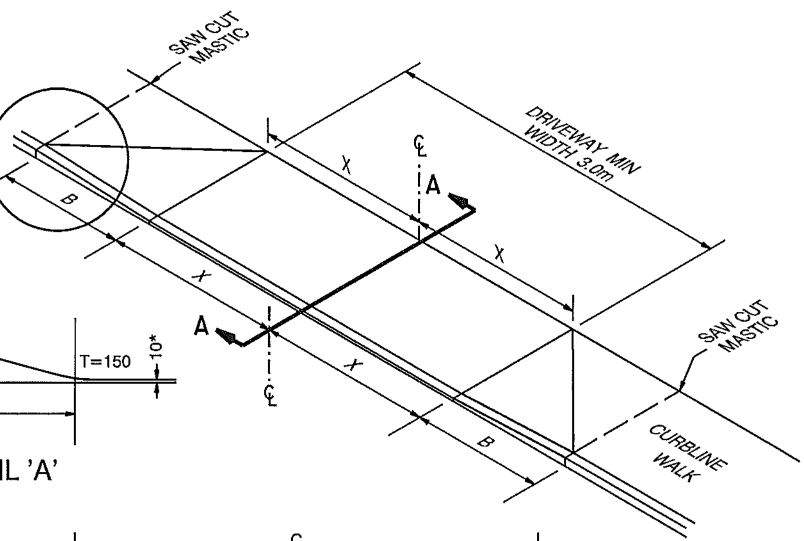
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

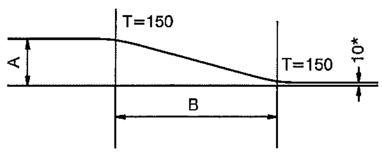
THE CITY OF Edmonton
STANDARD DRAWING

PRIVATE CROSSING

MONO WALK AND BOULEVARD WALK
(BOULEVARD < 1.5m)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5330
Scale: N.T.S.	Checked By:		–	





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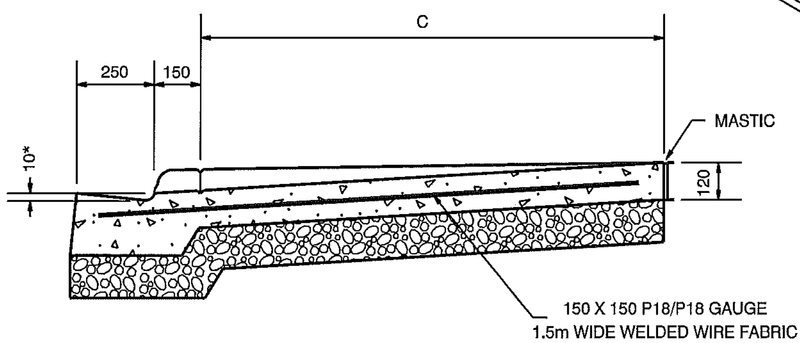
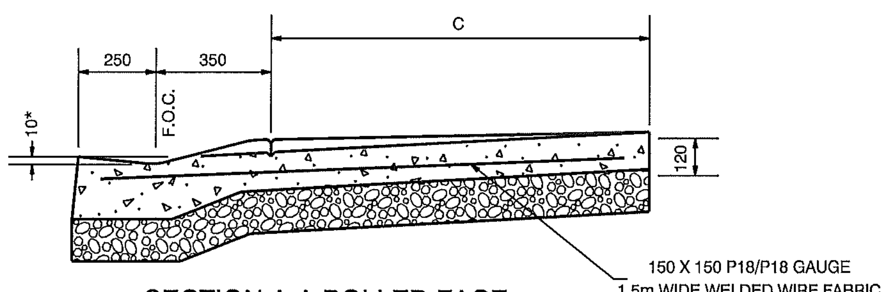


SECTION A-A STRAIGHT FACE



SECTION A-A ROLLED FACE

Curb Height	125	150	200	215	A
Roll up	1250	1500	2200	2700	B
FoC to BoW	1250	1500	2200	2700	C

NOTES:

1. MAXIMUM SLOPE 8% UNLESS OTHERWISE APPROVED BY ENGINEER.
2. CROSSING MUST BE POURED MONOLITHICALLY WITH CURB AND GUTTER.
3. * IF THE STANDARD LIP HEIGHT OF 10mm CREATES EXCESSIVE X-FALL ON THE CROSSING THE LIP HEIGHT MAY BE MODIFIED TO A MAXIMUM OF 25mm.
4. ALTERNATIVE REINFORCING 10M REBAR ON A 300mm GRID WITH 75mm COVER FROM BOTTOM AND EDGE OF SLAB.

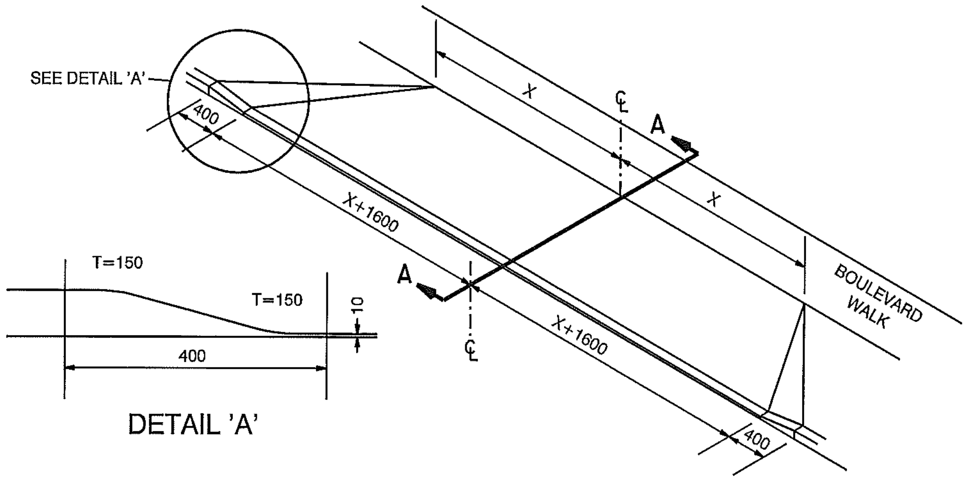
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

PRIVATE CROSSING

MONO WALK
(RETROFIT)

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			5340
Scale: N.T.S.	Checked By:		–	



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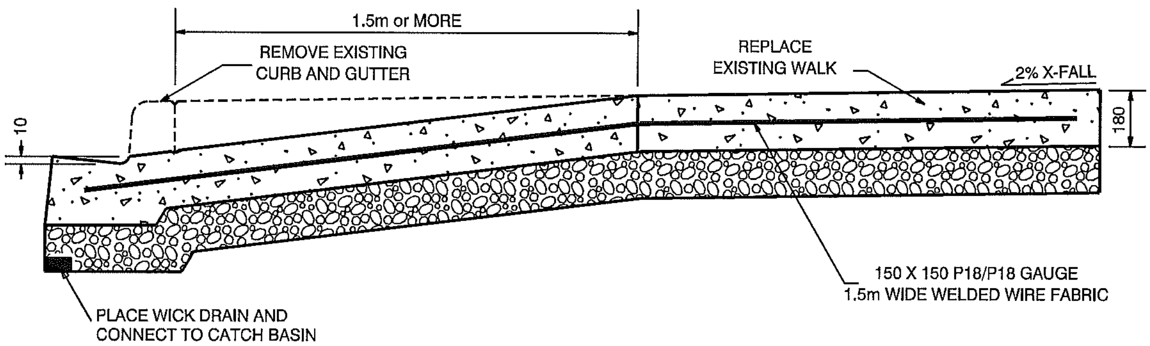
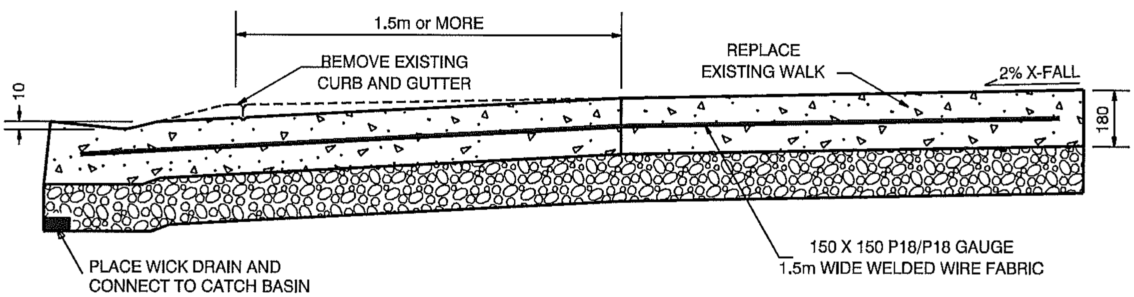


SECTION A-A STRAIGHT FACE



SECTION A-A ROLLED FACE

NOTES:
1. MAXIMUM SLOPE 8% UNLESS OTHERWISE APPROVED BY ENGINEER.
2. CROSSING MUST BE POURED MONOLITHICALLY WITHCURB AND GUTTER.
3. ALTERNATIVE REINFORCING 10M REBAR ON A 300mm GRID WITH 75mm COVER FROM BOTTOM AND EDGE OF SLAB.

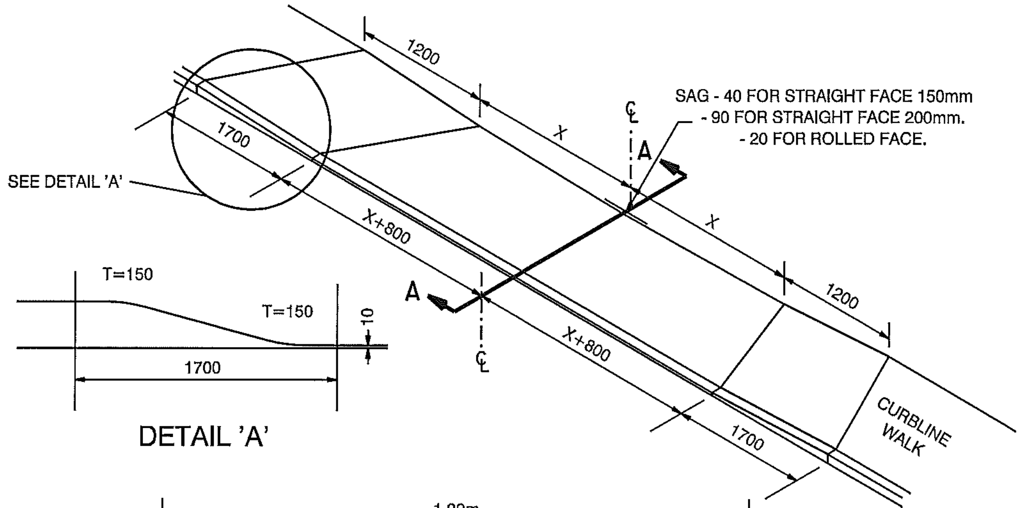
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

COMMERCIAL CROSSING

BOULEVARD WALK AND APRONS
(BOULEVARD > 1.5m)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5400
Scale: N.T.S.	Checked By:		—	



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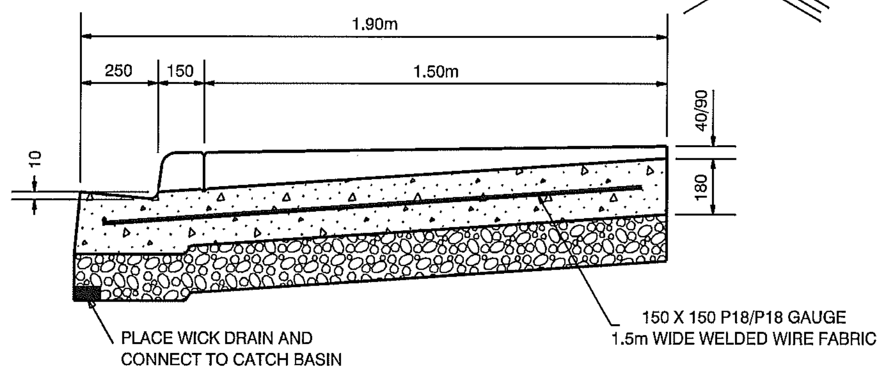
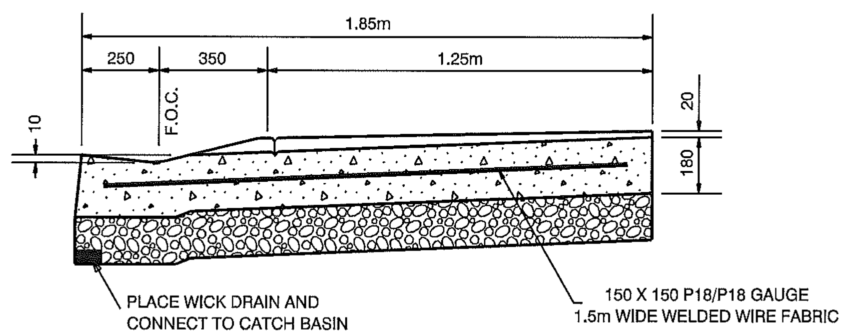


SECTION A-A STRAIGHT FACE



SECTION A-A ROLLED FACE

NOTES:

1. MAXIMUM SLOPE 8% UNLESS OTHERWISE APPROVED BY ENGINEER.
2. CROSSING MUST BE POURED MONOLITHICALLY WITH CURB AND GUTTER.
3. ALTERNATIVE REINFORCING 10M REBAR ON A 300mm GRID WITH 75mm COVER FROM BOTTOM AND EDGE OF SLAB.

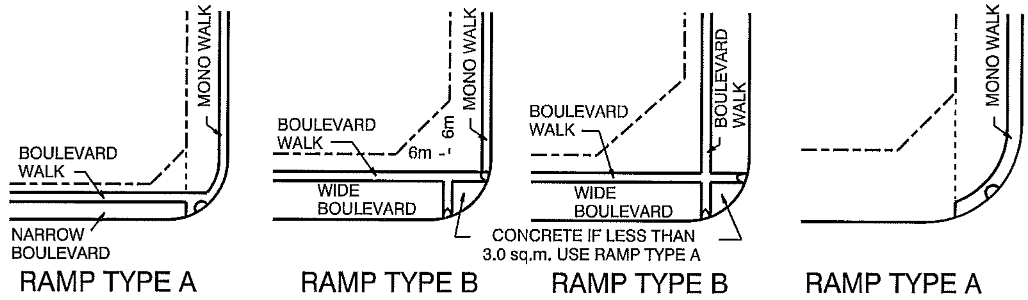
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

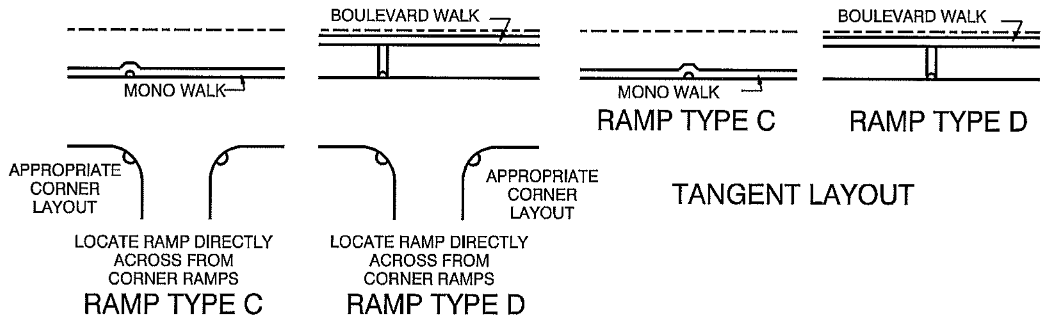
COMMERCIAL CROSSING

MONONWALK AND BOULEVARD WALK (BOULEVARD < 1.5m)

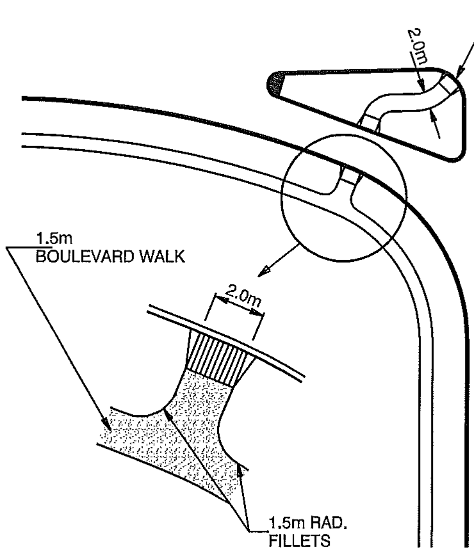
Date Approved: FEB., 2011	Drawn By: JW	Approved:	Revision #	Drawing # 5410
Scale: N.T.S.	Checked By:		–	



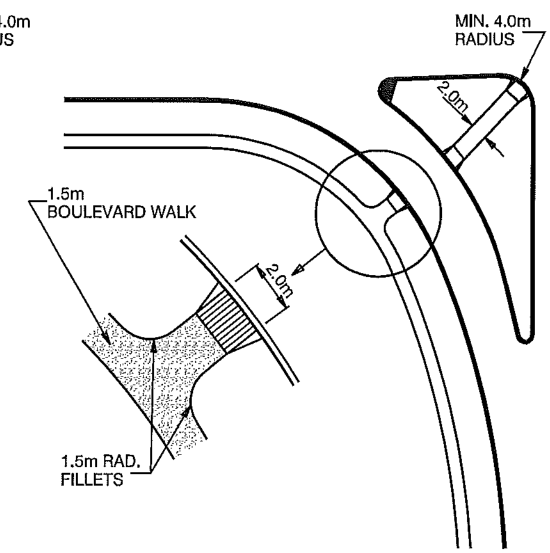
CORNER LAYOUT



TANGENT LAYOUT



RAMP TYPE D
HIGH ENTER ANGLE RIGHT TURN LAYOUT



RAMP TYPE D
LOW EXIT ANGLE RIGHT TURN LAYOUT

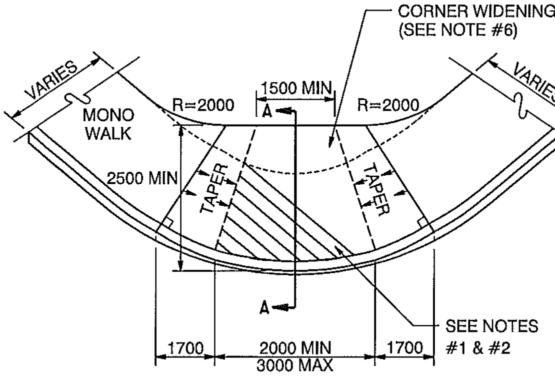
NOTES:

1. SEE DRAWING 5510 FOR RAMP TYPES

THE CITY OF Edmonton
STANDARD DRAWING

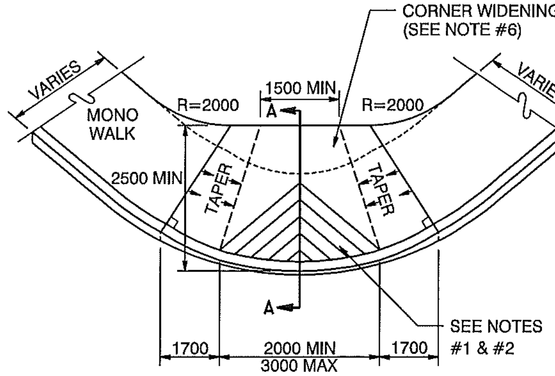
CURB RAMP LOCATIONS

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			5500
Scale: N.T.S.	Checked By:		—	



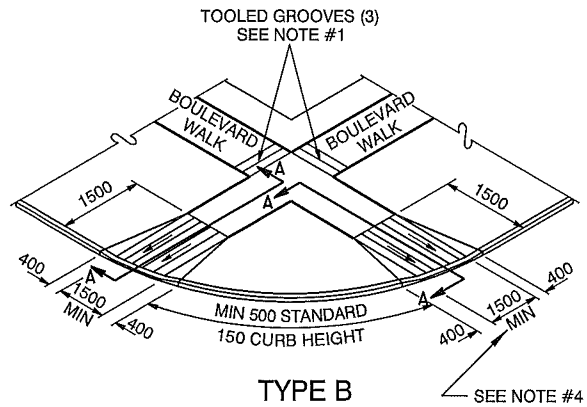
TYPE A1 (ONE DIRECTION)

N.T.S.



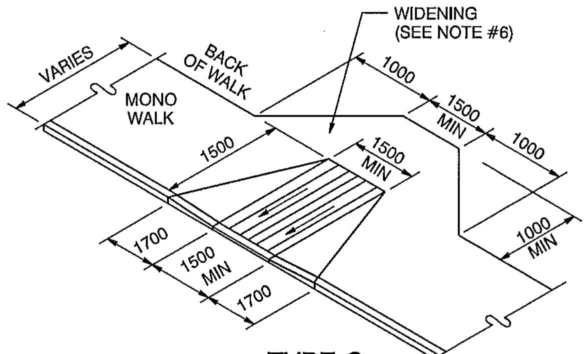
TYPE A2 (TWO DIRECTIONS)

N.T.S.



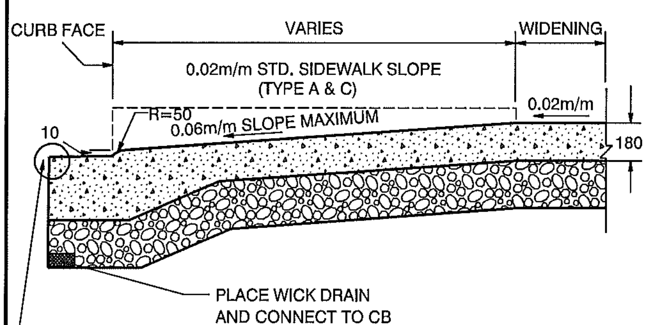
TYPE B

N.T.S.



TYPE C

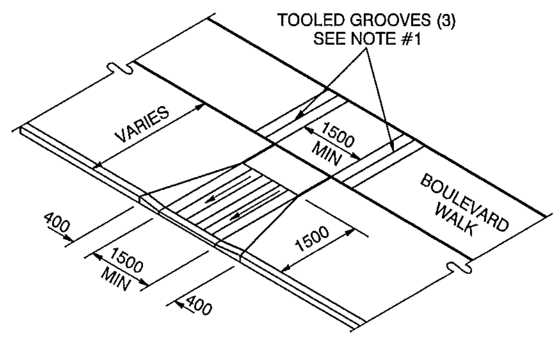
N.T.S.



a) MATCH ASPHALT SURFACE TO GUTTER LIP WITHIN 3mm.
b) IF ASPHALT TOPLIFT IS DEFERRED, PLACE ASPHALT RAMP FOR THE WIDTH OF CURB RAMP, AND EXTENDING MINIMUM 1.0m INTO ROAD.

TYPICAL CROSS SECTION A-A

SCALE: N.T.S



TYPE D

N.T.S.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

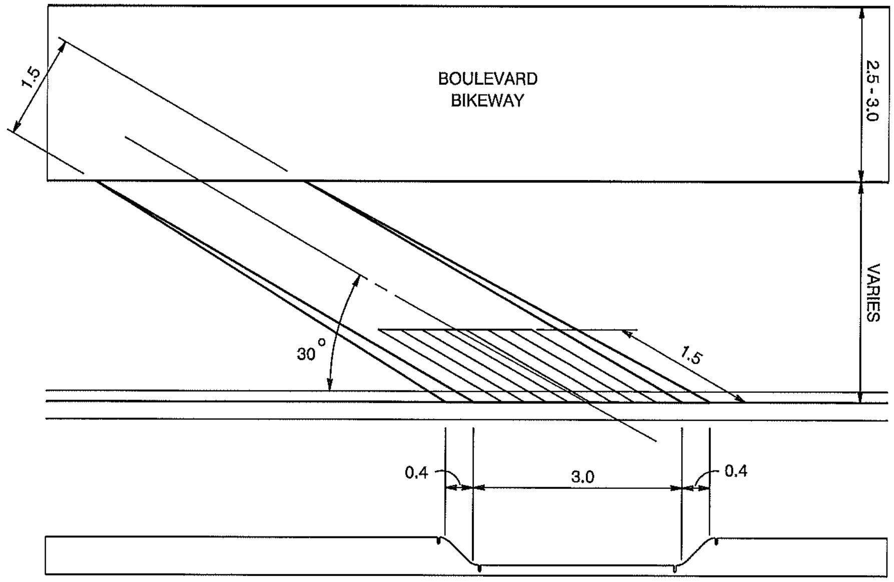
NOTES:

1. TOOLED GROOVES 5mm WIDE X 10mm DEEP, BROOM FINISH. GROOVE SPACING 150mm O.C. ADJACENT TO CURB.
2. GROOVES TO BE IN DIRECTION OF TRAVEL.
3. WHEN REQUIRED, TRANSITION FROM STRAIGHT FACE CURB TO ROLLED FACE CURB AT CURB RAMP.
4. CURBS AND RAMPS TO BE POURED MONOLITHICALLY.
5. WIDTH OF RAMP MUST EQUAL WIDTH OF WALK (MIN 1.5m, MAX 3.0m) EXCEPT "TYPE A".
6. PROVIDE 1.0m WIDENING (AT 2.0% X-FALL) FROM BACK OF CURB RAMP (TYPES A & C) WHERE ROAD RIGHT-OF-WAY ALLOWS.
7. FOR BOULEVARD WALK TO CURBLINE WALK, REFER TO DRAWING #5052 FOR CURB RAMP LOCATIONS AND TYPES.

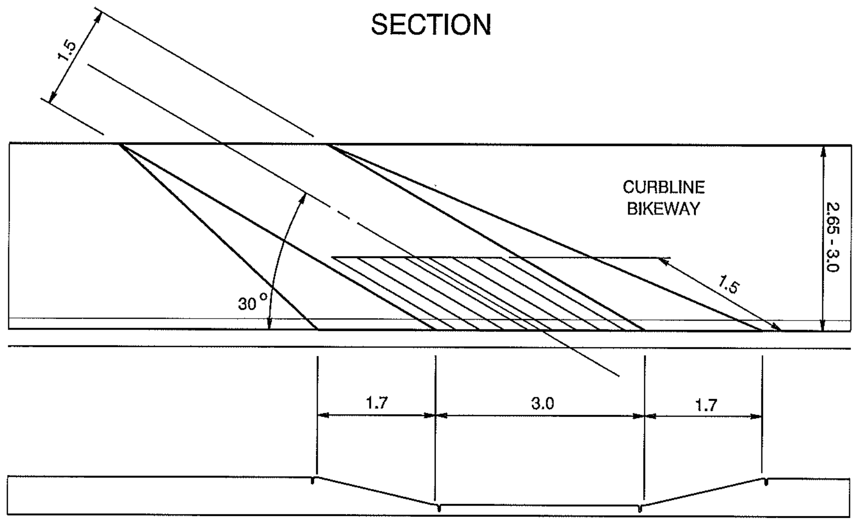
THE CITY OF Edmonton
STANDARD DRAWING

CURB RAMP

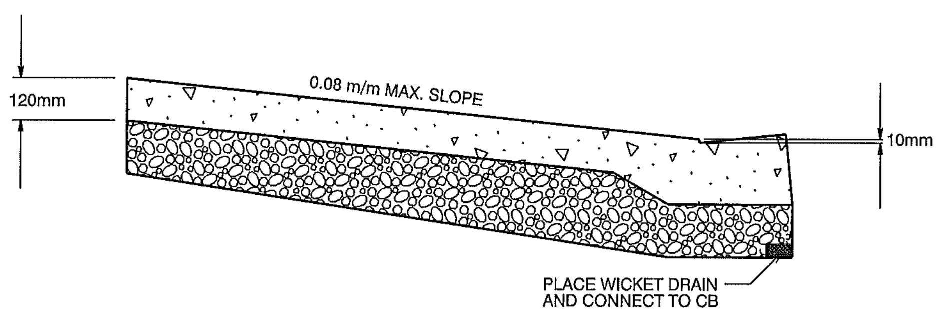
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5510
Scale: N.T.S.	Checked By:		—	



SECTION



SECTION



ALL DIMENSIONS
IN METRES UNLESS
OTHERWISE NOTED

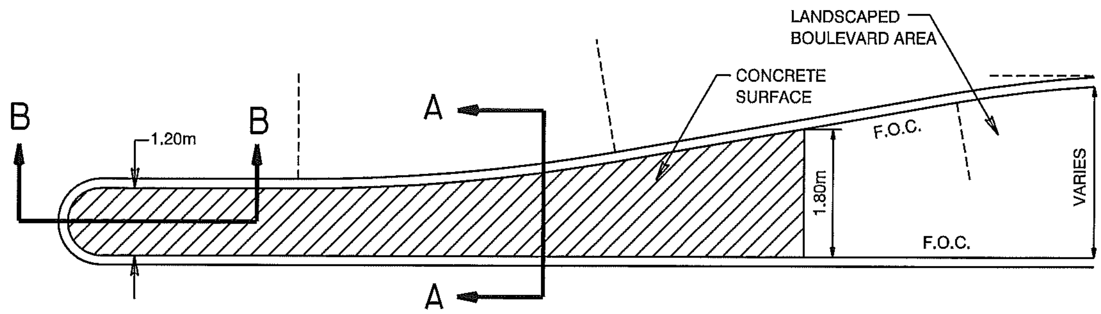
NOTES:

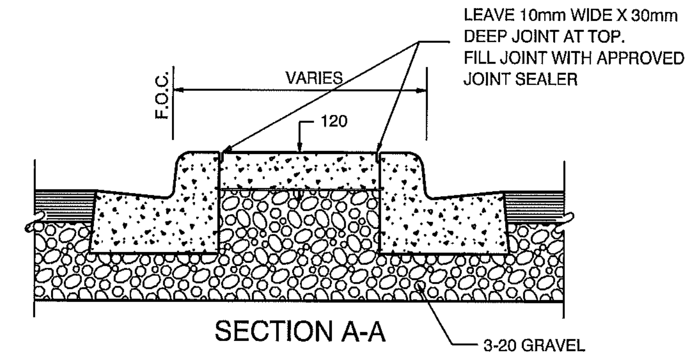
1. REPLACE CURBLINE BIKEWAY TO NEAREST JOINTS.
2. CURB AND RAMP TO BE POURED MONOLITHICALLY.
3. BROOMED FINISH. TOOLED GROOVES 5mm WIDE X 10mm DEEP, SPACED 150mm O.C.

