CITY OF
FORT SASKATCHEWAN
ALBERTA

# Engineering and Servicing Standards

JANUARY 2025

# LIST OF REVISIONS

| REVISION | DESCRIPTION |
|---|---|
| NOVEMBER 2013 | Issued for approval |
| AUGUST 2019 | Schedule C, Section 6.0 Landscaping. Entire section has been updated. |
| APRIL 2022 | Schedule C, Section 5.0 Transportation. Entire section has been updated. |
| FREBRUARY 2024 | Schedule C, Section 4.0 Storm Drainage. Entire section has been updated. |
| JANUARY 2025 | Schedule C, Section 2.0 Water Distribution and Section 3.0 Sanitary Collection. Entire sections have been updated |
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SCHEDULES:

## 1.0 DEFINITIONS

Unless the context requires otherwise:

"Act" means *Municipal Government Act*, *Land Titles Act*, and any other *Act* named herein and found in the Statutes of Alberta, as amended, both before and after the date of this document.

"Alley" means a narrow highway intended chiefly to give access to the rear of buildings and parcels of land.

"Applicant" means a person applying for the approval of a subdivision, pursuant to the provision of the *Municipal Government Act*, as amended, or a person applying for development other than subdivision, whether as the Owner of the property proposed to be subdivided or developed or as agent for the Owner or his contractor.

"Approval, Preliminary Layout" means written notification of a review of information presented to the Subdivision Authority previous to submission of a subdivision plan for final approval.

"Arterial Roadway" means a highway with the primary function of carrying all types of through traffic from one area to another and a secondary function of providing access to adjacent parcels of land.

"Boulevard" means that portion of a highway between the curb lines or the lateral boundary lines of a roadway and the adjoining property or between curbs on median strips or islands, but does not include curbs, sidewalks, ditches or driveways.

"City" means the City of Fort Saskatchewan or the area within the municipal boundaries thereof as the context may require.

"City Engineer" means the Engineer, or his designate, as appointed by the Chief Administrative Officer of the City of Fort Saskatchewan.

"Collector Roadway" means a highway with equal priority functions of distributing traffic between arterials and lower classifications of roads such as other collectors and local roads and providing access to adjacent parcels of land.

"Community Sewer System" means a sanitary sewer or a system of sewage disposal works which is owned, operated and maintained by the Municipality.

"Community Water System" means a waterworks system, which is owned, operated and maintained by the Municipality.

"Construction Completion Certificate" means the certificate issued by the City of Fort Saskatchewan certifying the completion of the municipal improvements, or a portion thereof, once the municipal improvements have been constructed and installed by the Owner/Applicant to the satisfaction of the Municipality without defects or deficiencies.

"Council" means the Council of the City of Fort Saskatchewan.

"Cul-de-sac" means a local street that is connected to the remainder of the road network at only one point and that terminates in a vehicle-turning area.

"Design Engineer" means the Professional Engineer engaged by the Owner/Applicant to design and prepare drawings for construction of works in a subdivision or development, or his authorized representative.

"Development" shall be interpreted as defined in the *Municipal Government Act*, as amended.

"District" means an area created by the current City of Fort Saskatchewan Land Use Bylaw, as amended, or as replaced from time to time both before and after the effective date of this document.

"Drainage System" means a system of works designed and constructed to control the flow of storm water and/or ground water.

"Final Acceptance Certificate" means a written acceptance issued by the City of Fort Saskatchewan for the municipal improvement, or a portion thereof, upon the completion of any repairs for defects or deficiencies, and the expiration of the Maintenance period.

"Frontage" means the length of a lot boundary which immediately adjoins a highway other than a lane or a walkway.

"Highway" means any thoroughfare, street, road, trail, avenue, parkway, driveway, viaduct, lane, alley, square, bridge, causeway, trestleway or other place or any part of any of them, whether publicly or privately owned, that the public is ordinarily entitled or permitted to use for the passage or parking of vehicles and includes

(i) a sidewalk, including a boulevard adjacent to the sidewalk,
(ii) if a ditch lies adjacent to and parallel with the roadway, the ditch, and
(iii) if a highway right of way is contained between fences or between a fence and one side of the roadway, all the land between the fences, or all the land between the fence and the edge of the roadway, as the case may be,

but does not include a place declared by regulation not to be a highway.

"Industrial Roadway" means a local street that provides access to adjacent parcels districted for industrial use.

"Land Use Bylaw" means the current Land Use Bylaw of the City of Fort Saskatchewan as amended.

"Local Roadway" means a highway with the primary function of providing direct access to adjacent parcels of land and generally connects to other local roads and collector roads.

"Lot" means a quarter section; a part of a parcel where the boundaries of the part are separately described in a certificate of title other than by reference to a legal subdivision; or in part of a parcel where the boundaries of the part are described in a certificate of title by reference to a Plan of Subdivision.

"Lot Depth" means the average horizontal distance between the front and rear lot lines.

"Lot Line, Front" means the property line of a lot abutting a public roadway other than a lane. In the case of a corner lot, the front lot line is the shorter of the property lines abutting a public roadway, other than a lane.

"Lot Line, Rear" means either the property line of a lot which is furthest from and opposite the front lot line, or where there is no such property line, the point of intersection of any property lines other than a front lot line which is farthest from and opposite the front lot line.

"Lot Line, Side" means the property line of a lot other than front lot line or rear lot line.

"Lot Width" means the horizontal distance between side lot lines of the site measured at a distance from the front lot line equal to the minimum required front yard.

"Medical Officer of Health" means the Medical Officer of Health appointed under the *Public Health Act*, as amended.

"Municipality" means the City of Fort Saskatchewan or the area within the municipal boundaries thereof as the context may require.

"Owner" shall be interpreted as defined in the *Municipal Government Act*, as amended.

"Panhandle Parcel" means any parcel which is serviced and gains highway frontage through the use of a narrow strip of land which is an integral part of the parcel (hereinafter called the "Access Strip").

"Parcel" means the aggregate of the one or more areas of land described in a Certificate of Title or described in a Certificate of Title by reference to a plan filed or registered in a Land Titles Office.

"Pathway" means a path which follows routes independent of motor vehicle roadways, sidewalks and bike lanes, intended for use by pedestrians and other non-motorized modes of travel.

"Potable Water" means water which is approved for drinking purposes by the Medical Officer of Health.

"Professional Engineer" means a person who is registered or duly licensed as such with the Association of Professional Engineers, Geologists, and Geophysicists of Alberta (APEGGA).

"Proven Supply" means that a supply of potable water is available and proven with respect to volume, delivery and continuity of supply from an on-site groundwater system, a source requiring a water license from Alberta Environment or a community water system.

"Roadway" means the portion of the highway that is improved, designed or ordinarily used for vehicular traffic.

"Service Level" means the standard of municipal services required for development of subdivisions under the provisions of this document.

"Site" means any combination of lots or titled areas for which application is made for a Development Permit.

"Statutory Plan" means a planning document as described in Part 17, Division 4 of the *Municipal Government Act*, as amended, including Intermunicipal Development Plans, Municipal Development Plans, Area Structure Plans, or Area Redevelopment Plans.

"Street" means a highway except a lane, trail or walkway.

"Subdivision" means the division of land into two or more parcels by plan or apt descriptive words.

"Subdivision Authority" means any person duly authorized by the Municipal Council to act as Subdivision Authority Officer pursuant to the provisions of the *Municipal Government Act*, as amended.

"Top of Slope, Embankment or Escarpment" means the natural defined top edge of a slope, embankment or escarpment; or, where a gradual steepening exists, the point at which the slope exceeds 30% grade.

"Watercourse" means any natural or man-made drainage course or source of water, whether usually containing water or not, and includes any lake, river, creek, spring, ravine, swamp, gulch, or source of groundwater, whether enclosed in a conduit or not.

## 2.0 SUBDIVISION AND DEVELOPMENT REQUIREMENTS AND REGULATIONS

### 2.1 Purpose Statement

No person shall subdivide or develop land in the City of Fort Saskatchewan except in compliance with the provisions of this document, the Land Use Bylaw, any applicable statutory plan, or the requirements of the *Municipal Government Act*, as amended. Compliance with the above documents or regulations does not remove obligations to conform with other municipal, provincial, or federal legislation, policies, or bylaws, or any caveats, covenants, or easements that may be attached to a site.

### 2.2 General Requirements for Design of Subdivisions

No subdivision of land shall be approved which:

a) is not suited to the configuration of land being subdivided;

b) is not suited to the use to which it is intended;

c) is not in conformance with the Land Use Bylaw;

d) is not in conformance with any statutory plan adopted by the City of Fort Saskatchewan; or

e) will make impracticable the future subdivision of the land within the proposed subdivision or of any adjacent land.

### 2.3 Area, Shape and Dimensions of Lots

a) No subdivision shall be created in any district so that any lot created by the subdivision has an area in square metres or hectares or a width in metres less than those set out for the district in which it is located as set out in the current City of Fort Saskatchewan Land Use Bylaw, as amended.

b) The side lines of parcels to be created by the subdivision shall be as close as practicable at right angles or radial to street lines and the Subdivision Authority shall ensure that the parcels to be created are logical in shape and dimension for the use intended.

c) No panhandle parcels will be permitted as part of any decision of a tentative plan of subdivision by the Subdivision Authority.

d) The location of all public utility lots, utility rights-of-ways, municipal reserve and environmental reserve parcels proposed under a tentative plan of subdivision shall be to the satisfaction of the Subdivision Authority.

## 3.0 PROVISION OF SERVICES IN SUBDIVISIONS AND DEVELOPMENTS

### 3.1 Level of Service

Unless otherwise approved by the Subdivision Authority, all subdivisions and developments shall be provided with municipal water and sewer servicing.

### 3.2 Expense of Service to be Borne by the Owner/Applicant

The following expenses are to be borne solely by the Owner/Applicant:

a) All reasonable and justifiable charges or accounts rendered to the City of Fort Saskatchewan by Consulting Engineers that may be engaged by the City of Fort Saskatchewan from the time plans are submitted until final acceptance of all municipal improvements.

b) All reasonable and justifiable legal charges or accounts rendered to the City of Fort Saskatchewan by solicitors from the time of application for subdivision until final acceptance of all municipal improvements.

c) Cost of additional work performed or of work repaired or redone by reason of orders and direction by the City's Engineer under the terms of the Development Agreement.

d) Cost of providing the security and insurance required to be provided by the Owner/Applicant under the terms of the Development Agreement.

e) Cost of preparation of an easement or utility right-of-way document(s) to be provided by the Owner/Applicant including cost of registration of the same.

f) Cost of land title registrations of the Development Agreement.

### 3.3 Indemnity and Insurance

The Owner/Applicant shall indemnify and save harmless the City of Fort Saskatchewan from any and all losses, costs, damages, actions, causes of action, suits, claims and demands, resulting from anything done or omitted to be done by the Developer in pursuance or purported pursuance of this Agreement.

The Owner/Applicant must provide and maintain, at the Owner/Applicant's expense, at all times until the Certificate of Final Acceptance is issued, Comprehensive General Liability Insurance coverage, covering premises and operations liability, contingency liability with respect to the operations of contractors and sub-contractors, completed operations liability, contractual liability and automobile liability for owned, non-owned and hired units.

The limits of liability must be not less than $5,000,000 for each occurrence for bodily injury, death and damage to property. Each policy must provide that it can not be cancelled, lapsed, or materially altered without a minimum thirty (30) days notice in writing to the City by registered mail, must name the City and its officials and employees as an additional insured, and must contain a cross-liability clause.

The insurance coverage required to be provided by the Owner/Applicant may be embodied in a blanket insurance policy obtained by the Owner/Applicant. The Owner/Applicant must deliver a copy of each insurance policy to the City prior to the commencement of Construction of the Works and Services. If the Owner/Applicant fails to obtain and maintain the said insurance or deliver the said policy or policies to the City, the City may but will not be obliged to obtain and maintain such insurance at the expense of the Owner/Applicant.

### 3.4 Traffic Impact Assessment

Depending on the nature of the development, the surrounding neighbourhood and the adjacent transportation system, the City of Fort Saskatchewan may require that the Owner/Applicant submit a Traffic Impact Assessment completed by a qualified professional engineer(s).

The cost for the preparation and submission of the Traffic Impact Assessment will be entirely borne by the Owner/Applicant.

### 3.5 Offsite Utilities Impact Analysis

Depending on the nature of the development, the surrounding neighbourhood and the adjacent offsite utilities systems, the City of Fort Saskatchewan may require that the Owner/Applicant submit an Offsite Utilities Impact Analysis, completed by a qualified professional engineer(s). The Offsite Utilities Impact Analysis will discuss the impacts of the proposed development on the City's water, sanitary and storm sewer systems.

The cost for the preparation and submission of the Offsite Utilities Impact Analysis will be entirely borne by the Owner/Applicant.

### 3.6 Excess or Extended Capacity

Pursuant to Section 651(1) of the *Municipal Government Act*, as amended, the City may require that the Owner/Applicant provide excess or extended services to provide access to or service land other than the land being subdivided or developed.

### 3.7 Cost of Excess or Extended Capacity

The cost of providing excess capacity shall be derived by the following formula:

Cost of excess capacity = cost of installing system with excess capacity minus cost of installing system to service the proposed subdivision only or the minimum permitted for the size of line in the City servicing standards, as amended, whichever is greater.

The determination of the cost of excess capacity shall be based on estimates prepared by a professional engineer representing the Owner/Applicant of the land being subdivided, agreed to by the City Engineer.

### 3.8 Payment of Cost of Excess Capacity

Where the City requires the provision of excess capacity under Section 3.6, the cost of the excess capacity will be paid for by the Owner/Applicant of the land being subdivided.

### 3.9 Cost Recovery by an Owner/Applicant

Where the Owner/Applicant of land being subdivided pays for the cost of providing excess capacity under Section 3.8, the City may impose a charge under Section 3.10 and shall pay to that land owner all the charges collected during the period beginning after the works or services were completed and ending on a date to be agreed upon by the land owner and the City and failing agreement, to be determined pursuant to the International Commercial Arbitration Act, but no charges are payable beyond ten (10) years from the date service is completed and a Final Acceptance Certificate is issued.

### 3.10 Endeavour to Assist for Excess Capacity

The City may, as a condition of an Owner/Applicant connecting to works and services where excess capacity has been provided under 3.8, impose a charge and the charge shall be calculated as a proportion of the cost of providing excess capacity as determined under Section 3.7. The proportion of costs to be imposed on an Owner/Applicant shall be derived on the basis of the capacity of the system to be utilized by the Owner/Applicant in relation to the total excess capacity provided.

In calculating the charge to be imposed on the Owner/Applicant who wishes to connect, there shall be included in the total cost of providing excess capacity, interest calculated annually at the current Bank of Canada prime rate plus two percent (2%) payable for the period commencing when the work or service providing the excess capacity was completed, up to the date that the connection is made.

### 3.11 Off-Site Services

The Owner/Applicant shall be required to contribute towards the cost of upgrading or upsizing of off-site roads and utilities.

### 3.12 Right-of-Way Agreement

Pursuant to Sections 648, 651 and 655 of the *Municipal Government Act*, as amended, where the provisions of this document require an Owner/Applicant to grant a utility or drainage right-of-way to the City of Fort Saskatchewan, the Owner/Applicant shall be required to enter into a development agreement and shall pay all associated costs.

### 3.13 Subdivision Endorsement Prior to Completion of Works and Services

Endorsement of a subdivision must be granted prior to the construction and installation of any and all works and services as prescribed in Schedules A to D hereto at the expense of the Owner/Applicant to serve said subdivision.

Construction and installation of the required works and services may begin prior to endorsement of the plan of subdivision where:

a) the Owner/Applicant provides a Letter of Credit to the City of Fort Saskatchewan in an amount representing Fifty Percent (50%) of the cost of installing and paying for all the works and services required as estimated by the Owner/Applicant's Engineer and approved by the City's Engineer, and

b) the Owner/Applicant has submitted Detailed Engineering Design Drawings and after approval of the plans and specifications by the City, as outlined in Section 8.1 of Schedule A.

## 3.14 Site Preparation

a) The Owner/Applicant shall erect fencing and provide other measures satisfactory to the City to ensure the stripping and grading does not encroach into Environmental Reserve land where applicable.

b) The Owner/Applicant, at no expense to the City, shall erect "Private Property" and "No Trespassing" signs on the perimeter of the lands, stating the Owner/Applicant's name and the telephone number of a representative.

c) The Owner/Applicant shall submit to the City for approval, proposed access routes identifying streets for site preparation and general construction.

d) The Owner/Applicant shall be responsible for controlling restricted and noxious weeds and excessive vegetative growth within the Development Area.

e) No grading, filling or excavation is permitted within existing utility and road rights-of-way, under any overhead utility lines, or over any underground utilities, unless prior written authorization has been obtained from the utility agencies concerned.

f) If, during stripping and grading operations or any other construction within the Development Area, the Owner/Applicant or any of their agents or contractors becomes aware of any contamination, the person discovering such contamination shall forthwith report the contamination to Alberta Environmental Protection, the Capital Health Authority and the City of Fort Saskatchewan.

g) In the event the Owner/Applicant encroaches into the adjacent land during the stripping and grading operations, the Owner/Applicant, at its sole expense, shall rehabilitate the adjacent lands to the satisfaction of the land owners immediately after completion of the stripping and rough grading of the adjacent lands.

h) The Owner/Applicant, at its sole expense, and to the satisfaction of the City's Engineer, shall rehabilitate in a timely manner any offsite areas or operations, storm water runoff, soil erosion, soil instability, sedimentation, dust or other problems which may arise from the stripping and grading, and shall employ the use of gravel pads to curb dirt, mud or other debris from being tracked out onto any streets located within and adjacent to the Development Area and reduce or stop activity when the site has excessive dust emissions.

## 3.15 Dust Control

During construction of works and services, the Owner/Applicant shall be responsible for providing for and maintaining dust control at all times wherever:

a) the operation of any equipment causes dust that becomes a nuisance to property land owners and residents in the area; or

b) bare soil conditions are created in performing work.

Should the Owner/Applicant not implement dust control procedures as required or as directed by the City's Engineer, the City will undertake the dust control procedures and charge back the Owner/Applicant to recover all costs incurred including such things as engineering and administration costs, wages, equipment costs, etc.

## 3.16 Clean-Up

During construction of works and services within the subdivision or development, the Owner/Applicant shall be responsible for ensuring that the construction area shall be maintained free of accumulation of excess waste material and debris.

The disposal of waste materials and rubbish by burning or burial on the site will not be permitted. The disposal of volatile wastes such as mineral spirits, oil, gasoline or paint thinner into storm or sanitary sewer drains will not be permitted.

During and after construction of works and services, the Applicant shall be responsible for ensuring that all access streets into the subdivision or development are maintained free of accumulation of excess waste material and debris. The City reserves the right to carry out the maintenance of such access streets and charge the cost of such work to the Owner/Applicant, if the Owner/Applicant fails to restore the street(s) to normal levels within forty-eight (48) hours of being notified in writing by the City.

## 3.17 Construction Completion

Upon 100% completion of the works, the Design Engineer must schedule a field inspection with the City Engineer. Upon verification by the City Engineer that 100% Construction Completion of all Works and Services has been achieved, the Owner/Applicant must provide the City with:

a) a confirmation of Professional Assurance;

b) confirmation in writing from an Alberta Land Surveyor (A.L.S.) that all survey pins have been installed on the Parcel;

c) all copies of required manuals, videos, testing reports and results in the form specified in Schedule A; and

d) sanitary, storm and water service connection invert elevations.

Upon receipt of the above, the City will issue the Construction Completion Certificate.

## 3.18 Maintenance

Where the Owner/Applicant of land is required to construct and install works and services in accordance with the provisions of this Document, the Owner/Applicant shall be responsible to:

a) provide the City with a Letter of Credit for up to two (2) years to the value of 10% of the constructed works plus 200% of the value of Deficiencies as security against unsatisfactory operation and maintenance of the works and services during the maintenance periods specified in the Development Agreement. Identified deficiencies must be addressed in a timeline considered reasonable by the City; and

b) pay the City the inspection fees as specified in the Development Agreement.

With reasonable notice, the City may cash the Letter of Credit provided under Section 3.18 a) to address deficiencies that have not been appropriately remedied by the Owner/Applicant.

### 3.19 Certificate of Final Acceptance

Upon the expiration of all Maintenance Periods, submission and City approval of asbuilt drawings, receipt from the Owner/Applicant of a Statutory Declaration and verification by the City Engineer that all information, documents, agreements, covenants, and fees required from the Owner/Applicant and Design Engineer pursuant to this Document have been provided to the City, the City will:

a) provide the Owner/Applicant with a Final Acceptance Certificate of all Works and Services; and

b) release to the Owner/Applicant the balance of the Letter of Credit.

### 3.20 Business License

All contractors or other businesses undertaking works related to the requirements of this document must possess a valid business license from the City.

## 4.0 ADMINISTRATION AND ENFORCEMENT

### 4.1 Application Fee

An Application for Subdivision Approval will not be accepted by the City of Fort Saskatchewan unless the appropriate fee, as identified by Schedule A of the current Fees and Charges Bylaw as amended, has been provided.

### 4.2 Inspection Fees

The Development Agreement sets out inspection fees for constructing utilities and roads required for the new subdivision.

### 4.3 Authorization to Enter Lands Being Subdivided

Officers of the City of Fort Saskatchewan, or their designates, are authorized to enter, at all reasonable times, upon the lands for which application to subdivide has been made, in order to ascertain whether the provisions of this Document are being met.

### 4.4 Violation

Every person who:

a) violates any of the provisions of this Document;

b) causes or permits any act or thing to be done in contravention or violation of any of the provisions of this Document;

c) neglects or omits to do anything required under this Document;

d) carries out, causes or permits to be carried out any development in a manner prohibited by or contrary to any of the provisions of this Document;

e) fails to comply with an order, direction or notice given under this Document; or

f) prevents or obstructs or attempts to prevent or obstruct the authorized entry of an officer on a property under Section 4.3;

shall be deemed to be guilty upon summary conviction of an offence under this Document.

### 4.5 Offence

Each day's continuance of an offence under Section 4.4 constitutes a new and distinct offence.

### 4.6 Penalty

Any person who violates any of the provisions of this Document shall, on summary conviction, be liable to a penalty not exceeding $10,000 plus the cost of prosecution for each offence.

### 4.7 Completion

Should any person fail to construct or install any works or services required under this Document, the Municipality, its agents or servants may construct or install the works and services at the expense of the person in default, and the expense thereof, with interest at the Bank of Canada prime rate plus two percent (2%) per annum with costs, may be recovered in like manner as municipal taxes as provided under the provisions of Section 553 of the *Municipal Government Act*, as amended, and may in addition to any other remedy available to the City, be collected in the same manner and with the like remedies as ordinary taxes upon Land and improvements are collected under the said Act, as amended.

### 4.8 Severability

If any section, subsection, sentence, clause or phrase of this Document is for any reason deemed to be invalid by the decision of any court of competent jurisdiction, the invalid portion shall be severed and the decision that it is invalid shall not affect the validity of the remainder of this Document.

### 4.9 Schedules Form Part of Document

Schedules A through C are attached to and form part of this Document.

CITY OF
FORT SASKATCHEWAN
ALBERTA

# Engineering and Servicing Standards

**SCHEDULE B**

**ENGINEERING DRAWING STANDARDS**

**NOVEMBER 2013**

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## 1.0 GENERAL REQUIREMENTS

This Document outlines the minimum standards and requirements for design and As-Built Drawing submissions for engineering work(s).

Where a standard drawing exists, it shall be sufficient to refer to the appropriate drawing by reference number and date of issue. Where a standard drawing does not exist, or is unsuitable for a particular case, detail drawings shall be prepared to accurately portray the various elements of the installation.

Where no standard is defined in this Document for the preparation of a drawing to portray a particular service, structure, or other item, instructions and requirements may be obtained by discussion with City of Fort Saskatchewan staff.

Drawings shall clearly show existing and proposed locations of all utilities using offsets from property lines or boundaries of rights-of-way.

All drawings shall be signed and sealed by a Professional Engineer registered in the Province of Alberta.

Elevations shall be referred to geodetic datum. Horizontal coordinates shall be referenced to 3TM grid coordinate system NAD83.

## 2.0 ABBREVIATIONS

| | |
|---|---|
| 3TM | 3-degree Transverse Mercator |
| NAD83 | 1983 North American Datum |
| FOC | Face of Curb |
| GUT | Gutter Line |
| EC | End of Curve |
| BC | Beginning of Curve |
| PI | Point of Intersection |

## 3.0 DRAFTING STANDARDS

### 3.1. Sheet Layout

Drawing sheet layout(s) shall conform to and include the following:

a) sheet size to be ANSI D 558.8 mm x 863.6 mm (22″ x 34″);

b) a north arrow shall be placed close to the top right side of each plan view on the sheet. Where feasible, the north arrow shall point to the top of the page;

c) a title block which describes the contents of the drawing (eg. Key plan, road, etc) and shall clearly indicate the location of the works by road name(s) and/or legal description; and

d) drawing scale, date, revision history block, and a detailed legend shall also be included on each sheet layout.

## 3.2. Dimensions and Units

The following conventions must be used:

a) dimensions and units must be shown in metric. No imperial units are permitted;

b) all distances, elevations, and coordinates shall be given in meters to accuracy of 2 decimal places;

c) grades shall be given as a percentage to accuracy of 2 decimal places;

d) areas shall be in hectares to accuracy of 2 decimal places;

e) all pipe sizes shall be given in millimeters as per ASTM specifications using: 1" = 25mm; and

f) existing imperial dimensions, except for pipe sizes, are to be soft converted using the factors:

1 inch = 25.4 millimeters
1 foot = 0.3048 meters.

## 3.3. Lettering

The following conventions must be used:

a) lettering is to be an open style of Vertical Gothic (eg. Leroy or AutoCAD – 'romans');

b) all lettering to maintain a 1:10 ratio between plotted text height and plotted pen thickness;

c) minimum plotted text height shall be 1.5 mm;

d) maximum plotted text height shall be 5.0 mm; and

e) standard lettering height is 2.0 mm.