THE CITY OF Edmonton
STANDARD DRAWING

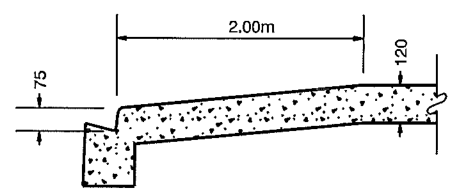
MID-BLOCK BIKEWAY SLIP RAMP

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5600
Scale: N.T.S.	Checked By:		—	

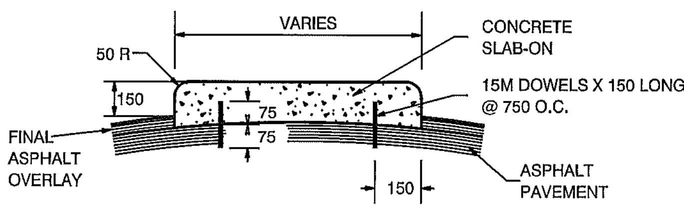




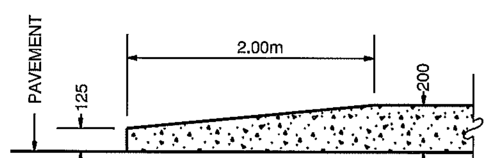
SECTION A-A



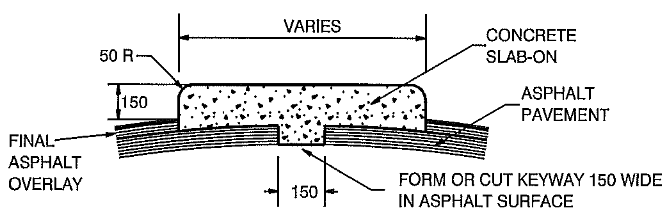
SECTION B-B



SECTION A-A



SECTION B-B



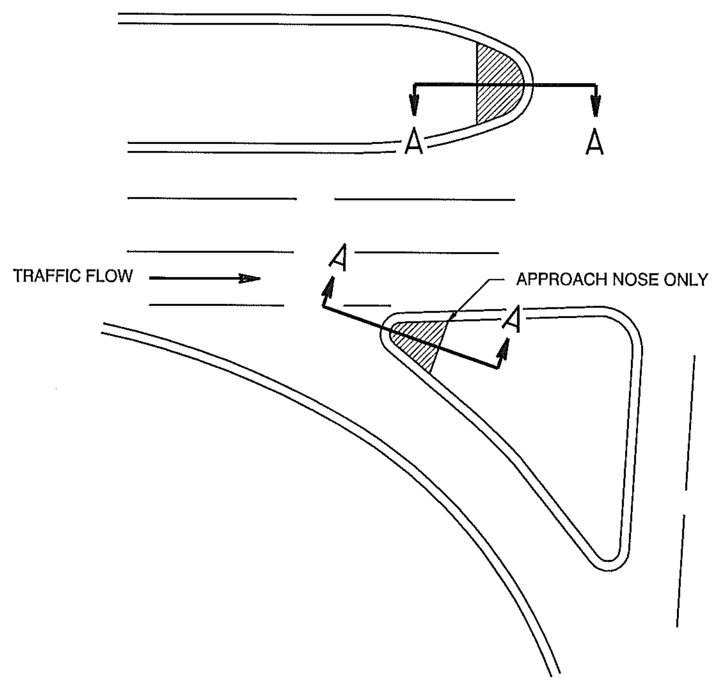
SECTION A-A

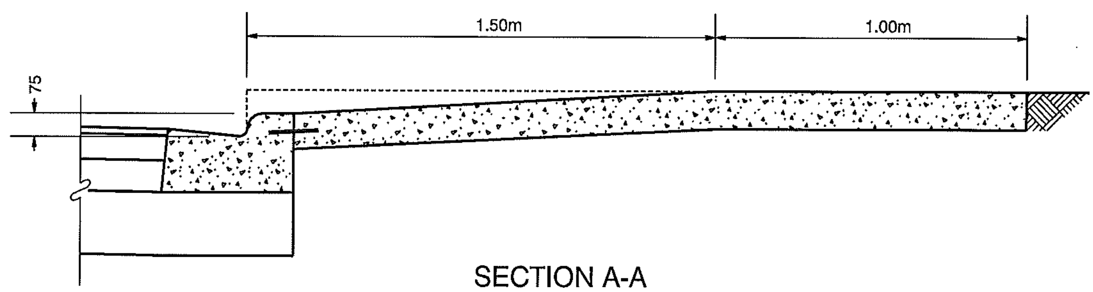
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

CENTRE MEDIAN - END TREATMENT

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			5610
Scale: N.T.S.	Checked By:		–	





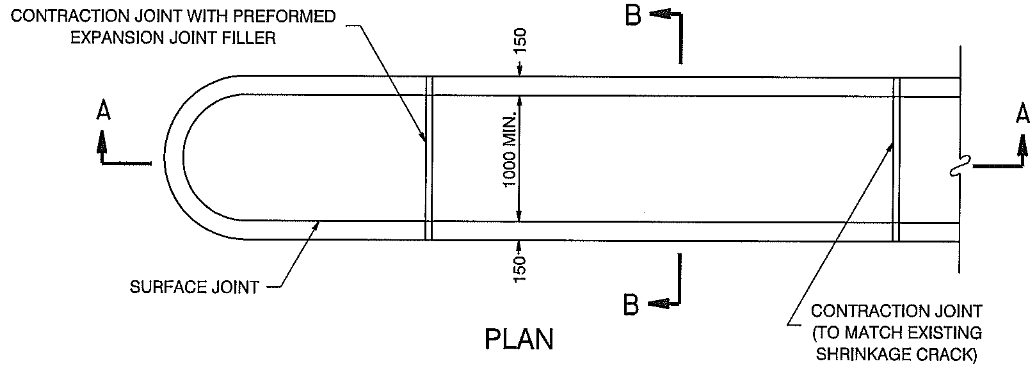
SECTION A-A

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

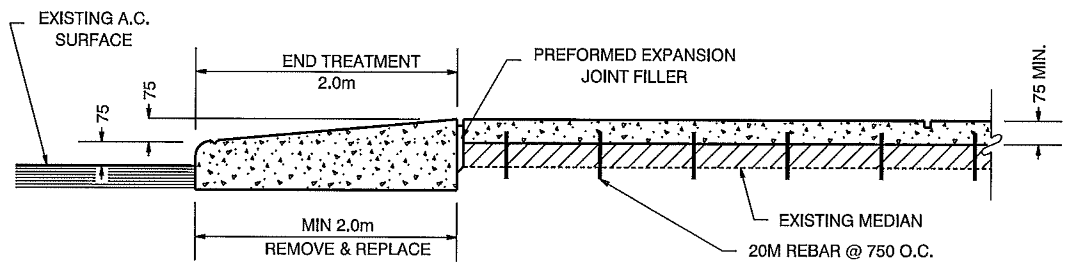
THE CITY OF Edmonton
STANDARD DRAWING

WIDE MEDIAN - END TREATMENT

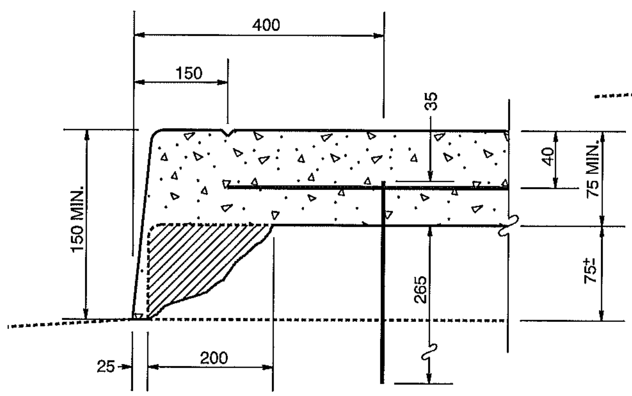
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 5620
Scale: N.T.S.	Checked By:		—	



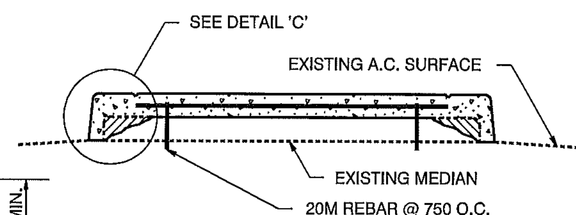
PLAN



SECTION A-A



DETAIL 'C'



SECTION B-B

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

NOTES:

1. PREFORMED EXPANSION JOINT FILLER SHOULD ALSO BE PLACED AT MATCH TO EXISTING ISLAND.

THE CITY OF Edmonton
STANDARD DRAWING

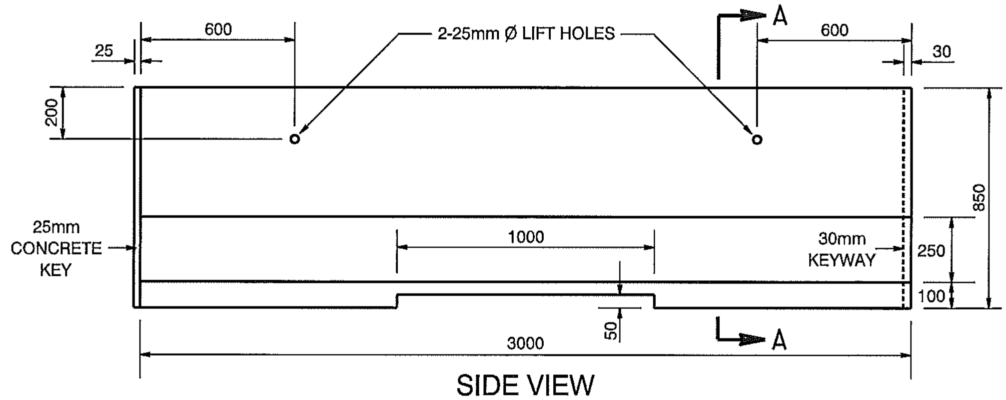
CENTRE MEDIAN REHABILITATION

Date Approved: FEB., 2011	Drawn By: JW	Approved:	Revision #	Drawing # 5630
Scale: N.T.S.	Checked By:		–	

MISCELLANEOUS

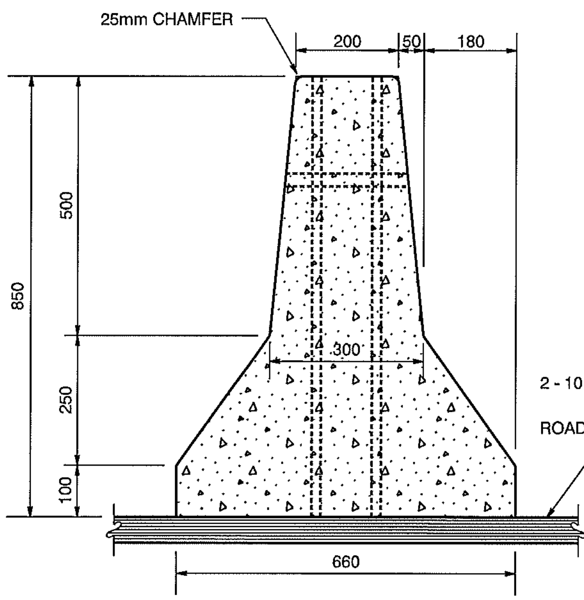
STANDARD DETAILS

SECTION 6000

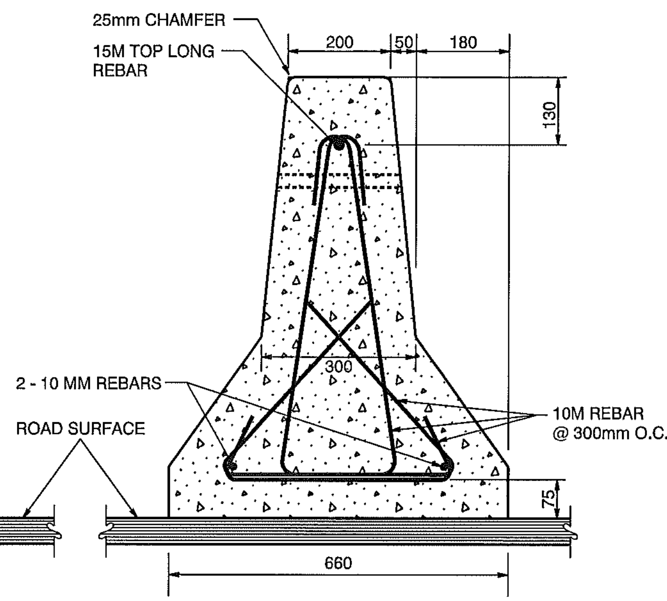


SIDE VIEW

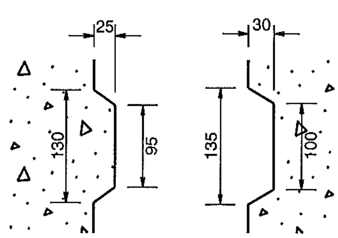
NOTE: KEY AT ONE END AND
KEYWAY AT THE OTHER END.



SECTION A-A



SECTION A-A WITH REINFORCING DETAIL



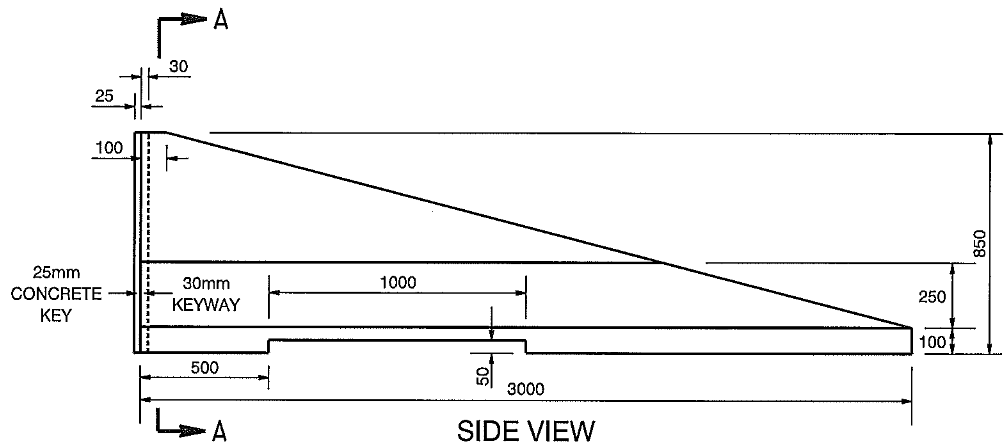
PLAN VIEW
KEY & KEYWAY

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

850 PRE-CAST CONCRETE BARRIER

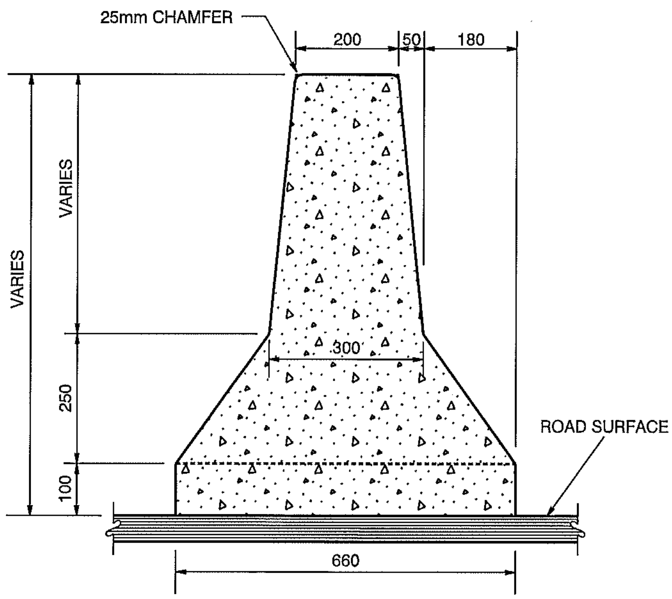
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision # —	Drawing # 6000
Scale: N.T.S.	Checked By:			



SIDE VIEW

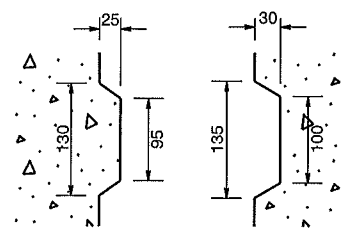
SCALE 1:30

NOTE: EITHER KEY OR KEYWAY AT THE HIGH END.



SECTION A-A

SCALE 1:60



PLAN VIEW

KEY & KEYWAY

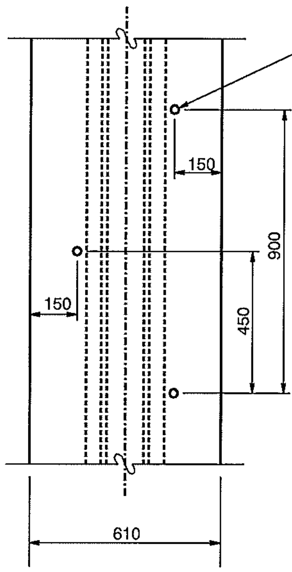
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

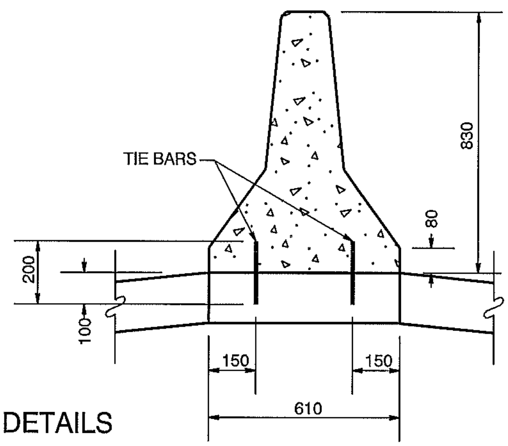
THE CITY OF **Edmonton**

STANDARD DRAWING

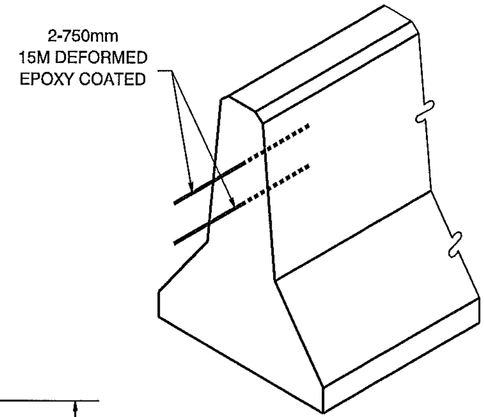
END TRANSITION PRE-CAST CONCRETE BARRIER

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6001
Scale: N.T.S.	Checked By:		–	



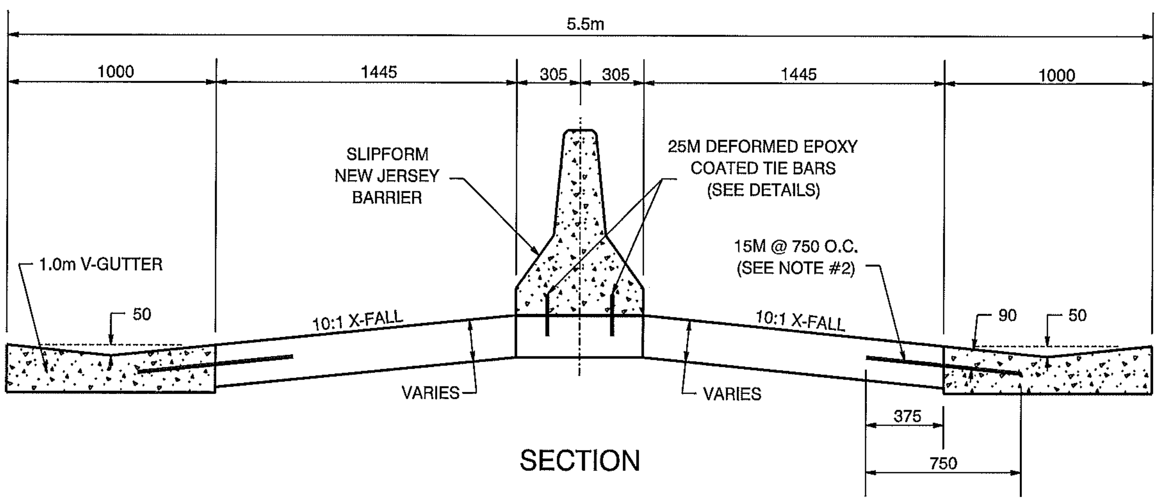


TIE BAR DETAILS



CONSTRUCTION JOINT DETAIL

NOTE:
CONSTRUCTION JOINT TO BE FILLED WITH JOINT FILLER



SECTION

NOTES:

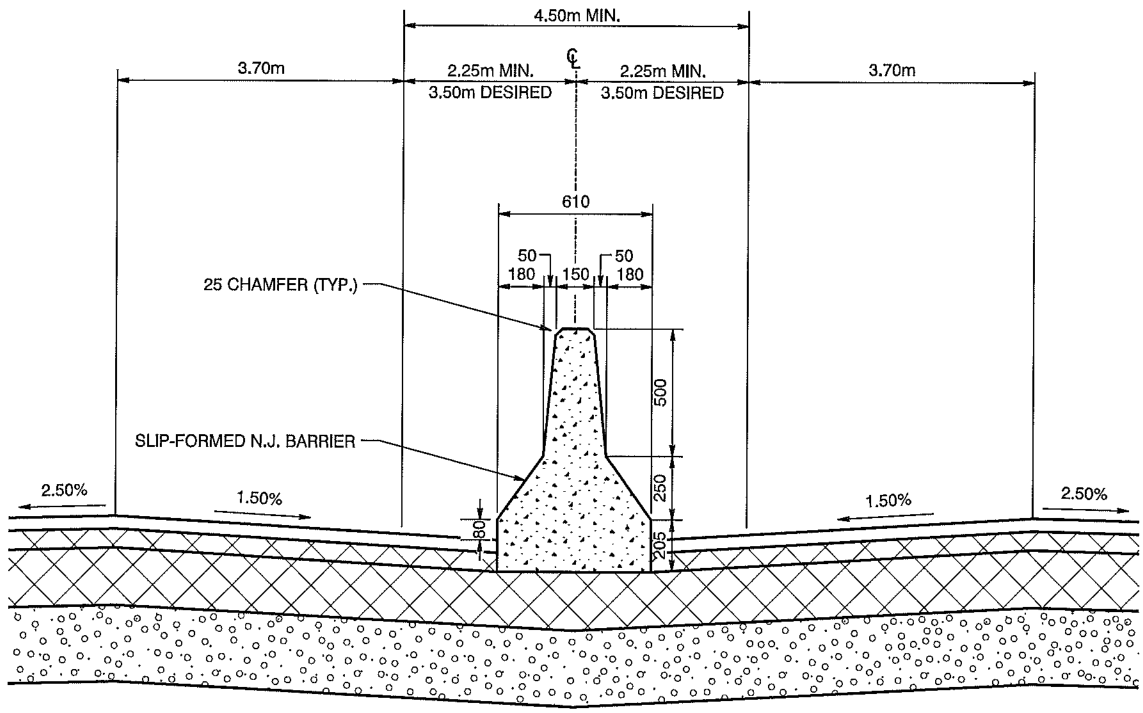
1. NO LONGITUDINAL REINFORCEMENT REQUIRED.
2. CONTRACTION JOINTS IN MEDIAN BARRIER TO BE MADE EVERY 5.0m (1/4 THE WIDTH OF BARRIER IN DEPTH).
3. NO JOINT SEALER REQUIRED.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

SLIPFORMED CONCRETE BARRIER 5.5m MEDIAN

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6010
Scale: N.T.S.	Checked By:		—	

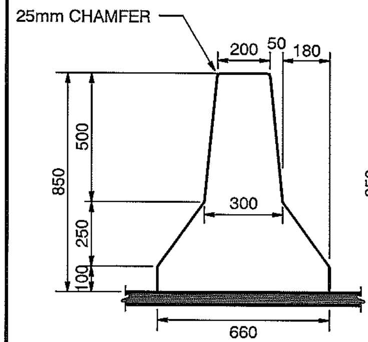


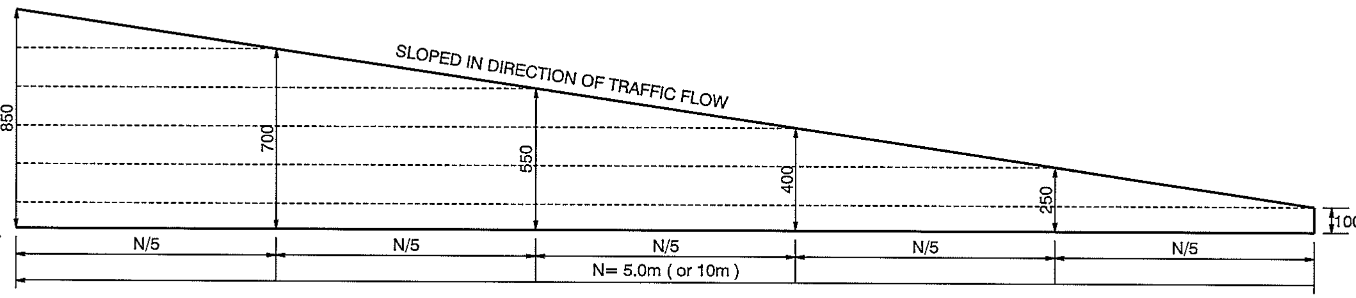
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

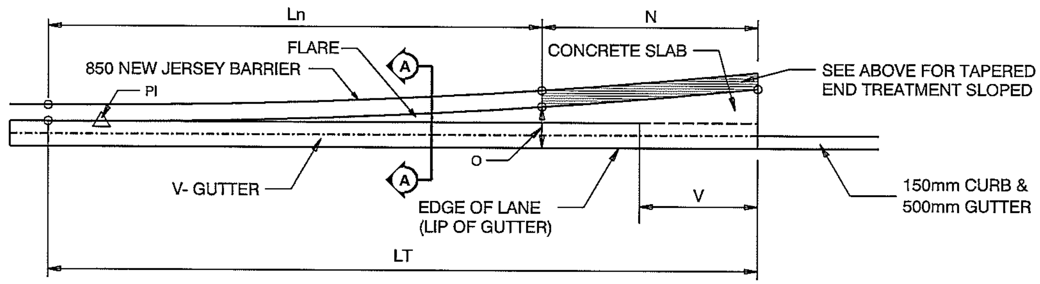
CONCRETE BARRIER ON PAVED MEDIAN

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6020
Scale: N.T.S.	Checked By:		–	

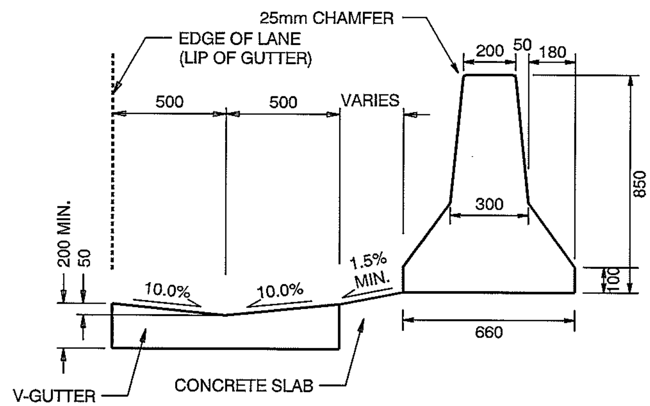




N (TAPERED END TREATMENT SLOPED)



LT= TOTAL LENGTH OF BARRIER
Ln= LENGTH OF NEED (TO BE DETERMINED USING TAC GUIDELINES)
N= TAPERED END TREATMENT
V= CURB & GUTTER END TREATMENT
O= SHY LINE OFFSET
FLARE= FLARE RATES FOR BARRIERS PLACED BEYOND THE SHOULDER



SECTION A-A

NEW JERSEY BARRIER - TYPICAL FLARED END DETAILS

DESIGN SPEED	LT	N	V	FLARE	O
≤60	Ln+N	5	5	12:1	1.4
70	Ln+N	10	5	17:1	1:7
≥80	(THRIE - BEAM SYSTEM REQUIRED)				

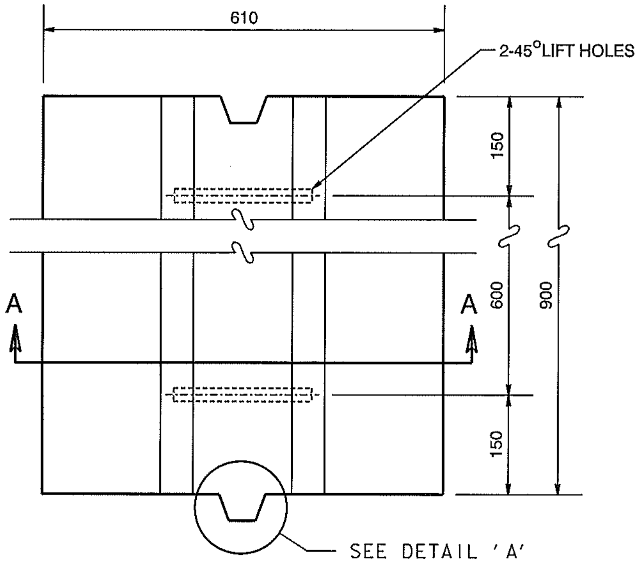
*IN SOME INSTANCES, TRANSITION COULD BE 1.0m V-GUTTER TO 250mm GUTTER.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

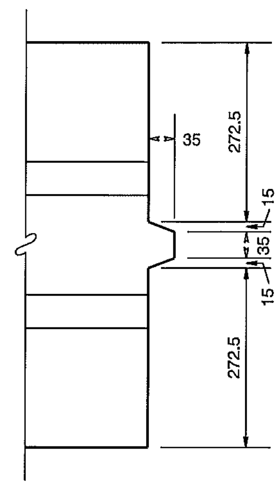
THE CITY OF Edmonton
STANDARD DRAWING

END TRANSITION CONCRETE BARRIER

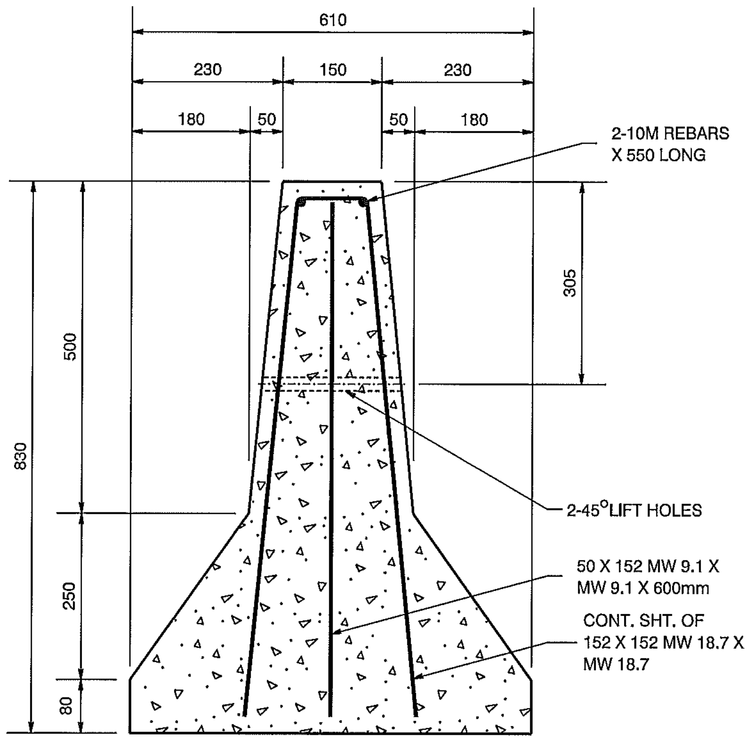
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6030
Scale: N.T.S.	Checked By:			



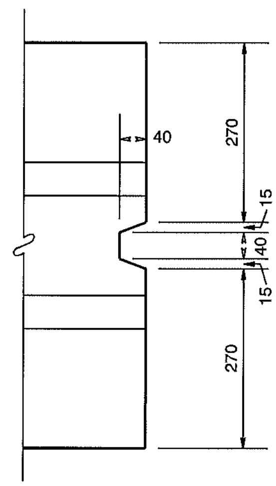
PLAN VIEW



DETAIL 'A'



SECTION A-A



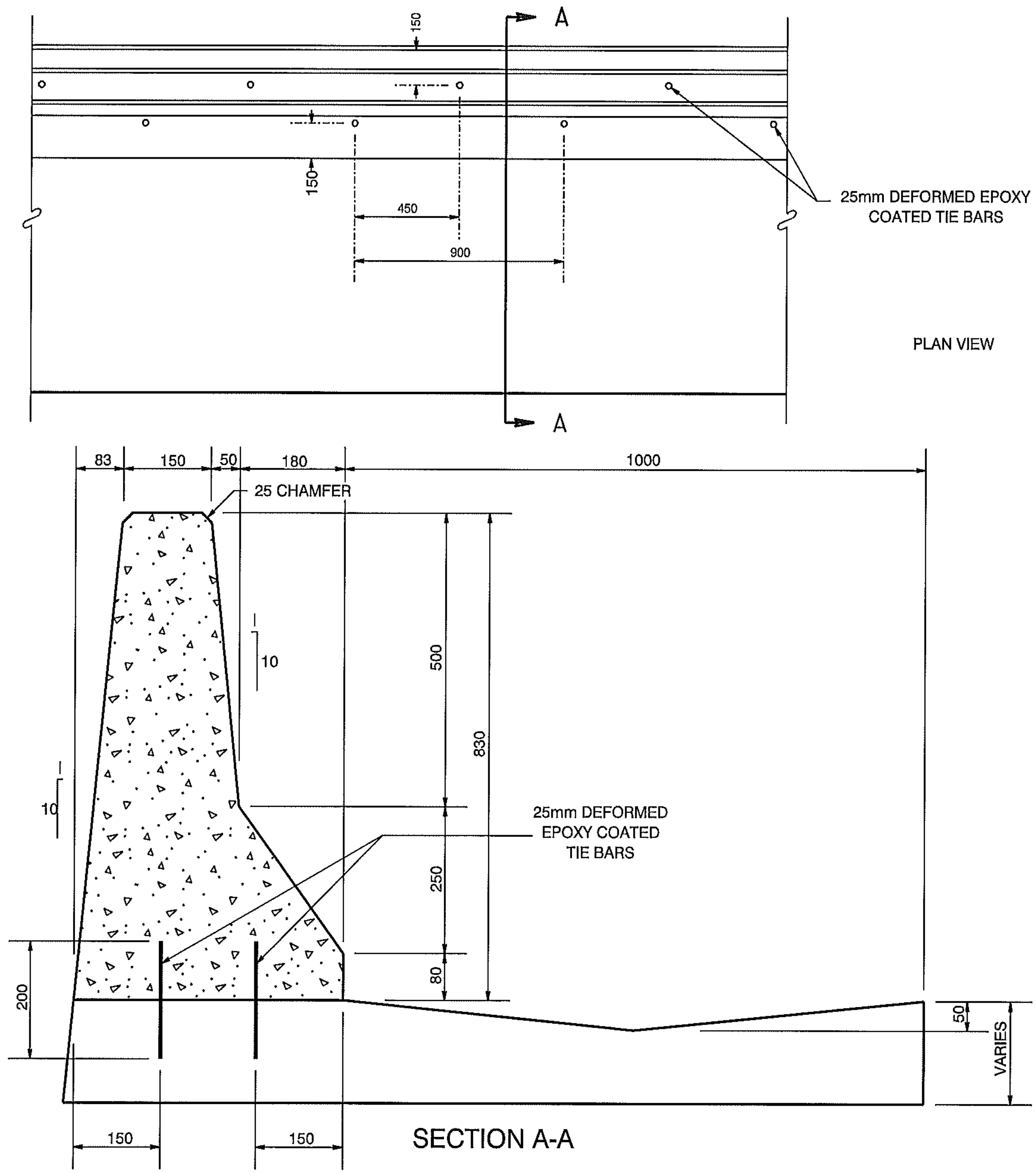
END OF SLIP FORMED BARRIER DETAIL

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

LIFT OUT FOR CONCRETE BARRIER

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6050
Scale: N.T.S.	Checked By:			



ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

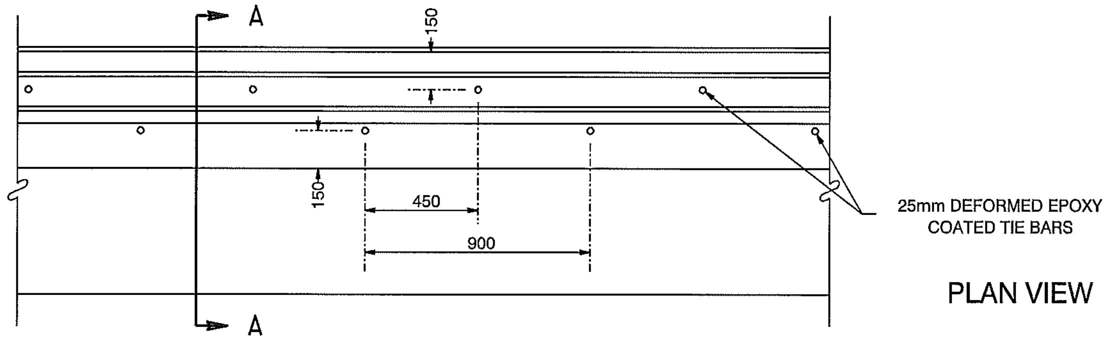
NOTES:

1. FOR TIE BAR DETAIL SEE DRAWING 6010.
2. FOR CONSTRUCTION JOINT DETAIL SEE DRAWING 6010.

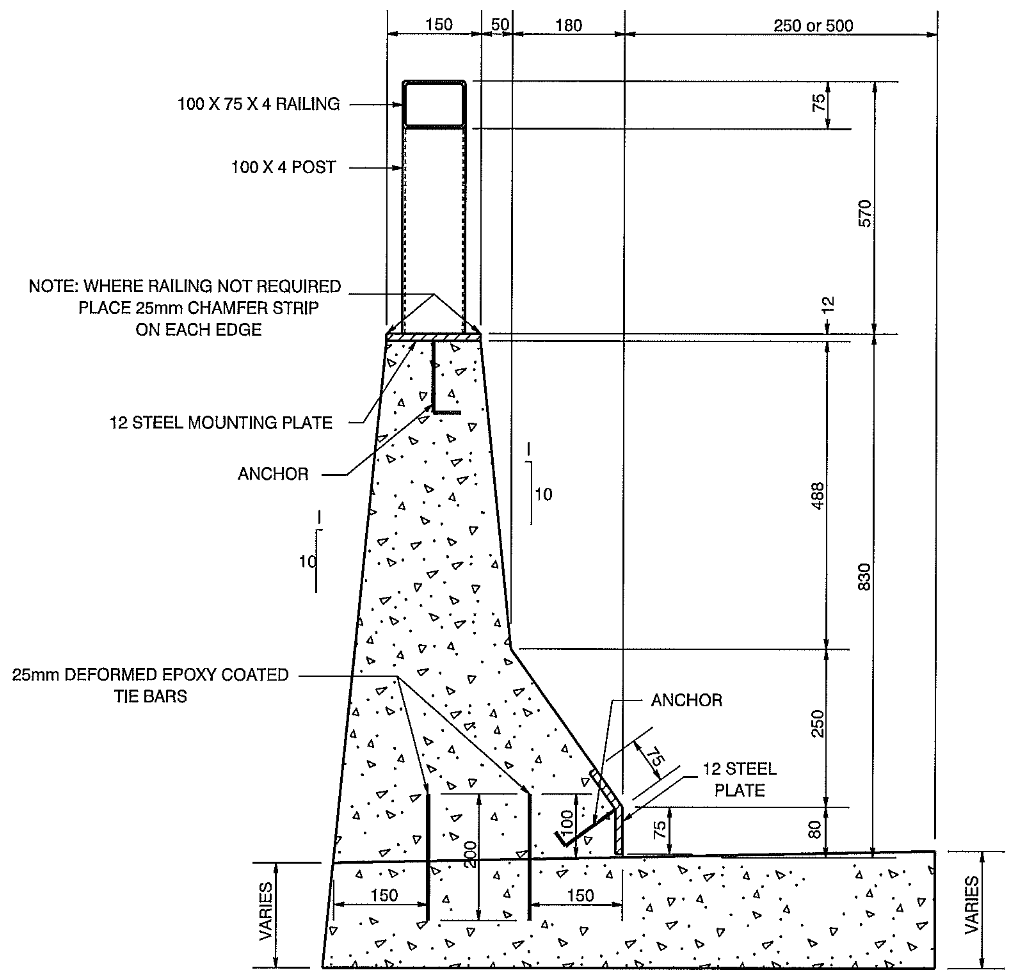
THE CITY OF Edmonton STANDARD DRAWING

830 CONCRETE SLIP-FORMED PARAPET WITH 1.0m SWALE

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision # —	Drawing # 6060
Scale: N.T.S.	Checked By:			



PLAN VIEW



SECTION A-A

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

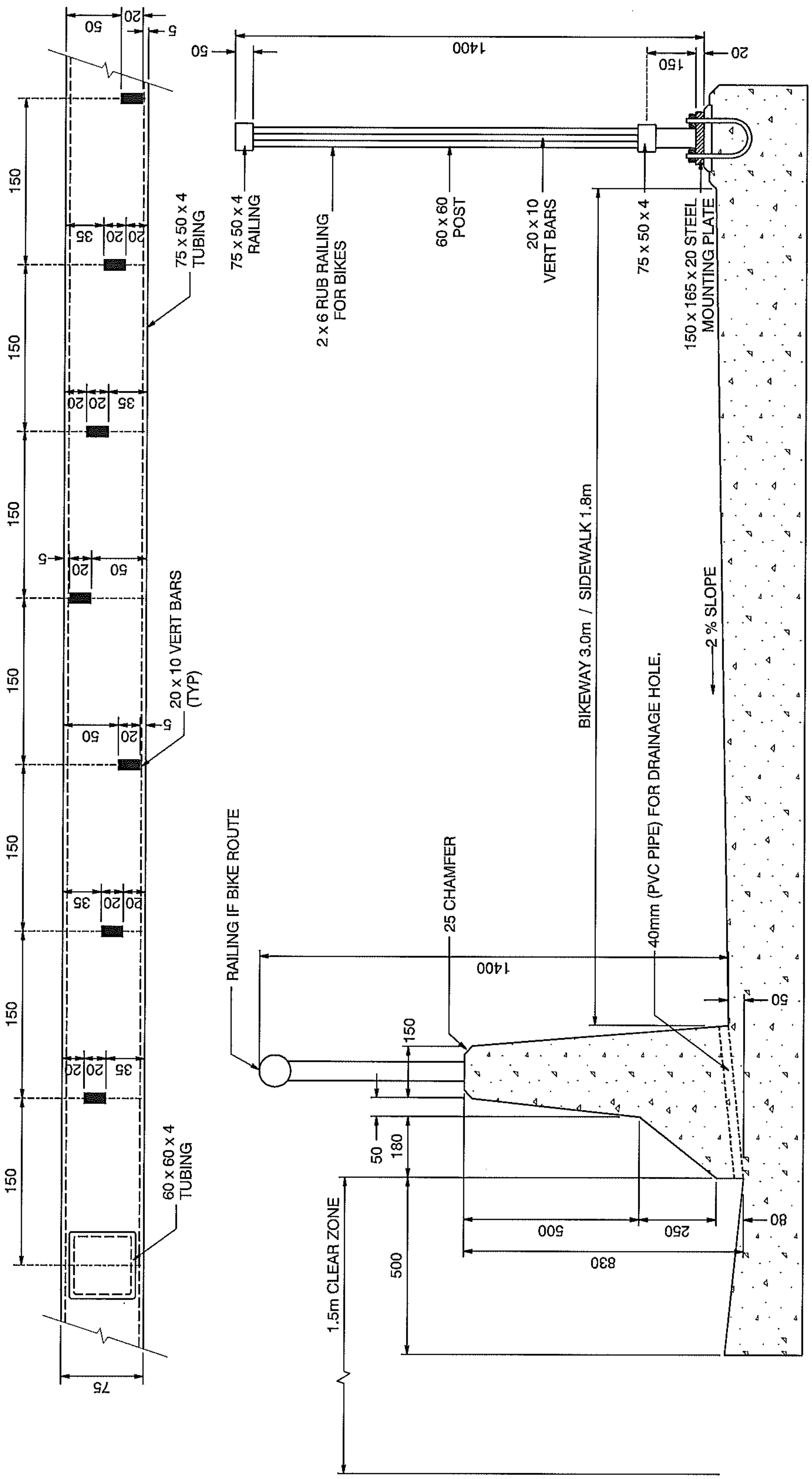
NOTES:

1. FOR CONSTRUCTION JOINT DETAIL SEE DRAWING 6010.

THE CITY OF Edmonton
STANDARD DRAWING

830 BRIDGE PARAPET

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6070
Scale: N.T.S.	Checked By:		–	



NOTES:

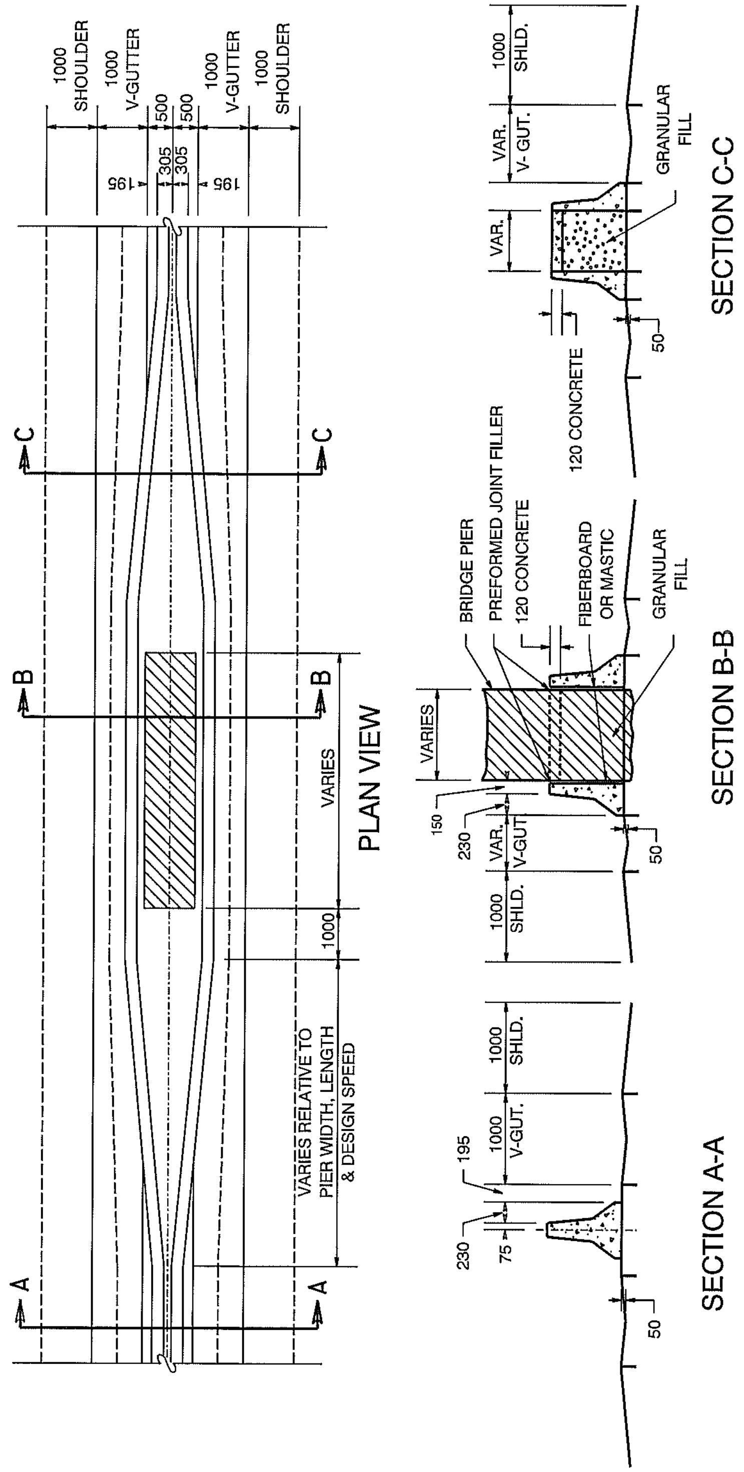
1. FOR PARAPET DETAIL SEE DRAWING 6070.

THE CITY OF Edmonton

STANDARD DRAWING

830 BRIDGE PARAPET AND HANDRAIL

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			6080
Scale: NTS	Checked By:			



NOTES:

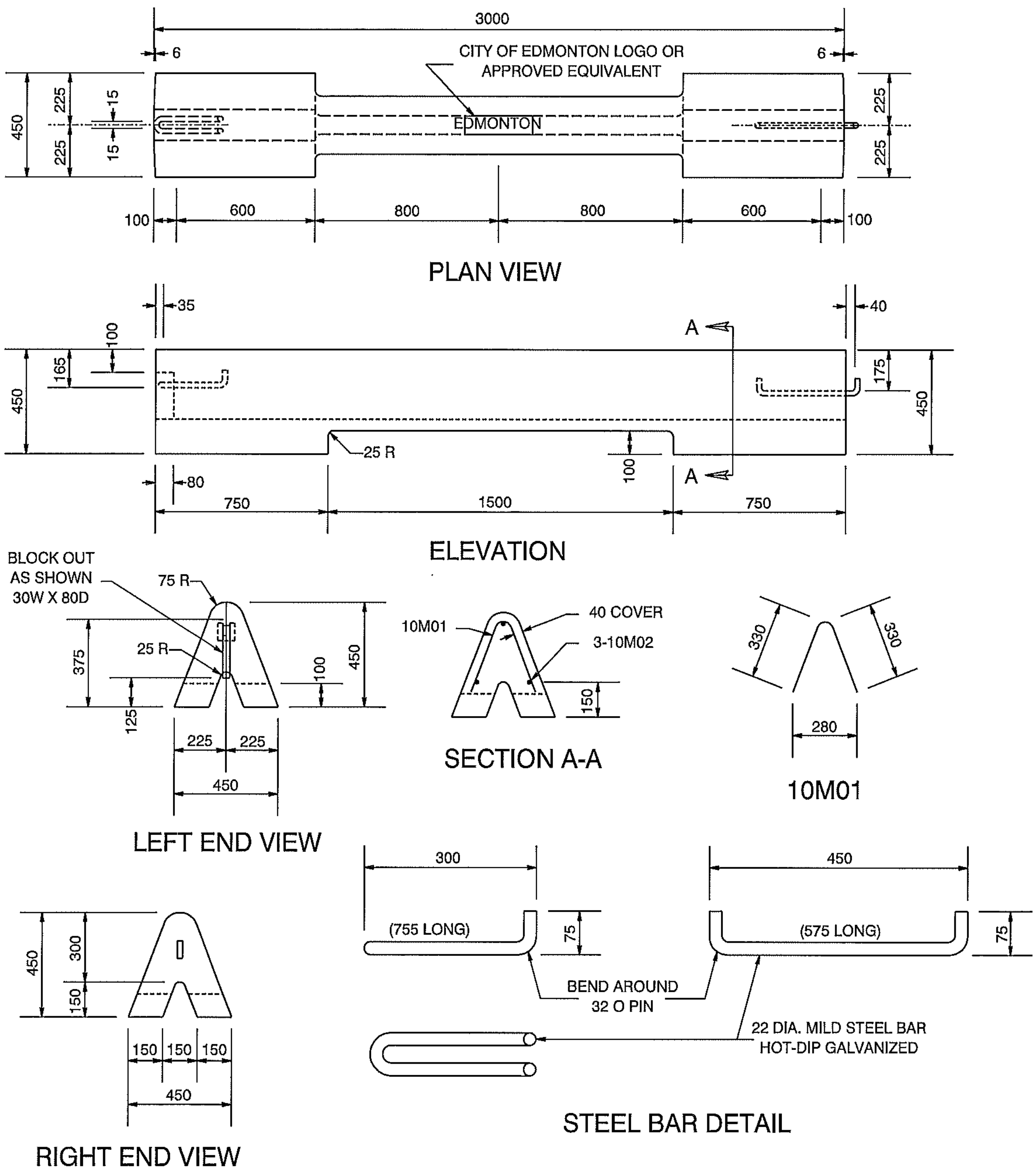
1. WIDTH AND LENGTHS WILL VARY.
2. CONCRETE BARRIER TO MAINTAIN STANDARD FACE DIMENSION THROUGHOUT SEE STANDARD DRAWING 6001.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

STANDARD TAPER AT BRIDGE PIERS CONCRETE BARRIER

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6090
Scale: N.T.S.	Checked By:		—	



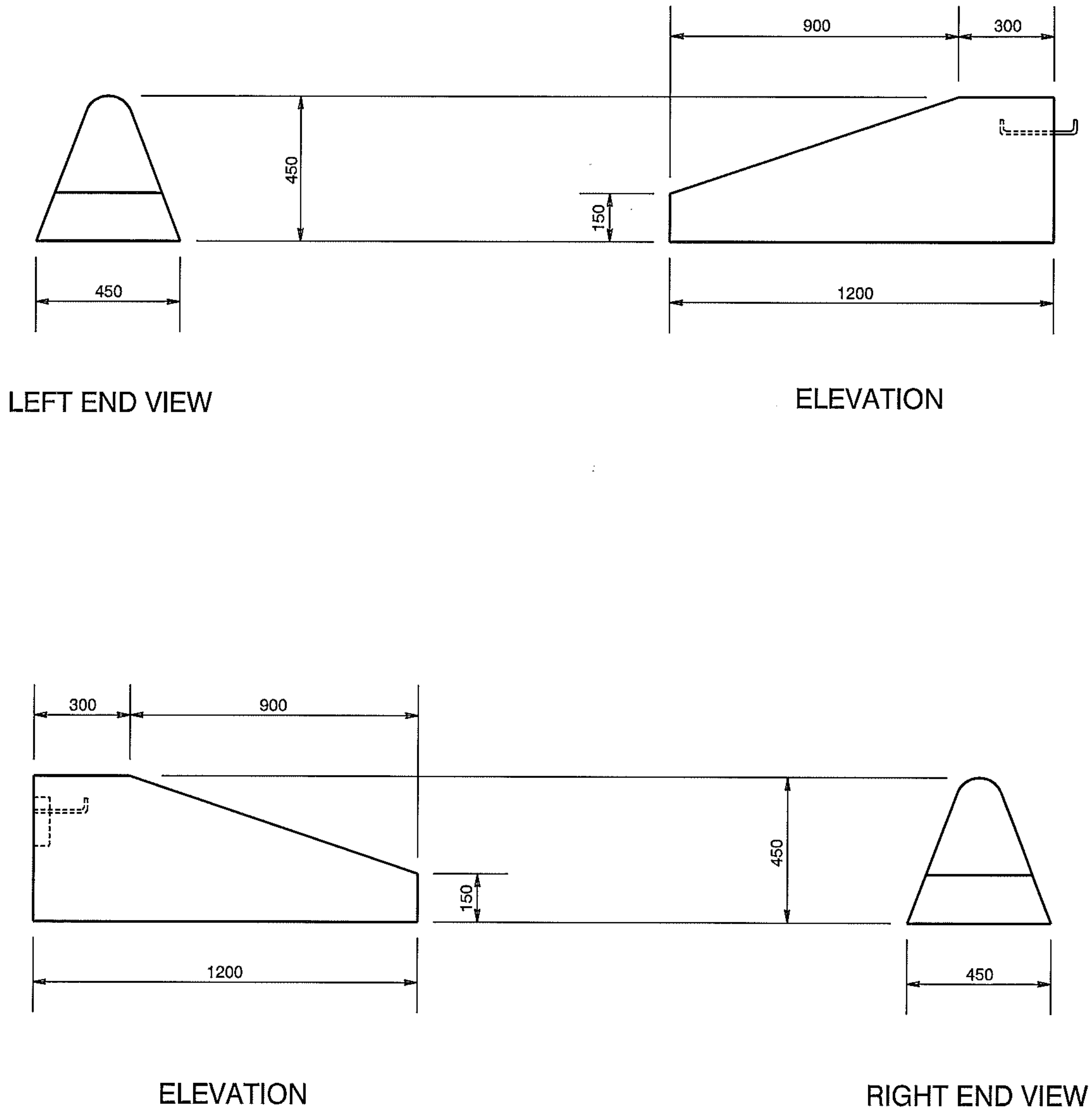
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

NOTE:
1. CLASS "C" CONCRETE

THE CITY OF Edmonton
STANDARD DRAWING

PRE-CAST CONCRETE MINI-BARRIER

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6100
Scale: N.T.S.	Checked By:			



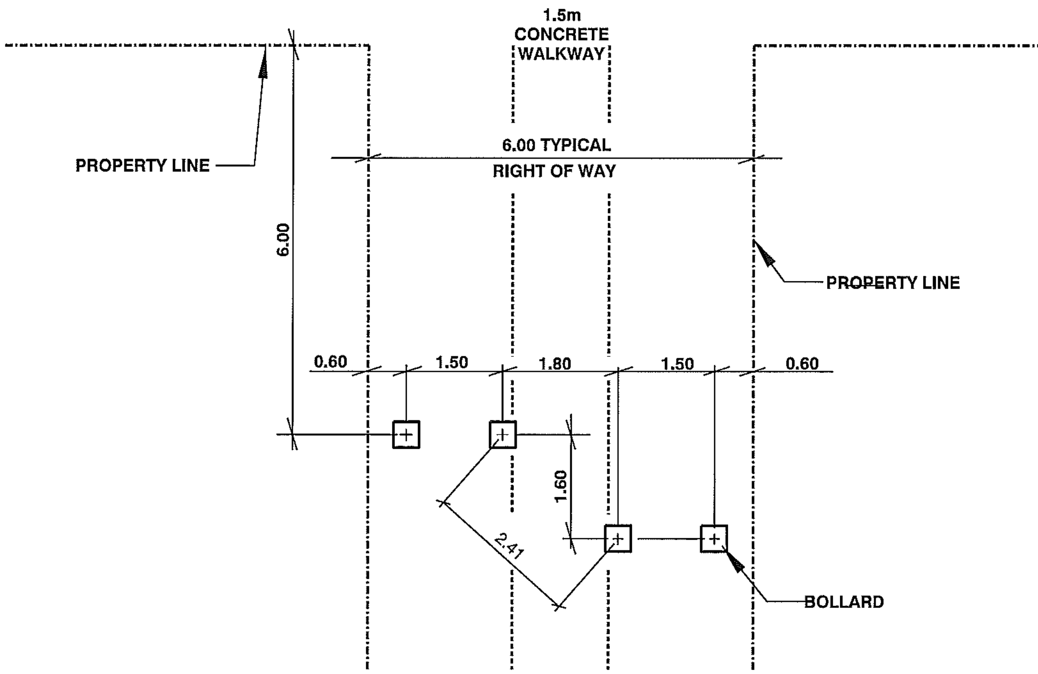
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

NOTES:
1. FOR STEEL DETAIL SEE STANDARD DRAWING 6100.

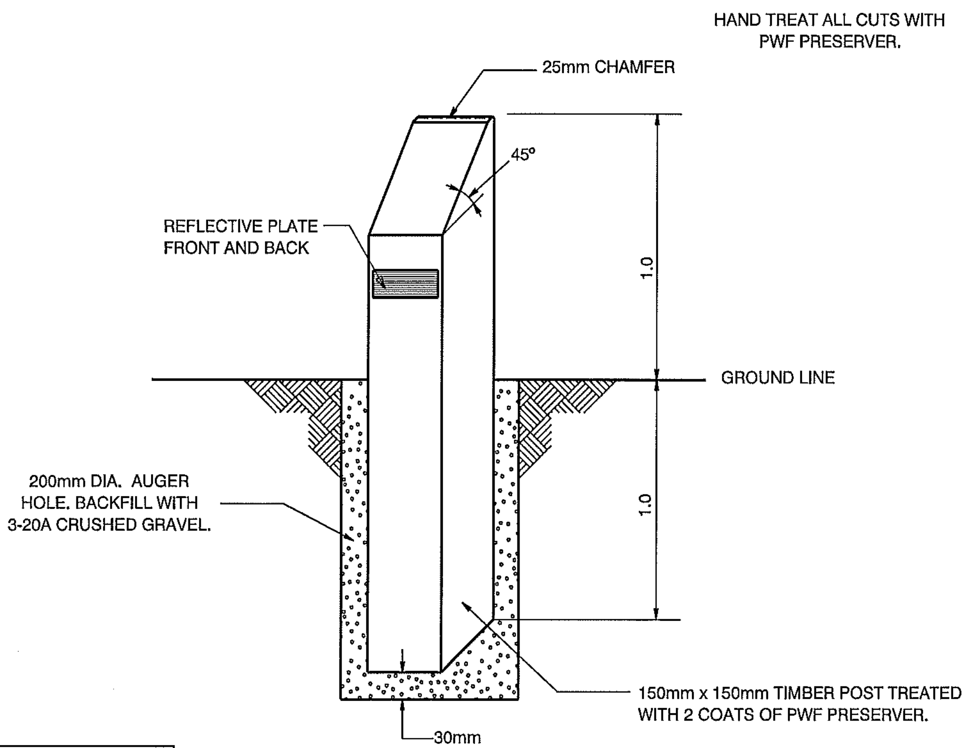
THE CITY OF Edmonton
STANDARD DRAWING

END TRANSITION PRE-CAST CONCRETE MINI-BARRIER

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6101
Scale: N.T.S.	Checked By:			



TYPICAL BOLLARD LAYOUT



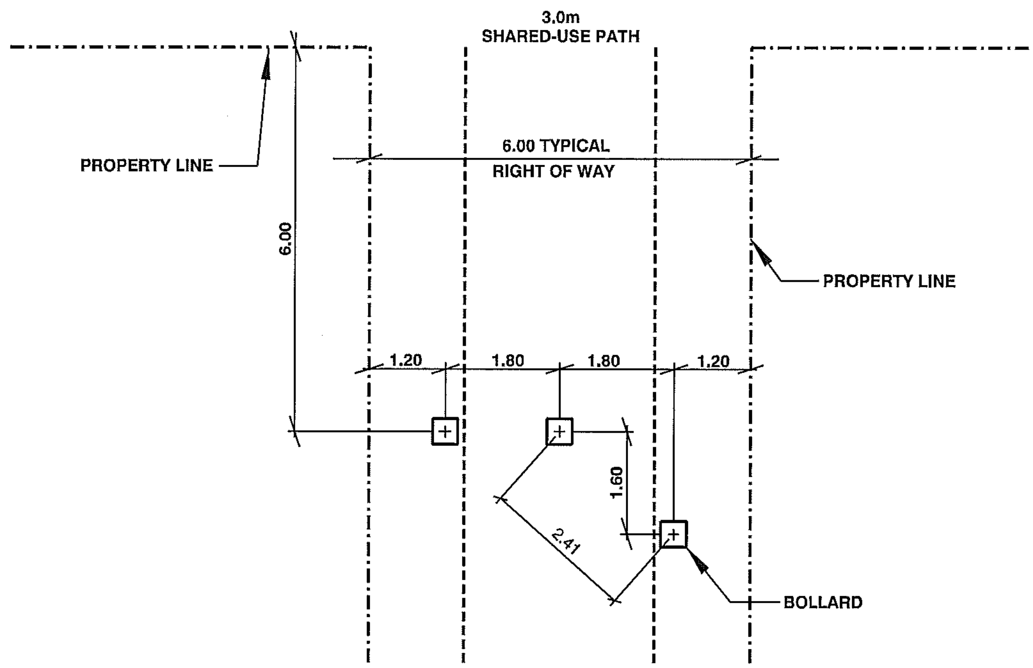
BOLLARD DETAIL

ALL DIMENSIONS
METRES UNLESS
OTHERWISE NOTED

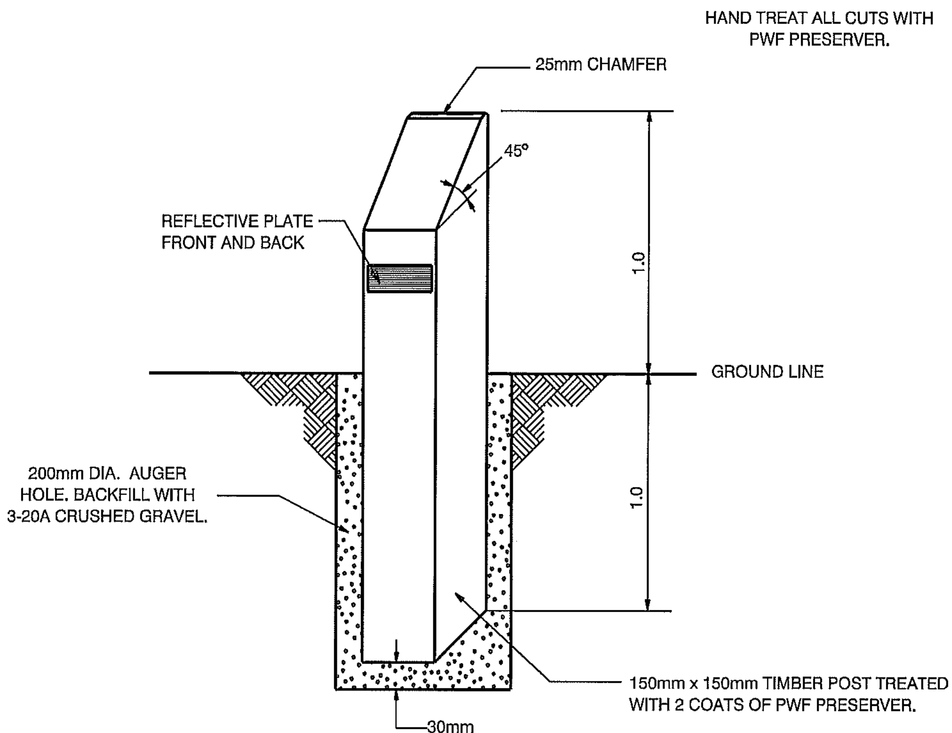
THE CITY OF Edmonton
STANDARD DRAWING

TYPICAL BOLLARD LAYOUT AND INSTALLATION FOR 1.5m WIDE CONCRETE WALKWAYS

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6200
Scale: N.T.S.	Checked By:			