## 3.4. Scales

The following scales shall be normally used:

a) Location and Key plans: 1:1000; 1:2500; 1:5000; 1:10000

b) Composite Plans: 1:500; 1:1000; 1:2500

c) Plan/Profile Drawings: Horizontal 1:500 or 1:250 Vertical 1:50 or 1:25

d) Cross Sections: Horizontal 1:100 Vertical 1:50

e) Details: 1:100; 1:20; 1:10

## 4.0 DRAWING STANDARDS (DIGITAL)

### 4.1. General Requirements

The Owner/Applicant will be required to submit to the City of Fort Saskatchewan a complete set of electronic drawings of the Subdivision or Development in AutoCAD DWG format compatible with the current version of AutoCAD upon completion of the proposed works.

All drawing objects colour and linetype properties shall be set to 'bylayer'.

All drawings must be purged of all unnecessary information prior to submission to the City of Fort Saskatchewan.

Sections 4.2 through 4.5 outline recommended drafting standards, however these are not required.

### 4.2. Layer Names and Colours

The City of Fort Saskatchewan uses the following convention for naming AutoCAD layers:

<category>-<object>-<type>

Where the available 'categories' are defined below and 'objects' could be lines, mains, manholes, valves, walls, fences, and text; and 'type' describes the type of object.

For example, concrete could be used to describe a 'type' of sidewalk as in ROAD-WALK-CONCRETE or ROAD-WALK-TEXT would describe text associated with the sidewalk.

| Layer Category | Category Description | Colour Pen # |
|---|---|---|
| COM | Communications (eg. Tel or Cable) | 230-239 |
| ELEC | Electrical | 190-199 |
| GAS | Gas | 190-199 |
| LAND | Landscape Information | 70-79 |
| LGL | Legal Information | 140-149 |
| ROAD | Roads | 20-29 |
| SAN | Sanitary Sewer | 10-19 |
| STM | Storm Drainage | 90-99 |
| STRUC | Structures and Hard Surface Features | 220-229 |
| SURV | Survey Information (eg. Control points) | 40-49 |
| TOPO | Topography (eg. Contours) | 60-69 |
| WAT | Water | 150-159 |

Some common layer examples are:

SAN-MAIN-200mm
ROAD-EDGE-ASPHALT
SURV-POINT-CONTROL

Required layer names may be prefixed as shown below to signify either existing, proposed, or future works.

| Prefix | Description | Range |
|---|---|---|
| E- | Existing Features | Colours 11-249 odd |
| P- | Proposed Works | Colours 10-248 even |
| F- | Future works | 250-255 |

## 4.3. Special Layers

Exceptions to the layer naming convention described are listed below:

| Layer Category | Category Description | Colour Pen # |
|---|---|---|
| _MVIEW | Viewports | 0 |
| _IMAGE | Externally Referenced Images | 0 |
| _TITLE | Title Block Data (text and line work) | 180, 182 & 184 |

## 4.4. Line Weight Conventions

Colours 180, 182, and 184 are generally used for Title blocks and miscellaneous text and notes.

| | | |
|---|---|---|
| 180 | 0.60 | black |
| 182 | 0.30 | black |
| 184 | 0.20 | black |

Colours 250-255 are generally used for FUTURE works and hatch patterns.

| | | |
|---|---|---|
| 250 | 0.10 | grey |
| 251 | 0.15 | grey |
| 252 | 0.20 | grey |
| 253 - 255 | 0.25 | grey |

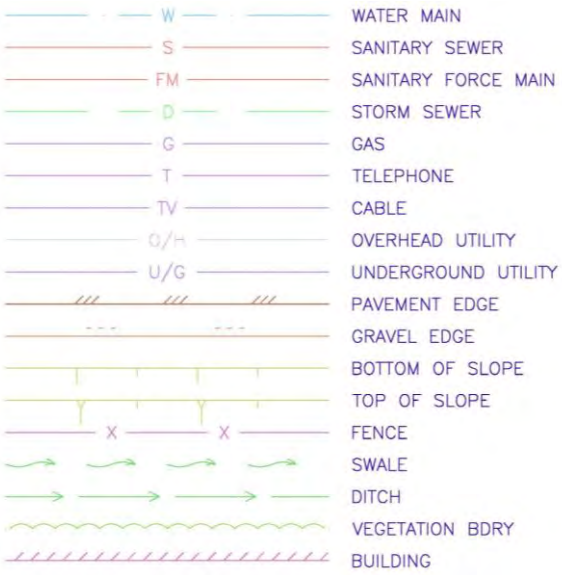
Colours 10-248 (even) are generally used for proposed works, as follows:

| | | |
|---|---|---|
| 10, 20, 150... | 0.60 | black |
| 12, 22, 152... | 0.40 | black |
| 14, 24, 154... | 0.35 | black |
| 16, 26, 156... | 0.30 | black |
| 18, 28, 158... | 0.20 | black |

Colours 11-249 (odd) are generally used for existing works, as follows:

| | | |
|---|---|---|
| 11, 21, 151... | 0.20 | black |
| 13, 23, 153... | 0.15 | black |
| 15, 25, 155... | 0.10 | black |
| 17, 27, 157... | 0.10 | screen 60 |
| 19, 29, 159... | 0.10 | screen 30 |

### 4.5. Line Types




## 5.0 REQUIRED DRAWINGS

All plans should include the property lines, lot-block numbers, street names and construction limits. Drawings and/or drawing elements may be combined at the discretion of the Engineer. Distinction shall be made between existing, proposed, and future features.

### 5.1. Cover Sheet (Title Page)

In addition to any other requirements presented in this document, the cover sheet shall show the following information:

a) Name of Development or Project.

b) City of Fort Saskatchewan Logo.

c) Name and/or logo of Owner/Applicant and Consulting Engineer.

d) Site location plan of Development or project.

e) File numbers of approving authorities, (i.e. Development Permit or Subdivision Application number).

f) Type of drawings.

g) Submission date.

h) Stage, phase, and year of the project or development.

i) Complete drawing index of all sheets belonging to the set.

Note: The standards defined in Sections 3.1 c), 3.1 d), and 3.3 do NOT apply to the cover sheet.

## 5.2. Index Plan

This Plan will indicate which portion of the development that relates to a particular plan/profile sheet. A complete list of the drawing set(s) is to be included.

## 5.3. Legal Plan

This Plan shall indicate parcel, ROW, easement, and PUL dimensions; relevant control stations and benchmarks.

## 5.4. Contour and Lot Grading Plan

This Plan shall indicate the following:

a) The existing contours and elevations at a maximum of 0.5metre intervals, all existing topographical features such as trees, buildings, utilities, etc., and the date and method of survey

b) Proposed finished lot corner elevations and lot grades

c) Proposed finished elevation of the building

d) Proposed swale locations

e) Directions of surface drainage flow

f) Ponding areas

g) Include note listing all ASCM's used for elevation control

## 5.5. Road, Sidewalk & Walkway Plan

This Plan shall indicate the following:

a) All locations, dimensions, and alignments of roads, lanes, ditches, walkways, curb ramps, temporary access connections, signs, and other proposed topographical features

b) BC and EC locations and radii of curvature

c) Date and author of geotechnical report specifying pavement structure

## 5.6. Sanitary, Storm & Watermain Overall Plan

This plan shall indicate the following for all mains and related components/ appurtenances:

a) The location, alignment, and offsets

b) Network type

c) Size

d) Material

e) Direction of flow

## 5.7. Basin Plan

This plan shall indicate the following:

a) Contributing storm and sanitary sewer catchment boundaries and areas in hectares

b) Direction of flow and discharge point through each catchment

c) Fire hydrant service radii in meters

d) Calculations for design flows, flow restrictors, pipe/channel capacities, and storage requirements and capacities

e) Date and author of report or outline plan used as a reference

## 5.8. Key Plan(s)

In addition to any other requirements presented in this document, Key Plans shall show the following information:

a) Lot numbers, plan numbers, and road names of the subject Development and adjoining properties.

b) Cross reference of the drawings by outlining the area contained in each drawing and referencing that drawing by drawing number.

c) General construction notes.

## 5.9. Building Envelope Plan (if applicable)

In addition to any other requirements presented in this document, Building Envelope Plan shall show the following information:

a) Overall plan of current phase.

b) Lot numbers.

c) Roads, curbs, gutters and sidewalks.

d) Rights of way and easements.

e) Offset lines from all property boundaries indicating required building setbacks.

f) 10 meter by 10 meter square on each parcel indicating the required minimum building envelope.

g) Notes that indicate the required setbacks from all property boundaries pursuant to the Zoning Bylaw.

## 5.10. Composite Plan(s) (as required)

In addition to any other requirements presented in this document, Composite Plans shall show the following information:

a) All existing and proposed utilities, roads, walkways, and sidewalks.

b) All rights of way and easements including widths.

c) Control monuments with identification number.

d) All legal information, including bearings, dimensions, lot numbers, block numbers, legal plan numbers, and street names. All lots must be numbered.

e) Show legal lot line dimensions.

f) All roadway dimensions including width of right of way, FOC to FOC (GUT to GUT) and FOC (GUT) to edge of right of way.

g) Area of each parcel.

## 5.11. Plan / Profile Drawings - General

In addition to any other requirements of this document, Plan/Profile drawings shall conform to the following:

a) Both plan and profile stationing must be tied to a property line or road boundary.

b) The profile shall be shown at true centerline length and projected below the plan in as close a horizontal relationship as possible.

c) The top half of a Plan/Profile sheet shall show the plan view and shall show the legal layout with legal descriptions of all properties, the location of all curbs, sidewalks, underground utilities such as water, sanitary and storm sewer, manholes, catch basins, culverts, valves, hydrants, shallow utilities such as gas, power, street lights, telephone, cable and all survey monuments, but not limited to the above.

d) Drawings shall also show existing dwellings, fences, trees, hedges, unusual ground features, existing roads and driveways including the type such as asphalt, concrete or gravel.

e) Plan/Profile drawings for various services are to be combined on one plan.

## 5.12. Road Plan/Profile Drawings (may be combined with Storm Drains)

Road **Plan** views shall show the following information:

a) Width of road, width of shoulders, and the offset of curb (FOC/GUT) from property line.

b) Chainages of the BC and EC of horizontal curves shall be shown together with the delta angle, centerline radius, tangent length, and centerline arc length. Curb radii are not required if the centerline radius and road width are shown, except on curb returns at intersections and at the end of cul-de-sacs.

c) Quarter point gutter elevations for cul-de-sac.

d) Catchbasin rim elevations.

Road **Profile** views shall show the following information:

a) Design gutter and/or centerline grade (%).

b) Vertical curve chainage and elevations of BC, EC and PI; the external value, e; the length of vertical curve; the chainage and elevation of the low spot of sag curves; and, K value of vertical curvature (crest on sag).

c) Existing ground elevation along the centerline of proposed roadway and/or the edge of existing asphalt.

## 5.13. Water Plan/Profile Drawings (may be combined with Sanitary Sewer and Storm Mains)

Water **Plan** views shall show the following information:

a) Offset of pipelines from property lines;

b) Length and size of pipe;

c) Offset of connections from property lines;

d) Locations of manholes, hydrants, valves, services, end-of-main, or other appurtenances referenced to nearest property line;

e) Information on any curves or pipe deflections;

f) Easements (existing and/or required); and

g) Location and connection details for all valves and fittings.

Water **Profile** views shall show the following information:

a) Surface profiles (existing and design, if applicable) over proposed main.

b) Length, size, grade, type, and material of pipe.

c) Profiles of invert and crown of pipes.

d) Location, type and invert elevation of all crossing utilities.

e) Stationing of all valves, fittings and appurtences.

f) Anchor block locations.

## 5.14. Storm Drains and Sanitary Sewer Plan/Profile Drawings

Storm & Sanitary **Plan** views shall show the following information:

a) The drawings shall show the structural details of all manholes and chambers, etc. not covered by standard drawings. Where the sanitary sewers and storm drains or other utilities are to be installed in a common trench, a typical cross-section showing vertical and horizontal distances between pipes and classes of pipe and bedding shall be shown.

b) Offset of pipelines from property lines.

c) The size of pipe.

d) Offset of connections from property lines (if applicable).

e) The locations of manholes, clean-outs and services relating to property lines.

f) Information on any curves or pipe deflections.

g) Easements (existing and/or required).

h) Future curb & gutter lines (if applicable).

i) Manhole identification numbers.

j) Inverts of service connections at property line (if applicable).

k) For storm drainage, features such as ditches, culverts, streams, channels, etc.

Storm and Sanitary **Profile** views shall show the following information:

a) Surface profiles (existing and design, if applicable) over proposed main.

b) Length, size, grade, type, and material of pipe.

c) Profiles of invert and crown of pipes.

d) Location, type and invert elevation of all crossing utilities.

e) Invert elevations of manholes.

f) Alignment station of manhole.

g) Manhole identification number.

h) Rim elevations of proposed or adjusted manholes.

## 5.15. Grading Plan(s)

In addition to any other requirements presented in this document, Grading plans shall show the following information:

a) Pre-Development contour lines. The topographic information shall extend a minimum 30.0m outside the Development site.

b) Proposed contours, slopes, grades, and spot elevations.

c) The minor (5 year return) storm sewer system with the flows noted per section and the accumulated flows from all upstream sections. Provision must be made for upstream Development potential where applicable.

d) The major (100 year return) system. The Consulting Engineer shall note wherever the major system is not in the pipe or the roadway, showing the routing and flows for the 100 year return storm.

e) All swales proposed to affect the submitted Storm Water Management Plan.

f) How the Development proposal will affect adjacent lands, attempts should be made to "meet" existing elevations along the Development boundary.

g) A legend noting all items proposed in the Storm Water Management Plan. Applicable "General Notes" should also be included.

Lot Grading Plans will show the following information

a) All existing corner lot elevations (uncircled).

b) All proposed corner lot elevations (circled).

c) The proposed building envelope with the minimum basement elevation (mbe) noted.

d) The slope of the lot (directional arrow), noting a minimum 1% grade on the lots.

## 5.16. Landscape Plan(s)

In addition to any other requirements presented in this document, Landscape plans shall show the following information:

a) Extent of proposed landscape works and services.

b) Existing and proposed property information, including lot lines, easements, legal descriptions, addresses and dimensions.

c) Existing and proposed contours, slopes, grades and spot elevations for landscaped areas (if not already shown on grading plan).

d) Existing and proposed buildings, structures, roads, curbs, sidewalks, walls, fences, signs, site features and other appurtenances.

e) Existing vegetation proposed to be removed, relocated or retained.

f) Areas of proposed preservation, naturalization, restoration, lawn and landscaping, including soil types, depths and amendments.

g) Proposed plant species name (botanical and common), size and planting condition.

h) Existing and proposed irrigation system.

i) Construction details and specifications as required.

## 5.17. Storm Water Management Plan (SWMP)

In addition to any other requirements presented in this document, Storm Water Management plans shall show the following information:

a) Site and surrounding area (400 m minimum outside Development) showing roads and major features. A small location plan of the watershed is also to be included.

b) Contours of existing ground (0.5 m intervals where slope <10%, 1.0 m >10%) for the site and surrounding area mentioned above.

c) Major flood routing (1:100 year); show as arrows and indicate if in pipe or on surface show an "open" arrow for surface routes and the same arrow "shaded" for routes in pipes).

d) Detention pond details, if applicable.

e) Area, in hectares, of Development and the total area of drainage basin.

f) Directional arrows of flow within the site and on surrounding areas.

g) Sub-catchment boundaries, coefficients and areas.

h) Pipe system including size, grade, and minor and major flows (a table may be utilized).

i) The subject Development is to be highlighted.

## 5.18. Erosion and Sediment Control Plan(s)

The Erosion and Sediment Control Plan is to detail methods and procedures that will be used to prevent or minimize soil displacement and transport of sediment from the Development site. This is to include methods to prevent or minimize soil transport onto adjacent properties or onto existing roads adjacent to the site (i.e. tracking from vehicles). Preventative methods of soil displacement on the site are to be detailed. In addition to any other requirements presented in this document, the drawing shall show the following:

a) Existing contours of the site at an interval sufficient to determine drainage patterns.

b) Final contours if the existing contours are significantly changed.

c) Final drainage patterns/boundaries.

d) Existing vegetation such as significant trees, shrubs, grass, and unique vegetation.

e) Limits of clearing and grading.

f) Erosion and sediment control measures (temporary and permanent) including locations, names and details, in accordance with "Land Development Guidelines for the Protection of Aquatic Habitat".

g) Storm Drainage systems including drain inlets, outlets, pipes, and other permanent drainage facilities (swales, waterways, etc.).

The plan must have a narrative section describing the land, the disturbing activity and details of the methods used for controlling erosion and sedimentation. Include a description of the procedures for construction and maintenance of the control measures and note the persons involved in maintenance and provide a maintenance schedule that is to be followed. Where the land area to be subdivided is less than 10 hectares, this plan may be combined with the Stormwater Management Plan.

### 5.19. Street Lighting Plan(s)

A plan view of the street lighting shall be provided. There shall be General Notes included on the Plan noting reference(s) to the Municipal Standards and Specifications and the appropriate design criteria.

### 5.20. Street Sign, Paint Marking, and Traffic Control Device Plans

A drawing identifying signs, markings, and required control devices. Detailed drawings may be required for traffic control devices.

### 5.21. Traffic Management Plan(s)

Detail routes for construction traffic and traffic controls for traffic on existing roads affected by construction.

### 5.22. Road Cross Section Plan(s)

Shall be scaled at 1:100 horizontal and 1:50 vertical and shall note the existing ground elevation, the proposed elevations of the road centerline, the curb and gutter (or road edge) and property lines. Cross-sections are required at 20.0 m intervals.

### 5.23. Construction Details

Show all proposals for construction which are not covered or specifically detailed in the City of Fort Saskatchewan Standards and Specifications. Where there is a City of Fort Saskatchewan Standard, it is expected to refer to the Drawing Number. It is not necessary to include or provide work(s) for which there is a Standard Drawing.

### 5.24. Electrical, Gas, and Communication Utilities

Per appropriate authority (Individual utilities may provide separate drawings).

## 6.0 DRAWING SUBMISSIONS

### 6.1. Design Submissions

Submit to the City of Fort Saskatchewan 2 sets of full size paper prints accompanied with electronic drawings in DWF format compatible with the current version of Design Review Software for all design drawings.

## 6.2. Record Drawings

Record Drawings must be submitted for review after the completion of the Works and Services, and must be approved prior to issuance of an FAC.

The Owner/Applicant shall submit to the City of Fort Saskatchewan a complete set of electronic drawings of the Subdivision or Development in AutoCAD DWG format compatible with the current version of AutoCAD in addition to a Digital Hard copy in PDF format in accordance with Sections 5.3 and 5.4 of this document.

## 6.3. Electronic Drawings

The Owner/Applicant shall submit to the City of Fort Saskatchewan a complete set of electronic drawings of the Subdivision or Development in AutoCAD DWG format compatible with the current version of AutoCAD.

The electronic drawing shall be prepared in accordance with all requirements and conventions herein.

All external files associated with the electronic drawing (e.g. special fonts, line types, and/or images) shall also be supplied with the electronic drawing submission.

No drawing shall be submitted that contains any external references (xrefs). All externally referenced drawings shall be bound prior to submittal.

## 6.4. Digital Hard Copies

A digital hard copy is any digital file that is reproducible without the ability to modify the drawings contents or appearance.

Autodesk's Drawing Web Format (*.dwf)is the preferred file type. However alternatives will be considered. Alternative formats might be Adobe's Portable Document Format (*.pdf)or scanned tif or jpg images.

Drawing sets submitted as a digital hard copy shall be electronically sealed by the Owner/Applicant's Engineer.

## 6.5. Device/Document Settings for Plotting Adobe Portable Document Format

Ensure all text is legible and the shading and hatching ordered so as not to block or hide other line work and/or text.

The following settings shall be used when plotting the drawings to Adobe PDF:

a) Paper size to be ANSI D 558.8 x 863.6 mm.

b) Layout to be "landscape".

c) Graphic print quality to be no less than "600 dpi".

CITY OF
FORT SASKATCHEWAN
ALBERTA

# Engineering and Servicing Standards

SCHEDULE C

ENGINEERING DESIGN STANDARDS

JANUARY 2025

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# 1.0 GENERAL DESIGN CONSIDERATIONS

This Infrastructure Design Standards Manual was prepared to provide a standardized set of guidelines to be adopted by The City of Fort Saskatchewan for those involved with design and construction of municipal infrastructure. Users of this manual shall note the following:

Alternative criteria relating to such things as field conditions, climate, development standards and development density have been included in this manual where practical.

Design criteria variations may be adopted from time to time in the form of Supplementary Design Guidelines which will supersede the guidelines contained in this manual.

The contents of this manual are intended to complement the City of Fort Saskatchewan Specifications and Standard Detailed Drawings.

This manual is not intended to be a substitute for sound engineering knowledge and experience. It is the designer's responsibility to exercise professional judgment on technical matters in the best interests of the Owner/Applicant and the public. Standards contained herein are provided to assist in making these judgments, but shall not be used as a substitute. The standards do not, and cannot, cover all particular cases.

## 1.1 Sustainability and Asset Management

Development of appropriate design standards for municipal infrastructure involves consideration of the principles of sustainability and asset management. These principles include the following:

- enhancement of quality of life
- environmental protection
- financial economies
- preventative maintenance
- life-cycle costs

A balanced approach to design of municipal infrastructure requires careful consideration of all of the above principles.

## 1.2 Independent Utilities

Independent utilities are those not normally supplied by municipal or regional authorities and are not included in these standards. Independent utilities include Fortis Alberta Inc., Axia Netmedia Corporation, ATCO Gas, TELUS, Shaw Cable systems G.P., Prestige Telecom and Bell Canada.

Design of municipal infrastructure must include consideration of the above utilities. Design of these utilities is normally carried out by the utility owner and coordinated by the municipal designer and/or the City of Fort Saskatchewan. All layouts and installations shall be subject to the approval of the City of Fort Saskatchewan.

In new urban developments, all wiring is generally to be underground. See Schedule B Level of Service Standards for all other developments.

Easements shall be registered on each individual lot prior to the sale of any lot in the development area.

## 1.3 Utility Rights-of-Way

Utility right-of-way (ROW) locations shall be selected to avoid environmentally sensitive areas such as watercourses, wetlands and wildlife migration corridors and forested areas.

Where location of a municipal utility in a statutory right-of-way is approved by the City of Fort Saskatchewan, the minimum right-of-way widths are as follows:

a) Single Service Main – ROW width to be equal to twice the depth from surface to the crown of the pipe (6.0m minimum width).

b) Two Service Mains – ROW width to be equal to twice the depth from surface to the crown of the deeper pipe plus a separation allowance (9.0m minimum width).

c) When the service is within a road allowance, and the distance from the property line to the centre of the service is less than one half of the width indicated above for a single service, the difference shall be provided as right-of-way on the adjacent property.

In all cases, the width of right-of-way shall be sufficient to permit an open excavation with side slopes in accordance with the WCB regulations, without impacting on or endangering adjacent structures.

Where required, sanitary and storm trunk sewer mains shall have rights-of-way wide enough for future widening and/or twinning. The width of the right-of-way shall be the required separation between pipe centerlines plus two (2) times the depth to the crown of the deeper sewer.

The designer shall provide cross sections indicating the minimum safe distances to adjacent building footings based on a safe angle of repose from the limits of the excavation.

Where a utility is located within a right-of-way, and valves, manholes or other appurtenances which require maintenance are located within the right-of-way; provide road access from a public road. The maintenance access must be sufficiently wide and structurally adequate to support the maintenance vehicles for which the access is intended.

For independent utilities, the Owner/Applicant shall provide either registered rights-of-way or registered easements in the name of the City for the purpose of accommodating the utility services. Rights-of-way shall be sufficient width and satisfactory to the utility companies.

## 1.4 Utility Separation

Requirements for separation of sanitary or storm sewers from watermains are as follows, unless otherwise indicated by the local public health authority.

### 1.4.1 Horizontal Separation

At least 3.0m horizontal separation shall be maintained between a watermain and either a sanitary sewer or storm sewer (center line to center line).

In special circumstances separation less than 3.0m may be permitted provided that:

a) The sewer main and watermain are installed in separate trenches and the watermain invert is at least 0.5m above the crown of the sanitary sewer or storm sewer and the joints are wrapped with heat shrink wrap (or similar) or packed with compound and wrapped with petrolatum tape in accordance with the latest version of AWWA Standards C217, and C214 or C209; or

b) The pipes are installed in the same trench with the watermain located at one side on a bench of undisturbed soil at least 0.5m above the crown of the sanitary sewer or the storm sewer and the joints of the watermain are wrapped with heat shrink plastic or packed with compound and wrapped with petrolatum tape in accordance with the latest version of the AWWA Standards C217, and C214 or C209.

### 1.4.2 Vertical Separation

Where a sanitary sewer or storm sewer crosses a watermain, the watermain shall be installed with a minimum clearance of 0.3m above the sewer or 0.5m below the sewer.

Where it is not possible to obtain the vertical separation indicated above, and subject to City of Fort Saskatchewan approval, the following details may be used:

a) The joints of the watermain, over a length extending 3.0m either side of the sewer main, are to be wrapped with heat shrink plastic or packed with compound and wrapped with petrolatum tape in accordance with the latest version of the AWWA Standards C217, and C214 or C209.

b) The sewer shall be constructed of pressure pipe such as high-density polyethylene (HDPE) or PVC with fused joints and pressure tested to assure it is watertight.

## 1.5 Trenchless Technologies

Installation or rehabilitation of pipelines by trenchless methods is frequently mandatory or desirable. Circumstances favouring trenchless installation include:

- installation or rehabilitation in heavily built-up areas
- stream crossings
- railway crossings
- highway crossings.

Available technologies include the following:

- slip-lining
- cured-in-place pipe (CIPP)
- pipe bursting
- horizontal directional drilling (HDD)
- microtunnelling
- pipe jacking.

# 2.0 WATER DISTRIBUTION

This section outlines the design criteria that apply to the water distribution system. These guidelines are not intended to be a substitute for sound engineering knowledge and experience. Designs shall be prepared under the direction of a qualified professional who has the appropriate experience and is registered with the Association of Professional Engineers and Geoscientists of Alberta (APEGA). The design shall be approved by the City Engineers.

## 2.1 Water Distribution General Principles and Objectives

A water distribution system includes all piping, fixtures, and pumping/storage facilities required to safely deliver potable water from a treatment facility to residential, commercial and industrial users for the purposes of consumption and fire suppression. Systems must be designed to ensure:

- water is disinfected and suitable for consumption
- sufficient and reliable volume and supply
- infrastructure is sized to meet projected future demand
- water is delivered at sufficient pressure under key demand conditions and
- sufficient protection against corrosion, freezing, and other forms of damage/deterioration.

The design shall consider long term service area, land use, available capacity, and potential connection points. As the City wishes to promote an orderly process of development, temporary servicing schemes and the construction of infrastructure through undeveloped areas (leapfrog development) are discouraged.

## 2.2 Metering

See City of Fort Saskatchewan Bylaw C10-20 – Waterworks Bylaw.

Any premises intended to be metered must have a separate accessible external shut-off, either underground or in a heated mechanical room, accessible from the outside or common area.

Meters serving multiple residential units are to be located in a common area outside an individual dwelling unit unless otherwise approved by the City.

## 2.3 Water Demand

Residential, commercial, industrial and institutional demands shall be determined using specific data related to the development or zoning. In the absence of such data, use the following residential per capita demands and the following equivalent population factors. The equivalents apply to the average daily demand (ADD).

| | |
|---|---|
| average daily demand (ADD) | 250 litres per capita per day (L/c/d) |
| maximum day demand (MDD) | 2 x ADD L/c/d |
| peak hour demand (PHD) | 3 x ADD L/c/d |

| Land Use | Equivalent Population/Hectare (gross) |
|---|---|
| Country Residential | 5 people/ha |
| Low Density Residential | 40 people/ha |
| Medium Density Residential | 80 people/ha |
| High Density Residential | 160 people/ha |
| Commercial/Institutional | 37 equivalent population/ha |
| Industrial | 30 equivalent population/ha |

## 2.4 Fire Flow

Fire flow requirements shall be in accordance with the most current edition of the Fire Underwriters Survey (FUS) Guidelines. Generally, these are:

| Developments | Minimum Fire Flow |
|---|---|
| Single Family Residential | 100 L/s |
| Multi-Family Residential | 133 L/s |
| Industrial and Institutional | 183 L/s |
| Apartments and Commercial | 233 L/s |

If future development is unknown, a minimum fire flow of 233 L/s shall be assumed.

## 2.5 Design Flows for Watermains

Total design flows ($Q_{design}$) are to be the greater of the following:

$Q_{design}$ = MDD + F — Maximum Day Demand for the population or equivalent population plus the Fire Flow, or

$Q_{design}$ = PHD — Peak Hour Demand for the population or equivalent population

## 2.6 Pressure

| | |
|---|---|
| Maximum allowable pressure in System | 515 kPa (80 psi) |
| Minimum residual pressure at Peak Hour Demand (PHD) | 280 kPa (40 psi) |
| Minimum residual pressure in system during design Fire Flow and Maximum Day Demand (MDD+F) | 150 kPa (22 psi) |

Pressures in the above table are measured at ground elevation.

## 2.7 Roughness Coefficient

PVC pipe shall be used and the value of "C" in the Hazen-Williams formula shall be 120 for sizes less than 400mm and 130 for sizes larger than 400mm.

## 2.8 Water Storage

Potable water reservoirs must be sized to accommodate the larger of:

1. S = (A + B + C)

Where:

- S = Total Storage Requirement ($m^3$)
- A = Fire Storage ($m^3$)
- B = Equalization Storage = 25% of the maximum daily demand ($m^3$)
- C = Emergency Storage = min. 15% of the average daily demand ($m^3$)

2. 2 x Maximum Day Demand

The design of the reservoir must also consider mixing and turnover in consultation with the City.

## 2.9 Minimum Pipe Diameter

The minimum size of distribution mains shall be:

- 200mm for residential
- 250mm for industrial/commercial
- 200mm for cul-de-sacs, with a 150mm allowance for cul-de-sacs without hydrant connections

The minimum size of water service connections shall be:

- 25mm for residential
- 150mm for industrial/commercial

Oversizing may be required by the City Engineer to accommodate for future development.

## 2.10 Pipe Material

Pipes and fittings shall be Polyvinyl Chloride (PVC) Class DR 18 in accordance with AWWA Standard C900 for pipe sizes ranging between 100mm through 1500mm.

Pipes and fittings of other materials meeting AWWA Standards may be considered on a case-by-case basis, at the discretion of the City.

Joint lubricants must be certified for potable water use in accordance with National Sanitation Foundation standards.

Disinfection, flushing and bacteriological testing shall be carried out in accordance with AWWA standards and practices.

## 2.11 Dead Ends/Cul-de-sacs

A dead end watermain is allowed when:

- It is less than 120m in length.
- It serves less than 25 single family homes.
- It serves only 1 multifamily, institutional, or commercial site.
- It serves no more than 2 hydrants.

Watermain looping will be required if the cul-de-sac is of more than 120m. Where cul-de-sacs in excess of 120m are proposed, provision must be made for a 6.0m wide Public Utility Lot (PUL) for emergency vehicle access and water service looping. Emergency vehicle access PUL's shall be developed to a standard acceptable to the City Engineer.

150mm diameter watermain may be considered for cul-de-sacs without hydrant connections, otherwise 200mm diameter watermain is required.

Cul-de-sacs in excess of 120m and less than 170m will require an additional hydrant.

## 2.12 Depth of Cover

Watermains shall be installed to provide a minimum depth of cover of 2.75m from finished design grade to the top of pipe. Soil type and groundwater levels shall be considered, and depth increased if necessary.

Insulation may be used in cases where minimum depths cannot be achieved, subject to approval of City Engineer.

## 2.13 Grade

Grade shall be straight lines between defined deflection points. Elevations shall be recorded.

Grading shall be designed to minimize the number of high points. Where possible, high points are to correspond to hydrant locations.

If the pipe slope equals or exceeds 20%, appropriate joint restraint and pipe anchorage is required.

## 2.14 Alignment

Watermains shall be located within the road right-of-way in accordance with the Roadway Cross Section Standard Drawings T-3 through to T-13.

On straight roads, watermains shall have straight alignments with uniform offsets between intersections. Curved alignments must be parallel to property lines. Design joint deflections shall be limited to half the maximum deflection specified by the pipe manufacturer. Locations of short lengths, or field cut pipes, must be recorded during construction.

Watermains shall have a minimum horizontal clearance of 3.0m o/c from any sewer line, 1.5m from any catch basin and 2.0m from any gas, power or communication line or as required by the utility company whichever is greater.

Horizontal clearance may be reduced at the City's discretion where physical constraints exist but in no case shall clearance be reduced to less than 1.0m.

Where it is necessary for the watermain to cross below the sewer, the watermain shall be protected by providing:

1. A minimum vertical separation of 0.5m from watermain crown to sewer invert to allow for proper bedding and structural support.
2. If the minimum separation cannot be met, bridging options will be considered through consultation with the City (i.e., casing, metal plates, etc.).

3. Centering of the length of watermain at the point of crossing so that the joints are equidistant from the sewer.

Watermains shall have a minimum vertical clearance of 0.3m above any sewer lines.

## 2.15 Valves

Valves shall be located:

- At the projection of property lines
- Preferred at intersections; Mid-block locations are subject to the approval of the City Engineer
- Three (3) valves at cross intersections
- Two (2) valves at tee intersections
- Not more than three valves required to isolate line (four if cross intersection involved)
- Not more than two hydrants are taken out of service during shutdown
- Not more than 25 single family units, 1 multi-family site, or 1 commercial/institutional site are taken out of service during shutdown

Mueller brand gate valves are preferred. Alternatives are subject to approval of City Engineer. Gate valves shall conform to AWWA Standard C515 and shall include the following supplementary requirements:

- Iron body
- Stainless steel type 304 trim (nuts and bolts)
- 51mm square operating nut
- Type 304 stainless steel stem
- "O" ring stem seal
- Open by turning counterclockwise
- Non-rising stem
- Double disc or solid wedge type
- Resilient seated
- External epoxy coated

Valve boxes are to be Norwood Foundry or equivalent and include:

- Type B (screw)
- Cast iron valve box complete with cast iron lid
- Sufficient length to provide for adjustments of 300mm up or down
- Internal operating rod installed a minimum of 300mm and a maximum of 600mm from grade

When connection into the side of an existing watermain is required, the connection shall be accomplished by use of a tapping valve and sleeve and not shutting down the water service, unless otherwise approved by the City.

## 2.16 Hydrants

Fire hydrants shall be installed in all areas (including private developments) and in locations convenient for the Fire Department. Hydrants are to be installed and located as follows:

- Maximum allowable spacing between hydrants of 150m for residential zones.
- Maximum allowable spacing between hydrants of 90m for multi-family residential and school zones.
- Maximum allowable spacing between hydrants of 90m for commercial, institutional and industrial zones.
- Hydrants shall be installed at the projection of property lines except at intersections, where they shall be installed at the beginning of curb returns.
- An additional hydrant shall be required on cul-de-sacs longer than 120m and less than 170m.
- Hydrants leads are 150mm diameter and shall be a maximum length of 7.5m from the main. Longer leads will require a larger diameter.
- A gate valve is required on each hydrant lead. Gate valves shall not be located in a sidewalk or curb.
- Hydrant flange to be no less than 50mm and no more than 150mm above final grade.

The following minimum horizontal clearances are required for hydrants:

- 3.5m from catch basins
- 5.0m from manholes
- 3.5m from street poles and trees
- 2.0m from water, sanitary and storm services
- 2.0m from gas lines

In areas with rural roadway cross-sections, hydrants shall be located on special "pads" extending perpendicular to roadway centre lines and a minimum of 3.0m from the edge of the proposed road surface and be accessible from the roadway. The elevation of the "pads" shall be no more than 0.3 m below the crown of the road at that point.

Hydrants are to be Canada Valve Century. An allowance for other hydrants may be made, upon the discretion of the City, if internal components are interchangeable with the Canada Valve Century hydrants. Hydrants shall conform to AWWA C502 and include the following supplementary requirements:

- Four section breakaway flange
- Stainless steel type 304 trim (nuts and bolts)
- Compression type shutoff
- Two 63mm hose nozzles with Alberta Mutual Aid Thread
- Steamer port fitted with a 125mm Storz Fitting
- 3-sided operating nut
- All hydrants shall be self-draining unless groundwater conditions dictate otherwise

Public hydrants shall be painted as follows:

- Body – Chrome Yellow
- Side Port Caps – In accordance with NFPA 291 guidelines
- Top Port – Aluminum or Silver
- Front Port – Green if non-draining or Chrome Yellow if draining.

Private hydrants shall be painted as follows:

- Body – Red
- Side Port Caps – In accordance with NFPA 291 guidelines
- Top and Front Ports – At the discretion of the hydrant owner (white, silver, or matching the side caps is recommended)

## 2.17 Cathodic Protection

Cathodic protection to be applied to all iron fittings, based upon recommendation by the Engineer.

As minimum, cathodic protection shall be provided for:

1. Valves
   - Install one 4.1 kg packaged magnesium anode
   - Attached anode to valve body via thermit weld process
   - Install one #10 or 12 AWG test lead to valve body and route to surface

2. Hydrant
   - Install one 4.1 kg packaged magnesium anode
   - Install two #10 or 12 AWG test leads using thermit weld process and route to surface
   - Install cathodic test station adjacent to hydrant and terminate all three leads therein

3. Watermain – Cast/Ductile
   - Install one – 9.1 kg magnesium anode
   - Install two # #10 AWG test leads using thermit weld process
   - Install cathodic test station (flush mount) above line at street level and terminate leads therein
   - If watermain "broken, install 2 #8 AWG bond cables across repair joint using thermit weld process to attach leads to both sides

4. Services
   - Install one 4.1 kg magnesium anode
   - Attach anode directly to valve or saddle using solder (on copper) or thermit weld (on steel)

A record of the installation and the test results; including soil resistivity values, anode and the line potential and anode current, should also be submitted along with a drawing or site sketch.

Cathodic protection to be applied to all iron fittings.

Refer to Drawing W-3 Typical Anode Installation.

## 2.18 Thrust Restraint

Concrete thrust blocking and/or adequate joint restraining devices complete with corrosion protection must be provided at bends, tees, wyes, reducers, plugs, caps, valves, hydrants and blow-offs.

Refer to Drawing W-4 Horizontal Thrust Block and W-8 Vertical Bend Pipe Support.

## 2.19 Service Connections

### 2.19.1 Materials

1. Pipes and fittings shall be Polyvinyl Chloride (PVC) Class DR 18 in accordance with AWWA Standard C900 for pipe sizes ranging between 100mm through 1500mm.

2. Pipes and fittings of other materials meeting AWWA Standards may be considered on a case-by-case basis, at the discretion of the City.

3. Rubber rings for the couplings shall conform to A.S.T.M. D1869, latest revision thereof.

4. Joint lubricants must be certified for potable water use in accordance with National Sanitation Foundation standards.

5. Cast iron fittings shall be in accordance with A.W.W.A. Specification C110, latest revision thereof and shall be cathodically protected, with test station; cast iron tees, elbows and crosses will only be allowed if the fitting is not readily available in molded PVC.

6. For pipe diameters 50mm or less, water service pipe shall be copper, Municipex (*PEXa – cross linked polyethylene*), Q-Line (*PEX-AL-PEX – x-linked polyethylene and aluminum*), or accepted alternative.

    i) Copper water service pipe shall be Type K copper pipe conforming to ASTM-B88 and complying with AWWA-C800.
    ii) Municipex (*PEXa*) water service pipe shall conform to AWWA C 904, ASTM F876, CSA B137.5, NSF 14, NSF 61 and PPI TR-4, and shall be:
    iii) Q-Line (*PEX-AL-PEX*) water service pipe shall conform to AWWA C 903, ASTM F1282, CSA B137.9 and meet NSF-PW.

7. Services of sizes 100mm or greater shall be Polyvinyl Chloride (PVC) Class DR 18 in accordance with AWWA Standard C900.

8. A corporation stop is required for each service with a main. Service saddles must be used where the tap diameter is greater than 25mm or where the watermain is greater than 300mm. Curb stop to be located 300mm outside the property line, within the easement.

Fittings are to be as follows unless otherwise approved by City Engineer:

- Corporation stops to be Mueller H-15013N.
- Curb stops to be Mueller Oriseal H15209N, non-draining type.
- Curb stops to be installed as per Drawings T-3 through to T-10.
- Service boxes to be epoxy coated cast iron extension type with type 304 stainless steel operating rod, manganese bronze clevis and brass cotterpin for connection to the curb stop.

- The set screw is to be installed in the CC by hand tightening or slightly tighter, so as to retain the pieces of the CC together during backfilling, allow for the operation of the CC and prevent rotation of the CC cap, and allow for vertical displacement of the CC under heavier loads.

2.19.2 Location

Every legal lot and each residential, commercial or industrial unit shall be provided with a separate service connection as per Drawing W-5 Water Service Connection. Refer to the City's Waterworks Bylaw for details on water meter installation.

For residential services, minimum size for service connections should be 25mm, with 30m maximum length from the watermain to the house.

For industrial, commercial and other major users, the service connections should be sized based on the required hydraulic conditions and design flows with minimum size of 150mm. Sizing calculations should be provided and approved by the City Engineer.

No pipe sizes between 50mm diameter and 100mm diameter will be allowed.

All service lines shall be installed to provide a minimum depth of cover of 2.75m at property line.

CC operating rod to be installed at a length where the top of the operating rod is 500mm (+/- 150mm) below the approved final grade at the CC location.

Tapping for residential service connections shall be done with full operating pressure on the main unless otherwise approved by the City, and in strict compliance with manufacturer's instructions.

For 100mm and larger services, a tapping valve and sleeve must be used for connection to an existing main.

Cathodic protection to be provided per Section 2.17.

## 2.20 Trenching, Bedding and Backfilling

All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Guidelines.

If unsuitable soil conditions are encountered, proper measures for dealing with the conditions shall be identified either on the design drawings or as a report to the City Engineer prior to the construction.

Class "B" pipe bedding shall be utilized in suitable soil conditions. Washed rock shall be used if water table is above the pipe zone. Bedding sand shall have a minimum depth of 100 mm below the pipe and provide a minimum cover of 300mm above the pipe.

The minimum trench width measured at the pipe springline shall be equal to the pipe outside diameter plus 450mm.

Excavated material shall be stockpiled at a safe distance from the edge of the trench.

Native backfill under existing or proposed roads, alleys, sidewalks and trails shall be compacted to 98% standard proctor density.

Native backfill in all other areas shall be compacted to 95% standard proctor density.

Refer to:

- Drawing W-6 Typical Trench Section
- Drawing W-7 Typical Pipe Support

## 2.21 Cleaning and Preliminary Flushing

Before flushing and testing, ensure waterworks system is completely finished except tie-ins to existing watermains and services and make arrangements with the City Engineer for scheduling of testing and disinfection of mains. Notify the Engineer and City representative at least 24 hours before the proposed date when preliminary flushing will commence.

If required, isolation of existing water system will be performed by the City. Do not operate any valves without the City Engineer's authorization.

Remove foreign material from the pipe and related appurtenances by flushing with water. All water used for flushing must come from a clean portable source. Main is to be flushed at water velocities as high as can be obtained from available water sources. Minimum velocity is to be 1.0m/s and in accordance with AWWA C651. Flushing water is to be discharged to storm sewer, water courses or ditches that have sufficient capacity to carry flow. De-chlorination will be required before being discharged. Flushing should continue at least until flow from most distant point has reached the discharge location and until the discharged water is clean and clear.

## 2.22 Hydrostatic Testing

Upon completion of construction of any section, which shall be defined as that pipeline and appurtenances located between any two adjacent line valves, make section ready for testing. Notify the Engineer and City representative at least 24 hours before the proposed date when pressure testing will commence. Ensure that preliminary flushing and cleaning has been completed before commencement of hydrostatic test procedure.

The maximum length of distribution main test sections shall be 450m. The maximum length of transmission main sections shall be 800m.

Before pipe is filled with water, pipe bedding, concreting of all valves and fittings and backfilling shall be completed as required in this specification. Fill each section of pipe and allow to remain full of water for a period of at least 24 hours prior to commencement of any pressure tests.

Submit pipeline to a test of whichever is greater amongst the following:

- 1035 kPa (150 psi)
- 1.5 times the normal operating pressure (based upon the elevation of the lowest point in the main and corrected to elevation of the test gauge).
- 1.25 times the normal operating pressure, as measured at the highest point in the test section.

Valves within the test section must not be operated for the duration of the pressure and leakage test.

Ensure that test pressure does not exceed pipe or thrust restraint design pressures. Minimum duration of test period is two hours. The pressure shall be maintained within 20 kPa of the specified test pressure throughout the test. Maximum test pressures should not exceed those specified in CSA B137.3 – Table 9.

Perform pressure and leakage testing of polyvinyl chloride (PVC) piping to AWWA M23 and AWWA C605. Compare against the allowable leakage calculated as follows:

PVC Pipe $$Q_m = \frac{LD\sqrt{P}}{795{,}000}$$

Ductile Iron Pipe $$Q_m = \frac{LD\sqrt{P}}{794{,}797}$$

Where: $Q_m$ = quantity of makeup water, L/hr
L = length of pipe section being tested, m
D = nominal pipe diameter, mm
P = average test pressure, kPa

Should any test disclose excessive leakage, repair or replace defect and retest section until specified testing requirements are achieved.

## 2.23 General Disinfection, Flushing and Bacteriological Procedures

After Engineer has certified that pipes and appurtenances have passed all specified tests, flush and disinfect pipes and appurtenances.

Disinfect, flush, and bacteriological test shall be in accordance with AWWA C651 and the following:

Disinfection and Flushing procedures must be submitted to the City 72 hours in advance of any disinfection or flushing activities occurring on-site.

Disinfection and Flushing procedures shall be witnessed by the Engineer and a representative of the City of Fort Saskatchewan. Notify the Engineer and City representative at least 24 hours before the proposed date when disinfection will commence.

Do not use granular hypochlorite for disinfection of PVC pipe with solvent welded joints, due to explosive reaction potential.

The watermain shall be filled for disinfection through one boundary valve. The City shall operate the boundary valve. Notify the City in advance for valve operation.

Retained water containing not less than 25 mg/L free chlorine in water system for a period of at least 24 hours, in accordance with AWWA C651, Continuous Feed Method.

At a point not more than 3m downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will not have less than 25 mg/L free chlorine. To assure that this concentration is provided, measure the chlorine concentration at regular intervals as specified in AWWA C651.

Amount of chlorine required to produce 25 mg/L concentration in 30m of pipe of various sizes is:

| Pipe Size (mm) | 100% Chlorine (kg) | 1% Chlorine Solution (Litres) |
|---|---|---|
| 100 | 0.006 | 0.61 |
| 150 | 0.014 | 1.36 |
| 200 | 0.024 | 2.46 |
| 250 | 0.039 | 3.86 |
| 300 | 0.054 | 5.45 |
| 400 | 0.098 | 9.85 |

After completion of chlorination, flush chlorinated water from system, hydrants and services until chlorine concentration in remaining water is less than 0.3 mg/L. Water with a chlorine concentration greater than 1 mg/L shall not be discharged to a recognized water course without the approval of the Alberta Environment.

After final flushing and before the new watermain is connected to the distribution system, two consecutive sets of water samples taken at least 24 hours apart, shall be collected from the new main. Notify the Engineer and City representative at least 24 hours before samples are collected. Samples shall be taken at a minimum interval of 370m, plus one set from the end of the line and at least one set from each branch. Samples shall be tested at the Contractor's expense for total and fecal coliforms and background bacteria by a laboratory approved by the Engineer. Sampling and analysis shall be done in accordance with *Standard Methods for the Examination of Water and Wastewater*. The presence of total or fecal coliform bacteria and/or background bacteria greater than 200 CFU per 100 ml shall constitute a failed test.

Following successful bacteriological testing, the results of the bacteriological tests shall be delivered to the City of Fort Saskatchewan, stating that the water is free from contamination. Once satisfactory water quality and bacteriological test results have been confirmed, the City will notify the Contractor to proceed. Contractor shall remove test and bleed out apparatus and shall backfill and complete any work required to commission the waterworks systems. Final connections to existing mains and services shall be swab disinfected with 1% - 5% chlorine in accordance with AWWA C651, Section 4.6. Disinfection and final connections shall be witnessed by the Engineer and a representative of the City of Fort Saskatchewan.

All testing, disinfection, flushing, and water sampling shall be witnessed by the City Engineer.

Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least five days after placing concrete or two days if high early strength concrete is used.

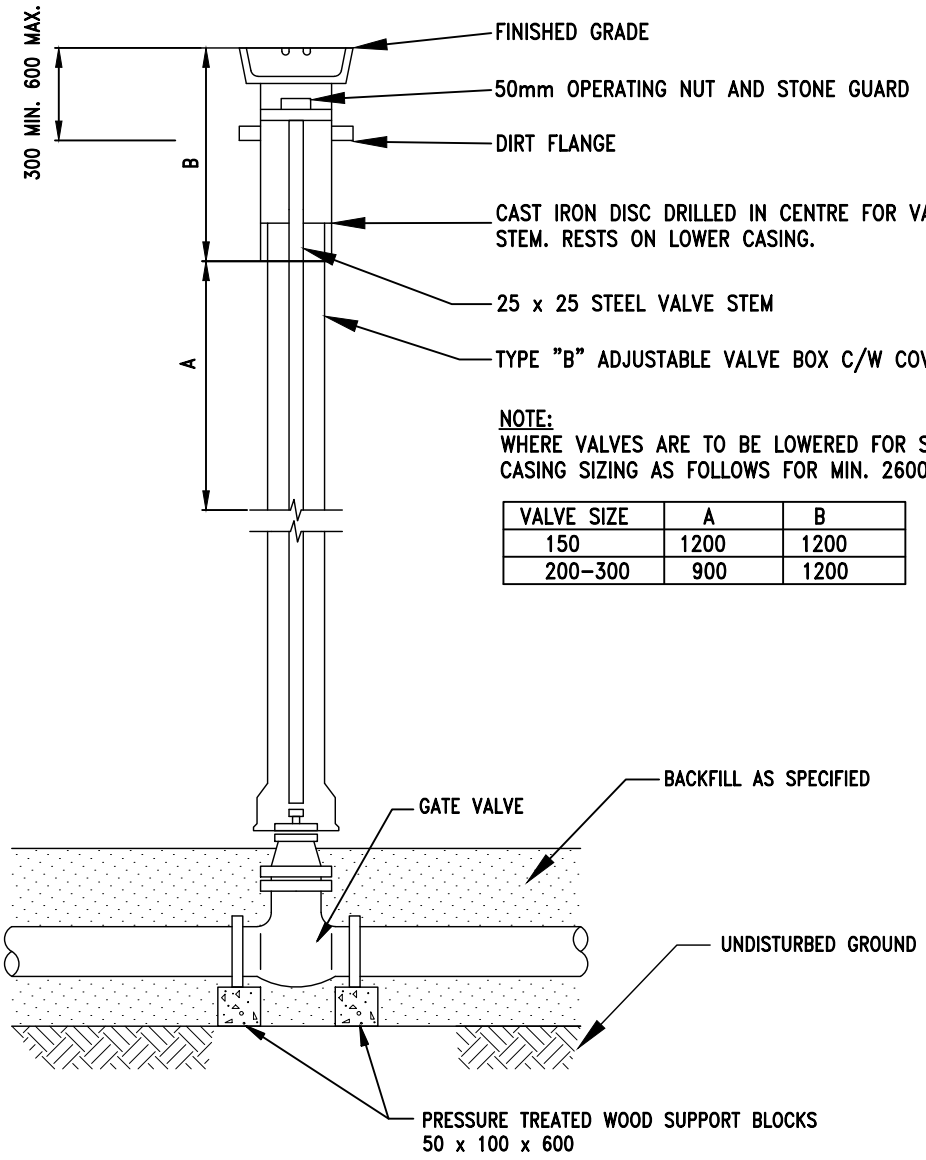
## 2.24 List of Standard Drawings and Forms

W-1 Valve and Casing
W-2 Hydrant Connection
W-3 Typical Anode Installation
W-4 Horizontal Thrust Block
W-5 Water Service Connection
W-6 Typical Trench Section
W-7 Typical Pipe Support
W-8 Vertical Bend Pipe Support
W-9 Single Service Connection
W-10 Dual Service Connection

See sanitary section detail S-1 for Trench Bedding Types.