TYPICAL BOLLARD LAYOUT



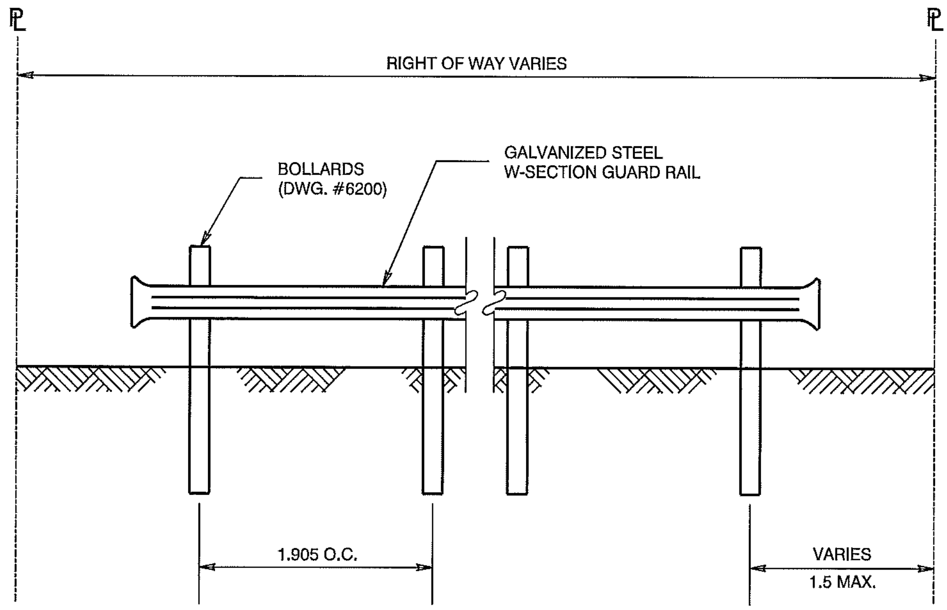
ALL DIMENSIONS
METRES UNLESS
OTHERWISE NOTED

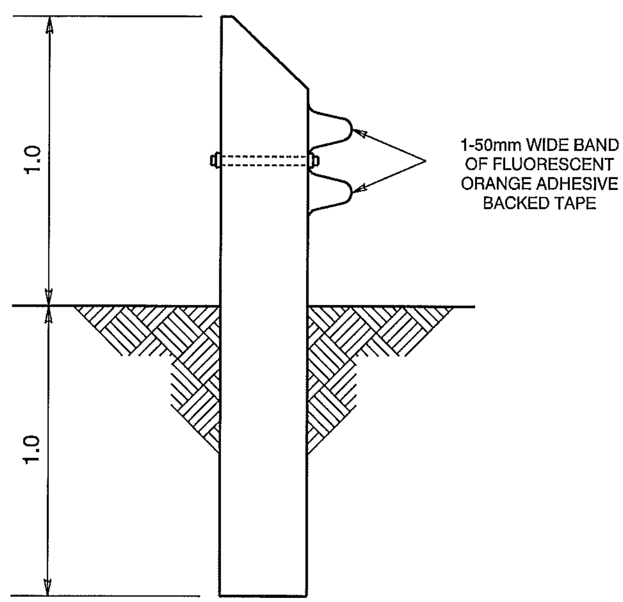
BOLLARD DETAIL

THE CITY OF Edmonton
STANDARD DRAWING

TYPICAL BOLLARD LAYOUT AND INSTALLATION
FOR 3.0m SHARED-USE PATH

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6210
Scale: N.T.S.	Checked By:			





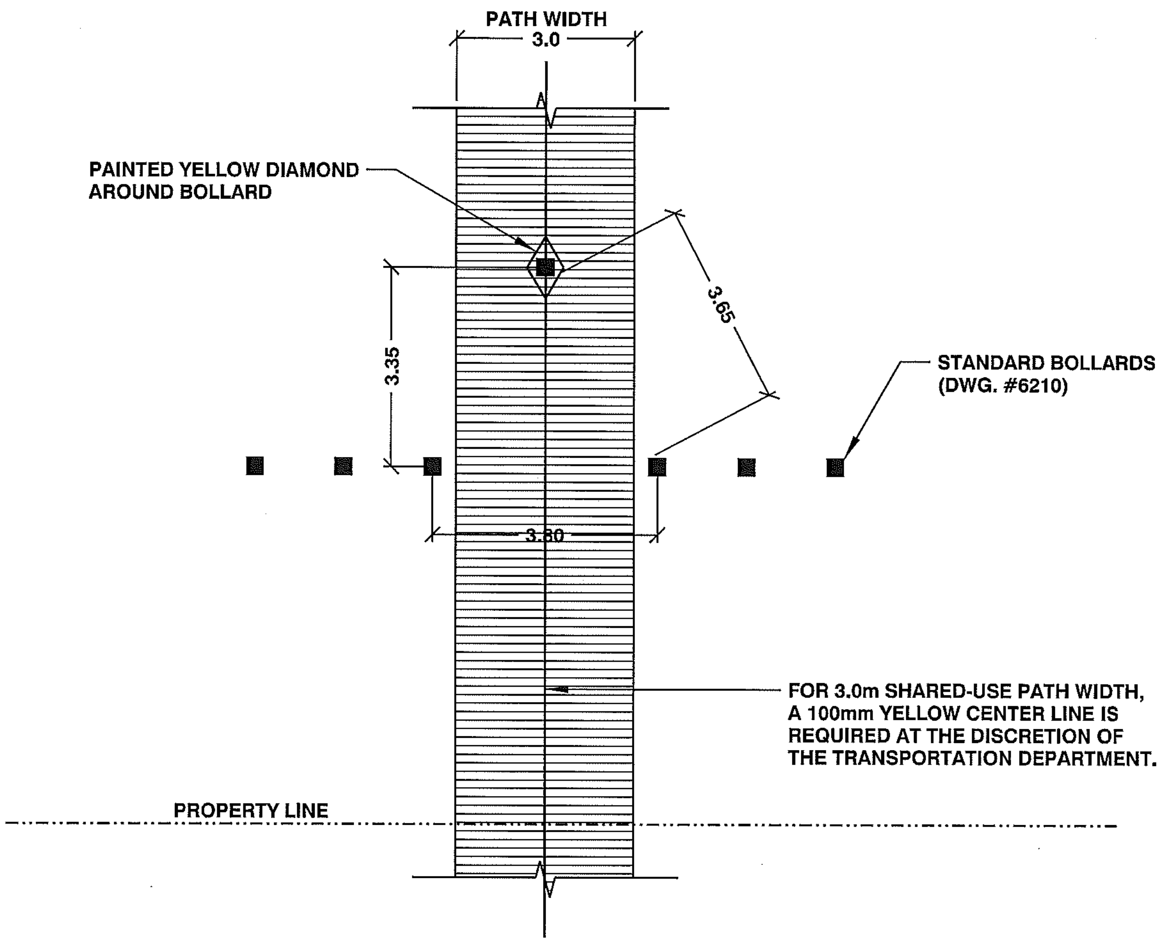
ALL DIMENSIONS
IN METRES UNLESS
OTHERWISE NOTED

NOTES:
1. ALL HARDWARE TO BE GALVANIZED.

THE CITY OF Edmonton
STANDARD DRAWING

TYPICAL BOLLARD WITH GALVANIZED STEEL W-SECTION

Date Approved: FEB., 2011	Drawn By: KSYC	Approved	Revision #	Drawing # 6220
Scale: N.T.S.	Checked By:			



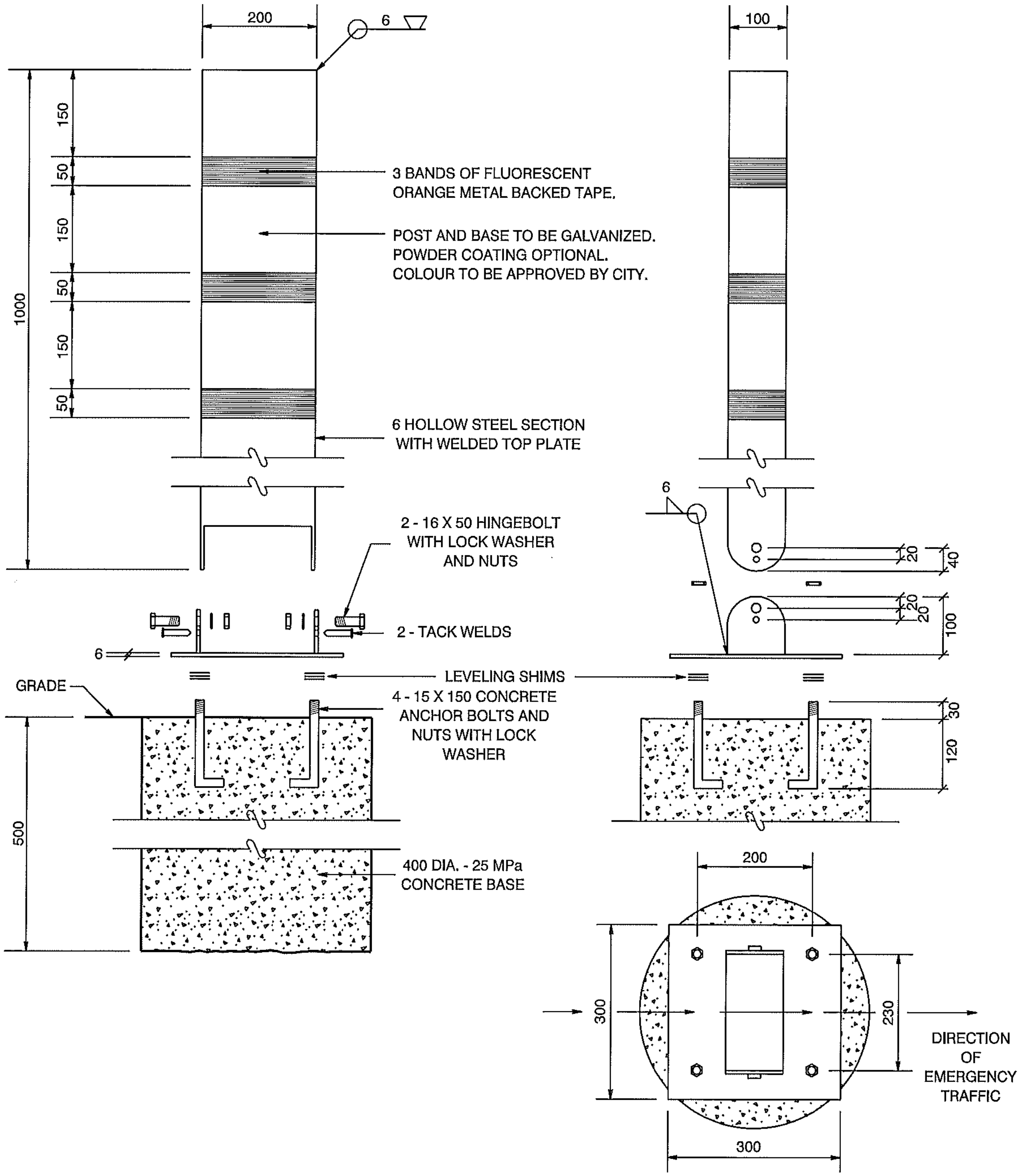
TYPICAL BOLLARD LAYOUT FOR 3.0m ASPHALT SHARED-USE PATH WITHIN PIPELINE/POWER R/W

ALL DIMENSIONS METRES UNLESS OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

TYPICAL BOLLARD LAYOUT FOR 3.0m ASPHALT SHARED-USE PATH WITHIN PIPELINE / POWER R/W

Date Approved: FEB., 2011	Drawn By: JW	Approved:	Revision #	Drawing # 6230
Scale: N.T.S.	Checked By:			

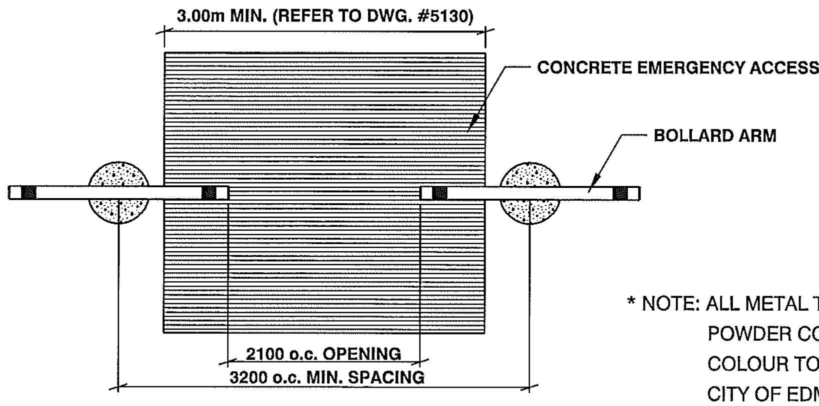


ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

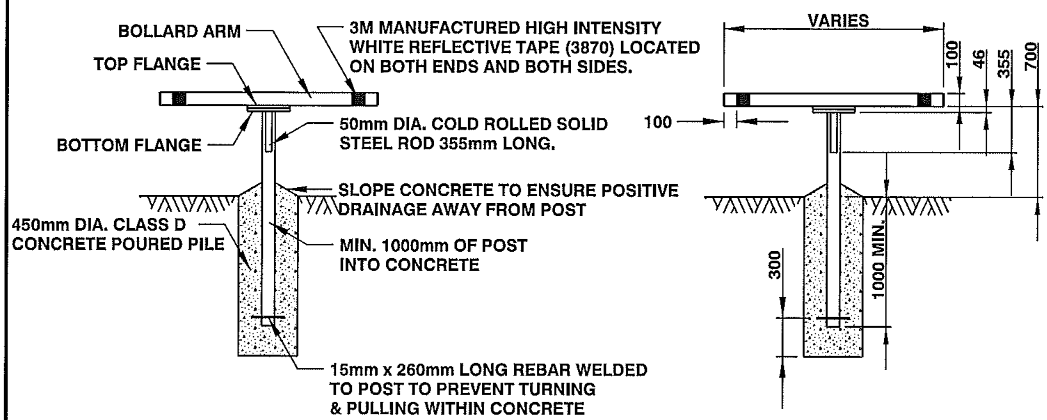
THE CITY OF Edmonton
STANDARD DRAWING

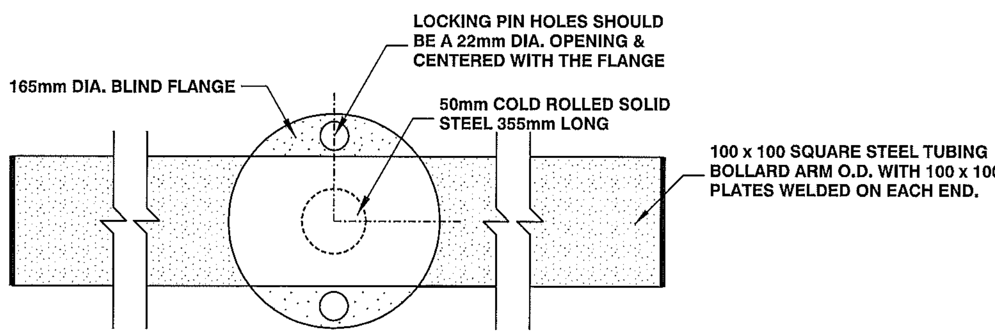
EMERGENCY KNOCK-DOWN POST (RETROFIT)

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			6240
Scale: N.T.S.	Checked By:			

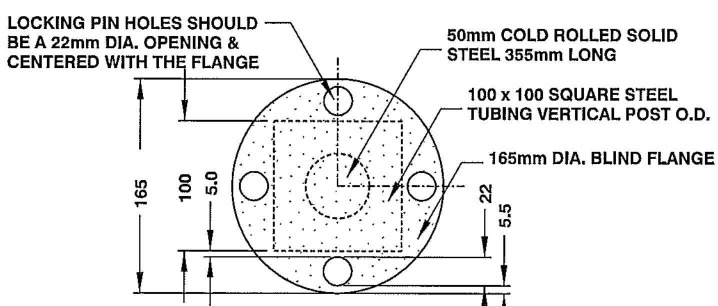


* NOTE: ALL METAL TO BE GALVANIZED.
POWDER COATING OPTIONAL.
COLOUR TO BE APPROVED BY
CITY OF EDMONTON.





TOP FLANGE



BOTTOM FLANGE

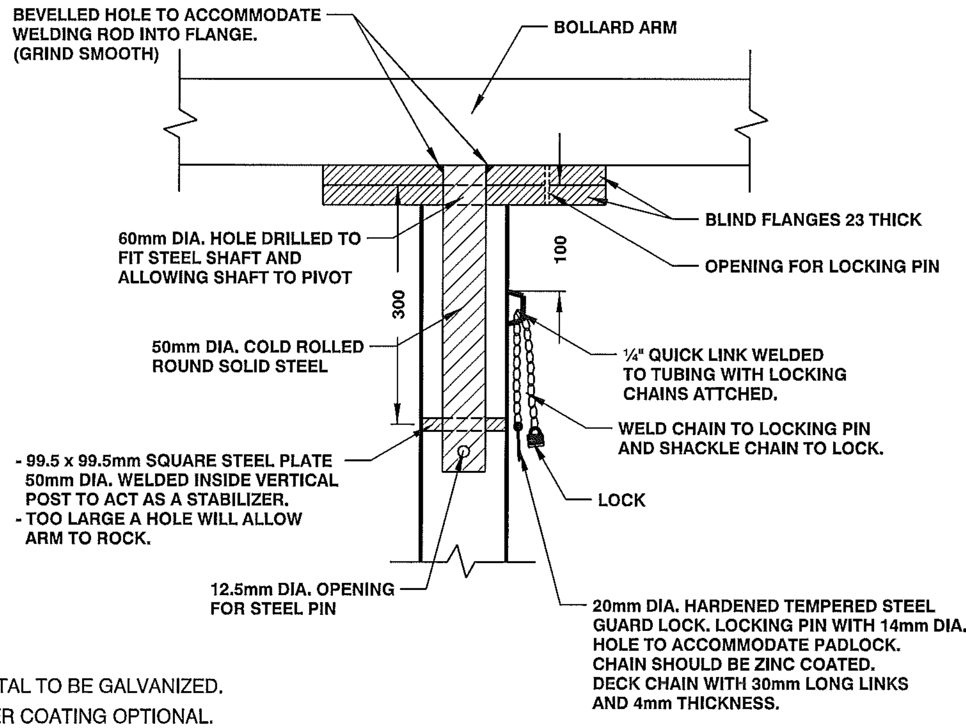
REFER TO DRAWING
#6251 FOR T-BOLLARD
ASSEMBLY DETAIL

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

THE CITY OF Edmonton
STANDARD DRAWING

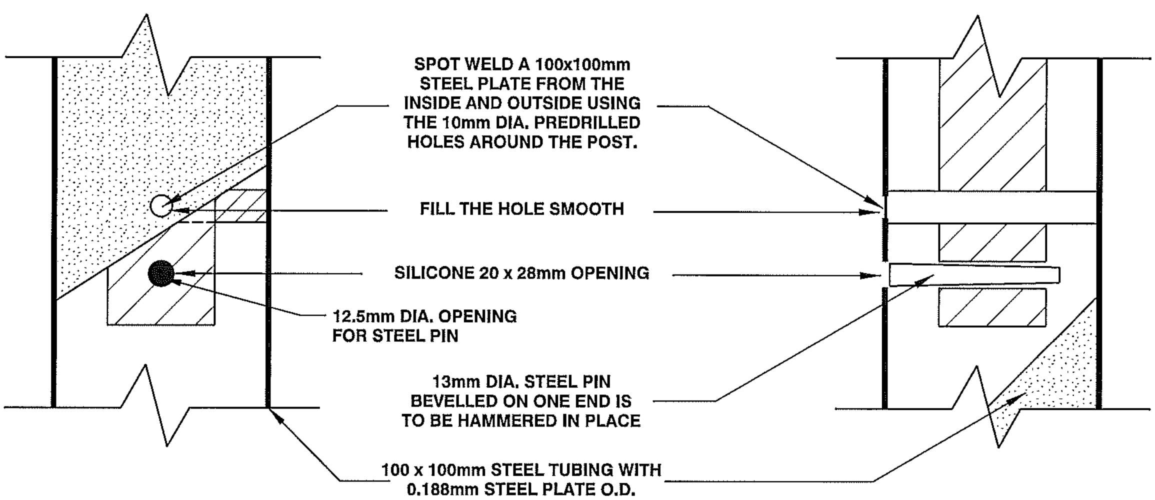
T-BOLLARD IN EMERGENCY ACCESS

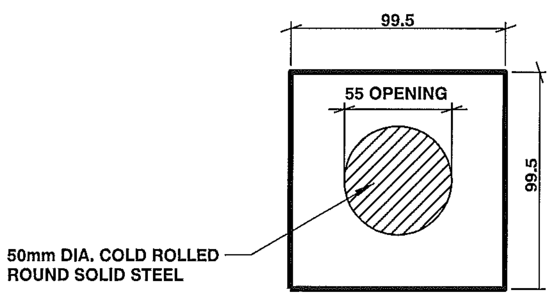
Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			6250
Scale: N.T.S.	Checked By:			



* NOTE: ALL METAL TO BE GALVANIZED.
POWDER COATING OPTIONAL.
COLOUR TO BE APPROVED BY
CITY OF EDMONTON.

ASSEMBLY DETAIL





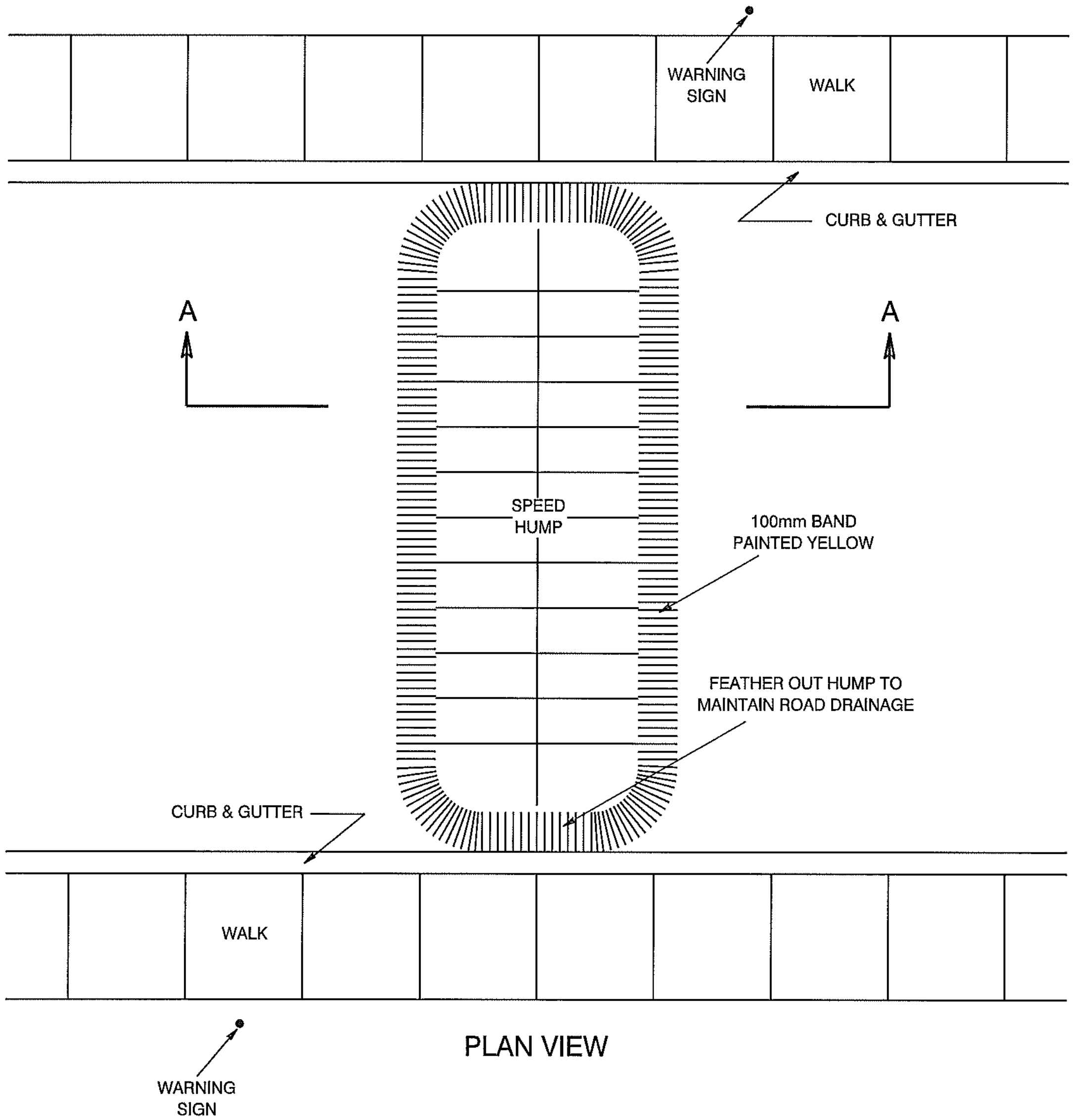
99.5 x 99.5mm SQUARE STEEL PLATE

ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

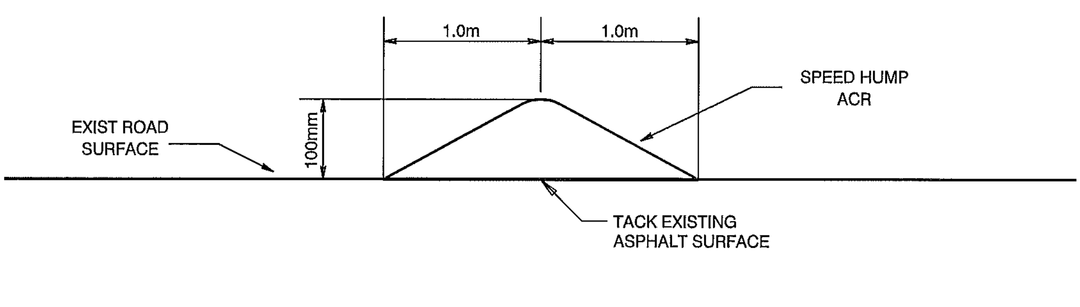
THE CITY OF Edmonton
STANDARD DRAWING

T-BOLLARD ASSEMBLY DETAIL

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW			6251
Scale: N.T.S.	Checked By:			



PLAN VIEW



SECTION A-A

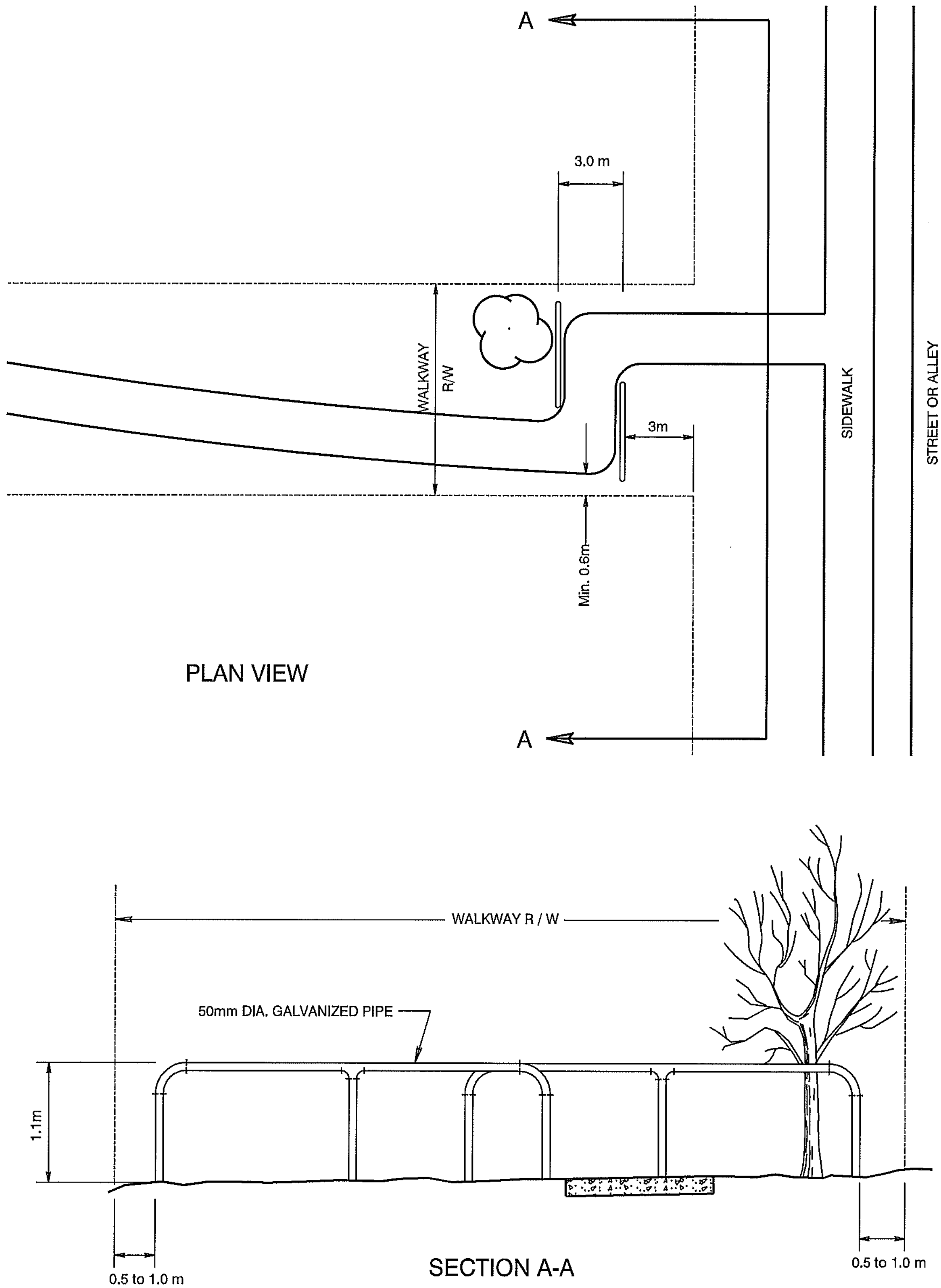
TAC CLASSIFICATION U.L.U. 50

THE CITY OF Edmonton

STANDARD DRAWING

ASPHALT SPEED HUMP

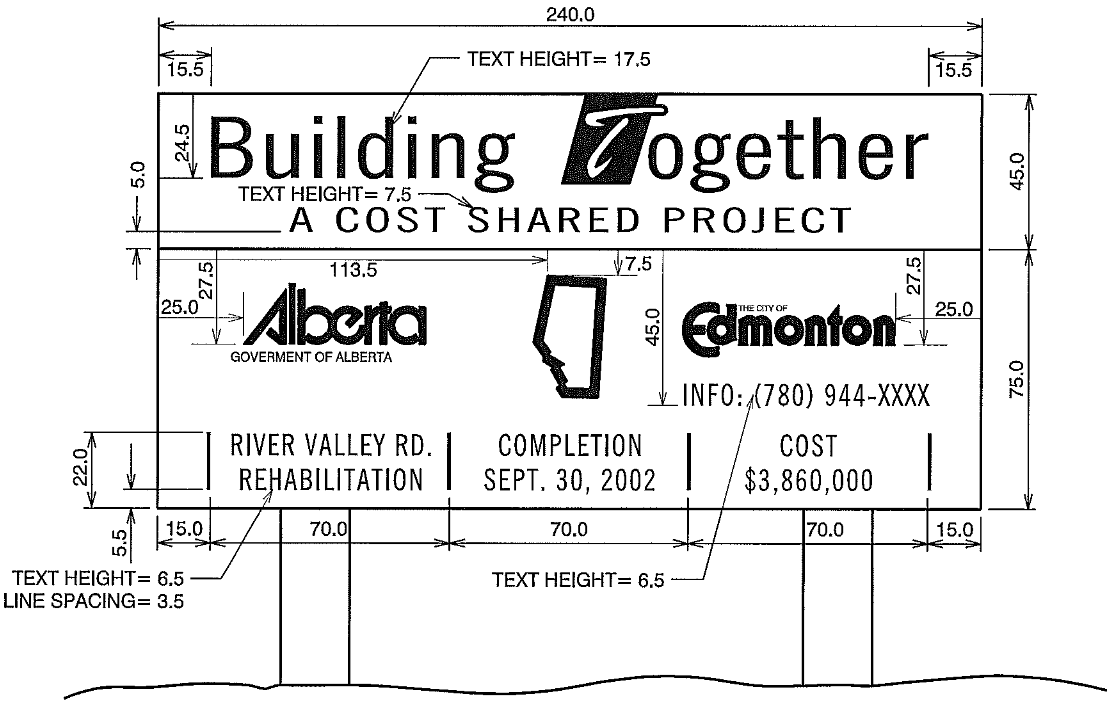
Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6300
Scale: N.T.S.	Checked By:			



THE CITY OF Edmonton
STANDARD DRAWING

PEDESTRIAN PROTECTION WALKWAY AND STREET / ALLEY INTERSECTIONS

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6400
Scale: N.T.S.	Checked By:			



DIMENSIONS: - 240cm x 120cm

MATERIAL: - HIGH INTENSITY GRADE REFLECTIVE SHEETING
- 19mm HIGH DENSITY OVERLAY FIR PLYWOOD

COLOUR: - TOP BACK GROUND - WHITE / MESSAGE - BLUE (PMS 286)
- BOTTOM BACKGROUND - BLUE (PMS 286) / MESSAGE - WHITE

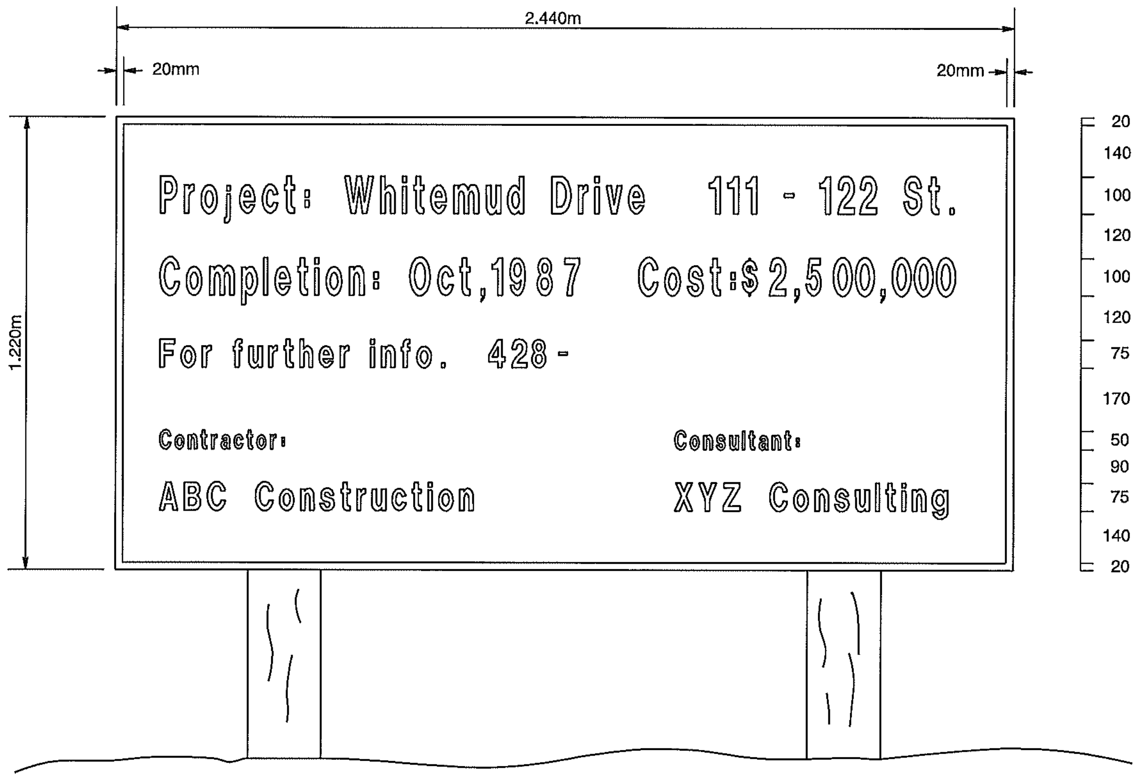
LETTER STYLE: - GILL SANS BOLD

NOTES: - LETTER SPACING TO BE DETERMINED WHEN EACH SIGN IS FABRICATED

THE CITY OF Edmonton
STANDARD DRAWING

COST SHARE PROJECT SIGN

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6500
Scale: N.T.S.	Checked By:			



MATERIALS: - HIGH INTENSITY GRADE REFLECTIVE SHEETING 2870-SILVER (SCOTCHLITE)
- 19 mm HIGH DENSITY OVERLAY FIR PLYWOOD

INK: - 810 TRANSPARENT BLUE 3M

LETTER STYLE: - COOPER BLACK ITALIC & HELVETICA MEDIUM - SIZES AS SHOWN

COLOUR: - TRANSPARENT BLUE ON SILVER BACKGROUND

NOTES: - LETTER SPACING TO BE DETERMINED WHEN EACH SIGN IS FABRICATED

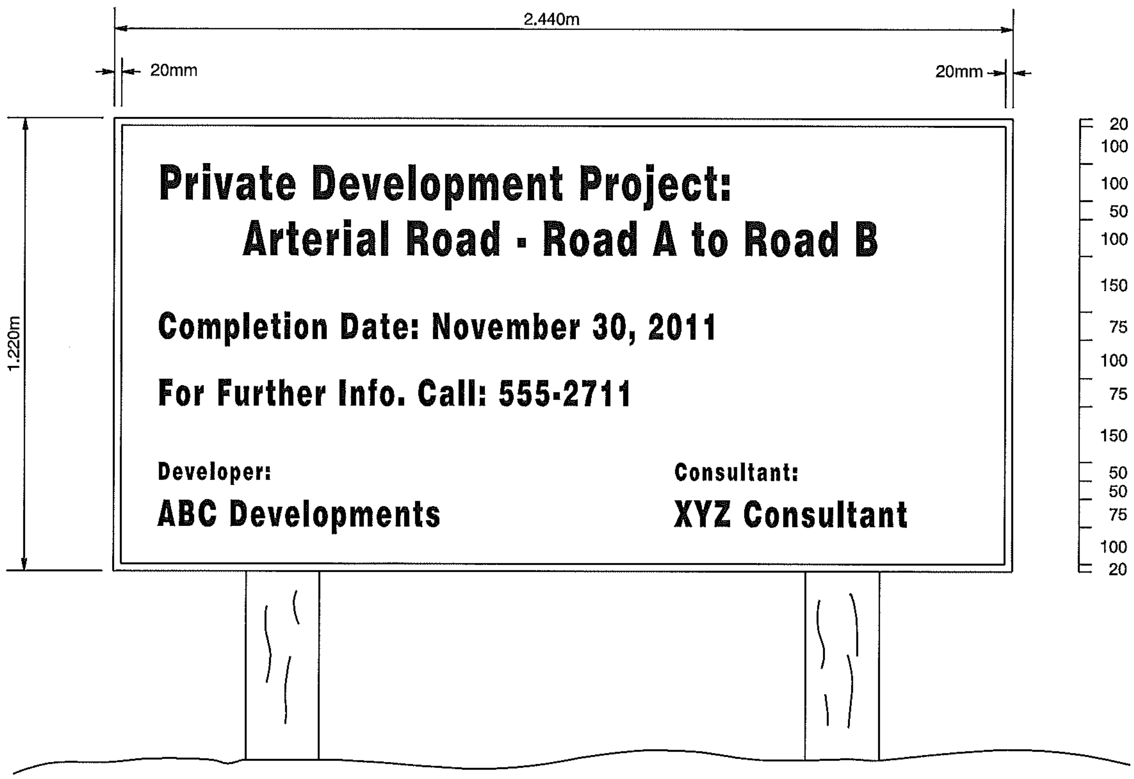
DIMENSIONS: - mm UNLESS SHOWN OTHERWISE

COST: - CONTRACT $ TO NEAREST 100,000

THE CITY OF Edmonton
STANDARD DRAWING

AUXILIARY PROJECT SIGN

Date Approved: FEB., 2011	Drawn By: JW	Approved:	Revision #	Drawing # 6510
Scale: N.T.S.	Checked By:			



MATERIALS: - HIGH INTENSITY GRADE REFLECTIVE SHEETING 3870-SILVER (HIGH INTENSITY SCOTCHLITE)
- 19 mm HIGH DENSITY OVERLAY FIR PLYWOOD

INK: - 810 TRANSPARENT BROWN 3M

LETTER STYLE: - HELVETICA MEDIUM OR CLEAR VIEW FONT - SIZES AS SHOWN

COLOUR: - TRANSPARENT BROWN ON SILVER BACKGROUND

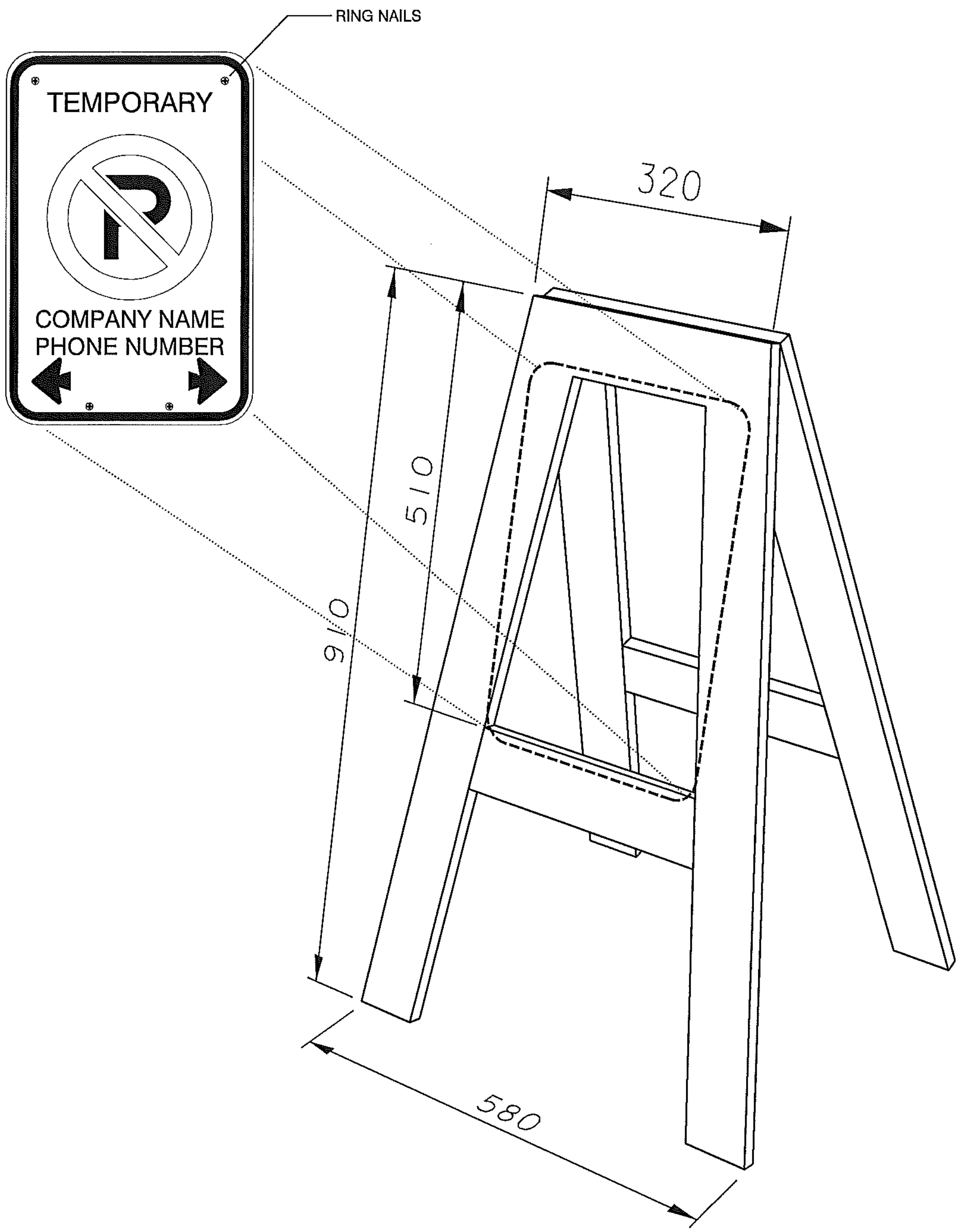
NOTES: - LETTER SPACING TO BE DETERMINED WHEN EACH SIGN IS FABRICATED

DIMENSIONS: - mm UNLESS SHOWN OTHERWISE

THE CITY OF Edmonton
STANDARD DRAWING

DEVELOPER-BUILT ARTERIAL ROAD PROJECT SIGN

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6520
Scale: N.T.S.	Checked By:			



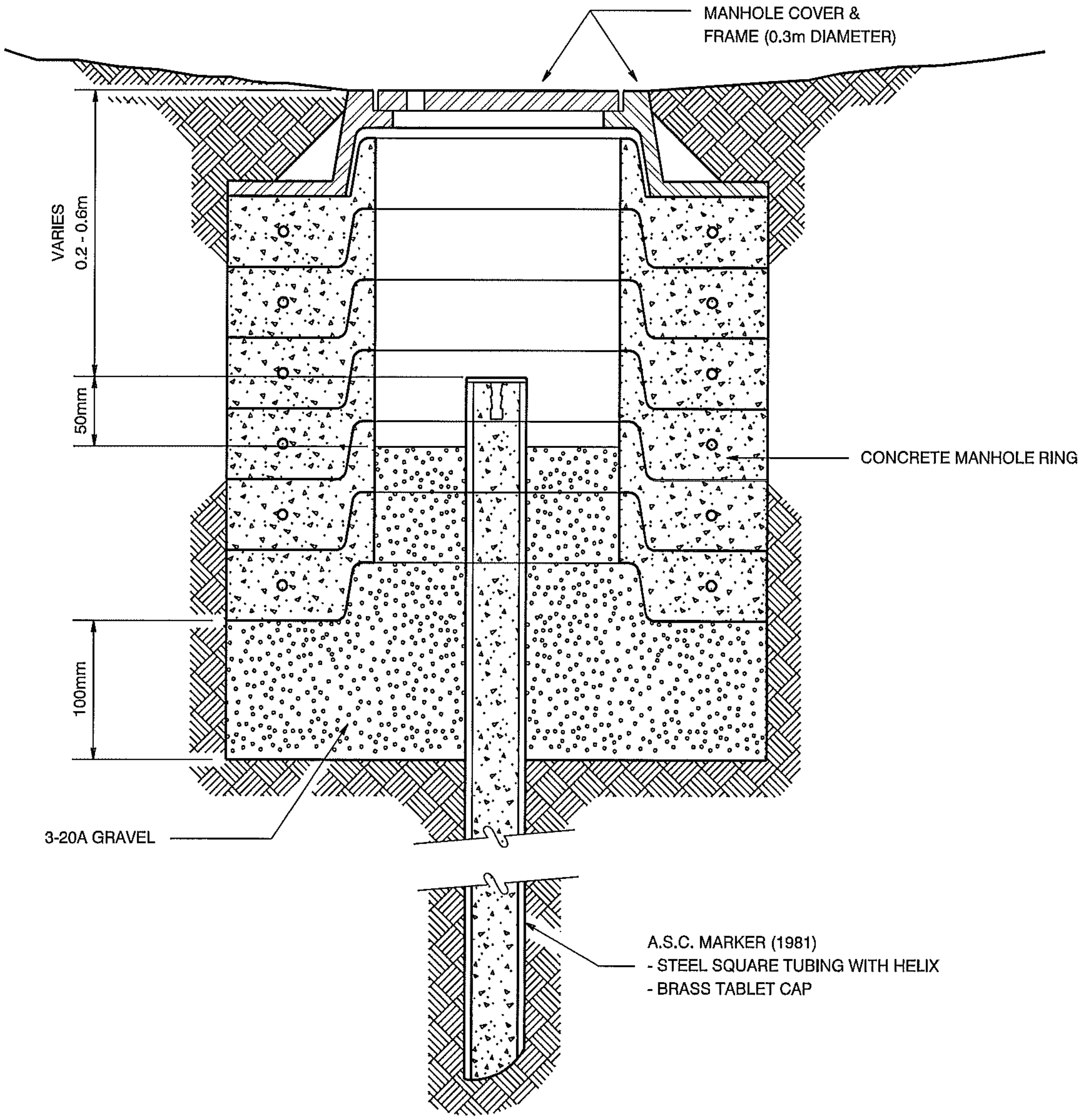
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. SIGN: 30 x 45 cm BLACK MESSAGE AND BORDER, RED CIRCLE AND WHITE BACKGROUND. (RB-5203)
3. PLACE AT 45° FACING TRAFFIC. MAXIMUM SPACING 25 m.

THE CITY OF Edmonton
STANDARD DRAWING

TYPICAL A-FRAME SIGN

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6530
Scale: N.T.S.	Checked By:			



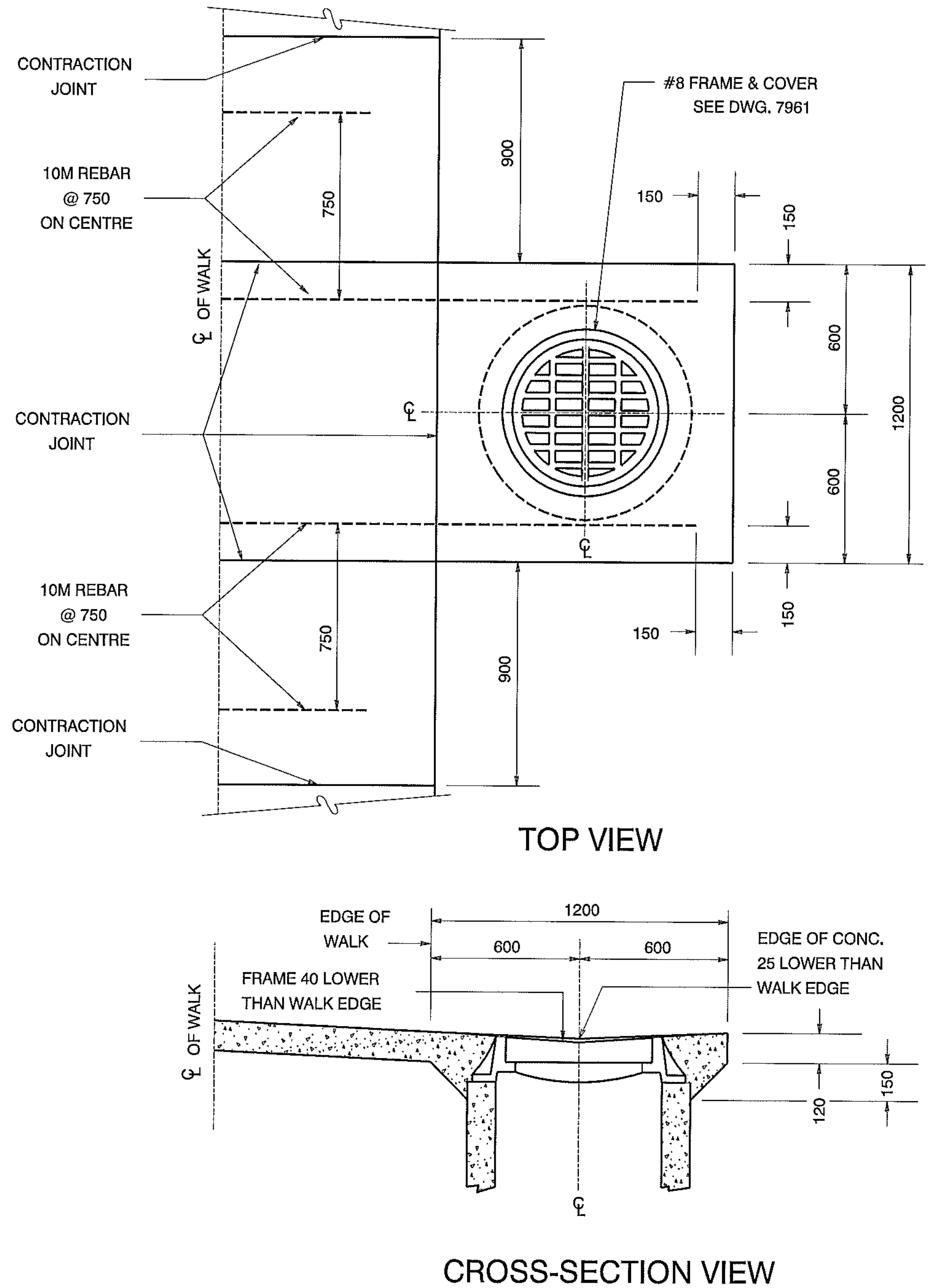
ALL DIMENSIONS
IN MILLIMETRES UNLESS
OTHERWISE NOTED

NOTES:
1. NUMBER OF CONCRETE RINGS VARIES WITH DEPTH.

THE CITY OF Edmonton
STANDARD DRAWING

MANHOLE INSTALLATION FOR SURVEY CONTROL MARKERS (DEPTHS 0.2m - 0.6m)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 6600
Scale: N.T.S.	Checked By:			



NOTES:

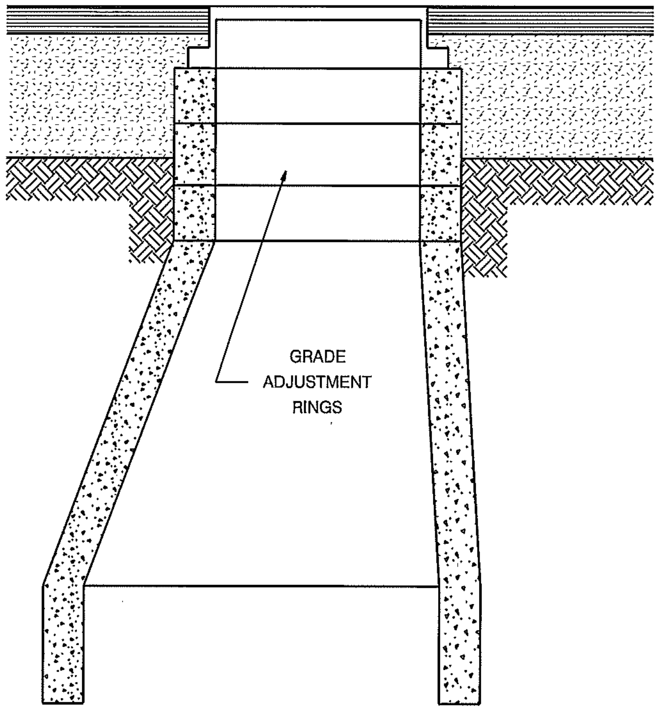
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.

THE CITY OF Edmonton

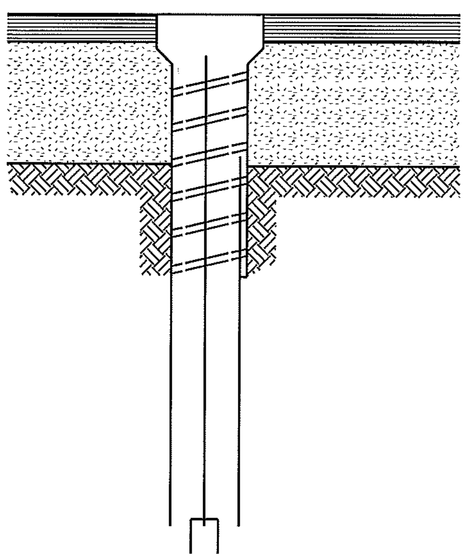
STANDARD DRAWING

CATCH BASINS IN WALKWAY RIGHTS-OF-WAY

Date Approved:	Drawn By:	Approved	Revision #	Drawing #
FEB., 2011	JW		–	7976
Scale: N.T.S.	Checked By:			



MANHOLE DETAIL



VALVE DETAIL

NOTES:

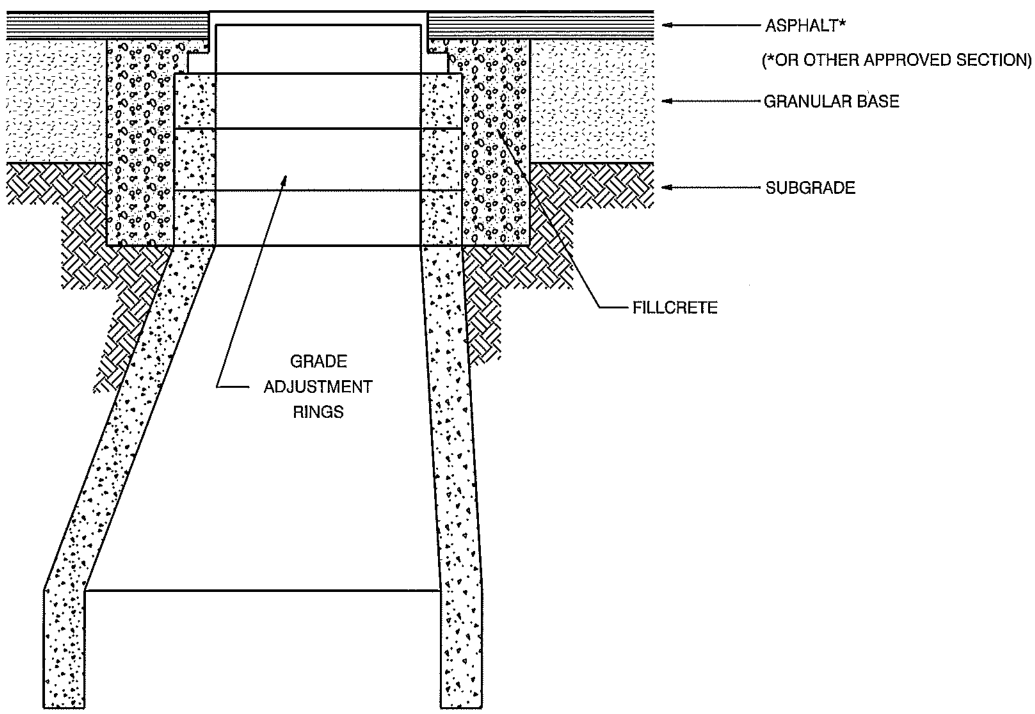
1. THIS DETAIL APPLIES TO BACKFILL FOR MANHOLE AND VALVE RAISED TO FINISHED SUBGRADE, FINISHED GRAVEL GRADE, AND FINISHED ASPHALT GRADE IN SUCCESSIVE OPERATIONS.

2. BACKFILL WITH EXISTING MATERIALS (CLAY OR GRANULAR BASE) WHEN MANHOLE FRAMES AND COVERS ARE RAISED FROM BELOW SUBGRADE TO TOP OF SUCCESSIVE LAYER (SEVERAL OPERATIONS). IF NOT, REFER TO DWG. #7981.

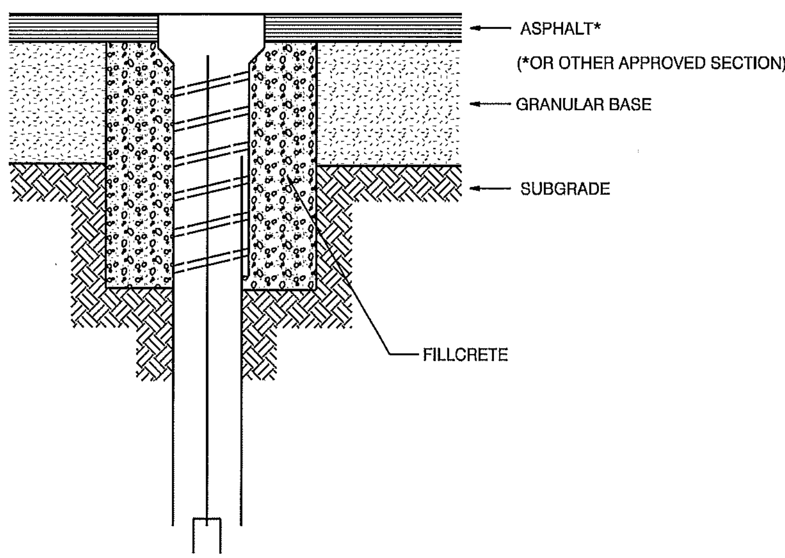
THE CITY OF Edmonton
STANDARD DRAWING

BACKFILL DETAIL OF MANHOLE AND VALVE RAISED TO GRADE

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision #	Drawing # 7980
Scale: N.T.S.	Checked By:		—	



MANHOLE DETAIL



VALVE DETAIL

NOTES:

BACKFILL WITH FILLCRETE WHEN MANHOLE FRAMES AND COVERS ARE RAISED FROM BELOW SUBGRADE TO FINISHED ASPHALT GRADE IN ONE OPERATION.