Forms

Chlorine Residual and Bacterial Sampling Report
Watermain Pressure and Leakage Test Form




NOTE:
WHERE VALVES ARE TO BE LOWERED FOR STREET CONSTRUCTION, USE CASING SIZING AS FOLLOWS FOR MIN. 2600mm DEPTH OF BURY.

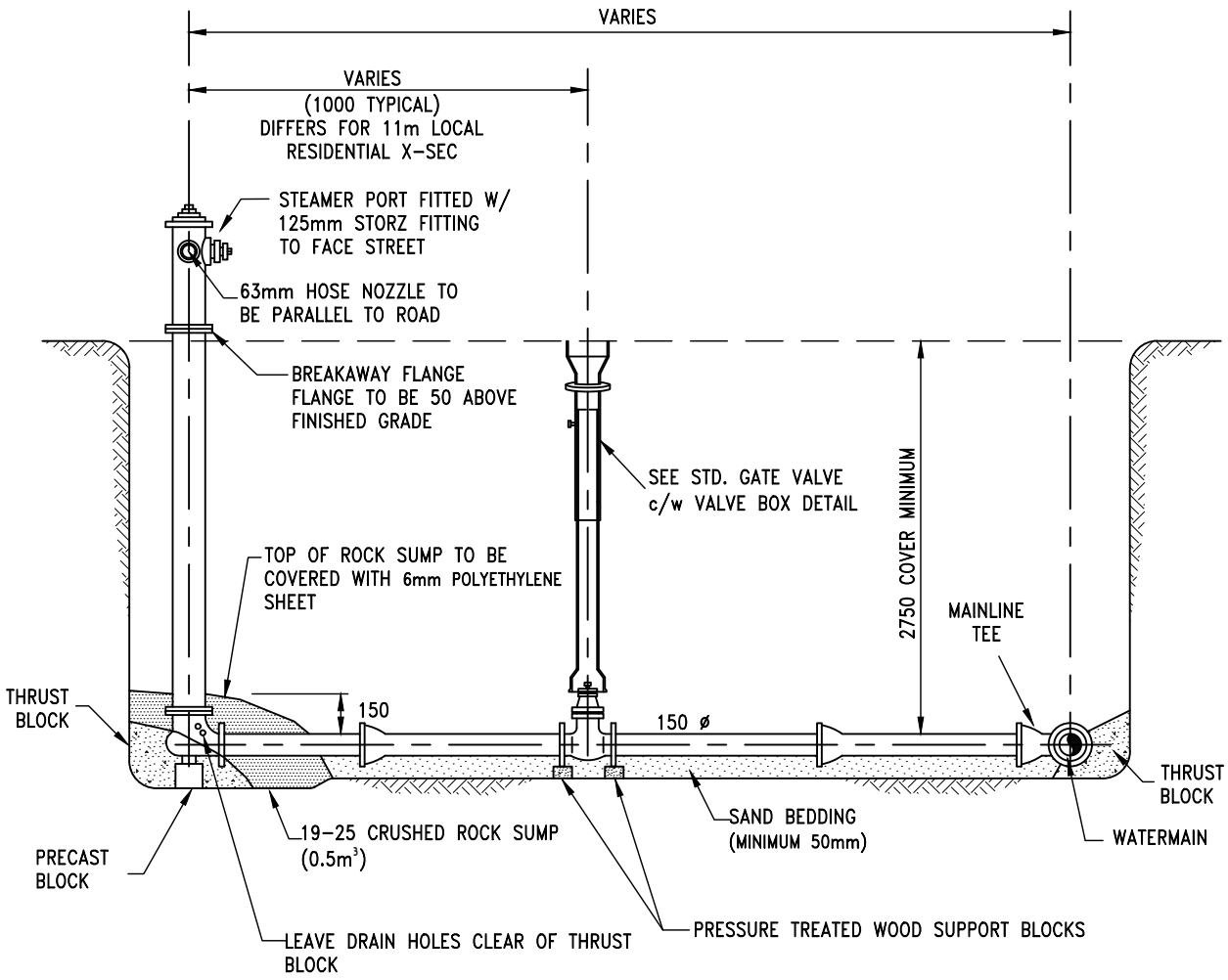
| VALVE SIZE | A | B |
|---|---|---|
| 150 | 1200 | 1200 |
| 200–300 | 900 | 1200 |

NOTES:

1. VALVE BOX TOPS TO BE SET FLUSH WITH SURFACE.
2. VALVE BOXES SHALL BE BITUMINOUS COATED TO PREVENT CORROSION.
3. TYPE "B" VALVE BOX MAY BE USED
4. VALVE TO BE EPOXY COATED WITH STAINLESS STEEL NUTS AND BOLTS.
5. VALVE TO BE RESILIENT SEATED WEDGE TYPE.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| VALVE & CASING DETAIL | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | W–1 |
| NOT TO SCALE | DRAWN: MP, DF | |

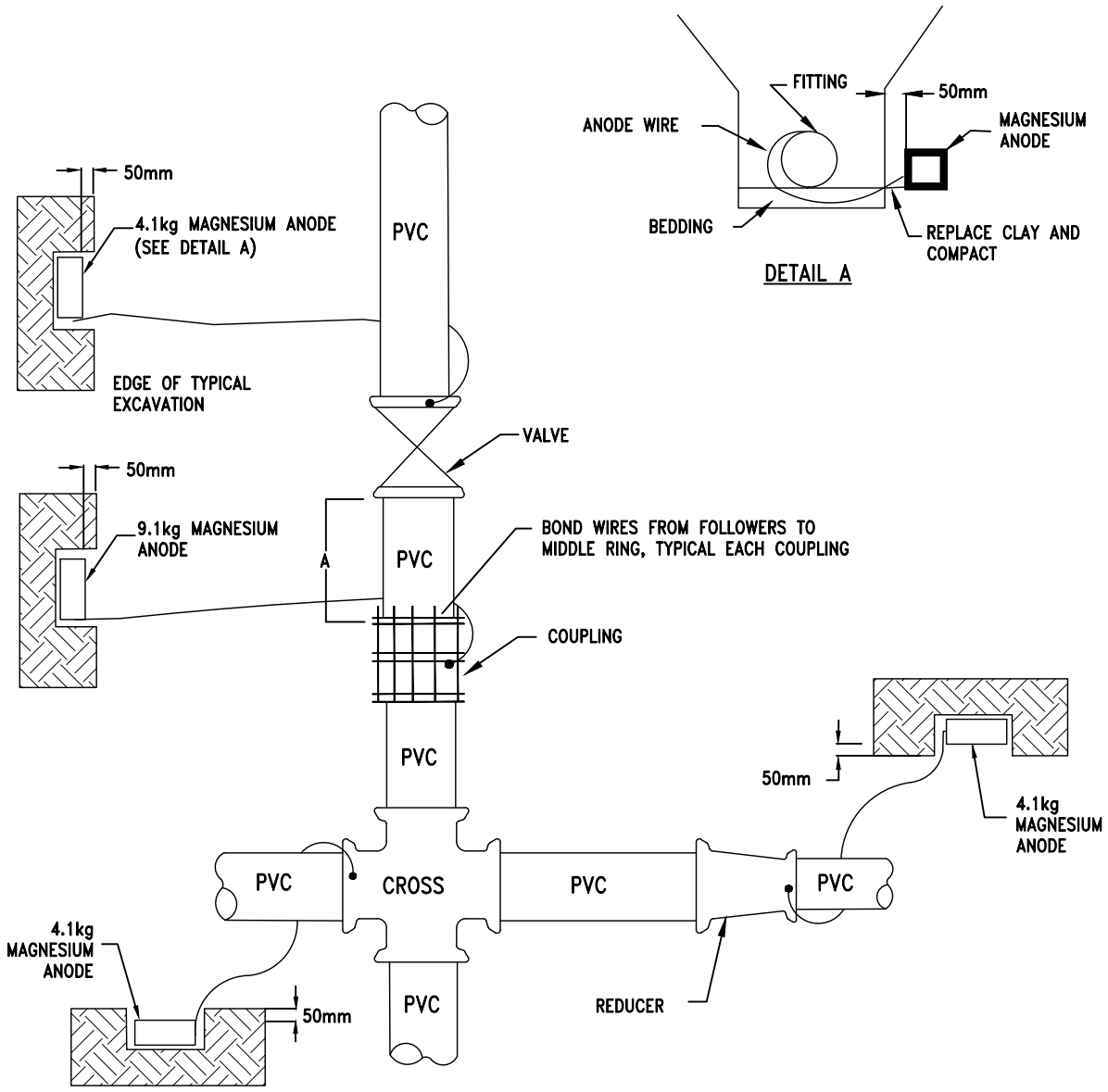



NOTES:

1. HYDRANT AND VALVE TO BE CATHODICALLY PROTECTED WITH A 4.1KG (9 LB) MAGNESIUM ANODES.
2. HYDRANT TO BE PAINTED SAFETY YELLOW WITH ALUMINUM TOPS AND CAPS. PUBLIC HYDRANTS TO BE PAINTED CHROME YELLOW WITH SIDE PORT CAPS IN ACCORDANCE WITH NFPA 291 GUIDELINES. TOPO – ALUMINUM OR SILVER, FRONT PORT – GREEN IF NON-DRAINING OR CHROME YELLOW IF DRAINING. PRIVATE HYDRANTS TO BE PAINTED RED WITH SIDE PORT CAPS IN ACCORDANCE WITH NFPA 291 GUIDELINES, TOP AND FRONT PORT – AT THE DISCRETION OF THE HYDRANT OWNER (WHITE, SILVER OR MATCHING THE SIDE CAPS IS RECOMMENDED).
3. ALL NUTS AND BOLTS TO BE STAINLESS STEEL.
4. HYDRANT MUST NOT RESTRICT SIDEWALK.
5. OPERATOR NUT TO BE 1-1.25 INCH 3 SIDED.
6. HYDRANT SHOULD BE LOCATED SO STEAMER PORT FACES THE ROAD OR MOST ACCESSIBLE SPOT FOR A FIRE TRUCK TO CONNECT.
7. ALL HOSE CONNECTIONS TO BE 63mm THREADED CONNECTIONS TO ALBERTA MUTUAL AID THREAD SPECIFICATIONS.
8. STEAMER PORT TO BE FITTED WITH 125mm STORZ FITTING
9. HYDRANTS TO BE CANADA VALVE CENTURY OR APPROVED EQUIVALENT.

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| HYDRANT CONNECTION | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | W-2 |
| NOT TO SCALE | DRAWN: MP, DF | |

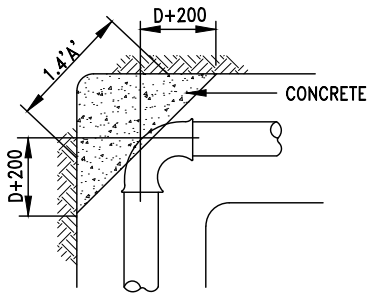


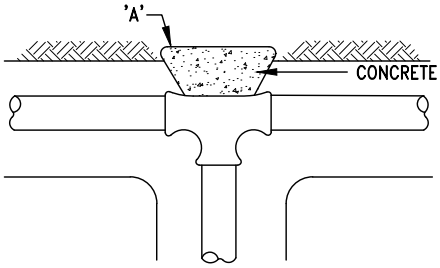

NOTES:

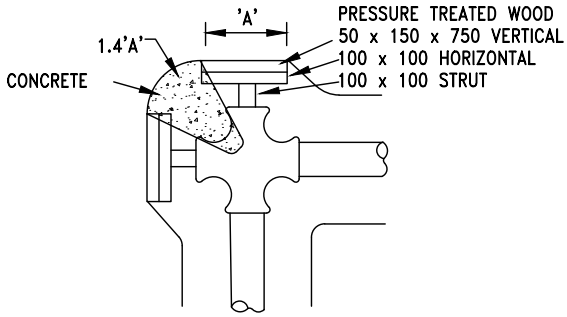
1. MINIMUM DISTANCE FROM ANODE TO PIPE FITTING, VALVE, OR HYDRANT IS 150mm.
2. INSTALL ANODE AT APPROX. PIPE DEPTH IN NATIVE SOIL.
3. ALL MAGNESIUM ANODES ON HYDRANTS ARE 4.1kg
4. MAGNESIUM ANODES TO BE EMBEDDED INTO TRENCH WALL TO BE PROVIDED FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPLETELY SURROUNDING THE ANODE.
5. ANODES TO BE AT LEAST 300mm CLEAR OF THRUST BLOCK

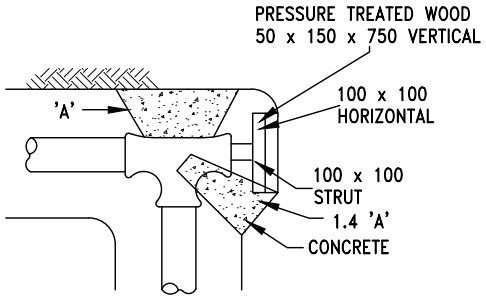
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

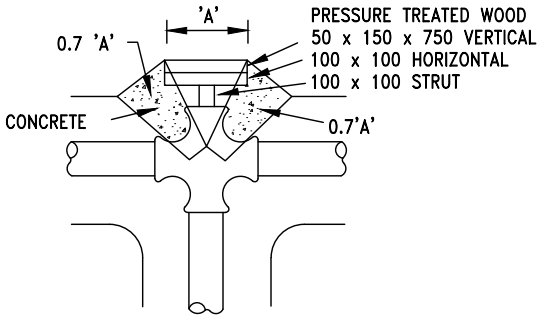
| TYPICAL ANODE INSTALLATION | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | W-3 |
| NOT TO SCALE | DRAWN: MP, DF | |

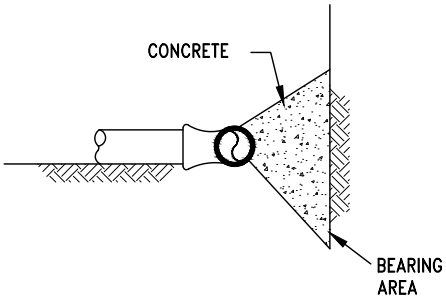


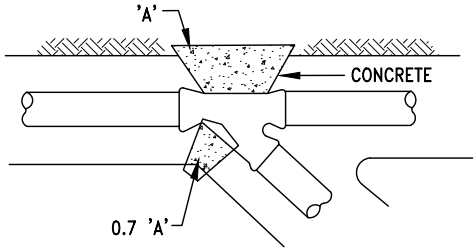



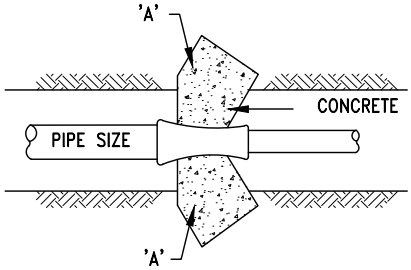




FOR CALCULATION OF BASIC THRUST BLOCK BEARING AREA 'A'

| PIPE SIZE | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
|---|---|---|---|---|---|---|---|
| 'A' ($m^2$) | 0.40 | 0.68 | 1.06 | 1.54 | 2.08 | 2.72 | 3.44 |

THRUST BLOCK DESIGN IS BASED ON:

1. 1050kPa MAX. SYSTEM PRESSURE OR 700kPa OPERATING PRESSURE PLUS A SURGE ALLOWANCE OF 345kPa (2fps SURGE ALLOWANCE AT 25psi/fps)
2. THRUST BLOCK DESIGN ASSUMES A MIN. VERTICAL SOIL BEARING OF 100kPa.
3. THRUST BLOCK BEARING AREA BASED ON PVC PIPE (AWWA C900 AND C905 DR18).
4. CONCRETE 20MPa TYPE 50 CEMENT.

BEND DEFLECTION

| | |
|---|---|
| 90° | 1.4A |
| 45° | 0.7A |
| 22 ½° | 0.35A |
| 11 ¼° | 0.18A |

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

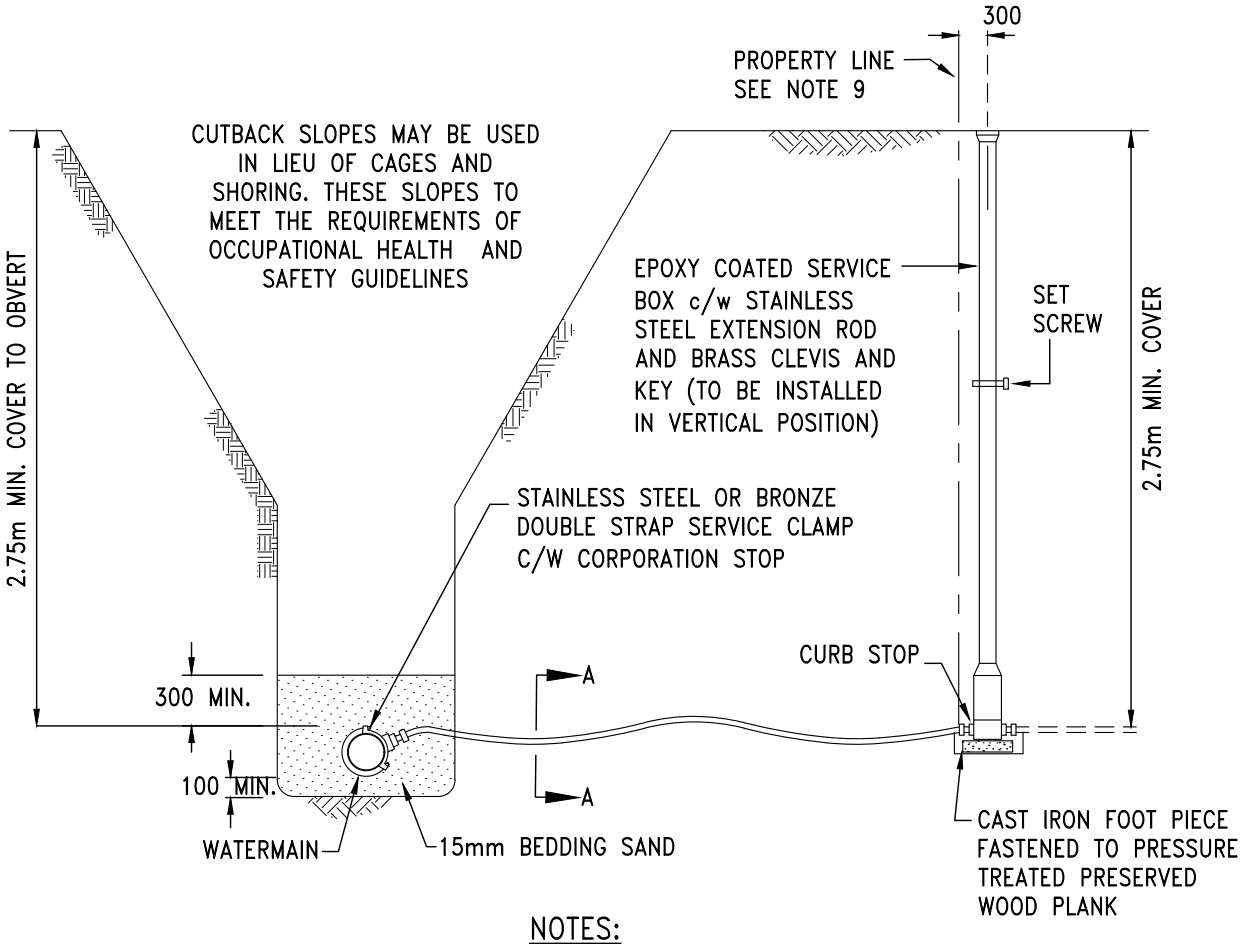
# HORIZONTAL THRUST BLOCK

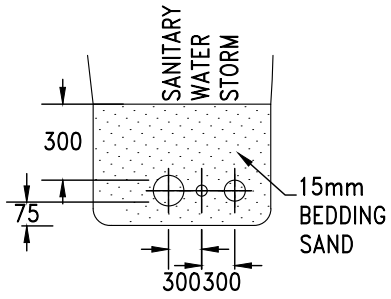
CITY OF FORT SASKATCHEWAN STANDARD DETAIL

DWG. NO. W-4

REVISION NUMBER: B | DATE: DEC 2024

NOT TO SCALE | DRAWN: MP, DF



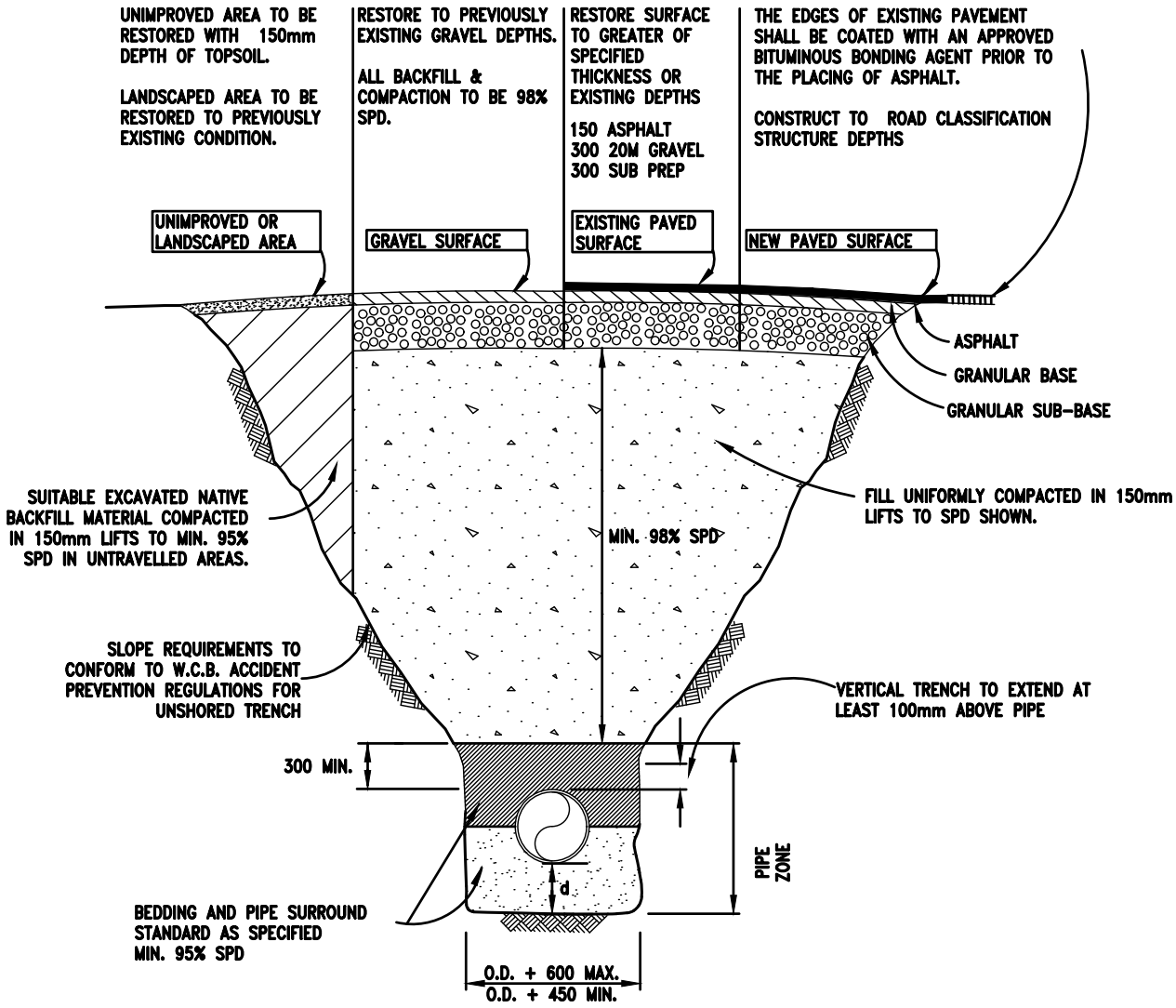

SECTION A
(FACING PROPERTY)

NOTES:

1. WATER SERVICE TO BE TAPPED AT THE 2 TO 3 O'CLOCK POSITION.
2. WATER SERVICE:
   UP TO 50mm TO BE TYPE K COPPER, MUNICIPEX, OR Q-LINE.
3. WATER SERVICE UP TO 50mm TO BE SNAKED IN THE TRENCH.
4. WATER SERVICE IS TO INCLUDE A HORIZONTAL GOOSENECK AT THE CORPORATION STOP.
5. CORPORATION STOP AND CURB STOP TO BE CATHODICALLY PROTECTED WITH 4.1kg PACKAGED MAGNESIUM ANODES.
6. ALL FITTINGS TO BE PACKER NUT TYPE, NOT GRIPPER NUT.
7. WHEN A GAS EASEMENT OCCURS ADJACENT TO THE P/L THE COIL IS TO BE LEFT CONNECTED TO THE CC AND SHALL BE STUBBED 300mm BEYOND EASEMENT LIMITS.
8. APPROVED MANUFACTURERS OF SERVICE BOXES AND CAPS INCLUDE NORWOOD FOUNDRY, TROJAN INDUSTRIES, AND WESTVIEW SALES.
9. CURB STOP MAY BE PLACED ON PROPERTY LINE IF THERE IS NO SIDEWALK. REFER TO DRAWINGS T-3 TO T-10 FOR MORE INFORMATION.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

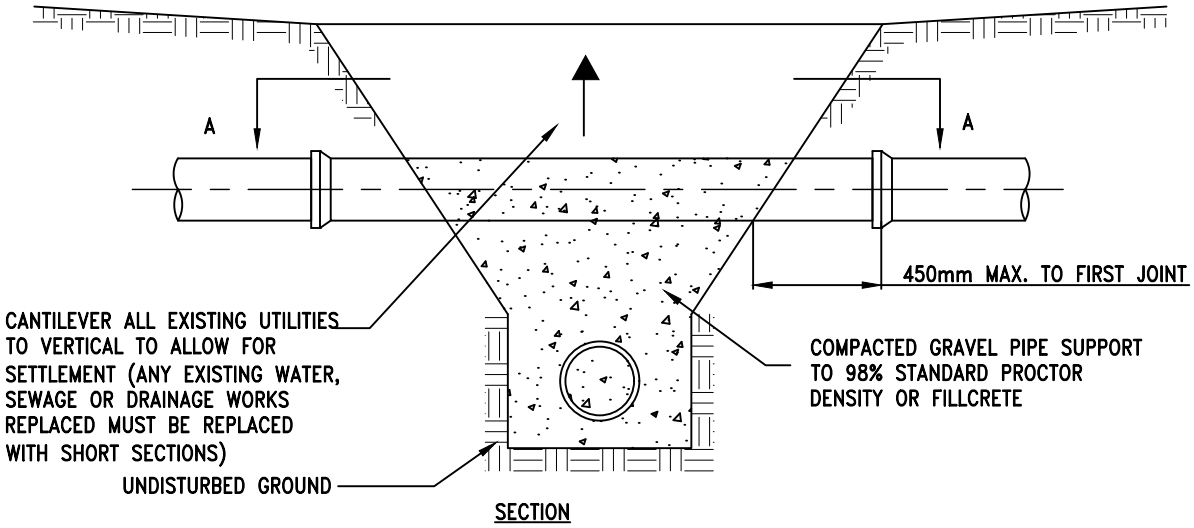
| WATER SERVICE CONNECTION | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | W-5 |
| NOT TO SCALE | DRAWN: MP, DF | |



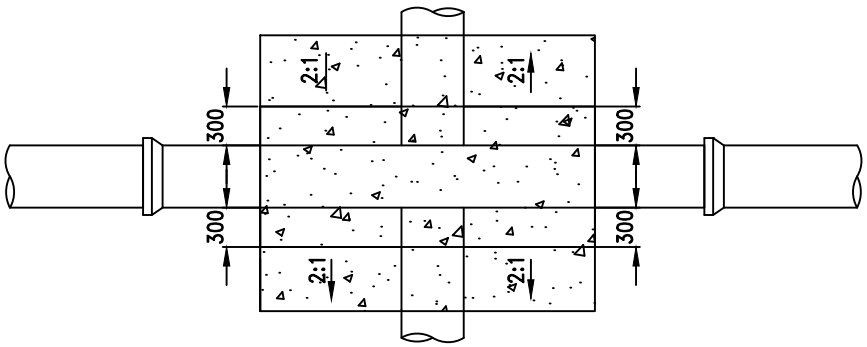

d = 100mm MIN. DEPTH OF BEDDING BELOW PIPE

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| TYPICAL TRENCH SECTION | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | W–6 |
| NOT TO SCALE | DRAWN: MP, DF | |



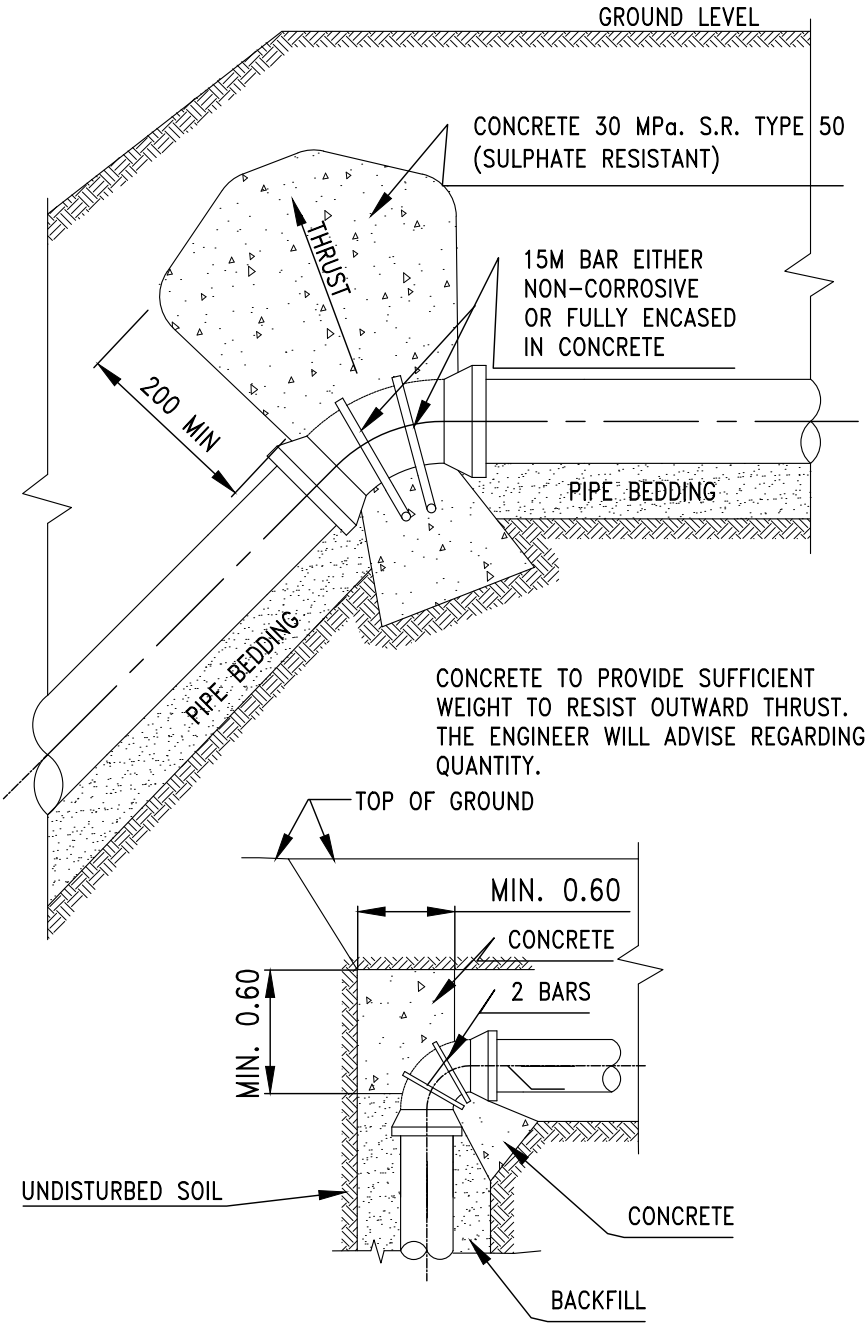

SECTION




SECTION A–A

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| TYPICAL PIPE SUPPORT | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | W–7 |
| NOT TO SCALE | DRAWN: MP, DF | |




# VERTICAL BEND PIPE SUPPORT

CITY OF FORT SASKATCHEWAN STANDARD DETAIL

DWG. NO. W-8

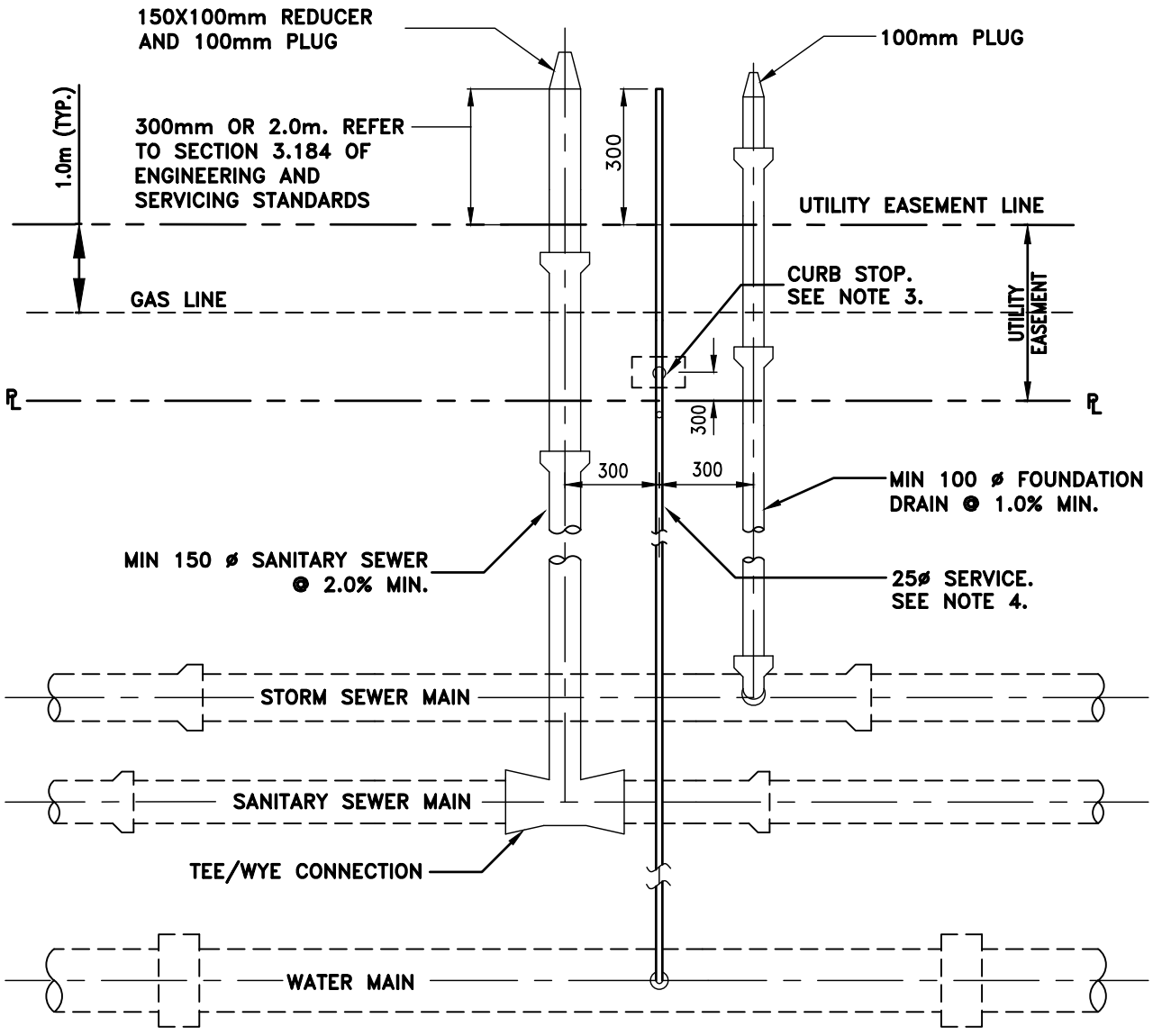
REVISION NUMBER: B

DATE: DEC 2024

NOT TO SCALE

DRAWN: MP, DF

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

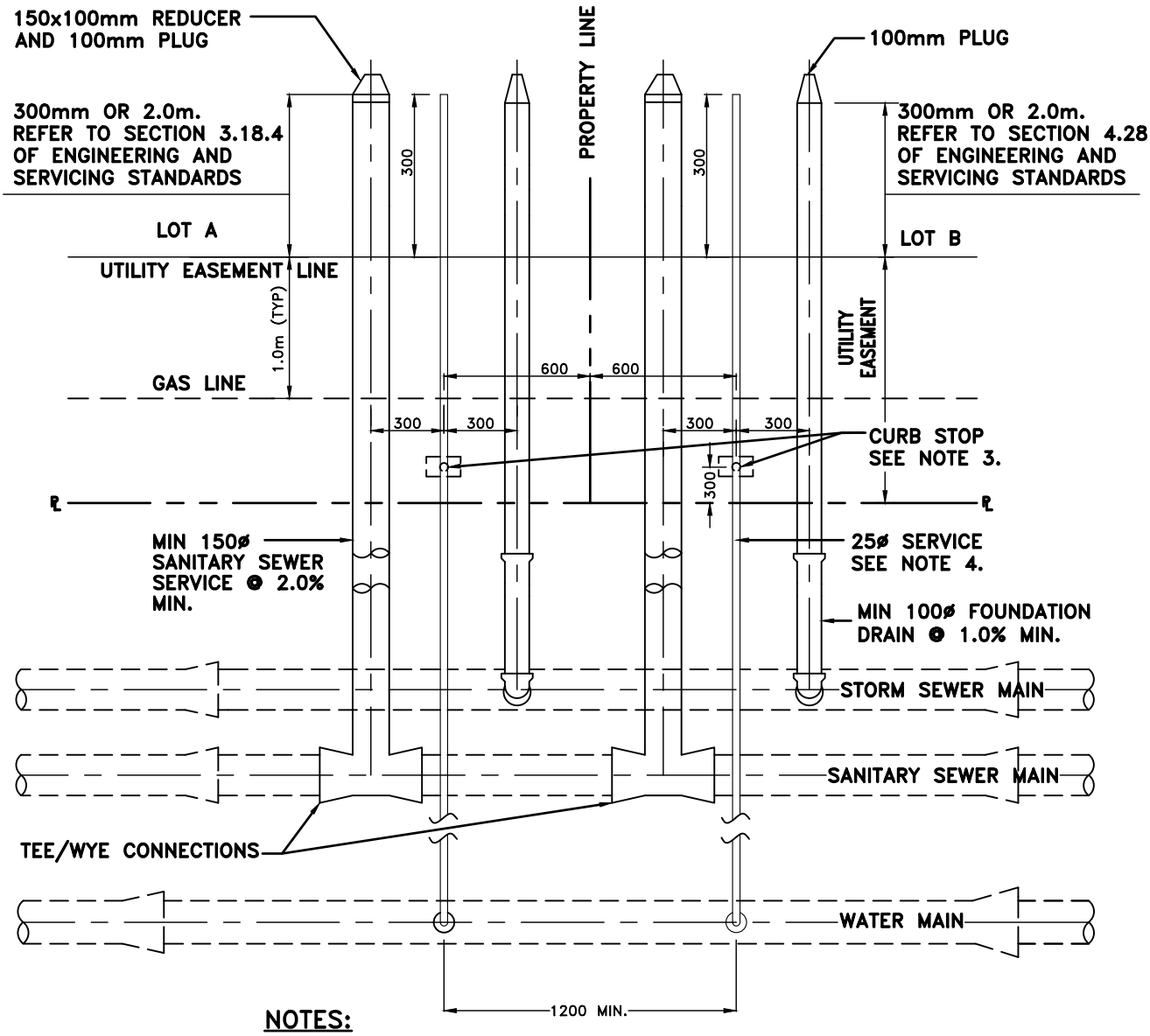



## NOTES:

1. STORM CAPS TO BE PAINTED WHITE. SANITARY CAPS TO BE PAINTED BLACK.
2. THE LAST PIPE TO THE PROPERTY LINE SHALL BE A FULL LENGTH PIPE. THIS INCLUDES THE PIPE SEGMENT IN THE EASEMENT AND THE REQUIRED 300mm PAST THE EASEMENT.
3. CURB STOP LOCATION IS DEPENDENT ON PRESENCE OF A SIDEWALK. REFER TO DRAWINGS T-3 TO T-10 FOR MORE INFORMATION.
4. WATER SERVICES UP TO 50mm MAY BE MUNICIPEX OR Q-LINE AS AN ALTERNATIVE TO TYPE K COPPER.

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| SINGLE SERVICE CONNECTION | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | W-9 |
| NOT TO SCALE | DRAWN: MP, DF | |




## NOTES:

1. STORM CAPS TO BE PAINTED WHITE. SANITARY CAPS TO BE PAINTED BLACK.
2. THE LAST PIPE TO THE PROPERTY LINE SHALL BE A FULL LENGTH PIPE. THIS INCLUDES THE PIPE SEGMENT IN THE EASEMENT AND THE REQUIRED 300mm PAST THE EASEMENT.
3. CURB STOP LOCATION IS DEPENDENT ON PRESENCE OF A SIDEWALK. REFER TO DRAWINGS T-3 TO T-10 FOR MORE INFORMATION.
4. WATER SERVICES UP TO 50mm MAY BE MUNICIPEX OR Q-LINE AS AN ALTERNATIVE TO TYPE K COPPER.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| DUAL SERVICE FOR SINGLE FAMILY LOTS | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | W-10 |
| NOT TO SCALE | DRAWN: MP, DF | |

# Chlorine Residual and Bacterial Sampling Report

The following form shall be prepared by the Developer's Representative for submission to the City of Fort Saskatchewan.

Developer: _____ Date: _____

Consultant: _____ Subdivision: _____

Contractor: _____ Pump Location: _____

Location: _____

_____

| Diagram of Test Area |
| --- |
| |

| Location | Test Date | Total Chlorine (mg/L) | Free Chlorine (mg/L) | Standard Plate Count (cfu/mL) |
| --- | --- | --- | --- | --- |
| 1) | | | | |
| 2) | | | | |
| 3) | | | | |
| 4) | | | | |
| 5) | | | | |
| 6) | | | | |

Notes:

_____

_____

_____

# WATERMAIN PRESSURE AND LEAKAGE TEST FORM

The following form shall be prepared by the Developer's Representative for submission to the City of Fort Saskatchewan.

Date: _____

Project: _____

Location: _____ *From:* _____ *To:* _____

Pipe Size: _____ Length of Test Section: _____

Pipe Type: _____ Number of Joints: _____

Allowable Leakage per Hour (L/hr): _____ (for test pressure of: kPa)

Actual Leakage per Hour (L/hr): _____ (for test pressure of: kPa)

## Diagram of Test Area

| Pump Start Time | Meter Reading | Pump Stop Time | Meter Reading | Total Loss (L) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

High Pressure Water Meter Used (Brand name, model, and serial number)

_____

Date meter tested and calibrated: _____

Date complete: _____ Operator's Signature: _____

Company: _____ Company's Address: _____

Phone No.: _____

Developer's Representative's Signature: _____

# 3.0 SANITARY COLLECTION

This section outlines the methodology and design criteria that apply to the design of the sanitary sewage conveyance system. These guidelines are not intended to be a substitute for sound engineering knowledge and experience. Sanitary sewer system designs shall be prepared under the direction of a qualified professional who has the appropriate experience and is registered with the Association of Professional Engineers and Geoscientists of Alberta (APEGA). The design shall be approved by the City Engineers.

## 3.1 Sanitary Collection General Principles and Objectives

Sanitary sewers are intended to convey wastewater only. This includes standard domestic plumbing fixtures, floor drains, approved industrial and commercial wastes and unavoidable infiltration. Sanitary sewer systems are intended to exclude stormwater, roof drains, foundation drains and groundwater.

All residential, commercial and industrial development within Fort Saskatchewan city limits shall be provided with sanitary sewer service.

Sanitary sewers collect and convey wastewater to treatment facilities for treatment. To accomplish this, new systems must be designed and constructed with reliable conveyance capacity and minimal potential for rainfall and groundwater inflows, such that system backup is limited to cases of unforeseeable blockage. To achieve this objective, new system extensions will be sized to flow at less than full and with reasonable allowances for extraneous inflows. It is recognized that these criteria provide a safety factor compared to previously constructed systems, which will flow full at the design flow rate.

To protect the functional integrity of the sanitary sewer system, extraneous inflows must be prevented or controlled to match the design criteria and performance expectations.

A prime consideration in the selection of alternatives for the sanitary servicing of new development areas must be minimization of the long-term cost to the public. Economic analysis must include evaluation and comparison of operations and maintenance costs as well as capital cost. Extension of sanitary servicing by means of gravity sewer systems to the maximum extent possible is preferred and the utilization of pumping systems will be permitted only when insurmountable constraints cannot be resolved otherwise.

The City wishes to promote an orderly process of development with the objective of achieving permanent sanitary sewer system extensions in the most cost-effective manner. Hence,

- the proliferation of temporary servicing schemes in lieu of permanent system extensions is discouraged; and
- extensions of systems and developments will be discouraged when they involve the construction of downstream connections through undeveloped areas (leapfrogging) solely for the purpose of advancing service extensions to upstream areas.

## 3.2 Design Flow

The sanitary sewer system shall be of sufficient capacity to convey the peak dry weather flows plus infiltration and inflow (including future contributing areas).

Average Dry Weather Flows for:

- Residential Contributions: Minimum average contribution of 250 liters per capita per day (l/c/d)
- Commercial, Industrial and Institutional: Minimum average contribution of 0.2 liters per second per hectare (l/s/ha).

Average dry weather flows (ADWF) shall be based on specific data related to the development or zoning. In the absence of such data or local regulations, use the above per capita flow rates and the following equivalent population factors:

| Land Use | Equivalent Population/Hectare (gross) |
|---|---|
| Country Residential | 5 people/ha |
| Low Density Residential | 40 people/ha |
| Medium Density Residential | 80 people/ha |
| High Density Residential | 160 people/ha |

Average Annual Daily Water Demands for Commercial and Institutional Facilities may be used as an estimate of ADWF, subject to City of Fort Saskatchewan approval.

The Owner/Applicant should account for higher average flows if high water use facilities are being planned within the development e.g., food processing plant, large hotel, hospital, etc.

## 3.3 Peaking Factors

The peaking factor is the ratio of peak dry weather flow (PDWF) to the average dry weather flow (ADWF).

| | |
|---|---|
| Residential | Peaking factor shall be the larger of 1.5 or $PF = 2.6P^{-0.1}$ where P = population in thousands |
| Commercial/Industrial/ Institutional | $PF = 10Q_{Avg}^{-0.45}$. Min = 2.5, Max = 25. |

## 3.4 Extraneous Flow Allowance

Design flow shall include allowance for inflow and infiltration.

A general allowance of 0.28 litres per second per hectare shall be applied to all residential areas to account for wet weather inflow to manholes not located in street sags and for infiltration into pipes and manholes.

A general allowance of 0.05 litres per second per hectare shall be applied to all commercial, industrial and institutional areas to account for wet weather inflow to manholes not located in street sags and for infiltration into pipes and manholes.

A separate allowance of 0.4 litres per second per manhole shall be applied for inflows at manholes located within roadway sags or other low areas that may be flooded during major storm events. An effort should be made during the design stage to locate sanitary manholes away from sag locations. For planning purposes and downstream system design, the Owner/Applicant shall make a conservative estimate of the number of sag manholes that may be located in the future contributing area. For new construction, sanitary manholes should be avoided in sag locations, except where no other viable alternatives are available.

Connection of foundation drains (weeping tile) to sanitary sewers is not permitted.

## 3.5 Total Design Flow for Sanitary Sewers

The total design flow for the sanitary sewer is the sum of the peak dry weather flow and all extraneous flows.

$Q = ADWF * PF + AWWF$ Where: Q = design flow in $m^3/s$
ADWF = Average Dry Weather Flows
PF = Peaking Factor
AWWF = Average Wet Weather Flows

## 3.6 Sizing of Sanitary Sewers

### 3.6.1 Gravity Sewers

All sanitary sewers shall be sized using Manning's equation.

$$Q = \frac{AR^{0.667}S^{0.5}}{n}$$ Where: Q = design flow in $m^3/s$
A = cross sectional area in $m^2$
R = hydraulic radius (area/wetted perimeter) in m
S = slope of hydraulic grade line in m/m
n = roughness coefficient = 0.013 for all pipe

Sanitary sewers are to be designed to carry the design flow at flow depth of 80% of the sewer diameter, which results in a flow rate approximately 86% of the sewer's full flow capacity.

$$\text{required flow sewer capacity} = \frac{\text{estimated total design peak flow rate}}{0.86}$$

### 3.6.2 Sewage Force Mains

Use Hazen-Williams formula:

$$Q = \frac{CD^{2.63}S^{0.54}}{278780}$$ Where: Q = rate of flow in L/s
D = internal pipe diameter in mm
S = slope of hydraulic grade line in m/m
C = friction coefficient = 120 for all pipe

A "system-head" curve shall be provided for each force main. Supplementary information to be provided with the curves will include, but not limited to, population estimates, areas served, plan and profile of line, friction coefficients and line head losses.

## 3.7 Minimum Flow Velocities

Minimum full flow design velocities:

- gravity sewers at 0.6 m/s
- force mains at 0.75 m/s

## 3.8 Maximum Flow Velocities

Maximum full flow design velocities for gravity sewers and force mains at 3.0m/s.

## 3.9 Alignment

Wherever practical, straight alignments are preferred. Except as indicated for curved sewers, horizontal and vertical alignments shall be straight lines between manholes for gravity sewers, and between defined deflection points for force mains. Elevations are to be recorded.

Force main line and grade requirements are as indicated for watermains. Air release valves are required at high points.

## 3.10 Minimum Pipe Diameter

| | |
|---|---|
| Residential | 200mm |
| Commercial/Industrial/Institutional | 250mm |
| Service Connections | 150mm |
| Sewage Force Mains | 150mm[1] |

[1]Pipe diameters less than 150 mm shall be allowed on a case-by-case basis, upon the City's discretion.

Pipe and fittings material shall be PVC pipe – CSA B182.2 SDR35 (maximum 600mm diameter). Material selection for larger pipes shall be submitted for approval to the City of Fort Saskatchewan.

Installation is to comply with manufacturers recommendations.

## 3.11 Minimum Sanitary Pipe Grades

Minimum grades of gravity sewers are as required to obtain the minimum velocity of 0.60m/s except for the upstream section of a residential sewer serving a design population of 25 or less in which case the minimum grade is 1%, unless otherwise approved by the City of Fort Saskatchewan.

Minimum slopes permitted for various sewer sizes are as follows:

| Sewer Size | Minimum Slope |
|---|---|
| 200 mm | 0.40% |
| 250 mm | 0.28% |
| 300 mm | 0.22% |
| 375 mm | 0.15% |
| 450 mm | 0.12% |
| 525 mm or larger | 0.10% |

Force main grades are as indicated in Section 2.13 Grade.