THE CITY OF Edmonton
STANDARD DRAWING

BACKFILL DETAIL OF MANHOLE AND VALVE RAISED TO GRADE (FILLCRETE OPTION)

Date Approved: FEB., 2011	Drawn By: JW	Approved	Revision # —	Drawing # 7981
Scale: N.T.S.	Checked By:			

EXAMPLE COMPLETE STREET CROSS SECTIONS

STANDARD DETAILS

SECTION 8000

EXAMPLE COMPLETE STREETS CROSS SECTIONS ADDENDUM

1. GENERAL

The Way We Move recognizes that transportation is about more than simply moving people, goods, and services. Roadways are essential infrastructure that shape our urban form, impact our economic wellbeing and act as vital components of our community and quality of life. With these principles in mind, Edmonton's Complete Streets Policy and Guidelines were developed to better reflect these aspirations for the city through the design and operation of our streets. The Complete Streets policy C573 and guideline were approved and accepted as information by Council on May 22, 2013.

Complete Streets represents a change in roadway design philosophy. The intent of the Complete Streets Guidelines is to encourage a holistic, context sensitive approach to roadway design in order to develop a network of roadways that are designed to be safe, attractive, comfortable and welcoming of all users. Six principles for Complete Streets were established to be used to shape the goals and objectives of any road design projects and referenced through the development of the design to help reconcile tradeoffs. The Complete Streets Principles are:

- Provide travel options for all users and trip purposes in a safe, accessible, context sensitive way in all seasons.
- Form a network of streets that together accommodate all users and allow for efficient and high quality travel experiences.
- Be adaptable by accommodating the needs of the present and future through effective space allocation for the many functions of the street.
- Contribute to the environmental sustainability and resiliency of the city.
- Consider both direct and indirect costs, as well as the value of the roadway and the adjacent real estate
- Be vibrant and attractive people-places in all seasons that contribute to an improved quality of life.

The Example Complete Streets Cross Sections were designed with the intent of implementing the City of Edmonton Complete Streets principles described above and to supplement existing designs in the City of Edmonton's Design and Construction Standards. Complete Streets cross sections were seen as desirable by industry as well as by City administration to help facilitate the implementation of Complete Streets designs and to avoid impacts to the approval process. However, should a developer have a desire to implement a concept that is different from the Complete Streets example cross-sections, the Complete Street Guidelines will provide flexibility and design ranges that are typically acceptable to the City.

The following notes shall govern the use of the Example Complete Streets Cross Sections:

2. APPLICATION CONTEXT

In greenfield, brownfield and retrofit applications, a specific example cross section will not be limited to the land use context associated with that cross section. While cross sections were designed with a specific context in mind, alternate land-uses may be equally appropriate. Design will undergo the process considerations laid out in Section 3.0 of the Complete Streets Guidelines. A case by case analysis to judge appropriate design will be required to determine application. For example, a non-street oriented design identified for one land use type may be appropriate for other non-street oriented land uses.

3. UTILITIES

3.1 The provision of utilities within the cross section of narrow collectors must be considered prior to setting the reduced right-of-way widths. Roadway design must take into consideration the minimum clearances between buried utilities and surface breaking infrastructure as provided in the COE Design and Construction Standards. Additional carriageway width may be required to accommodate utilities.

3.2 Locate surface appurtenances associated to underground utilities outside of accesses, crosswalks, bus stops and turning movement areas.

3.3 In greenfield locations, if adequate setbacks from the roadway, sidewalk, cycle track, and/or shared use path cannot be maintained within the narrowed and/or congested rights-of-way, place transformers, pedestals, valves, etc. on easements or utility right of way (URW's) on private property.

3.4 To optimize on-street parking capacity, place hydrants on roadway opposite on-street parking, where parking is only on one side. Parking is banned on either side of hydrant.

3.5 Utility easements depicted on the cross sections may be necessary. It is the designer's responsibility to place gas mains and feeder mains on easement, under the walkway or in an alternate location as necessary. Design must take into consideration minimum clearance from other buried utilities as provided in the COE Design and Construction Standards.

3.6 In locations with curb bulb-outs, catch basins upstream of the bulb-outs would be preferable to swales and grates between the parking and the drive lanes. This is due to storm water flow continuity and maintenance considerations.

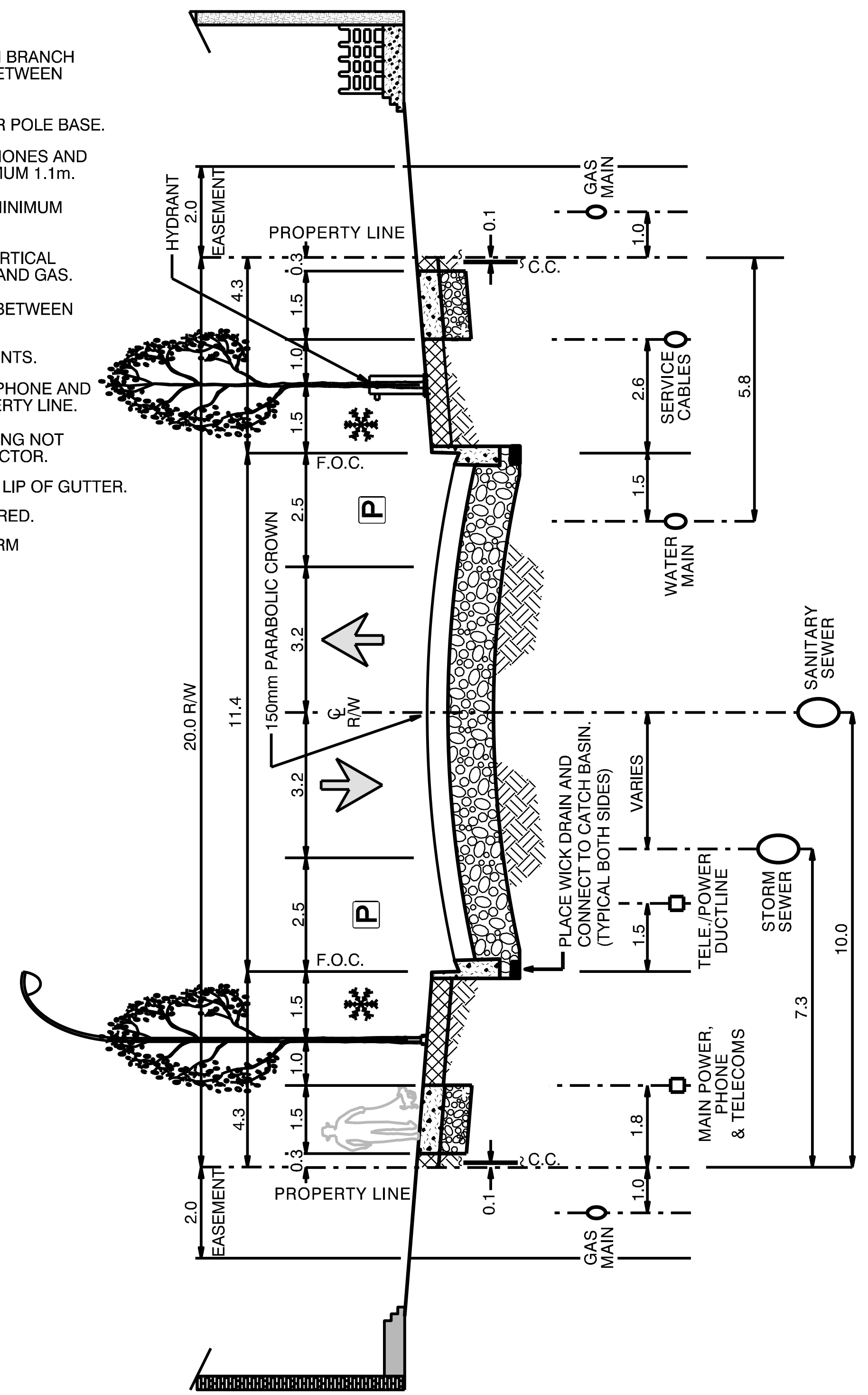
3.7 It is the designer's responsibility to ensure adequate on-street drainage of the cycle-tracks.

4. CYCLE FACILITIES

Refer to Complete Streets Guidelines for information regarding appropriate bicycle facility selection and design. Facility choice and design should be based on an analysis that includes traffic volumes, speeds, and mix of traffic as well as takes into consideration other local characteristics.

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. CROWNS ARE MEASURED FROM LIP OF GUTTER.
13. EASEMENT PROVIDED AS REQUIRED.
14. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

P PARKING

DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

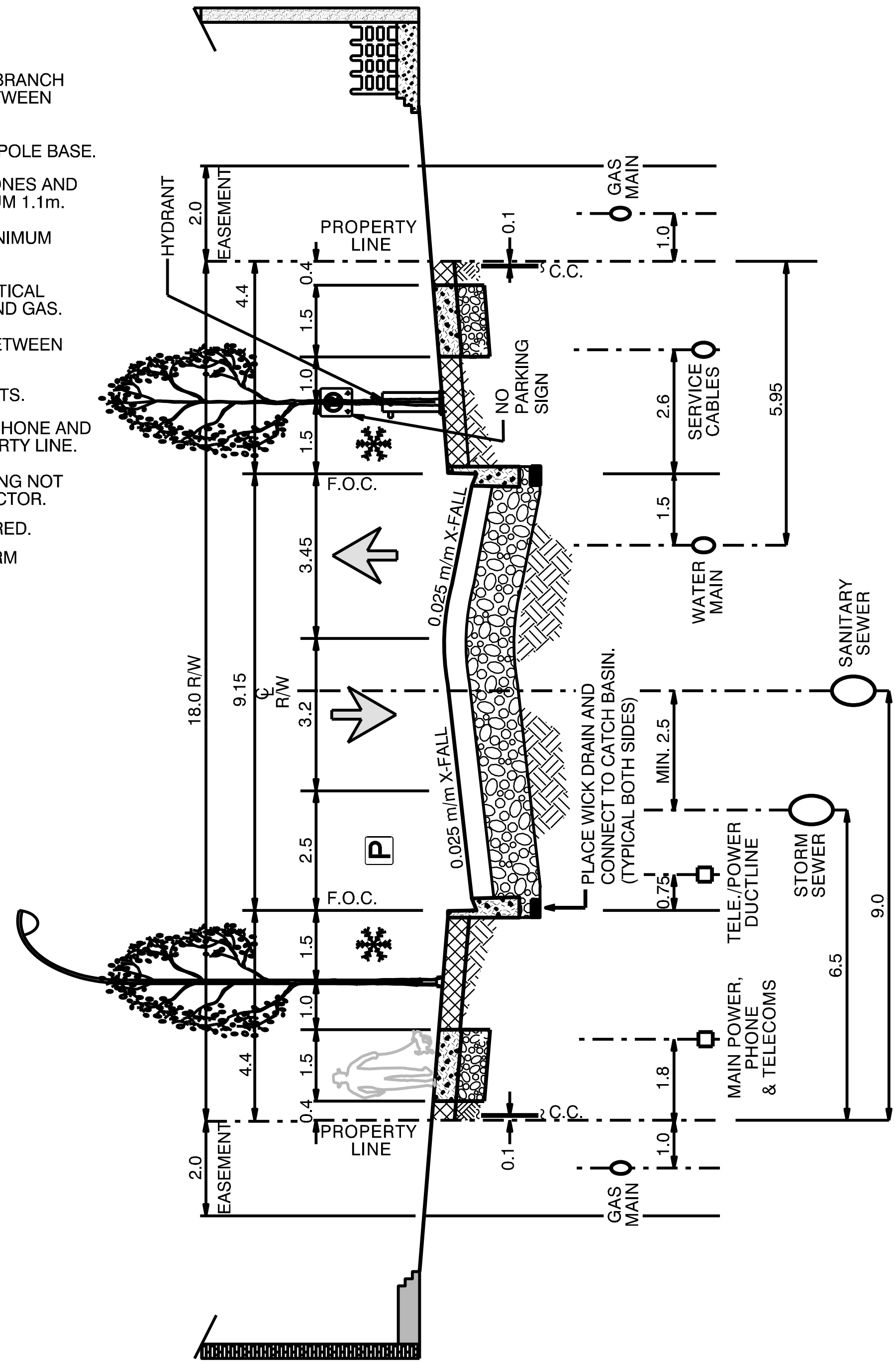
THE CITY OF Edmonton
STANDARD DRAWING

STREET ORIENTED RESIDENTIAL
COLLECTOR (NOT ON BIKE NETWORK) - 20m R/W

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8000
Scale: NTS	Checked By: MP			

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. EASEMENT PROVIDED AS REQUIRED.
13. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

P PARKING

DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

THE CITY OF Edmonton

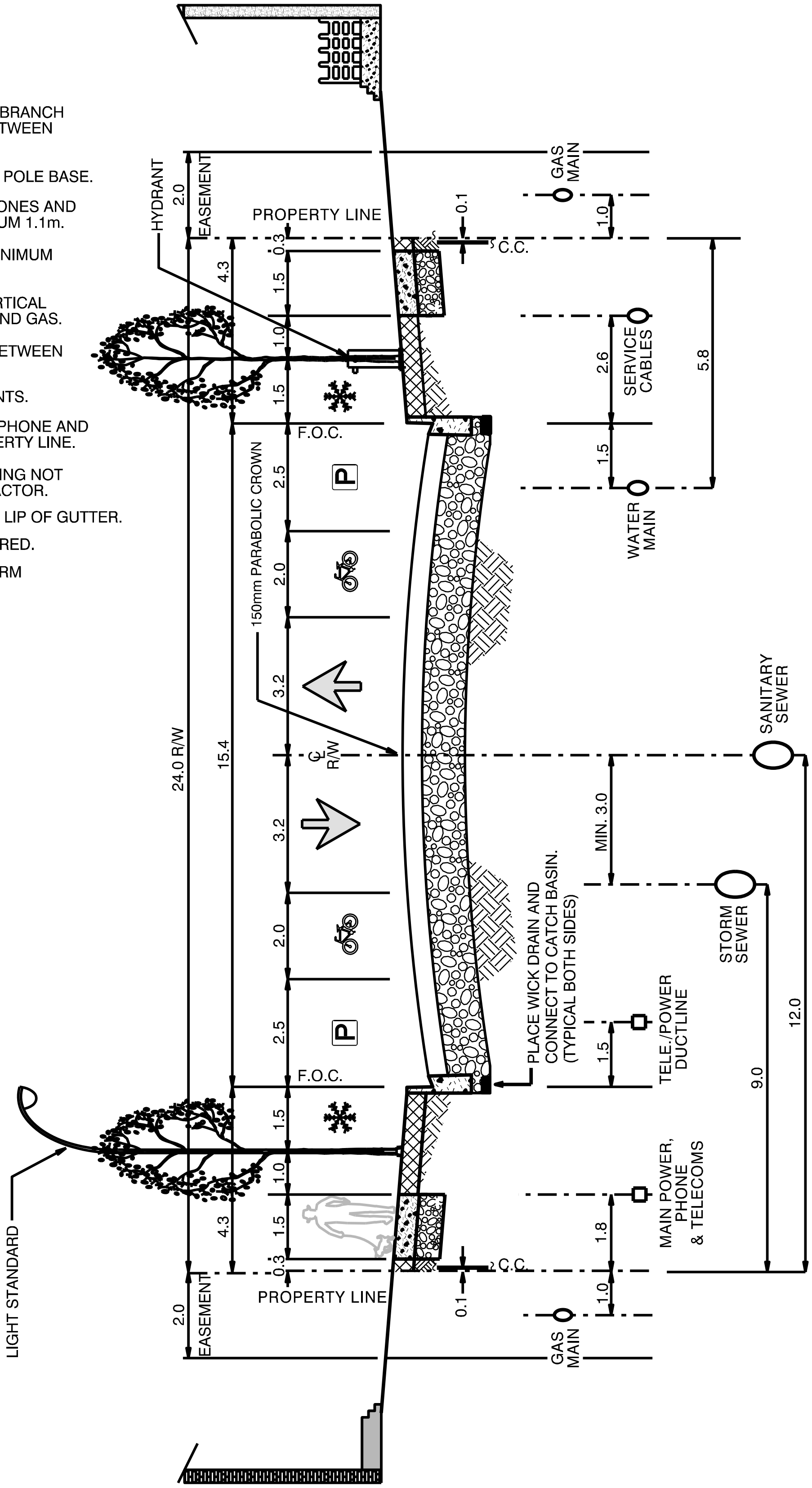
STANDARD DRAWING

STREET ORIENTED RESIDENTIAL COLLECTOR (NOT ON BIKE NETWORK) - 18m R/W

Date Approved:	Drawn By: rc	Approved: Rhonda Toohey	Revision #	Drawing # 8010
Scale: NTS	Checked By: MP			

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. CROWNS ARE MEASURED FROM LIP OF GUTTER.
13. EASEMENT PROVIDED AS REQUIRED.
14. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

- SNOW STORAGE AREA
- P PARKING
- DRIVING LANE
- BIKE LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

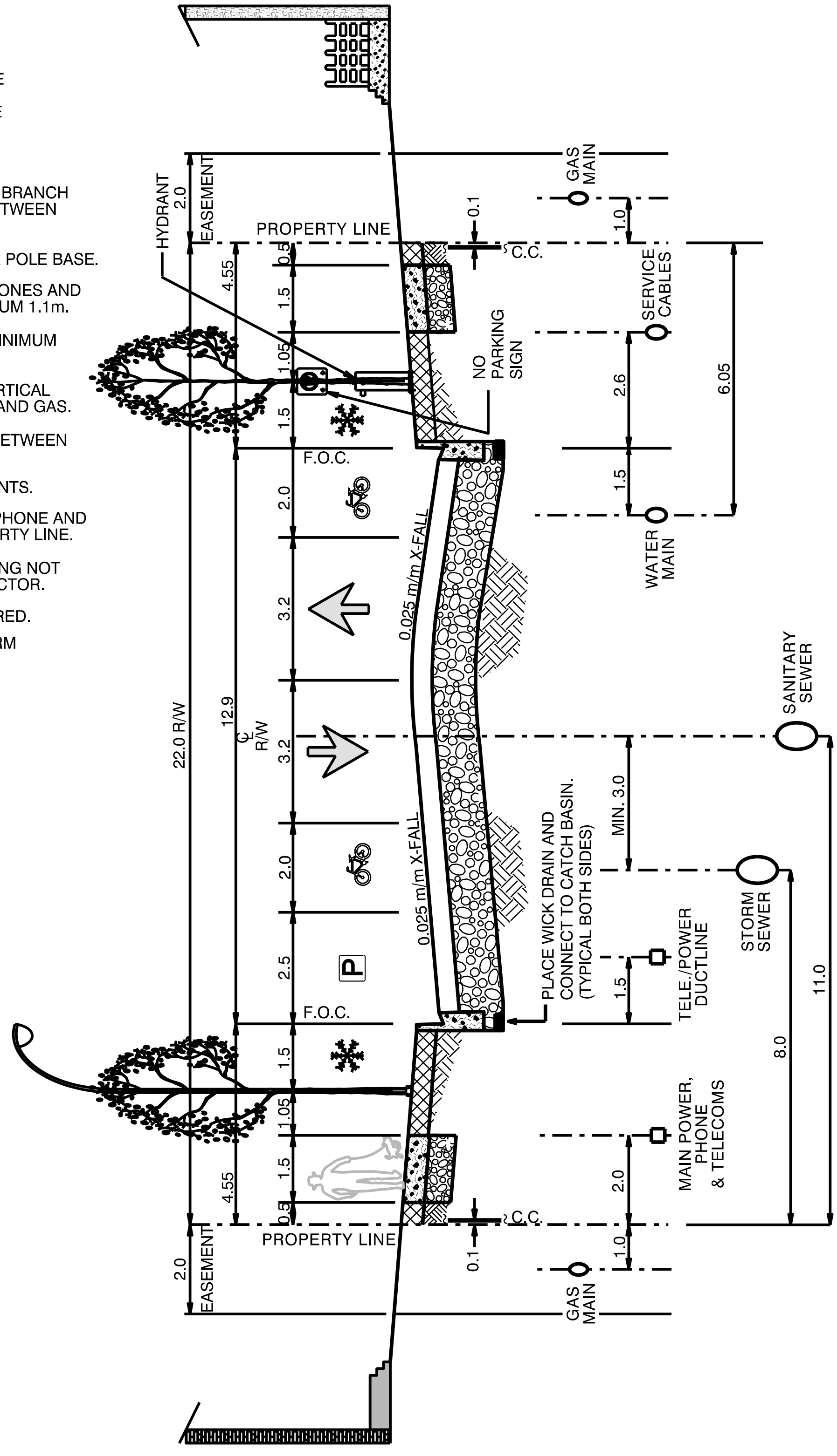
THE CITY OF Edmonton
STANDARD DRAWING

STREET ORIENTED RESIDENTIAL
COLLECTOR (ON BIKE NETWORK) - 24m R/W

Date Approved:	Drawn By: rc	Approved: Rhonda Toohey	Revision #	Drawing # 8020
Scale: NTS	Checked By: MP			

NOTES:

1. IT MAY BE DESIRABLE TO LIMIT PARKING WHERE APPROPRIATE
2. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
3. PIPE SIZES AND DEPTH VARY.
4. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
5. LANDSCAPING MUST NOT COVER POLE BASE.
6. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
7. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
8. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
9. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
10. GAS MAIN LOCATED ON EASEMENTS.
11. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
12. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
13. EASEMENT PROVIDED AS REQUIRED.
14. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

PARKING

DRIVING LANE

BIKE LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

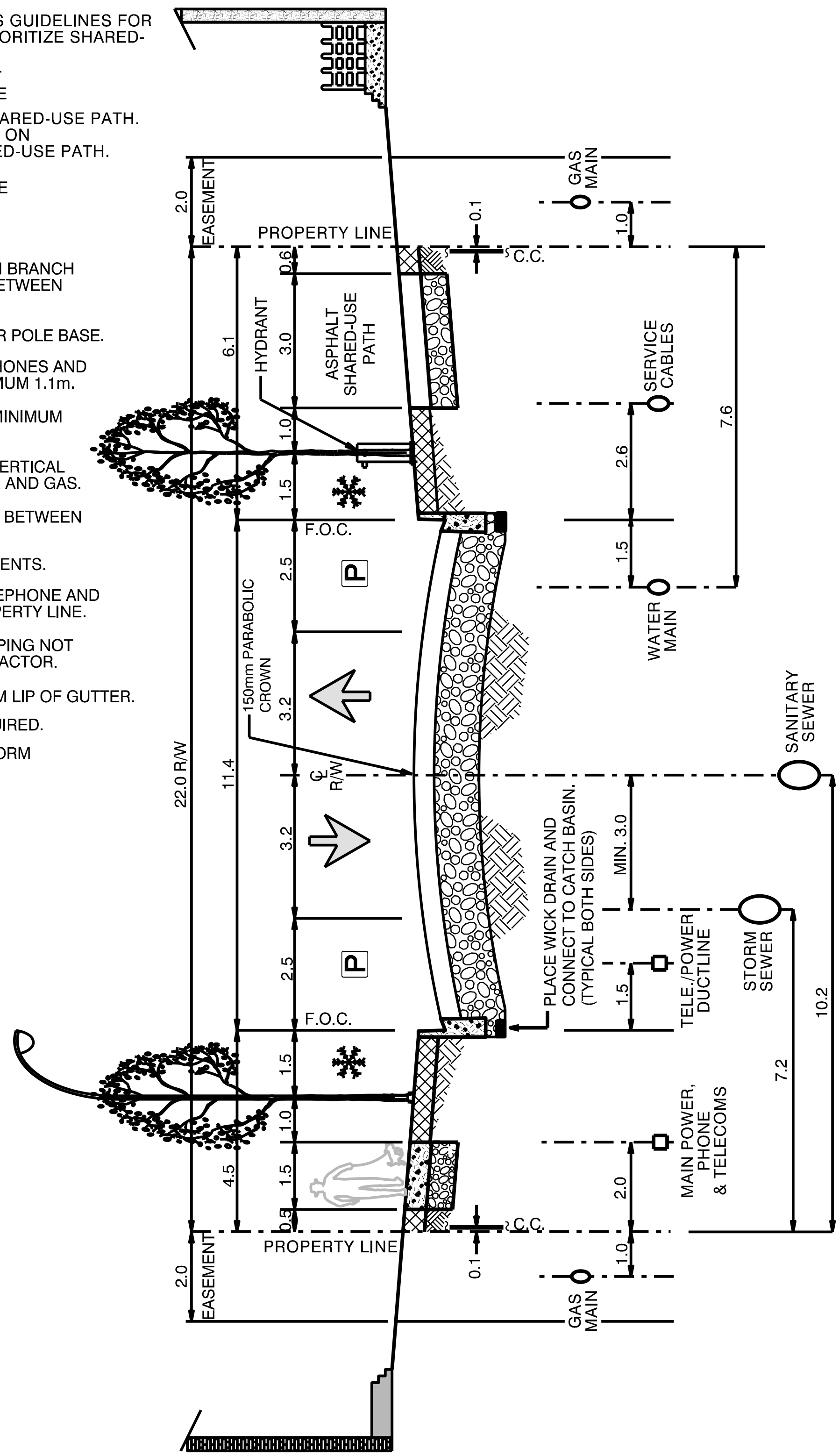
THE CITY OF Edmonton
STANDARD DRAWING

STREET ORIENTED RESIDENTIAL COLLECTOR (ON BIKE NETWORK) - 22m R/W - A

Date Approved:	Drawn By: rc	Approved: Rhonda Toohey	Revision #	Drawing # 8030
Scale: NTS	Checked By: MP			

NOTES:

1. REFER TO COMPLETE STREETS GUIDELINES FOR INTERSECTION DESIGN TO PRIORITIZE SHARED-USE PATH USERS.
2. IT MAY BE DESIRABLE TO LIMIT PARKING WHERE APPROPRIATE
3. LIMIT CONFLICT POINTS AT SHARED-USE PATH. FRONT DRIVES NOT PERMITED ON THE SAME SIDE AS THE SHARED-USE PATH.
4. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
5. PIPE SIZES AND DEPTH VARY.
6. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
7. LANDSCAPING MUST NOT COVER POLE BASE.
8. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
9. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
10. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
11. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
12. GAS MAIN LOCATED ON EASEMENTS.
13. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
14. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
15. CROWNS ARE MEASURED FROM LIP OF GUTTER.
16. EASEMENT PROVIDED AS REQUIRED.
17. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

✻ SNOW STORAGE AREA

P PARKING

⇩ DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

THE CITY OF Edmonton

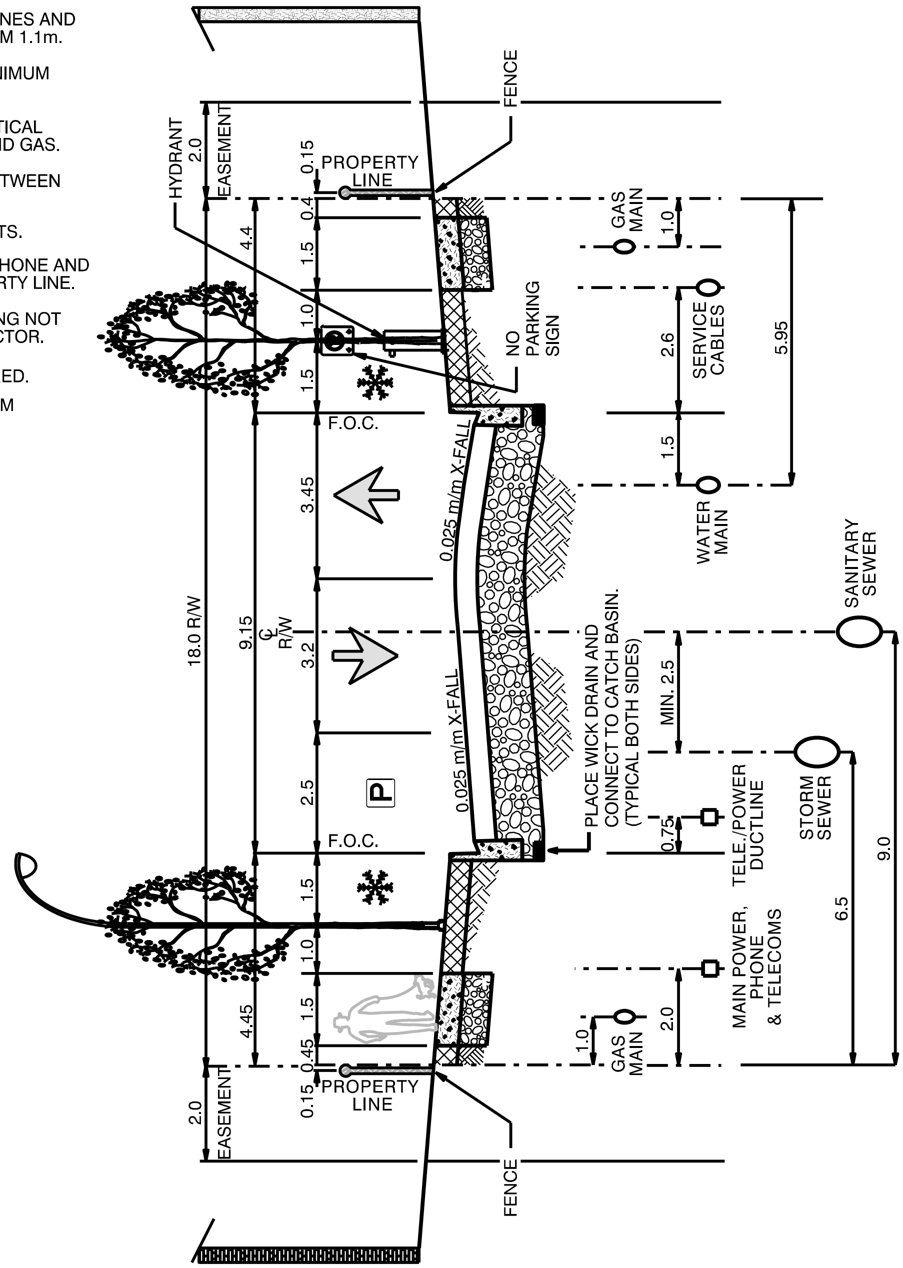
STANDARD DRAWING

STREET ORIENTED RESIDENTIAL
COLLECTOR (ON BIKE NETWORK) - 22m R/W - B

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8040
Scale: NTS	Checked By: MP			

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. EASEMENT PROVIDED AS REQUIRED.
13. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

❄ SNOW STORAGE AREA

P PARKING

⇩ DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

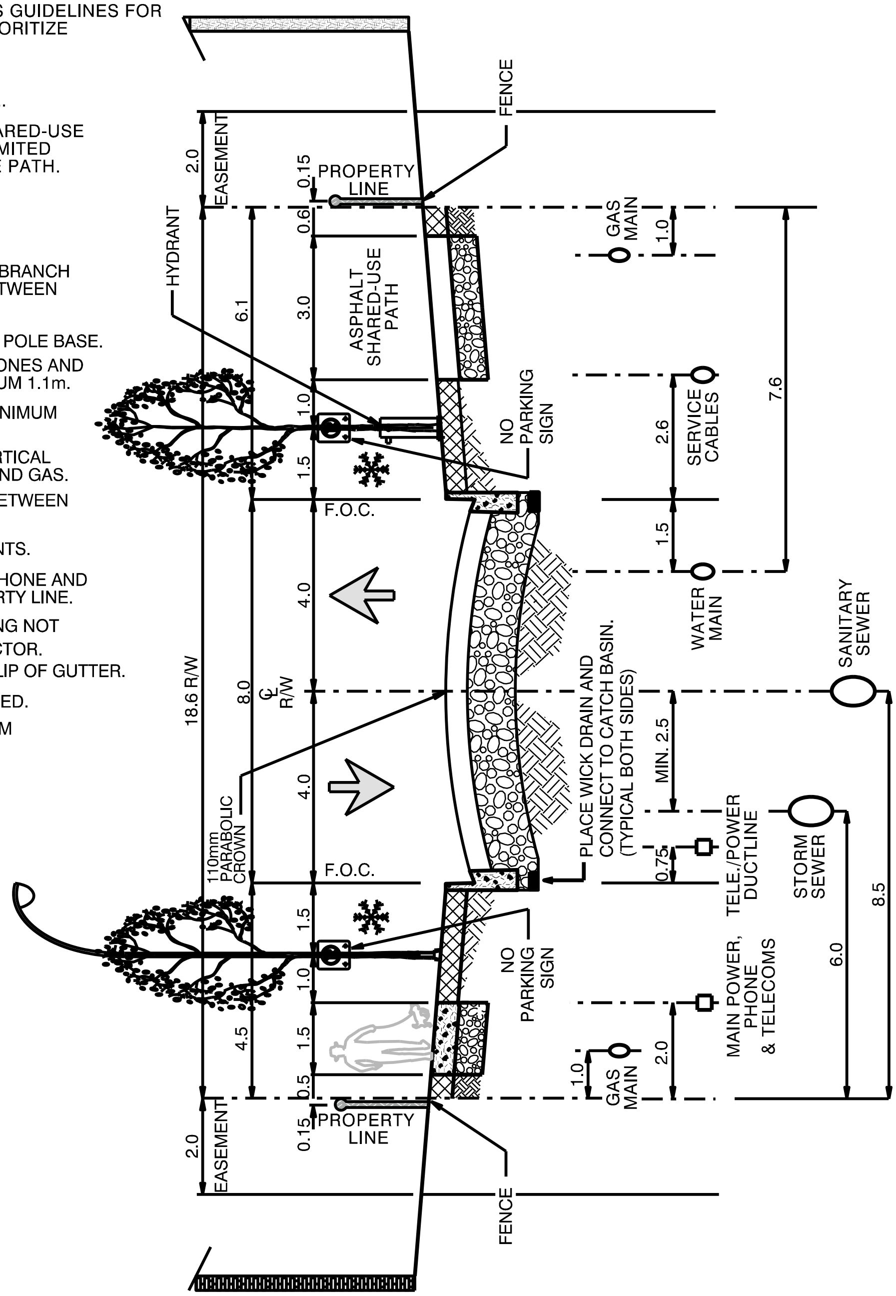
THE CITY OF Edmonton STANDARD DRAWING

NON-STREET ORIENTED RESIDENTIAL OR COMMERCIAL/MIXED USE COLLECTOR (NOT ON BIKE NETWORK) - 18m R/W

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8050
Scale: NTS	Checked By: MP			

NOTES:

1. REFER TO COMPLETE STREETS GUIDELINES FOR INTERSECTION DESIGN TO PRIORITIZE SHARED USE PATH USERS.
2. IT MAY BE DESIRABLE TO LIMIT PARKING WHERE APPROPRIATE.
3. LIMIT CONFLICT POINTS AT SHARED-USE PATH. FRONT DRIVES NOT PERMITED ON SAME SIDE AS SHARED USE PATH.
4. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
5. PIPE SIZES AND DEPTH VARY.
6. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
7. LANDSCAPING MUST NOT COVER POLE BASE.
8. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
9. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
10. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
11. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
12. GAS MAIN LOCATED ON EASEMENTS.
13. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
14. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
15. CROWNS ARE MEASURED FROM LIP OF GUTTER.
16. EASEMENT PROVIDED AS REQUIRED.
17. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

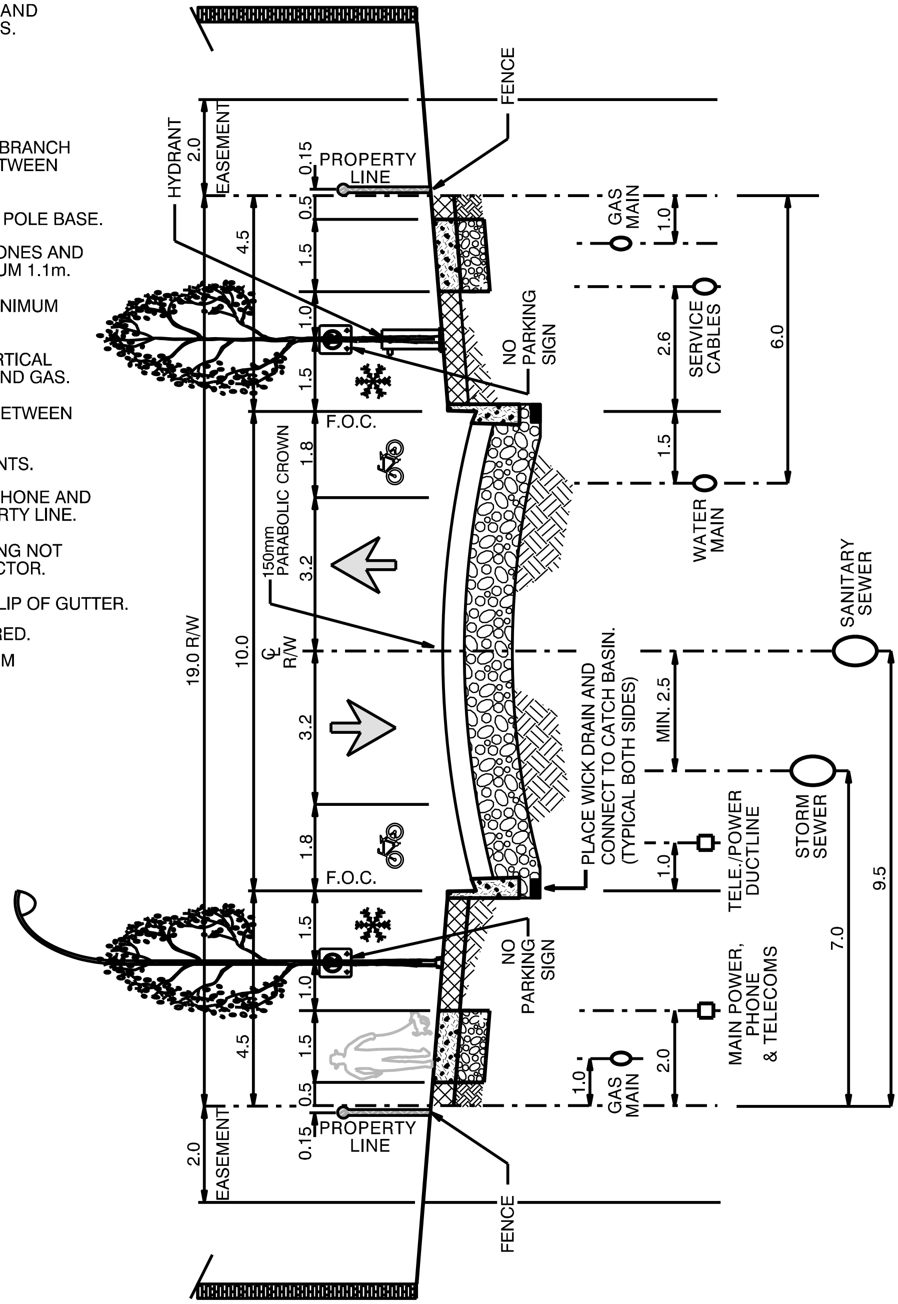
THE CITY OF Edmonton
STANDARD DRAWING

NON-STREET ORIENTED RESIDENTIAL COLLECTOR (ON BIKE NETWORK) - 18.6m R/W

Date Approved:	Drawn By: rc	Approved: Rhonda Toohey	Revision #	Drawing # 8060
Scale: NTS	Checked By: MP			

NOTES:

1. PROVIDE BUFFERS BASED ON DESIRED COMFORT LEVEL OF CYCLISTS AND VEHICLE VOLUMES AND SPEEDS.
2. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
3. PIPE SIZES AND DEPTH VARY.
4. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
5. LANDSCAPING MUST NOT COVER POLE BASE.
6. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
7. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
8. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
9. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
10. GAS MAIN LOCATED ON EASEMENTS.
11. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
12. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
13. CROWNS ARE MEASURED FROM LIP OF GUTTER.
14. EASEMENT PROVIDED AS REQUIRED.
15. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

DRIVING LANE

BIKE LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

THE CITY OF Edmonton

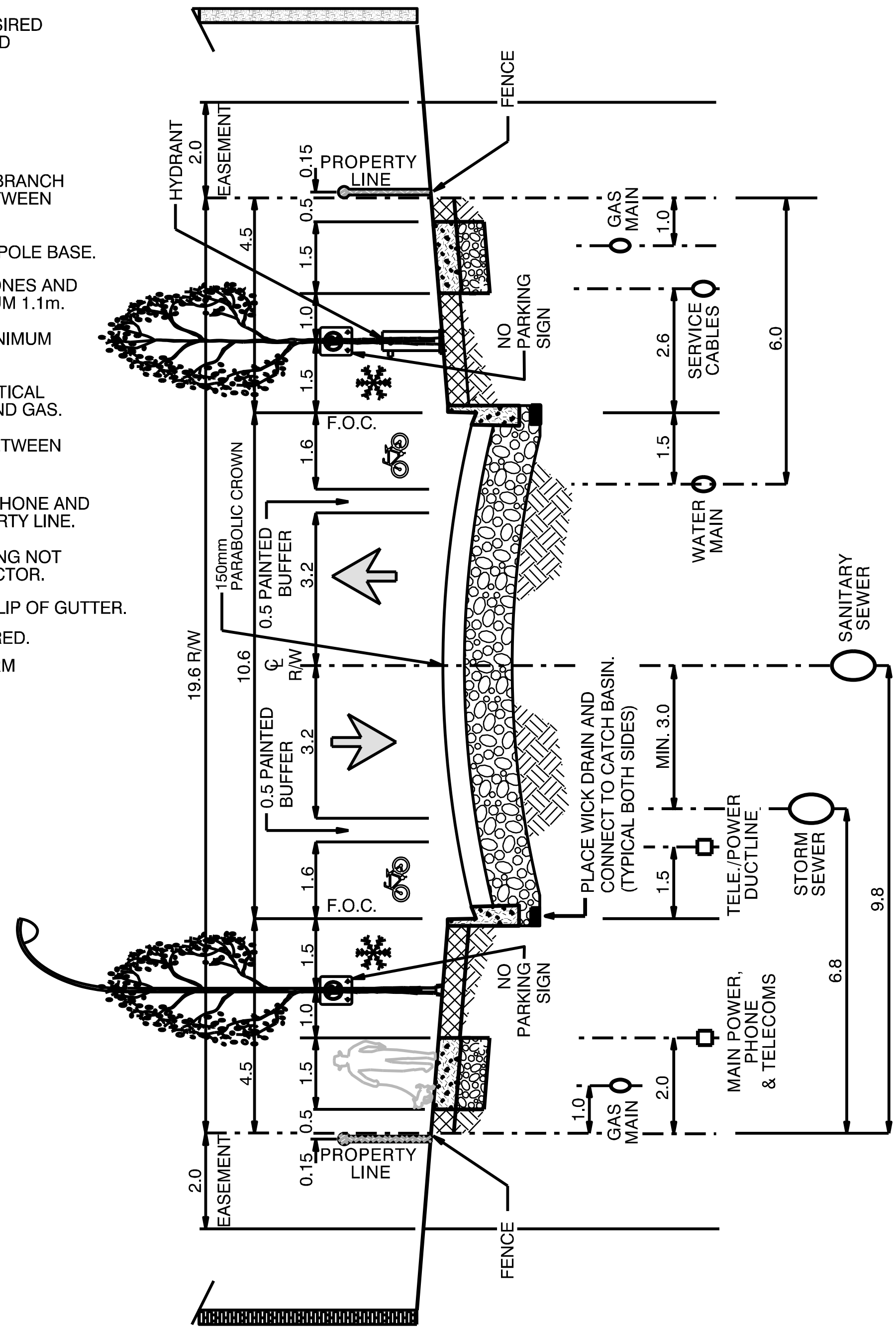
STANDARD DRAWING

NON-STREET ORIENTED RESIDENTIAL COLLECTOR (ON BIKE NETWORK) - 19m R/W

Date Approved:	Drawn By: rc	Approved: Rhonda Toohey	Revision #	Drawing # 8070
Scale: NTS	Checked By: MP			

NOTES:

1. PROVIDE BUFFERS BASED ON DESIRED COMFORT LEVEL OF CYCLISTS AND VEHICLE VOLUMES AND SPEEDS.
2. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
3. PIPE SIZES AND DEPTH VARY.
4. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
5. LANDSCAPING MUST NOT COVER POLE BASE.
6. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
7. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
8. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
9. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. CROWNS ARE MEASURED FROM LIP OF GUTTER.
13. EASEMENT PROVIDED AS REQUIRED.
14. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

DRIVING LANE

BUFFERED BIKE LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

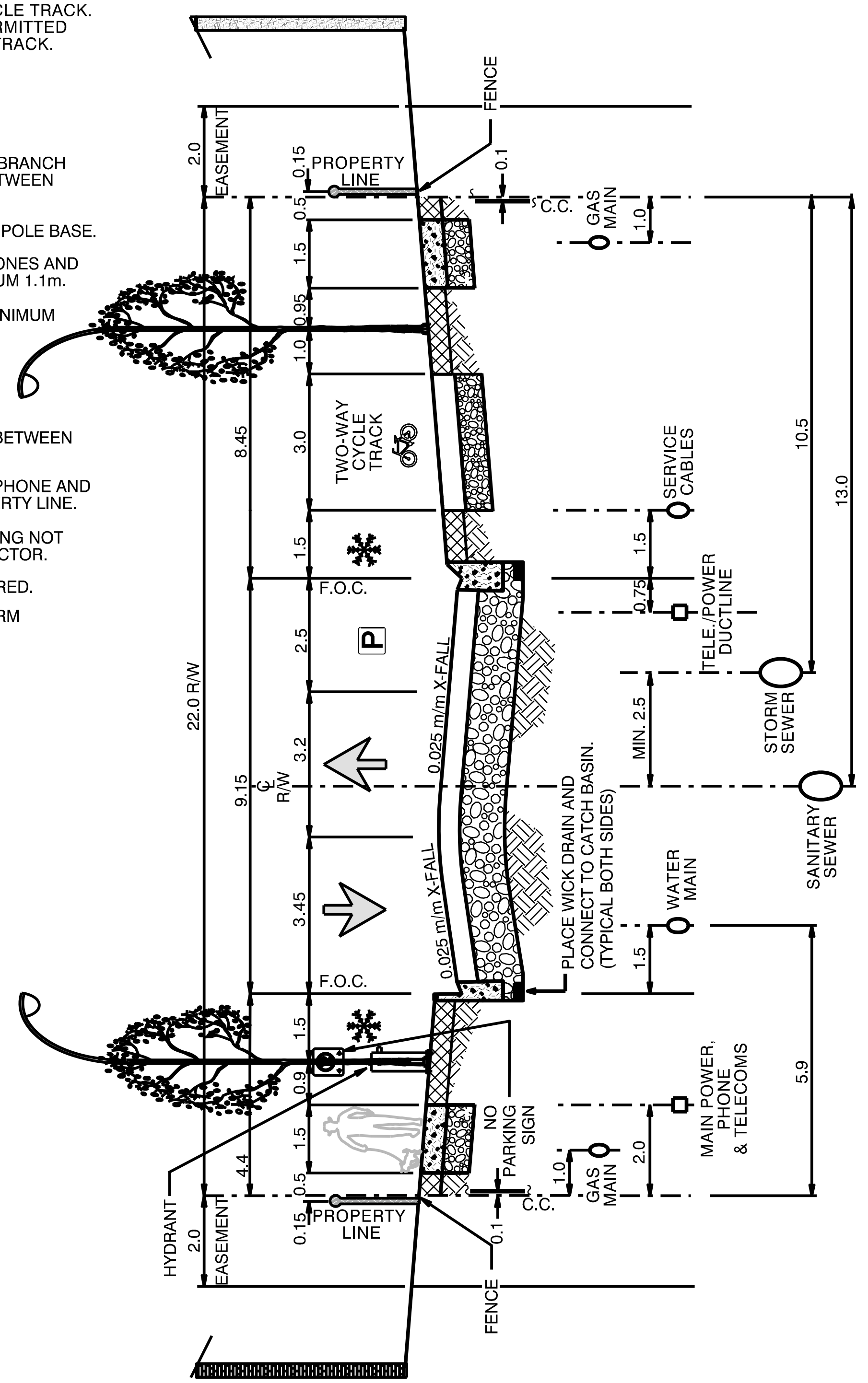
THE CITY OF Edmonton
STANDARD DRAWING

NON-STREET ORIENTED RESIDENTIAL OR COMMERCIAL/MIXED USE COLLECTOR (ON BIKE NETWORK) - 19.6m R/W

Date Approved:	Drawn By: rc	Approved: Rhonda Toohey	Revision #	Drawing # 8080
Scale: NTS	Checked By: MP			

NOTES:

1. REFER TO COMPLETE STREETS GUIDELINES FOR INTERSECTION DESIGN TO PRIORITIZE CYCLE TRACK USERS.
2. IT MAY BE DESIRABLE TO LIMIT PARKING WHERE APPROPRIATE.
3. LIMIT CONFLICT POINTS AT CYCLE TRACK. FRONT DRIVE ACCESS NOT PERMITTED ON THE SAME SIDE AS CYCLE TRACK.
4. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
5. PIPE SIZES AND DEPTH VARY.
6. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
7. LANDSCAPING MUST NOT COVER POLE BASE.
8. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
9. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
10. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
11. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
12. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
13. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
14. EASEMENT PROVIDED AS REQUIRED.
15. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

- SNOW STORAGE AREA
- P PARKING
- DRIVING LANE
- TWO-WAY CYCLE TRACK

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

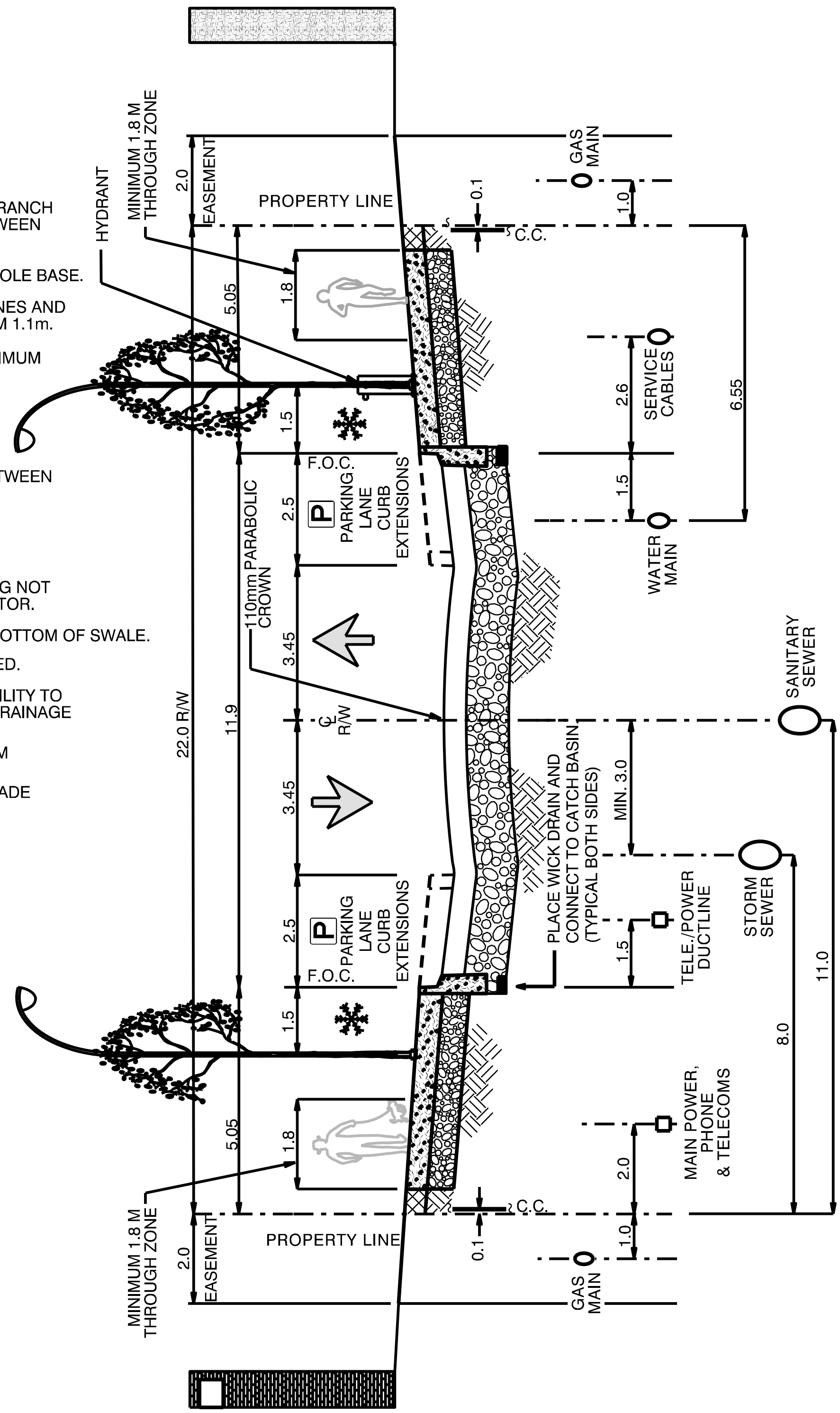
THE CITY OF Edmonton
STANDARD DRAWING

NON-STREET ORIENTED RESIDENTIAL COLLECTOR (ON BIKE NETWORK) - 22m R/W

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8090
Scale: NTS	Checked By: MP			

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. SERVICE BOX FOR POWER, TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
10. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
11. CROWNS ARE MEASURED FROM BOTTOM OF SWALE.
12. EASEMENT PROVIDED AS REQUIRED.
13. IT IS THE DESIGNER'S RESPONSIBILITY TO ENSURE ADEQUATE ON-STREET DRAINAGE OF CURB EXTENSIONS.
14. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.
15. A MINIMUM 1% LONGITUDINAL GRADE MUST BE MAINTAINED ALONG THE ASPHALT SWALE.



LEGEND:

SNOW STORAGE AREA

P PARKING

DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

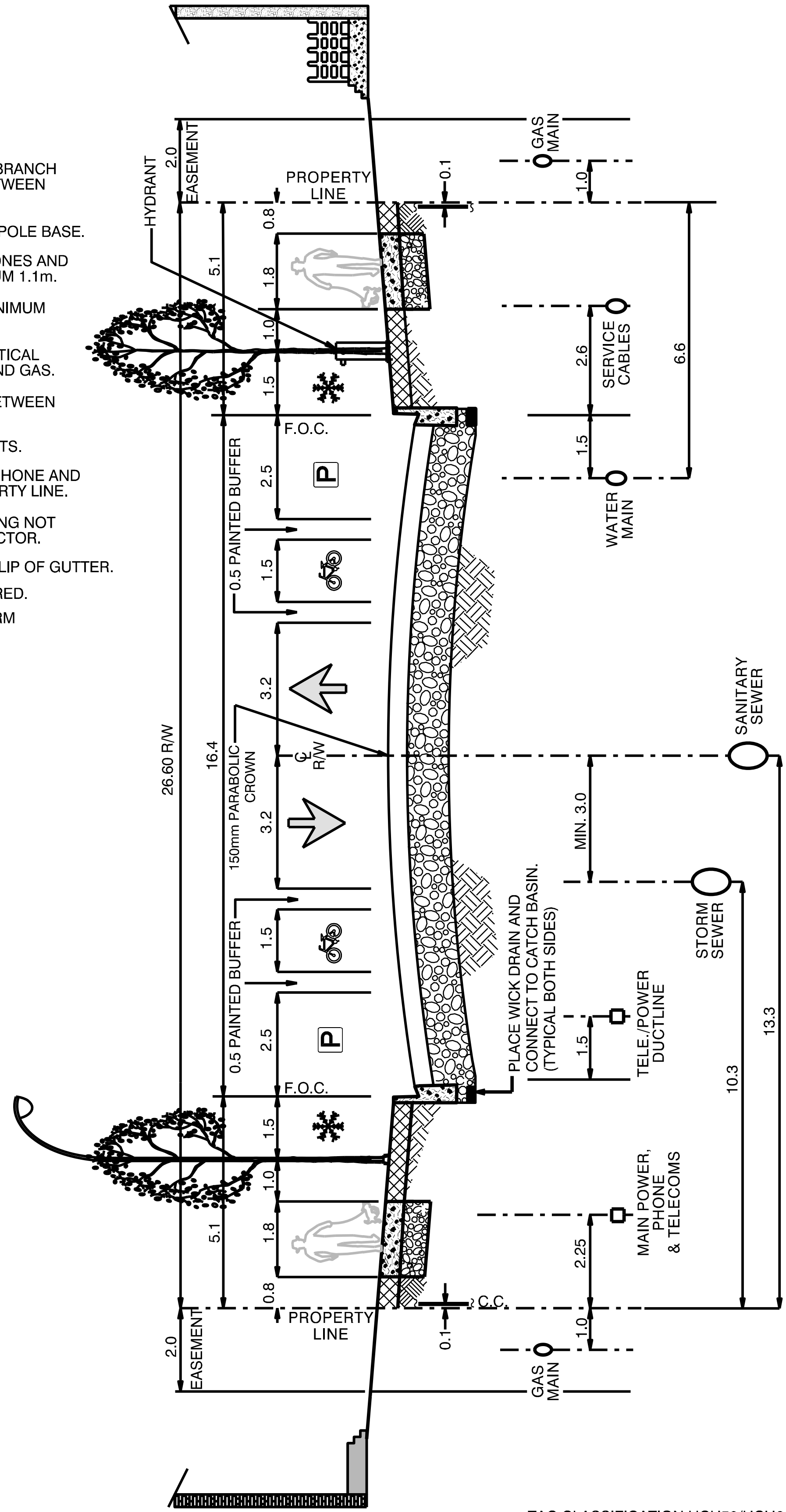
THE CITY OF Edmonton
STANDARD DRAWING

STREET ORIENTED COMMERCIAL/MIXED USE
COLLECTOR (NOT ON BIKE NETWORK) - 22m R/W

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8100
Scale: NTS	Checked By: MP			

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. CROWNS ARE MEASURED FROM LIP OF GUTTER.
13. EASEMENT PROVIDED AS REQUIRED.
14. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

PARKING

DRIVING LANE

BUFFERED BIKE LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

THE CITY OF Edmonton

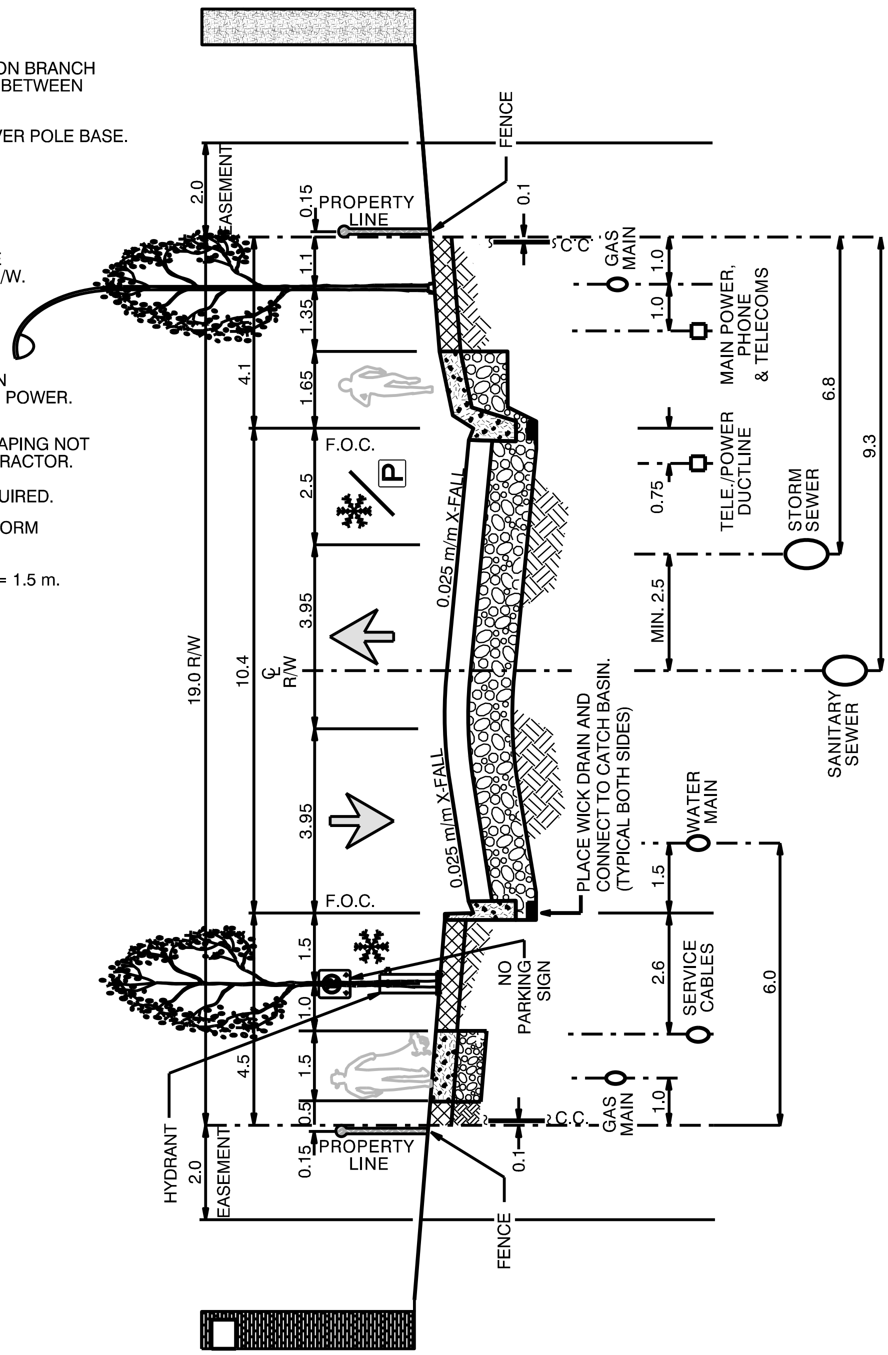
STANDARD DRAWING

STREET ORIENTED COMMERCIAL MIXED-USE COLLECTOR (ON BIKE NETWORK) - 26.6m R/W

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8110
Scale: NTS	Checked By: MP			

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
10. EASEMENT PROVIDED AS REQUIRED.
11. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.
12. MINIMUM MONOWALK WIDTH = 1.5 m.