## 3.12 Curved Sewers

Where straight sewers are not possible or practical, horizontal curves may be permitted using pipe joint deflections as follows:

- A radius equal to or greater than 90m or the manufacturers minimum recommended radius, whichever is larger
- constant radius throughout curve
- continuous curves between manholes

Curves shall run parallel to the curb or street center line, following the road alignment and within the road right-of-way.

Minimum slopes permitted for sewers on a curve shall be 50% greater than the minimum grade required for straight runs of sewers.

## 3.13 Depth

Sewers shall be of sufficient depth to:

- permit gravity service connections to building basements
- prevent freezing
- clear other underground utilities
- prevent damage from surface loading
- minimum depth of cover 2.8 m to top of pipe measured from finished design grade
- Clearance from sewers is as indicated in Section 1.4 of Schedule D

In cases where design grade does not comply with the minimum depth of cover, pipes must be insulated to provide frost and mechanical protection. Final design is subject to approval by the City Engineer.

Refer to:

- Drawing W-6 Typical Trench Section
- Drawing S-1 Trench Bedding Types

## 3.14 Manholes

### 3.14.1 Design Features

Manholes shall be a minimum 1200mm inside diameter in the main portion of the structure. Manholes shall be 1500mm diameter or larger when connecting sewers are 600mm or larger. Refer to:

- Drawing S-2 1200mm Manhole for Piping up to 600mm
- Drawing S-3 1200mm Perched Manhole
- Drawing S-4 T-Riser Manhole

The maximum change in the direction of flow in any sanitary sewer manhole shall be 90°.

The maximum drop allowed across a manhole is 0.6m. If the design of the sewer system is such that the difference in elevation between the manhole inlet and outlet exceeds 0.6m, a manhole drop structure will be required as per Drawing S-5 Manhole Drop Structure.

Internal drop structures shall be allowed for 200mm and 250mm sewer mains. External drop structures shall be used otherwise.

In situations where there is a higher risk of the sanitary system freezing, refer to Drawing S-10 Enhanced Frost Cover Detail; for example, the top end of the sanitary system on an urban infrastructure renewal project is at a higher risk of freezing. Manhole covers shall be insulated as per Drawing S-10 Enhanced Frost Cover Detail, where sanitary services tie directly into a manhole.

Aluminum safety platforms shall be required in all manholes with a depth greater than 6.0m. Safety platforms to be installed at 3.0m increments. A platform design shall be submitted to the City for acceptance and shall include structural details, fastening details, access hatch, and location within the manhole.

Manholes shall be installed with ladder rungs as per Drawing S-6 Ladder Rungs.

PVC mains shall be connected to manholes using either a manhole adaptor or an approved pre-benched manhole base. Refer to Drawing S-7 1200mm Manhole Benching.

All sanitary manholes shall be supplied with F-80 manhole covers. F-90 manhole covers shall be avoided unless absolutely necessary. Sanitary manholes should be avoided in sag locations, except where no other viable alternatives are available.

F-80 manhole covers must have one lifting hole.

### 3.14.2 Required Locations

Manholes are required at the following locations:

- every change of pipe size
- every change in grade
- every change in direction, expect as indicated in the Curved Sewers section
- upstream and downstream ends of curved sewers
- every pipe intersection except for 150mm and smaller service connections
- upstream end of every sewer main
- every future pipe intersection
- 150m maximum spacing for all nominal pipe sizes.

### 3.14.3 Hydraulic Details

Crown elevations of inlet sewers shall not be lower than crown elevation of outlet sewer.

Minimum drop in invert elevations across manhole is:

| | |
|---|---|
| Straight run | Continue slope of upstream or downstream sewer, whichever is greater |
| Deflections up to 45° | 25 mm drop |
| Deflections 45° to 90° | 50 mm drop |

Hydraulic losses are to be calculated for manholes with significant change of grade or alignment. For high velocity flows or large pipes (> 600mm diameter) detailed analysis is required. For low velocities and smaller pipes, use the following formula:

$$H_L = k \frac{V^2}{2g}$$

Where: $H_L$ = head loss (m)
$V$ = outlet flow velocity (m/s)
$g$ = gravitational acceleration (9.81 m/s$^2$)
$k$ = head loss coefficient (1.0 for channeled 90° bends and tees, to 1.5 without channelized benching)

Force main discharges shall be directed into the receiving manhole outflow pipe. Manhole benching shall be extended a minimum 200mm above the force main crown. If a manhole drop cannot be avoided, an inside drop pipe is required.

## 3.15 Testing of Sewers

In areas where the groundwater table may fluctuate at or above the sewer pipe invert or higher, each section of sewer mains and service connections shall be tested for water tightness by an infiltration test. In all other situations, an infiltration/exfiltration test may be required after review of the camera inspection report.

Maximum allowable leakage for an infiltration test of a sewer pipe is 5.0 l/d/mm of dia/km, with no allowance for external hydrostatic head. The groundwater table is to be above pipe crown at all locations of the test section.

Maximum allowable leakage for an exfiltration test of a sewer pipe while subjected to a minimum 0.6m hydrostatic head of water is 5.0 l/d/mm of diameter/km. All deficiencies shall be corrected by the Developer or Contractor, should they fail testing. Those portions of the system affected shall be subject to an additional video inspection.

Tests shall be undertaken on each section of sewer main and the results recorded and shall be performed in the presence of the City's engineer.

## 3.16 Camera

All inspections shall be conducted using closed circuit television (CCTV) camera equipment. The inspections shall be performed in accordance with the standard practices as set forth in NASSCO references.

The captured video shall be in colour and display on screen the Lot and Block numbers of all service connectors. The rate of camera progression shall not exceed 6m per minute. The inspections and reports shall include the main, lateral, and a pan and tilt at each service connection.

The Developer is responsible for cleaning and flushing all lines and manholes to facilitate CCTV inspections. Sewer lines to be cleaned utilizing low-pressure flushing. Sludge, dirt, sand, and other debris resulting from the cleaning operations shall be removed from the downstream manhole of the section being cleaned. Passing material from the section being cleaned to the downstream sewer section shall not be permitted.

The CCTV inspections shall be performed prior to the issuance of the Construction Completion Certificate (CCC) and within 120 days of the Final Acceptance Certificate (FAC). Manhole sumps must be emptied prior to CCC and FAC inspections. If deficiencies are found during the inspection, the Developer shall be required to correct them before the CCC and/or FAC are issued.

All mains and laterals shall be required to undergo a CCTV inspection.

## 3.17 Pipe Locations and Corridors

Sewers shall be located within the road right-of-way in accordance with the Roadway Cross Section Standard Drawings T-3 through to T-13.

Clearance from watermains is as indicated in Section 1.4, Schedule C.

## 3.18 Service Connections

Every legal lot and each residential unit shall be provided with a separate service connection as per Drawing S-8 Sanitary Service Connection.

Unless otherwise approved by the City of Fort Saskatchewan, connections are to serve all plumbing by gravity. Drawings to provide service invert at property line.

### 3.18.1 Size

Pipe size is to accommodate peak design flow. Minimum pipe size is 150mm diameter.

3.18.2 Location and Depth

Connections to large lots are to be located at the lower portion of each lot. For residential developments, locate connections in accordance with detail drawings.

Service connections shall maintain a minimum horizontal spacing of 0.6m between them.

Depth requirements are as indicated in Section 3.13 Depth herein.

3.18.3 Grade

Minimum grade from property line to sewer main is:

| | |
|---|---|
| 150mm diameter pipe | 2.00 % |
| Larger Sizes | Grade based on minimum velocity of 0.75m/s |

3.18.4 Connections

Use standard wye fittings for connections to new mains. For connections to existing mains, strap-on or inserted tee type services are permitted. The service connection centerline must not be below the sewer main centerline.

Service connections may be permitted into manholes if:

- the connection is not oriented against the flow in the main
- manhole hydraulic requirements are met
- no more than 2 service connections into manhole

Connections exceeding 30m in length shall be treated as mains and must have a cleanout.

Installation of bends in service lines shall be done as per Drawing S-8 Sanitary Service Connection.

All sanitary sewer service lines must extend 300mm beyond the easement or 2.0m from the property line on the private side. The last pipe to the property line shall be a full-length pipe; this includes the pipe segment in the easement and the required 300mm past the easement as per detail W-9 Single Service Connection and W-10 Dual Service Connection. End of sanitary connection to be capped and painted black as per Drawing S-8 Sanitary Service Connection. Service connections made directly to manholes should extend into the manhole by 100mm.

For commercial, industrial, institutional, and multi-family residential lots, a sampling manhole shall be provided on the wastewater service connection, either inside of the road right of way or at an accessible location upon private property (minimum 1.5m inside private property). The sampling manhole shall be installed at the time that the lot is developed.

Where services are required to connect to mains in excess of 4.0m in depth, risers shall be installed and properly plugged. The risers shall be firmly supported and anchored to the trench wall in all cases.

1. Pipe and Joints
   Sewer pipe shall be Polyvinyl Chloride (PVC) pipe shall be SDR 35 service pipe conforming to ASTM Specification D3034.

2. Fittings
   Sewer fittings shall conform to the pipe material being used and shall be in accordance with the corresponding manufacturer's recommended standards and specifications.

3. Plugs

The ends of the pipe at the edge of the easement shall be sealed with plastic plugs fitted to the bell end of the pipe and braced. Blue painted marker posts shall be placed from the invert of the pipe and extend 600mm from the design (or final) ground surface to identify the location of all plugged ends.

## 3.19 Sanitary Lift Stations

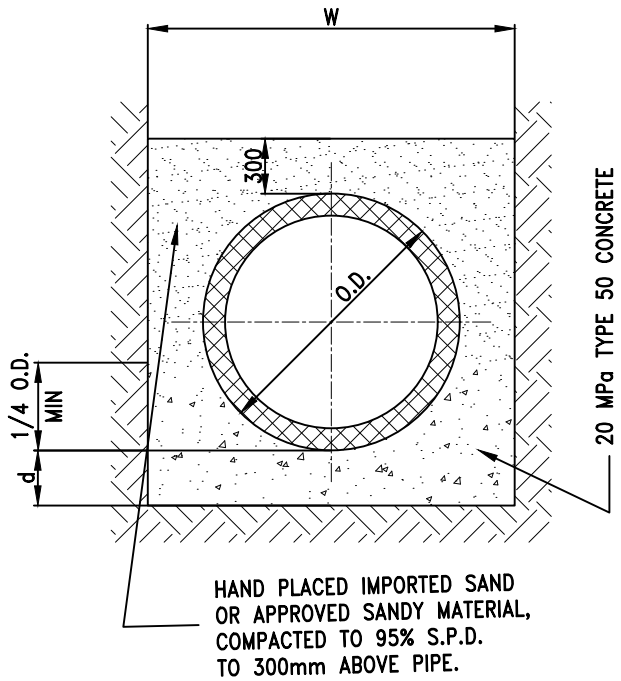
The extension of sanitary servicing by use of sanitary lift stations, low pressure sewers, and force mains shall be avoided where possible. Should they be required, the design criteria must be agreed to by the City before the system is designed and constructed. Sanitary pump stations shall only be considered where physical constraints dictate. Sanitary servicing concepts in which a pump station is required shall be justified through the Area Structure Plan requirements for new development areas and be supported by the Sanitary Master Plan. Any use of pump stations must be proposed by a professional engineer and submitted to the City Engineer for approval. Preliminary design must be approved before detailed design proceeds. Check with City Engineer for requirements.

## 3.20 List of Standard Drawings

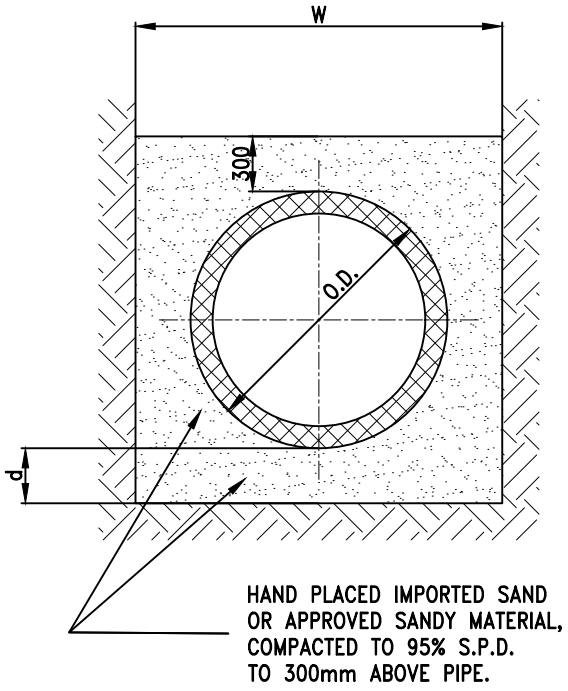
S-1 Trench Bedding Types
S-2 1200mm Manhole for Piping up to 600mm
S-3 1200mm Perched Manhole
S-4 T-Riser Manhole
S-5 Manhole Drop Structure
S-6 Ladder Rungs
S-7 1200mm Manhole Benching
S-8 Sanitary Service Connection
S-9 Residential Servicing Installation Detail
S-10 Enhanced Frost Cover Detail

See water section detail W-6 for Typical Trench Section.
See water section detail W-9 for Single Service Connection.
See water section detail W-10 for Dual Service Connection.

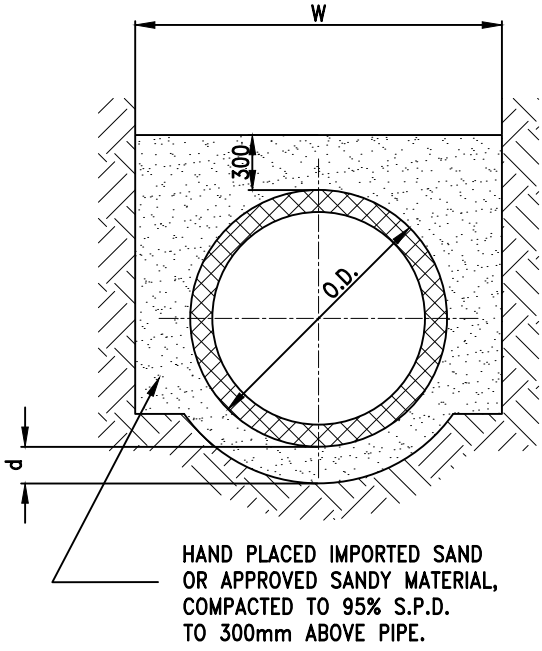
CLASS 'A' BEDDING




CLASS 'B' BEDDING




CLASS 'B' BEDDING
ALTERNATE – 375mm & UNDER I.D.




NOTES:

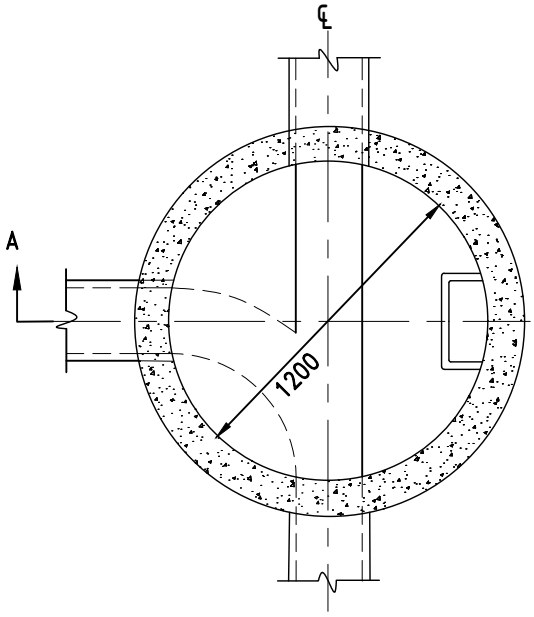
W = TRENCH WIDTH = 600mm MIN
O.D. = OUTSIDE PIPE DIAMETER
I.D. = INSIDE PIPE DIAMETER
d = DEPTH OF BEDDING BELOW PIPE

I.D. = 675mm AND SMALLER:
W = 600mm MIN
d = 100mm MIN
I.D. = 750mm AND LARGER:
W = O.D. + 750mm MIN
d = 150mm MIN

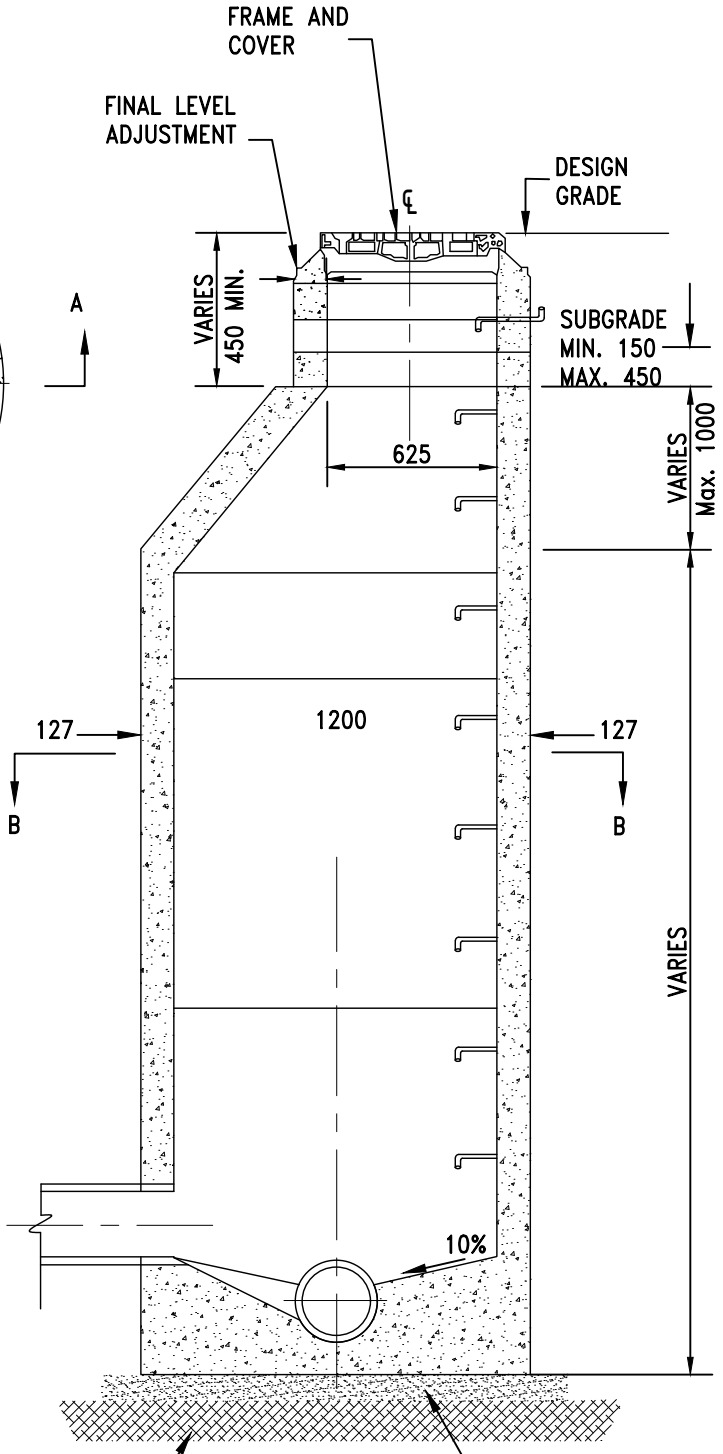
1. THESE BEDDING TYPES APPLY ONLY WHERE SOLID, SUITABLE SOIL CONDITIONS EXIST. IN AREAS WITH UNSUITABLE SOIL CONDITIONS, SPECIAL BEDDING AND PIPE FOUNDATION DESIGNS ARE REQUIRED.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| TRENCH BEDDING TYPES | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | S–1 |
| NOT TO SCALE | DRAWN: MP, DF | |




SECTION B–B




SECTION A–A

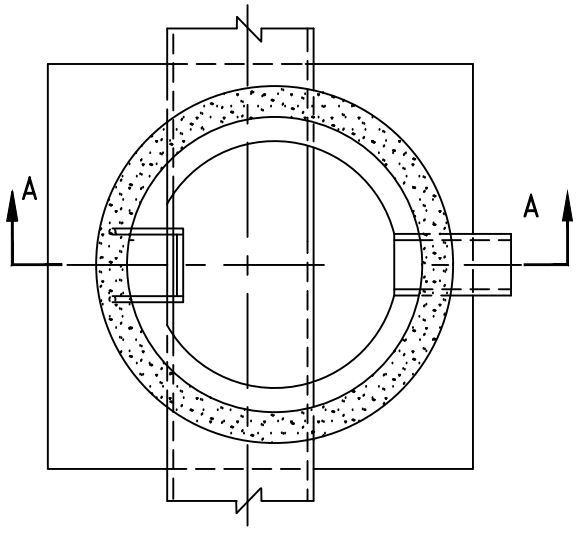
NOTES:

1. THIS STANDARD APPLIES TO MANHOLES ON PIPING OF MAXIMUM DIAMETER 600mm AND MINIMUM DEFLECTION ANGLE OF 120°
2. FOLLOW MANUFACTURER'S SPECIFICATIONS WHEN SIZING A MANHOLE. FOR PIPE 1200mm AND LARGER, MANHOLE TEE RISERS SHALL BE USED.
3. PREBENCHED MANHOLE BASE UNITS WITH INTEGRAL GASKET SHALL BE USED
4. THE SEWER PIPING IS AN EXAMPLE ONLY. REFER TO PROJECT DRAWINGS FOR LAYOUT AND ELEVATIONS.
5. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM C478 STANDARDS.
6. SANITARY MH JOINTS TO BE SEALED WITH A CONFINED O–RING GASKET, ASTM C445.
7. INLET AND OUTLET PIPES TO BE GROUTED FLUSH WITH WALL
8. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.
9. SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 400mm APART TO WITHIN 300mm BELOW COVER AND TO WITHIN 300mm OF THE BASE OR BENCHING. STEPS TO BE EPOXY COATED EXTRUDED ALUMINUM OR GALVANIZED STEEL.
10. COMPACT BACKFILL AROUND MH TO A MIN. OF 98% STANDARD PROCTOR DENSITY.
11. MANHOLE FRAME AND COVER TO HAVE A SINGLE LIFTING HOLE.
12. GRADE RINGS TO BE GROUTED AT CCC/FAC.

F–39 FRAME AND COVER IN LANDSCAPED AREAS.
F–80 FRAME AND COVER IN HARD SURFACED AREAS.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

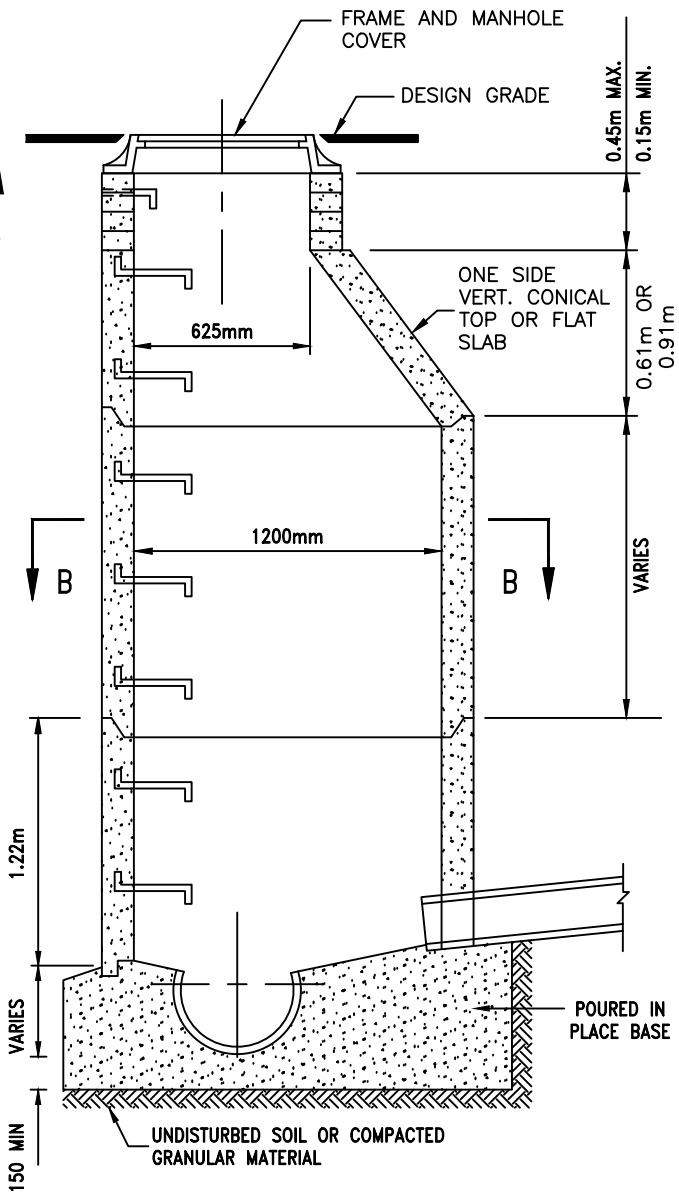
| 1200mm MANHOLE | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | S–2 |
| NOT TO SCALE | DRAWN: MP, DF | |




SECTION B – B

NOTES:

1. THE SEWER PIPING IS AN EXAMPLE ONLY. REFER TO PROJECT DRAWING FOR LAYOUT AND ELEVATIONS.
2. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM C478 STANDARDS.
3. SANITARY MH JOINTS TO BE SEALED WITH A CONFINED O–RING GASKET, ASTM C445.
4. CONNECTION OF PIPES TO MH TO BE SEALED WITH CEMENT MORTAR.
5. INLET AND OUTLET PIPES TO BE GROUTED FLUSH WITH WALL.
6. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.
7. SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 400mm APART TO WITHIN 300mm BELOW COVER AND TO WITHIN 300mm OF THE BASE OR BENCHING. STEPS TO BE EPOXY COATED EXTRUDED ALUMINUM OR GALVANIZED METAL.
8. COMPACT BACKFILL AROUND MH TO A MIN. OF 98% STANDARD PROCTOR DENSITY.
9. MANHOLE FRAME AND COVER TO HAVE A SINGLE LIFTING HOLE.
10. GRADE RINGS TO BE GROUTED AT CCC/FAC.

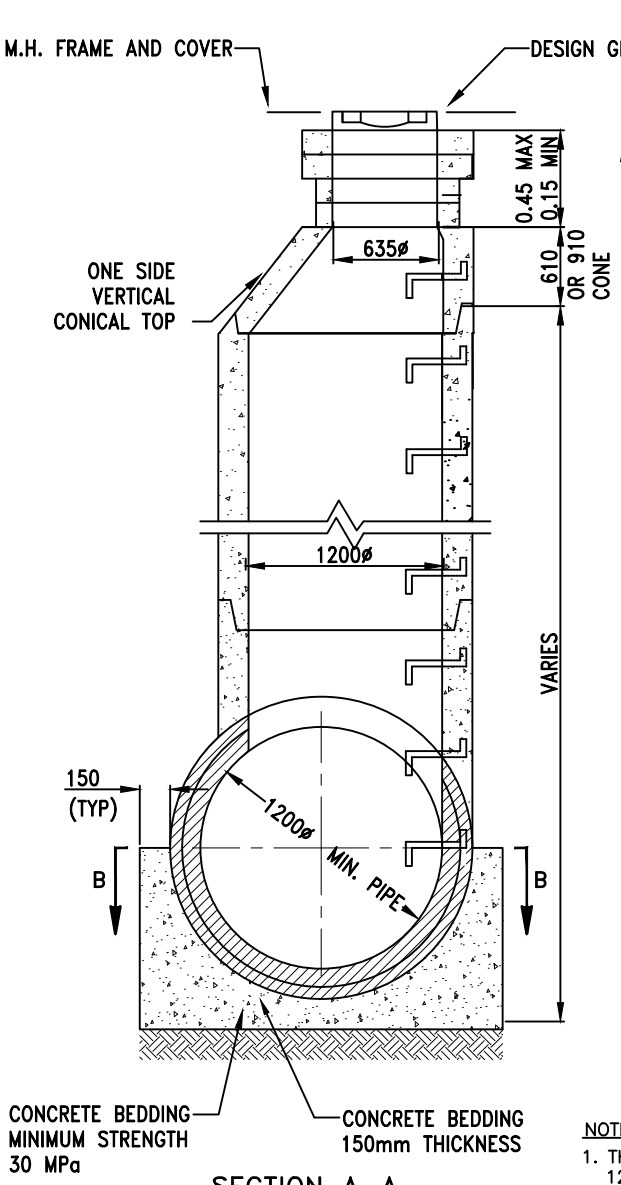



SECTION A – A

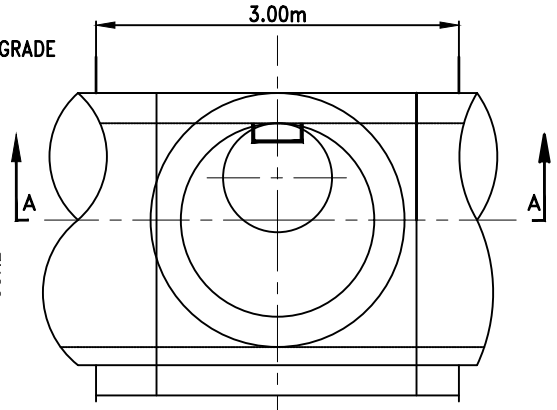
F–39 FRAME AND COVER IN LANDSCAPED AREAS.
F–80 FRAME AND COVER IN HARD SURFACED AREAS.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

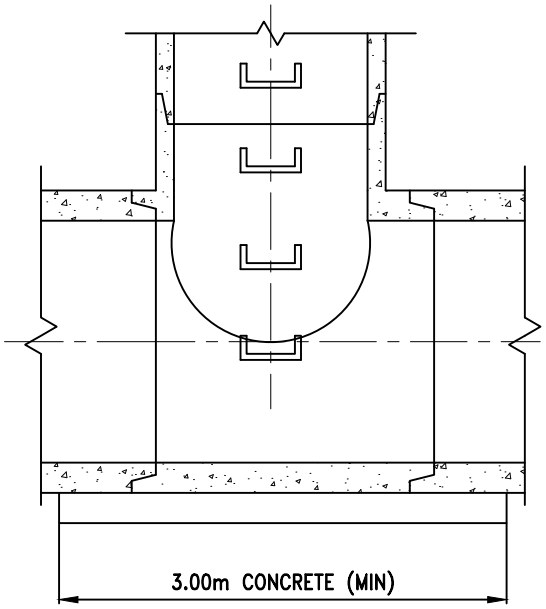
| 1200mm PERCHED MANHOLE | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | S–3 |
| NOT TO SCALE | DRAWN: MP, DF | |




SECTION A–A




SECTION B–B



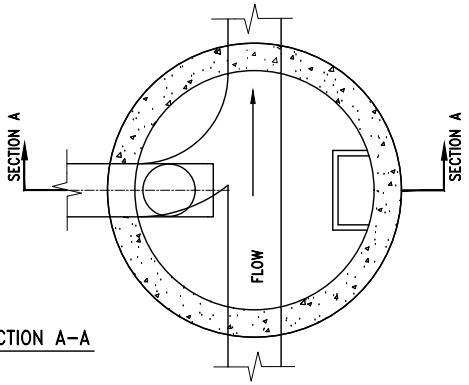

NOTES:

1. THIS TYPE OF MANHOLE IS TO BE BUILT ONLY ON MAINS OF 1200mm DIAMETER OR LARGER
2. ALUMINUM BARRELS TO MEET ASTM C–478 STANDARDS.
3. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM C478 STANDARDS.
4. SANITARY MH JOINTS TO BE SEALED WITH A CONFINED O–RING GASKET, ASTM C445.
5. SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 400mm APART TO WITHIN 300mm OF THE BASE OR BENCHING. STEPS TO BE EPOXY COATED EXTRUDED ALUMINUM OR GALVANIZED STEEL.
6. COMPACT BACKFILL AROUND MH TO A MIN. OF 98% STANDARD PROCTOR DENSITY.
7. MANHOLE FRAME AND COVER TO HAVE A SINGLE LIFTING HOLE.
8. GRADE RINGS TO BE GROUTED AT CCC/FAC.

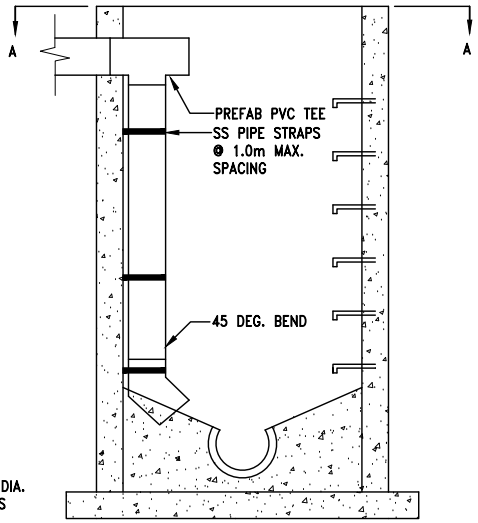
F–39 FRAME AND COVER IN LANDSCAPED AREAS.
F–80 FRAME AND COVER IN HARD SURFACED AREAS.

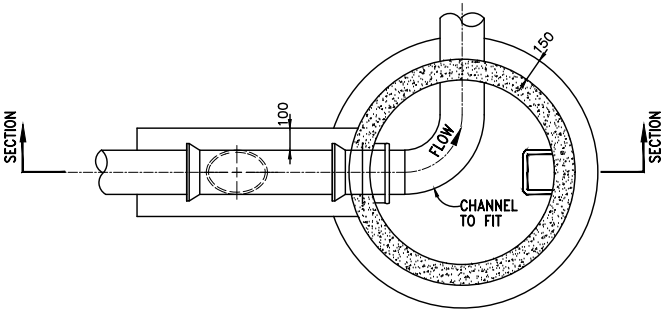
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| T–RISER MANHOLE | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | S–4 |
| NOT TO SCALE | DRAWN: MP, DF | |

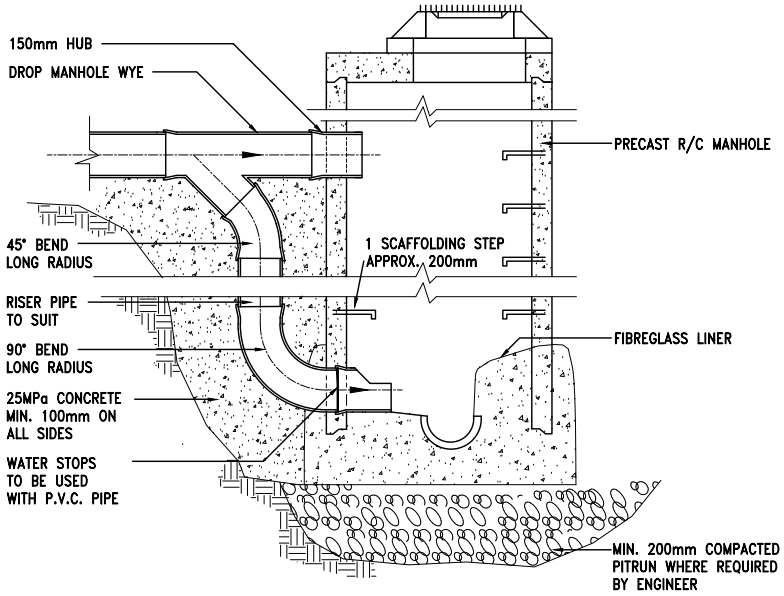



SECTION A–A




PLAN



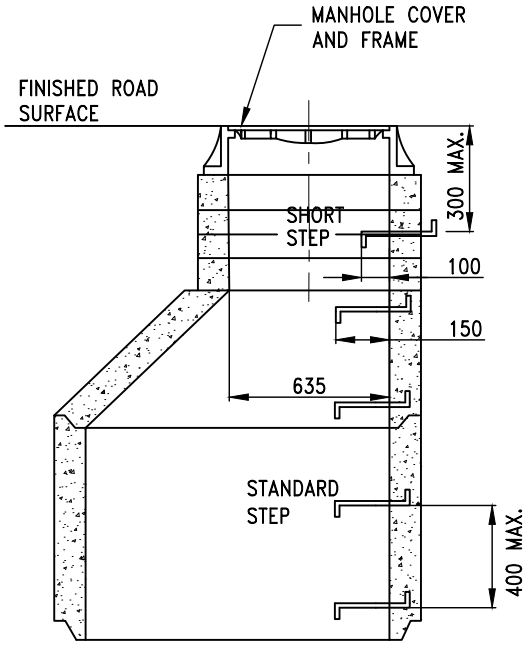

SECTION

NOTES
1. MAXIMUM INLET SEWER OF 300mm DIA.
2. DROP PIPE SIZE TO EQUAL INLET PIPE SIZE.
3. ALL JOINTS SHALL BE WATERTIGHT.
4. POSITION 45° BEND IN LINE WITH DIRECTION OF FLOW AND SECURE WITH BENCHING OR STAINLESS STEEL BRACKET.
5. USE INTERNAL DROP STRUCTURE FOR 200mm DIA. AND 250mm DIA. MAINS. USE EXTERNAL DROPS FOR ALL OTHER PIPE DIAMETERS.

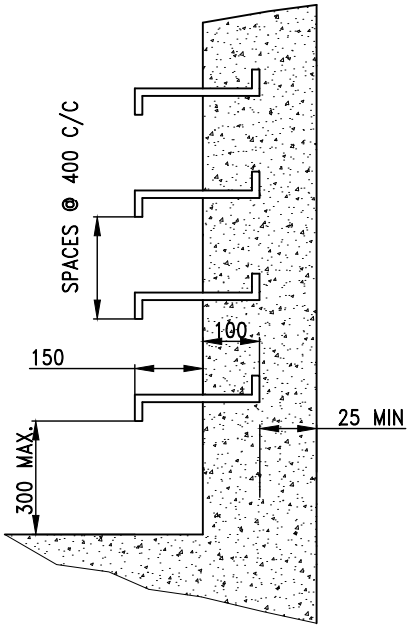
ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

# MANHOLE DROP STRUCTURE

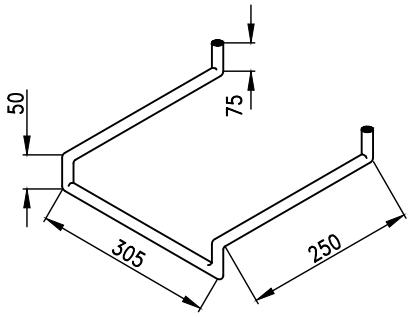
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: B | DATE: DEC 2024 | S–5 |
| NOT TO SCALE | DRAWN: MP, DF | |




TYPICAL MANHOLE SECTION
N.T.S.




LADDER RUNGS
N.T.S.

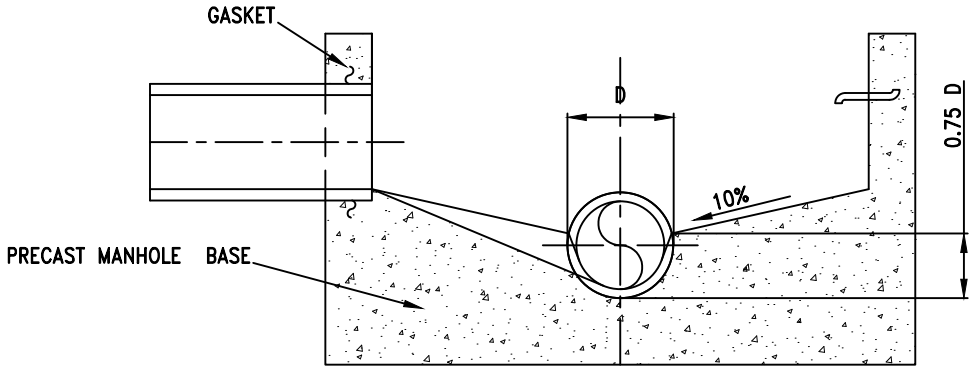



20mm ALUMINUM FORGED MANHOLE STEPS
OR AS PER MANUFACTURER SPECIFICATION

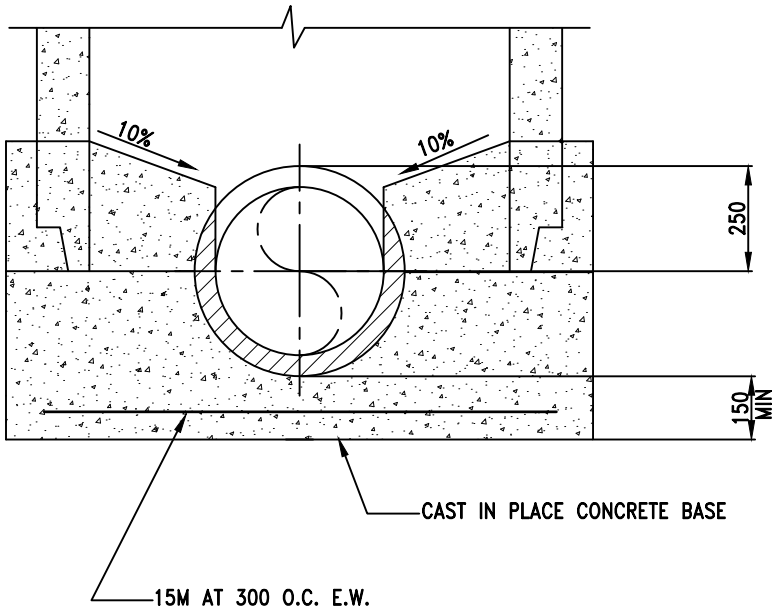
MANHOLE RUNG DETAIL
N.T.S.

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| LADDER RUNGS | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | S-6 |
| NOT TO SCALE | DRAWN: MP, DF | |




## BENCHING DETAIL 1



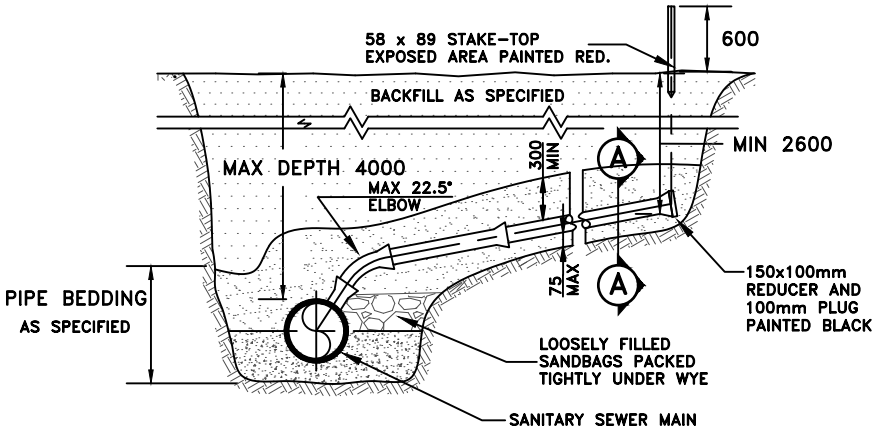

## BENCHING DETAIL 2

NOTES:

1. ALL POURED CONCRETE SHALL CONFORM TO C.S.A SPEC. A.23-1 AND SHALL HAVE A COMPRESSIVE STRENGTH OF 30 MPa AT 28 DAYS.
2. ALL REINFORCING STEEL TO BE GRADE 400 DEFORMED BARS CONFORMING TO C.S.A. SPEC. G30.18.
3. REINFORCE AS DETAILED OR AS ORDERED BY THE CITY.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| 1200mm MANHOLE BENCHING | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | S-7 |
| NOT TO SCALE | DRAWN: MP, DF | |

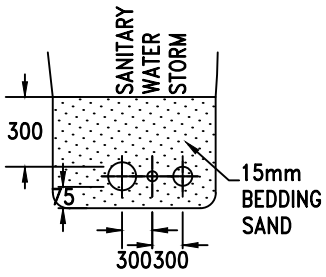



NOTES:

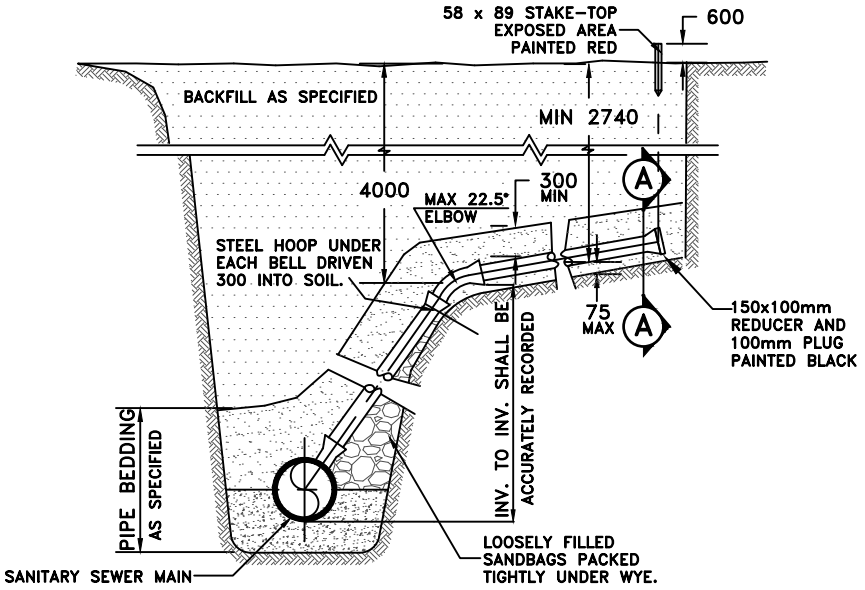
1. THE LAST PIPE TO THE PROPERTY LINE SHALL BE A FULL LENGTH PIPE.

## WITHOUT RISER

REFER TO SPECIFICATION
FOR WYE OR SERVICE SADDLE.



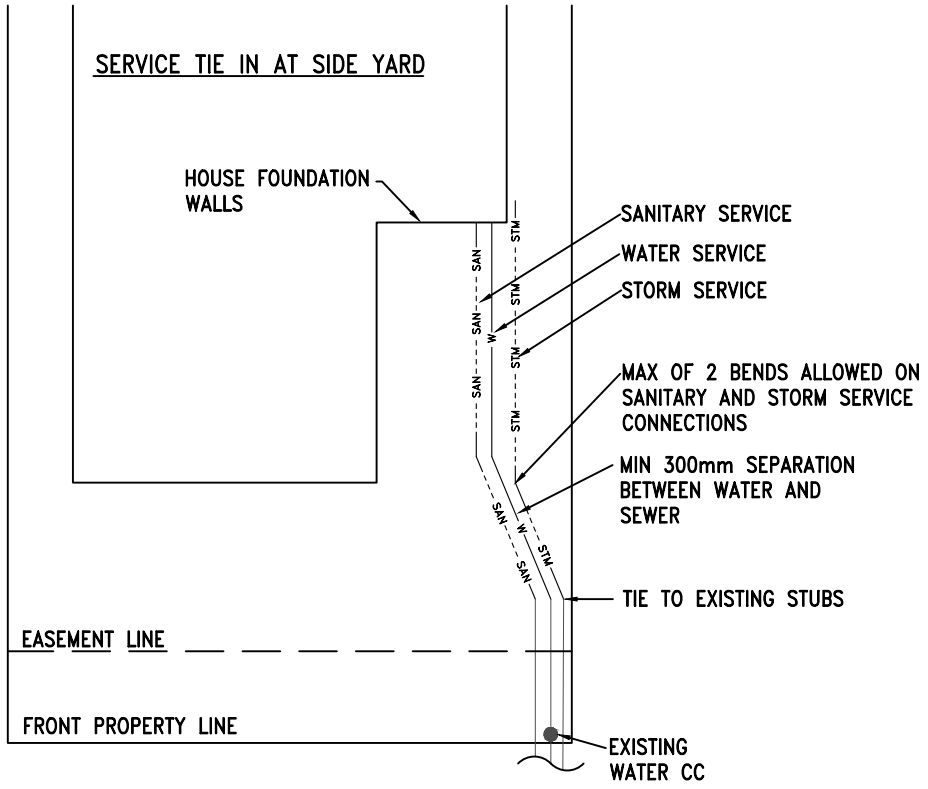

## SECTION A
(FACING PROPERTY)

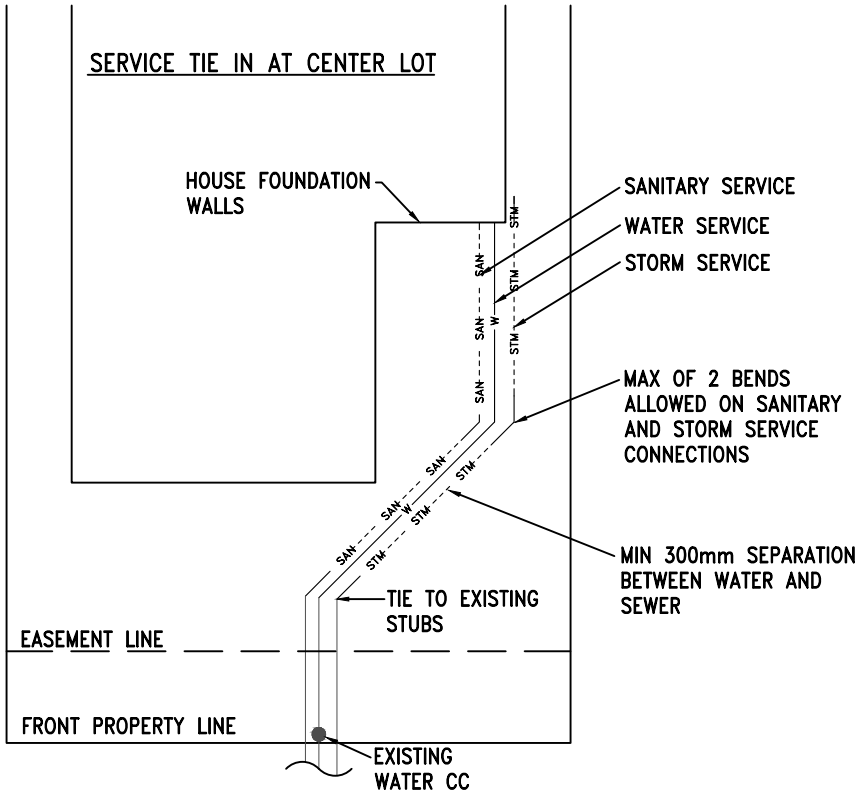



## WITH RISER

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| SANITARY SERVICE CONNECTION | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | S-8 |
| NOT TO SCALE | DRAWN: MP, DF | |



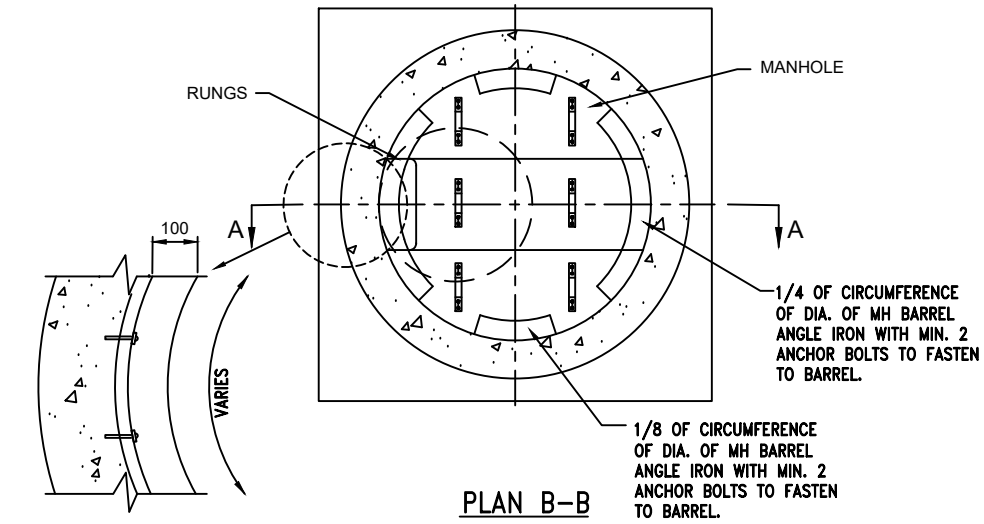




NOTES:

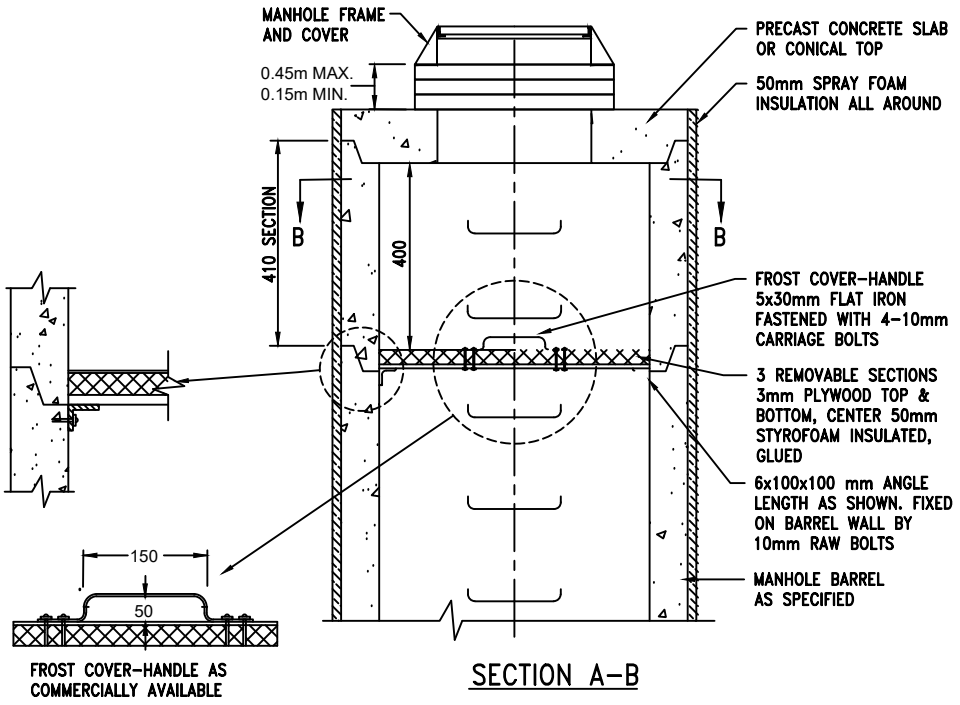
1. SANITARY AND STORM SERVICE TO BE MIN. 100mm DIAMETER FROM TIE IN TO HOUSE.
2. SANITARY AND STORM SERVICE TO HAVE MIN. 2.00% GRADE FROM TIE IN TO HOUSE. GRADE IS TO BE CONSISTENT (+/- 0.5%).
3. SANITARY TO HAVE MAX. 2 BENDS FROM TIE IN TO HOUSE. MAXIMUM 45° LONG SWEEP WILL BE PERMITTED. 22.5° BENDS ARE PREFERRED.
4. STORM TO HAVE MAX. 2 BENDS FROM TIE IN TO STANDPIPE.
5. ROOF LEADERS NOT BE CONNECTED TO STORM SERVICE. ONLY FOUNDATION DRAINS PERMITTED.
6. WATER SERVICE TO BE MIN. 19mm DIAMETER TO HOUSE.
7. EXISTING WATER STUB IS COPPER, MUNICIPEX OR Q-LINE.