LEGEND:

SNOW STORAGE AREA

DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

THE CITY OF Edmonton

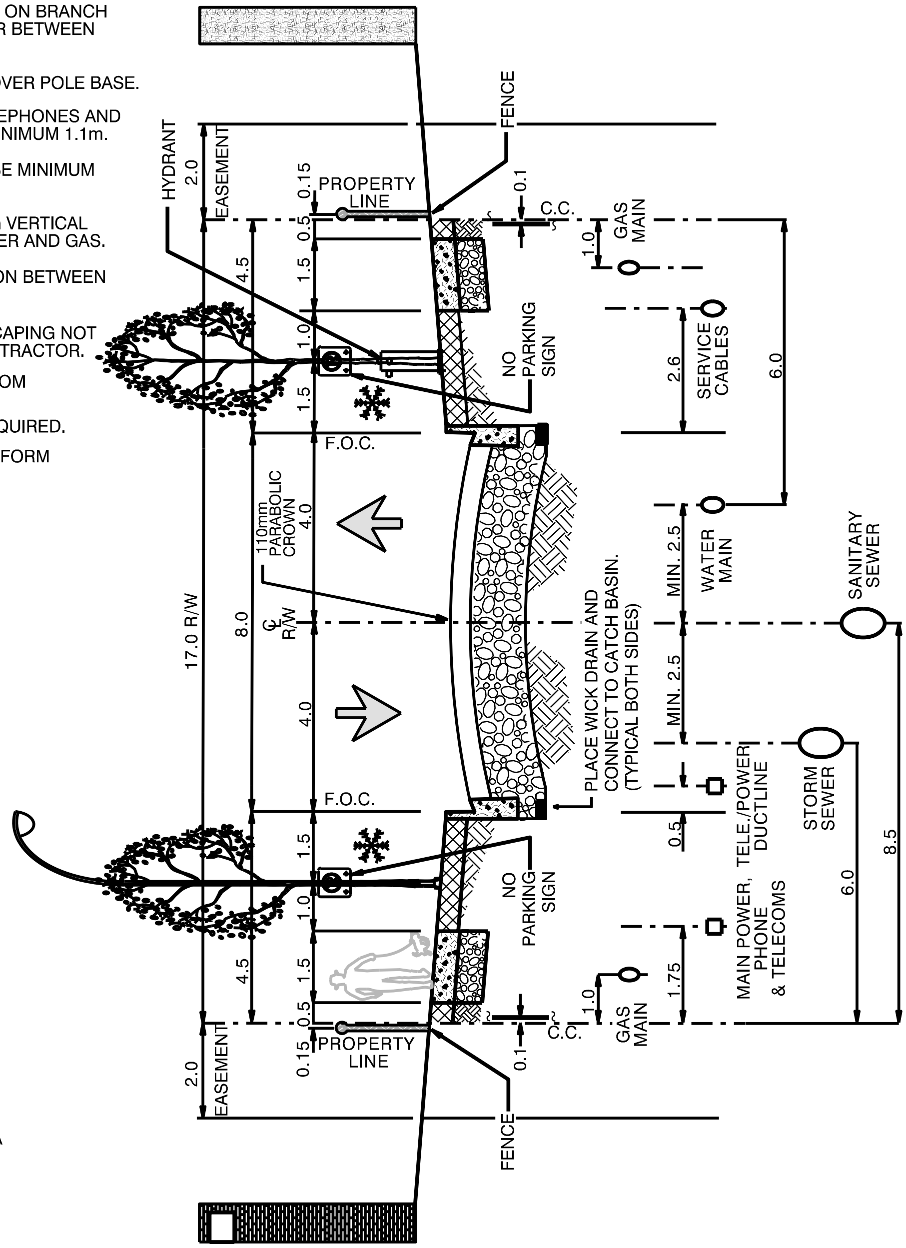
STANDARD DRAWING

NON-STREET ORIENTED COMMERCIAL/MIXED USE COLLECTOR (NOT ON BIKE NETWORK) - 19m R/W

Date Approved:	Drawn By: rc	Approved: Rhonda Toohey	Revision #	Drawing # 8120
Scale: NTS	Checked By: MP			

NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
10. CROWNS ARE MEASURED FROM LIP OF GUTTER.
11. EASEMENT PROVIDED AS REQUIRED.
12. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

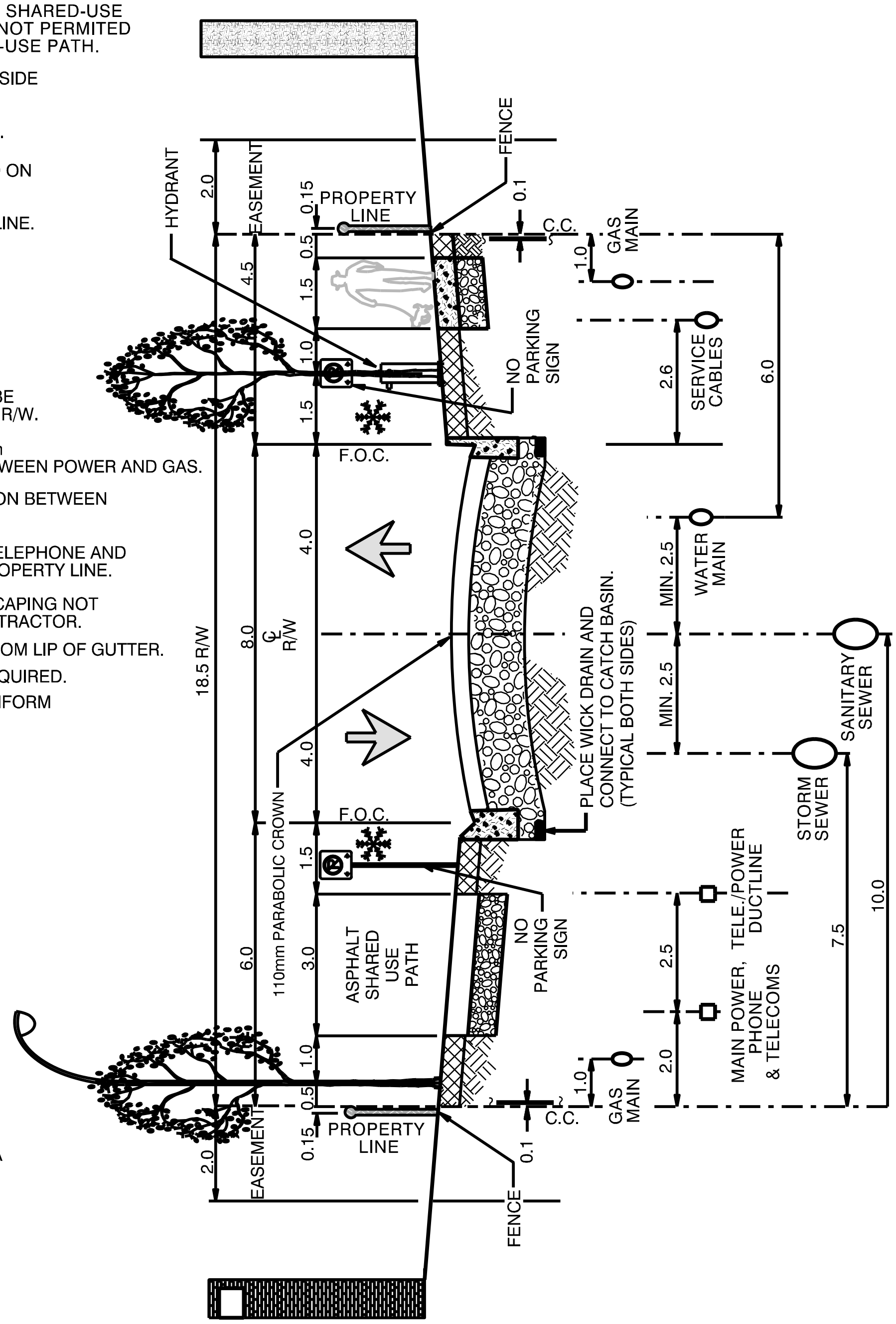
THE CITY OF Edmonton
STANDARD DRAWING

NON-STREET ORIENTED COMMERCIAL/MIXED USE COLLECTOR (NOT ON BIKE NETWORK) - 17m R/W

Date Approved:	Drawn By: rc	Approved: Rhonda Toohey	Revision #	Drawing # 8130
Scale: NTS	Checked By: MP			

NOTES:

1. REFER TO COMPLETE STREETS GUIDELINES FOR INTERSECTION DESIGN TO PRIORITIZE SHARED-USE PATH USERS.
2. LIMIT CONFLICT POINTS AT SHARED-USE PATH. FRONT DRIVES ARE NOT PERMITED ON SAME SIDE AS SHARED-USE PATH.
3. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
4. PIPE SIZES AND DEPTH VARY.
5. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
6. LANDSCAPING MUST NOT COVER POLE BASE.
7. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
8. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
9. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
10. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
11. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
12. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
13. CROWNS ARE MEASURED FROM LIP OF GUTTER.
14. EASEMENT PROVIDED AS REQUIRED.
15. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

THE CITY OF Edmonton

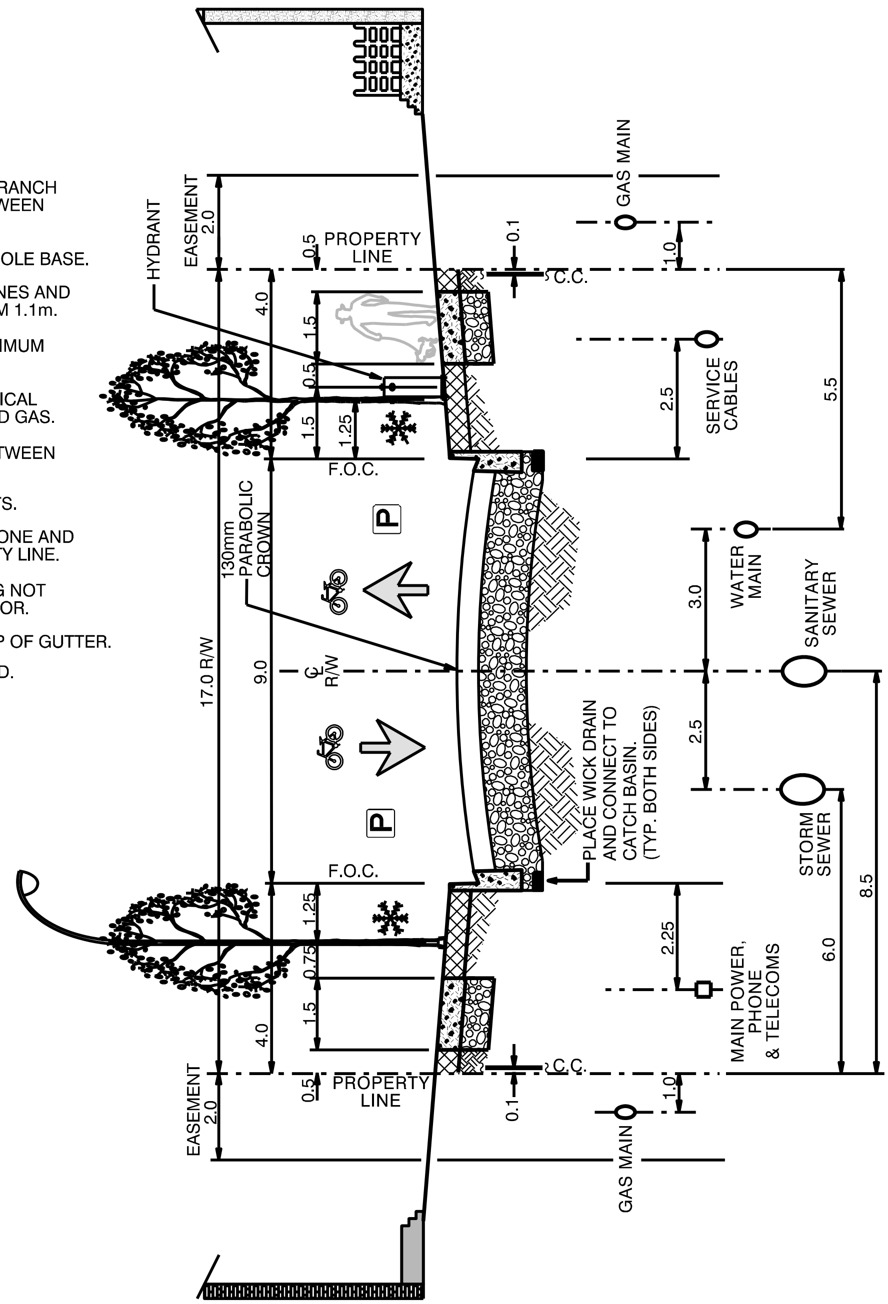
STANDARD DRAWING

NON-STREET ORIENTED COMMERCIAL/MIXED USE COLLECTOR (ON BIKE NETWORK) - 18.5m R/W

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8140
Scale: NTS	Checked By: MP			

NOTES:

1. CONSIDER SPEED AND VOLUME MANAGEMENT MEASURES TO ENHANCE COMFORT OF CYCLISTS.
2. SHARROW MARKINGS APPLIED TO BIKE NETWORK STREETS ONLY.
3. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
4. PIPE SIZES AND DEPTH VARY.
5. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
6. LANDSCAPING MUST NOT COVER POLE BASE.
7. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
8. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
9. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
10. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
11. GAS MAIN LOCATED ON EASEMENTS.
12. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
13. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
14. CROWNS ARE MEASURED FROM LIP OF GUTTER.
15. EASEMENT PROVIDED AS REQUIRED.
16. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

- SNOW STORAGE AREA
- P PARKING
- DRIVING LANE
- SHARROW MARKINGS

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION UCU50/UCU60

THE CITY OF Edmonton

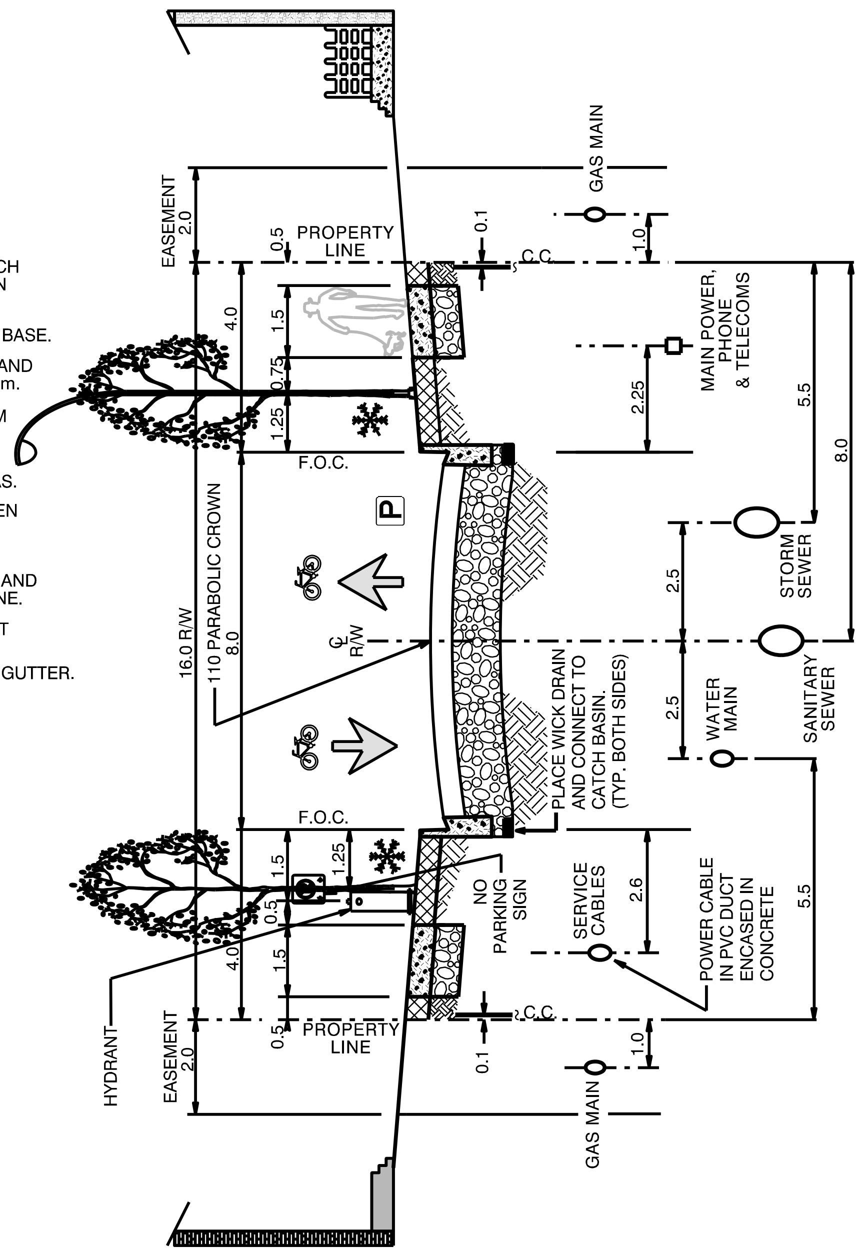
STANDARD DRAWING

STREET ORIENTED RESIDENTIAL LOCAL (ON BIKE NETWORK / NOT ON BIKE NETWORK) - 17m R/W

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8150
Scale: NTS	Checked By: MP			

NOTES:

1. CONSIDER SPEED AND VOLUME MANAGEMENT MEASURES TO ENHANCE COMFORT LEVEL OF CYCLISTS.
2. SHARROW MARKINGS APPLIED TO BIKE NETWORK STREETS ONLY.
3. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
4. PIPE SIZES AND DEPTH VARY.
5. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
6. LANDSCAPING MUST NOT COVER POLE BASE.
7. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
8. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
9. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
10. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
11. GAS MAIN LOCATED ON EASEMENTS.
12. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
13. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
14. CROWNS ARE MEASURED FROM LIP OF GUTTER.
15. EASEMENT PROVIDED AS REQUIRED.
16. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

PARKING

DRIVING LANE

SHARROW MARKINGS

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION ULU60

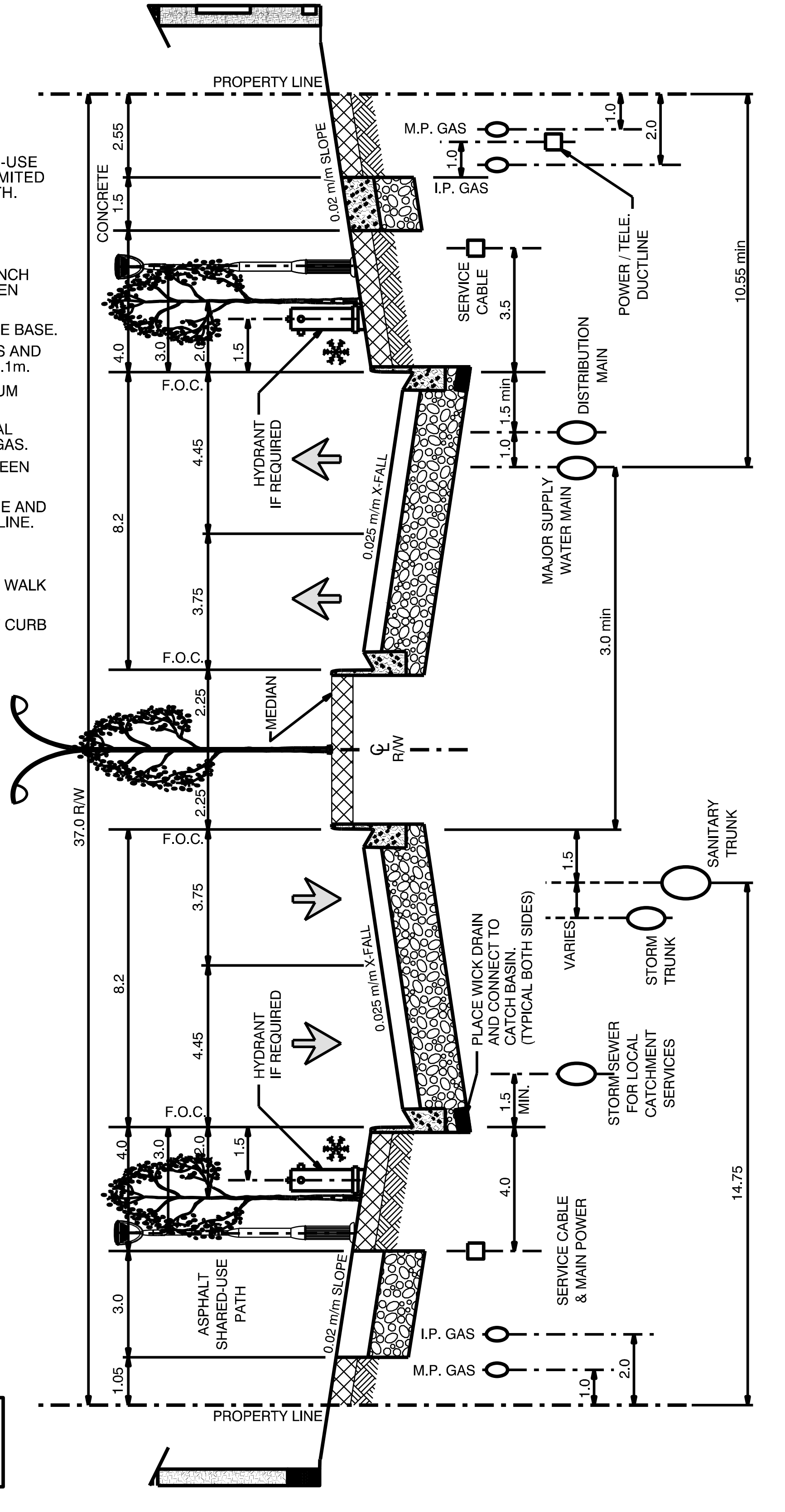
THE CITY OF Edmonton
STANDARD DRAWING

STREET ORIENTED RESIDENTIAL LOCAL (ON BIKE NETWORK / NOT ON BIKE NETWORK) - 16m R/W

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8160
Scale: NTS	Checked By: MP			

NOTES:

1. REFER TO COMPLETE STREETS GUIDELINES FOR INTERSECTION DESIGN TO PRIORITIZE SHARED-USE PATH USERS.
2. LIMIT CONFLICT POINTS AT SHARED-USE PATH. FRONT DRIVES ARE NOT PERMITED ON SAME SIDE AS SHARED-USE PATH.
3. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
4. PIPE SIZES AND DEPTH MAY VARY.
5. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
6. LANDSCAPING MUST NOT COVER POLE BASE.
7. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
8. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
9. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
10. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
11. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
12. CROSS FALLS ARE MEASURED FROM LIP OF GUTTER.
13. MAXIMUM SIDESLOPE FROM BACK OF WALK TO PROPERTY LINE IS 3.5:1.
14. MAXIMUM SIDESLOPE FROM BACK OF CURB TO SIDEWALK IS 10%.
15. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION ULU 70

THE CITY OF Edmonton

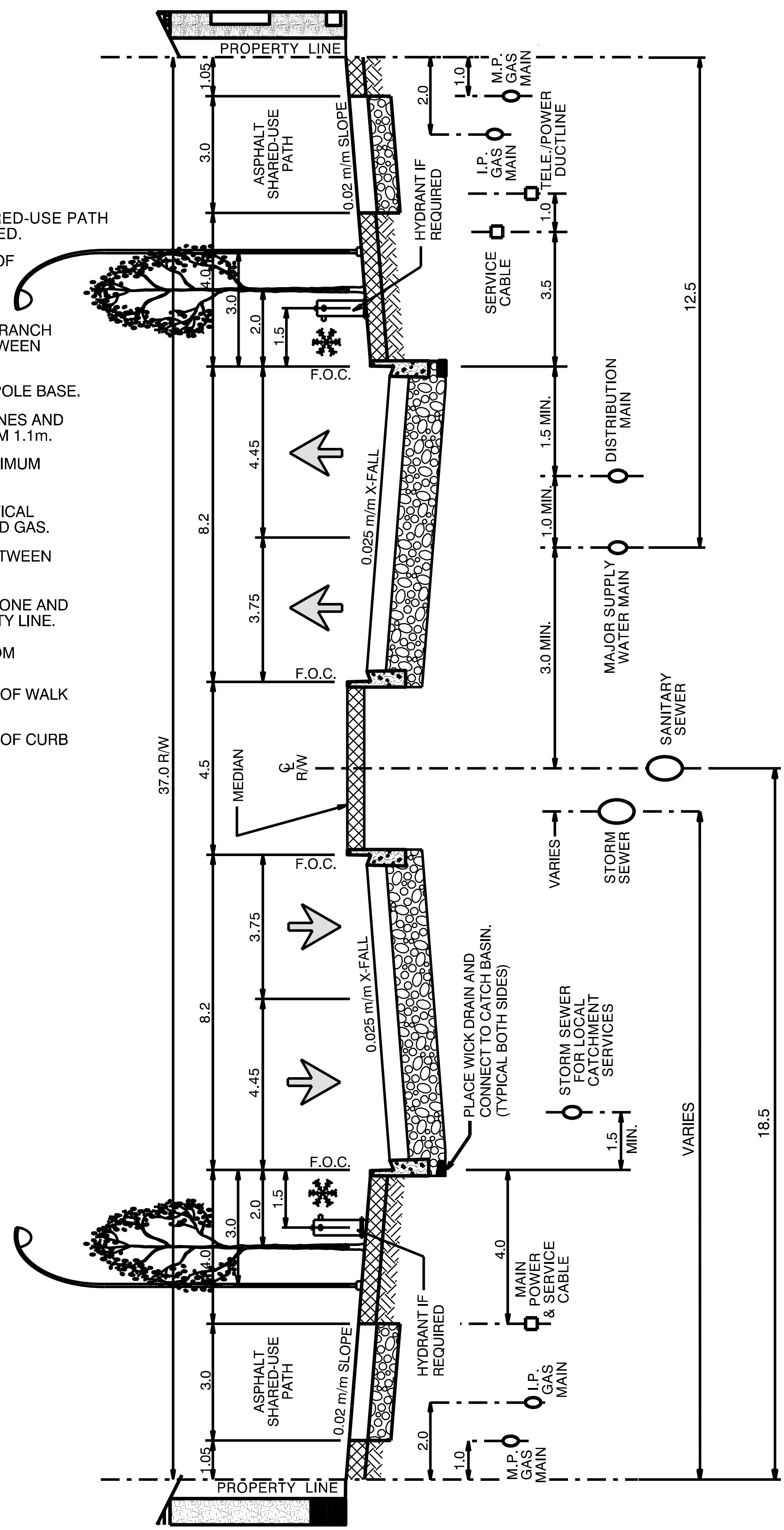
STANDARD DRAWING

NON-STREET ORIENTED RESIDENTIAL DIVIDED ARTERIAL - 37m R/W - A

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8170
Scale: NTS	Checked By: MP			

NOTES:

1. REFER TO COMPLETE STREETS GUIDELINES FOR INTERSECTION DESIGN TO PRIORITIZE SHARED-USE PATH USERS.
2. LIMIT CONFLICT POINTS AT SHARED-USE PATH FRONT DRIVES ARE NOT PERMITED.
3. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
4. PIPE SIZES AND DEPTH MAY VARY.
5. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
6. LANDSCAPING MUST NOT COVER POLE BASE.
7. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
8. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
9. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
10. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
11. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
12. CROSS FALLS ARE MEASURED FROM LIP OF GUTTER.
13. MAXIMUM SIDESLOPE FROM BACK OF WALK TO PROPERTY LINE IS 3.5:1.
14. MAXIMUM SIDESLOPE FROM BACK OF CURB TO SIDEWALK IS 10%.
15. SURFACE DRAINAGE TO CONFORM TO DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

DRIVING LANE

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION ULU 70

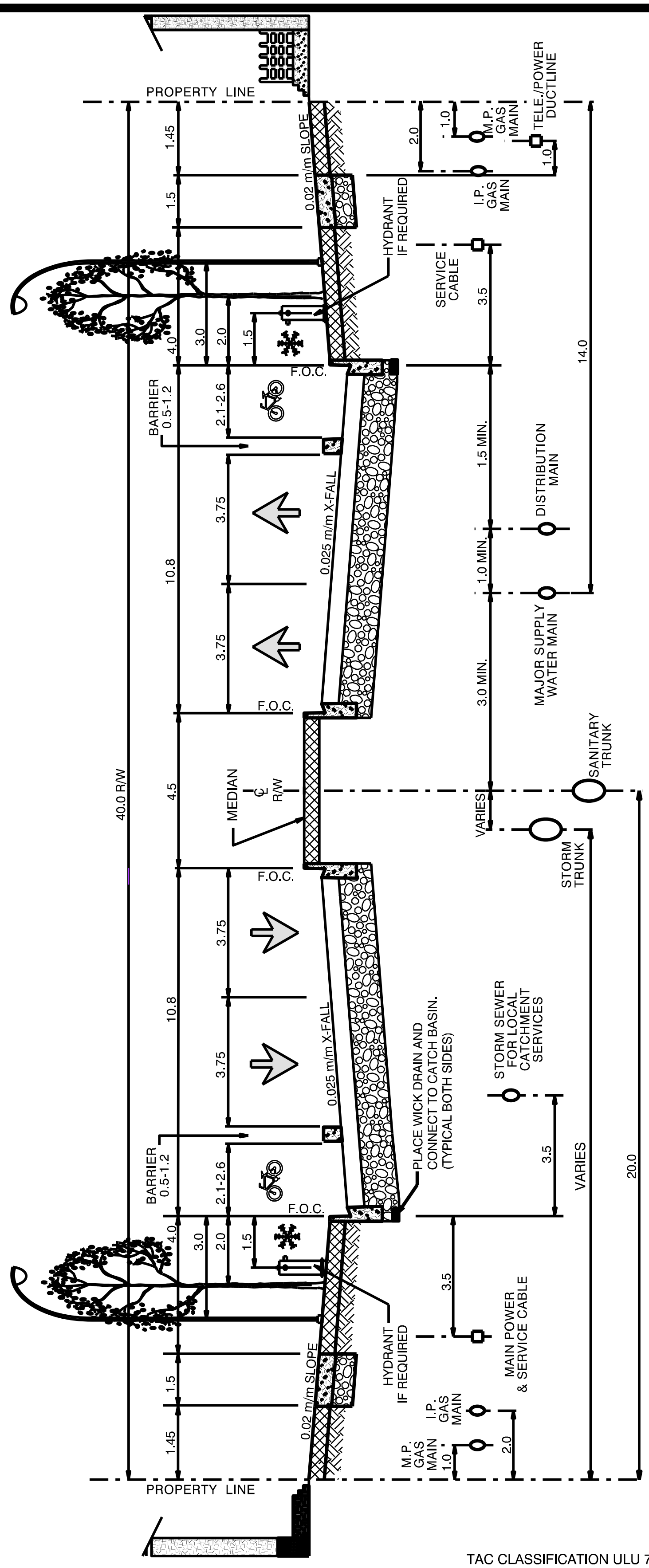
THE CITY OF Edmonton
STANDARD DRAWING

NON-STREET ORIENTED RESIDENTIAL DIVIDED ARTERIAL - 37m R/W - B

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8180
Scale: NTS	Checked By: MP			

NOTES:

1. CYCLE TRACK WIDTH AND BARRIER DESIGN BASED ON VEHICLE SPEEDS AND VOLUMES. POSSIBLE BARRIERS CAN BE DELINEATOR POSTS, CURBS, PLANTERS ETC.
2. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
3. PIPE SIZES AND DEPTH MAY VARY.
4. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK AND PROPERTY LINE.
5. LANDSCAPING MUST NOT COVER POLE BASE.
6. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 1.1m.
7. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
8. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
9. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
10. SERVICE BOX FOR POWER,TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. CROSS FALLS ARE MEASURED FROM LIP OF GUTTER.
12. MAXIMUM SIDESLOPE FROM BACK OF WALK TO PROPERTY LINE IS 3.5:1.
13. MAXIMUM SIDESLOPE FROM BACK OF CURB TO SIDEWALK IS 10%.
14. SURFACE DRAINAGE TO CONFORM TO THE DRAINAGE BYLAW.



LEGEND:

SNOW STORAGE AREA

DRIVING LANE

CYCLE TRACK

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

TAC CLASSIFICATION ULU 70

THE CITY OF Edmonton
STANDARD DRAWING

STREET ORIENTED RESIDENTIAL DIVIDED ARTERIAL - 40m R/W

Date Approved:	Drawn By: SC	Approved: Rhonda Toohey	Revision #	Drawing # 8190
Scale: NTS	Checked By: MP			