CONTACT CITY OF FORT SASKATCHEWAN AT 780-992-6248 TO SCHEDULE AN INSPECTION PRIOR TO BACKFILL. 24HR NOTICE IS REQUIRED. INSPECTIONS WILL TAKE PLACE MONDAY TO FRIDAY FROM 9:00am to 3:00pm

| RESIDENTIAL SERVICING INSTALLATION DETAIL | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | S-9 |
| NOT TO SCALE | DRAWN: GD, DF | |




PLAN B–B




SECTION A–B

NOTES:

1. ALL METAL PARTS IN MANHOLE TO BE PRIMED AND PAINTED.
2. USE EPOXY ANCHOR BOLTS TO FASTEN TO BARREL.
3. FABRICATE ANGLE TO SUIT BARREL RADIUS.
4. INSTALL COVER IMMEDIATELY ABOVE VALVES.
5. THIS DETAIL TO BE SPECIFIED IN SITUATIONS WHERE THERE IS A HIGHER RISK OF THE SANITARY SYSTEM FREEZING. FOR EXAMPLE, AT THE TOP END OF THE SANITARY SYSTEM ON AN URBAN INFRASTRUCTURE RENEWAL PROJECT. WHERE SANITARY SERVICES TIE DIRECTLY INTO A MANHOLE, MANHOLE COVERS SHALL BE INSULATED AS PER THIS DETAIL.
6. PRECAST RINGS, CONES, AND BARRELS TO MEET CURRENT ASTM C478 STANDARDS.
7. SANITARY MH JOINTS TO BE SEALED WITH A CONFINED O–RING GASKET, ASTM C445.
8. INLET AND OUTLET PIPES TO BE GROUTED FLUSH WITH WALL.
9. COMPACT BACKFILL AROUND MH TO A MIN. OF 98% STANDARD PROCTOR DENSITY.
10. MANHOLE FRAME AND COVER TO HAVE A SINGLE LIFTING HOLE.
11. GRADE RING TO BE GROUTED AT CCC/FAC.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| ENHANCED FROST COVER DETAIL | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DEC 2024 | S–10 |
| NOT TO SCALE | DRAWN: MP, DF | |

# 4.0 STORM DRAINAGE

This section outlines the methodology and design criteria that apply to the design of the storm drainage conveyance system. These guidelines are not intended to be a substitute for sound engineering knowledge and experience. Drainage designs shall be prepared under the direction of a qualified professional who has the appropriate experience and is registered with the Association of Professional Engineers and Geoscientists of Alberta (APEGA).

The following standards are intended to cover only minimum requirements. Drainage designs must conform to federal and provincial statutes and guidelines.

## 4.1 Service Connections

Every legal lot and each residential unit shall be provided with a separate service connection as per Drawing S-8 Sanitary Service Connection.

Unless otherwise approved by the City of Fort Saskatchewan, connections are to serve all plumbing by gravity. Drawings to provide service invert at property line.

### 4.1.1 Size

Pipe size is to accommodate peak design flow. Minimum pipe size is 150mm diameter.

### 4.1.2 Location and Depth

Connections to large lots are to be located at the lower portion of each lot. For residential developments, locate connections in accordance with detail drawings.

Depth requirements are as indicated in Section 3.13 Depth herein.

### 4.1.3 Grade

Minimum grade from property line to sewer main is

| | |
|---|---|
| 150mm diameter pipe | 2.00 % |
| Larger Sizes | Grade based on minimum velocity of 0.75m/s |

### 4.1.4 Connections

Use standard wye fittings for connections to new mains. For connections to existing mains, use wye saddles. The service connection centerline must not be below the sewer main centerline.

Service connections may be permitted into manholes if:

- the connection is not oriented against the flow in the main
- manhole hydraulic requirements are met
- no more than 2 service connections into manhole

Control inspection manholes are required on all industrial and commercial connections.

Connections exceeding 30m in length shall be treated as mains and must have a cleanout.

All sanitary sewer service lines must extend 300mm beyond the easement or 2.0m from the property line on the private side. Service connections made directly to manholes should extend into the manhole by 100mm.

Where services are required to connect to mains in excess of 4.0m in depth, risers shall be installed and properly plugged. The risers shall be firmly supported and anchored to the trench wall in all cases.

1. Pipe and Joints
   Sewer pipe shall be Polyvinyl Chloride (PVC) pipe shall be SDR 35 service pipe conforming to ASTM Specification D3034.

2. Fittings
   Sewer fittings shall conform to the pipe material being used and shall be in accordance with the corresponding manufacturer's recommended standards and specifications.

3. Plugs
   The ends of the pipe at the edge of the easement shall be sealed with plastic plugs fitted to the bell end of the pipe and braced. Blue painted marker posts shall be placed from the invert of the pipe and extend 600 mm from the design (or final) ground surface to identify the location of all plugged ends.

## 4.2 Stormwater Management General Principles and Objectives

Stormwater management is a comprehensive approach to planning, design, implementation, and operation of stormwater drainage systems. The purpose of the stormwater management approach is to develop effective drainage systems that balance the objectives of maximizing drainage efficiency and minimizing adverse environmental impacts.

The City's stormwater management objectives are as follows:

- Prevent all property damage and flooding and minimize disruption to public activity due to runoff from a 1:5-year return frequency, or more frequent rainfall event.
- Prevent significant damage, physical injury, and loss of life due to runoff from a 1:100-year return frequency, or more frequent rainfall event.
- Improve stormwater quality, through filtering of contaminants, prior to discharge to receiving watercourses and prevent erosion of the receiving watercourse.

Stormwater management involves the planning and design necessary to mitigate the hydrological impacts of land development or land use changes. Adverse hydrological impacts include increased stormwater peak flows, erosion, sedimentation, flooding, reduced surface infiltration, reduced minimum groundwater levels and stream base flows, water quality deterioration and degradation of aquatic and wildlife habitats. Mitigation measures should be implemented to minimize these adverse impacts on the watershed by incorporating tools to mimic natural (pre-development) hydrology conditions.

These methods include but are not limited to the following:

- Appropriate Land Use Planning.
- Increase permeable surface by incorporating green roofs, permeable paving, etc.
- Lot grading and landscaping to mimic the pre-development conditions.
- Appropriate sizing and routing of the drainage conveyance system.

- Incorporating storage facilities and Best Management Practices (BMPs).
- Water quality control.
- Sediment control.
- Erosion protection.

## 4.3 Dual Drainage Concept

Stormwater management plan shall include planning and design for both minor and major systems.

### 4.3.1 The Minor System

The minor system shall be an underground piped system for collection of high frequency runoff from the development area and any such areas outside the development area as may be required by definition of the overall catchment area. This system shall collect and convey runoff generated by a 1:5-year storm event.

Minor-system elements shall be designed to accommodate the rate of runoff which would occur in a 1:5-year return period rainfall event:

- Without surcharge of sewer pipes.
- With ponding of water to a depth no greater than 150mm at depressions and at drainage inlets.
- With depths of flow and ponding on roadways limited so that no over-topping of curbs occurs on local roadways, a width equivalent to one traffic lane remains free from inundation on collector roads and one traffic lane in each travel direction remains free from inundation on arterial roads.
- With stormwater quality Best Management Practices prior to discharging into piped system.

Sump pump discharge from weeping tile systems shall be collected in the minor system, or in a dedicated 'third pipe' system specifically designed to collect sump pump discharge. The 'third pipe' system shall be connected to the minor system and shall provide individual connection to each property.

### 4.3.2 The Major System

The major system shall be designed as overland flow to accommodate the 1:100-year storm. Overland conveyance in the major system shall be generally along roads, parks, and utility lots avoiding inundation of private property yet limiting flooding to depths that do not prevent vehicle access by emergency services (fire, ambulance, and police).

Major-system elements shall be designed to accommodate the rate of runoff which would occur in a 1:100-year return period rainfall event:

- With ponding of water to a depth no greater than 300mm in collector and arterial roadways and public utility lots.
- With depths not exceeding 150mm at the crown in collector and arterial roadways, with respect to the gutter elevation at the median.
- With ponding of water to a depth no greater than 200mm in local roadways.
- With depths not exceeding 50mm at the crown in local roadways

Storage elements of the major system shall be designed such that there is no overtopping of the storage facilities due to the more critical storm event applied to the catchment area serviced.

## 4.4 Stormwater Management Plan

Unless otherwise indicated, a Stormwater Management Plan is required for all new developments. The Stormwater Management Plan shall be in accordance with federal and provincial guidelines and shall conform to the Watershed and/or Master Drainage Plan.

In the absence of such plans, the following approach shall be considered and discussed with the City Engineer:

- Define design objectives and required information.
- Assessment of receiving waterbodies.
- Identify quality and environmental concerns.
- Selection of the appropriate type(s) of Best Management Practices (BMPs) and location.

The Stormwater Management Plan shall ensure that the adverse environmental and hydrological impacts of the development are minimized and shall:

- Identify pre-development drainage basins.
- Provide details indicating how the proposed development relates to its adjacent neighboring land.
- Identify and quantify upstream drainage entering the proposed development.
- Identify pre-development flows and pre-development point of discharge.
- Identify all existing flow channels and major flow paths.
- Identify the existing environmentally significant areas and resources within the proposed development including environmental classifications and/or fish presence information, if available.
- Identify the receiving waterbody(s) and its characteristics.
- Identify the impact of the proposed development on the watershed.
- Provide a conceptual lot grading plan that minimizes changes to existing topography.
- Quantify post-development flows (minor and major).
- Provide conceptual sizing and layout of the minor and major conveyance system.
- Identify the type, size, and location of stormwater management facility(s).
- Identify the required land size to accommodate the proposed stormwater management facility(s).
- Identify possible low impact development (LID) measures that can be incorporated into the proposed development. LID should not be viewed as a redundant system, but a necessary part of the integrated stormwater management system that helps to meet environmental objectives.
- Provide details of water quality enhancement measures, such as proposed source control and/or quality treatment facilities, and other BMPs.
- Provide details of hydraulic and hydrologic analyses.
- Provide hydraulic grade line (HGL) elevations for both major and minor storm events for the proposed stormwater management facility(s).
- Provide proposed minimum building elevations (MBE) and the relation to the 100-year HGL in the major flow paths.

- Provide the conceptual sizing and location of the point of discharge and/or outfall.
- Provide the erosion control mitigation measures.
- Provide construction sedimentation control plan.
- Provide any other proposed mitigation measures, if appropriate.
- Provide preliminary cost estimate.
- Identify all licensing and federal and provincial approval requirements.

Stormwater Management Plan requires approval from Alberta Environment, both under the Environmental Protection and Enhancement Act (EPEA) and the Water Act. It is the responsibility of the Owner/Applicant to get approval from Alberta Environment prior to construction.

## 4.5 Runoff Analysis

Storm drainage design shall be carried out using one or both of the following methods. Calculations are to be included and submitted with the design package.

1) Rainfall-Runoff Simulation Method: applicable to design of complex minor drainage systems, all stormwater management facility calculations and major drainage systems. The preferred computer programs are PCSWMM, SWMM and XPSWMM. Alternative models are subject to approval by the City.

2) Rational Method: applicable to preliminary design and to detailed design of minor drainage systems in urban areas where no storage facility is required. Use of the Rational Method should be limited to areas less than 65 ha. This method is not applicable if stormwater management facilities are proposed.

## 4.6 Rational Method

The Rational Method is used to quantify peak flows and quantify design flows to size the conveyance system:

$Q = CIA/360$ Where: $Q$ = peak flow in $m^3/s$
$C$ = runoff coefficient
$I$ = intensity of rainfall in mm per hour for a time equal to the time of concentration
$A$ = area of catchment in hectares (ha)

Rational Method design calculations are to be tabulated and submitted.

### 4.6.1 Runoff Coefficients

The following runoff coefficients are to be used in the Rational Formula. These coefficients are for general application only. Design values are subject to verification by the designer and approval by the City Engineer.

| Land Use | Percent Impervious | Runoff Coefficient (C) 5- and 10-Year Storm Events |
|---|---|---|
| Residential – Large/Medium Lot Single Detached (Lots > 0.49 ha) | <20% | 0.40 |
| Residential – Small Lot Single Detached | 60% | 0.60 |
| Residential – Low/Medium Density Multi-Family | 65% | 0.65 |
| Residential – High Density Multi-Family | 80% | 0.75 |
| Commercial | 90% | 0.90 |
| Light Industrial | 80% | 0.75 |
| Medium/Heavy Industrial | 90% | 0.85 |
| Institutional | 80% | 0.80 |
| Parks/Grasslands | 20% | 0.25 |
| Cultivated Fields | 30% | 0.35 |
| Woodlands/Agricultural | 5% | 0.15 |

For zonings not shown in this table, the runoff coefficient "C" and the percentage of imperviousness "Imp%" shall be estimated by the designer. This includes IR (Industrial Reserve) and IB (Industrial Buffer) UR (Urban Reserve).

When the Rational Method is used for land with multi-use and different surface types, the weighted average of the pervious and impervious area runoff coefficient shall be estimated using the following equation:

$$C = \frac{C_p A_p + C_i A_i}{A_p + A_i}$$

Where:

$C$ = runoff coefficient
$C_p$ = pervious surface = 0.10
$A_p$ = pervious area (ha)
$C_i$ = impervious surface = 0.95
$A_i$ = impervious area (ha)

For use of the Rational Method to determine peak runoff due to storms with return periods greater than a 1:5-year and 1:10-year events, the runoff coefficient shall increase accordingly. The relevant modifiers to be used for various design events factors up to a maximum of C=0.95 are:

| Design Return Period | Runoff Coefficient Modification |
|---|---|
| Greater than 1:5-year up to and including 1:25-year | multiply by 1.1 |
| Greater than 1:25-year up to and including 1:50-year | multiply by 1.2 |
| Greater than 1:50-year up to and including 1:100-year | multiply by 1.25 |

### 4.6.2 Rainfall Intensity

The rainfall intensity shall be determined by using the IDF curves that are in the current edition of the EPCOR Drainage Standards.

### 4.6.3 Time of Concentration

The time of concentration (Tc) is the time required for runoff to flow from the furthest point within the contributing catchment area under consideration to the design location. Determination of Tc requires estimation of two components, the "inlet time" (Ti) and "travel time" (Tt); Tc = Ti + Tt.

#### Inlet and Overland Flow Time

The inlet time is the time for flow from the extreme limits of the catchment to reach the first point of inflow into the defined conveyance system. It is dependent upon the imperviousness and the size of the catchment.

Typical inlet times for urban areas should not exceed 15 minutes.

#### Travel Time

The travel time is the time required for flow to travel within the conveyance system from the point of inflow to the design location.

In piped systems, travel time shall be determined based on the full flow pipe velocity in each pipe upstream of the design location.

$T_t = L/60V$ Where: $T_t$ = travel time in (minutes)
L = pipe length in (m)
V = average velocity in (m/s)

## 4.7 Simulation Method

Stormwater systems servicing areas greater than 65 ha and all stormwater systems with storage facilities shall be sized using computer modelling and simulation techniques. A list of acceptable computer programs is stated in Section 4.4 Runoff Analysis.

### 4.7.1 Model Selection

Selection of computer programs require review of the historical application of each program in watersheds similar to those under consideration. City approval of computer program selection shall be obtained before design is commenced.

The PCSWMM, SWMM and XPSWMM models are recommended to be used in the design of dual (major and minor) drainage systems. Other suitable programs may be used as approved by the City of Fort Saskatchewan. These programs must be equal to or better than the preferred programs.

### 4.7.2 Modelling Procedures

Using the proposed catchment areas, runoff hydrographs shall be calculated and used to size the conveyance system and storage facilities. Post-development hydrographs are to be determined at key points of the trunk sewer and major systems for the 5- and 100-year design storm events and for sizing of the stormwater management facilities.

Whenever possible, modelling results shall be calibrated using observed rainfall and flow data from the design watershed or a similar watershed. Sensitivity of the model predictions to variations of key parameters shall be tested and the findings used to develop realistic and conservative models.

### 4.7.3 Suggested Model Parameters

The value of runoff parameters used in the computer model, such as infiltration rates, evaporation rates, impervious and pervious roughness factors, and sufficient background information on the selection of these values shall be provided by the Owner/Applicant in the design brief.

4.7.4 Design Storm Events and Rainfall Data

The 4-hour Chicago distribution hyetographs should be used for analysis of major and minor conveyance systems by computer simulation. When the design of a stormwater management facility is involved, the 24-hour Huff distribution design hyetographs should be used.

For larger areas and urban areas with multiple detention facilities, the design storm with durations of, 12 and 24 hours should be considered for simulation. A different range of storm durations may be appropriate, subject to City approval. This will identify the critical storm event to be used in designing the system component. Note that the storm durations that generate the critical peak flow may be different from the durations that generate the critical storage volume. Systems with a number of interconnected ponds or with restricted outlet flow capacity may require analysis for sequential storm events or modelling with a continuous rainfall record.

Detailed designs shall include maximum hydraulic gradelines (HGLs) of the minor and major systems plotted on profiles of the minor system components and compared with minimum building elevations (MBE) to demonstrate flood protection.

4.7.5 Submission of Modelling Results

Modelling results are to be submitted to the City in a report containing the following information as a minimum:

- Plans showing catchment and sub-catchment boundaries, slopes, soil conditions, land uses and storage facilities.
- Name and version of modelling program(s).
- Parameters and simulation assumptions.
- Design storm details.
- Pre-development and post-development flow calculations.
- Hydraulic grade lines in the conveyance systems and storage facilities during minor and major storm events.

## 4.8 Discharge Rates

Drainage systems shall be designed to control post-development runoff so that it does not exceed the 1:100-year peak flow in pre-development conditions. Discharge rates shall be in accordance with the most recent version of Alberta Environment's Standards and Guidelines and Alberta Environment's Municipal Policies and Procedures Manual, April 2001.

## 4.9 Site and Lot Grading

4.9.1 General Grading Requirements

Grading is to comply with the Alberta Building Code and the following:

- Grade lots to drain to a municipal minor or major drainage system, natural drainage path or roadway at a minimum 2% grade. Lower grades require approval from City Engineer.
- Grade areas around buildings to direct the runoff away from foundations.
- Where lots are lower than the adjacent roadways, direct road runoff away from buildings and driveways and into a municipal drainage system.

Cross lot drainage is not permitted unless the City Engineer is satisfied that no other practical options are available. If no other options are available a utility right-of-way will need to be placed on the property titles affected noting the allowance of cross lot drainage.

The relative surface elevations must allow for the slope of the ground adjacent to the building to be at a minimum of 10% for a distance of 2.0m or to the property line whichever the smaller, on all sides of the house, with the slope directing drainage away from the building and then for reasonable slopes in the order of 2.0% from all points within the property to the property boundary at which the drainage may escape. If the distance from the building walls to the property line is less than 1.5m a minimum 15cm drop is required for all surfaces other than concrete. Refer to Drawing ST-1 Typical Lot Grading.

Public Reserves and lands shall be graded to drain toward developed streets, lanes and/or the storm sewer drainage system.

In cases where the backyard slopes towards the building, provisions are required to keep the runoff at least 2.0 m away from the rear of the building with the possibility of draining the surface water along the lot lines into the storm sewer drainage system.

Lots shall be pre-graded before Construction Completion Certificate (CCC) so there is positive drainage until a lot is developed. Pre-grade shall allow for earth balancing of future basement excavation.

Lot Grading plans submitted by the Owner/Applicant shall indicate the following information:

- Existing contours and proposed corner grades showing drainage for all multi-family residential, industrial or commercial developments.
- Minimum ground elevation at the building.
- Inverts of sanitary and storm sewer services.
- Location of water, sanitary sewer, and storm sewer connections.
- Direction of drainage showing lot grading away from buildings and on to public roadway only.
- Actual and proposed elevation of the top of the sidewalk at the corner of the property.
- Location of all street furniture (streetlights, electrical boxes, etc.)
- The proposed and existing grades for the Public lands (culverts, ditches, reserves, buffers and boulevards where applicable).

4.9.2 Lot Grading Program

All lot grading in the City of Fort Saskatchewan requires lot grading approval. The process is as follows:

- Developer and their Engineering Consultant submit subdivision grading plan to City Engineer for Approval.
- Home builder submits plot plan for individual lot to City of Fort Saskatchewan prepared by legal surveyor. City Engineer will review grading to ensure it matches approved subdivision grading plan.
- Home builder submits rough grade certificate for individual lot to City of Fort Saskatchewan (prepared by legal surveyor or professional engineer). City Engineer will review rough grading certificate and return to homebuilder indicating approval or deficiencies exist. If deficiencies exist, home builder is to correct within 60 days and submit new rough grade

certificate for review by City Engineer. The rough grade certificate submittal start date is May 1st and the end date is November 1st or first snowfall, whichever comes first. Certificates submitted after the end date will require new certificates the following year.

- Once rough grade has been approved, the homeowner has one year to complete the final landscaping and initiate final grade approval.
- Homeowner submits final grade certificate for individual lot to City of Fort Saskatchewan (prepared by legal surveyor or professional engineer). City Engineer will review final grading certificate and return to homeowner indicating approval or deficiencies exist. If deficiencies exist, homeowner is to correct within 60 days and submit new final grade certificate for review by City Engineer. The final grade certificate submittal start date is May 1st and the end date is November 1st or first snowfall, whichever comes first. Certificates submitted after the end date will require new certificates the following year.
- Homeowner will receive a copy of the Lot Grading Certificate once final grade is approved.

## 4.10 Swales

Approved drainage swales on municipal property shall be constructed prior to any development of subdivision lots. Complete swale construction shall be a prerequisite to the issuance of the construction completion certificate.

The minimum design slope for concrete swales on public property is 0.60%.

On approval by the City, grass swales with a minimum slope of 2% may be acceptable.

Drainage swales across multiple private properties are not permitted unless the City Engineer is satisfied that no other practical option is available. Where cross-lot drainage has been approved by the City, swales shall be used to convey flows. The developer will demonstrate to the City that there is no other option available.

Concrete swales to be constructed in accordance with Drawing T-18 Typical Swale Gutters. Earthen swales shall be protected from erosion by grass cover, appropriate ground cover or geotextile fabric.

## 4.11 Lowest Allowable Footing

The lowest basement footing of any building on a lot adjacent to a Stormwater Management Pond shall be a minimum of 300mm above the High Water Level and the lowest building opening shall be a minimum of 500mm above the High Water Level.

## 4.12 Piped System

In special circumstances, or to accommodate lower building elevations, the minor drainage system may be enlarged or supplemented to accommodate major flows. System details shall be included in the Stormwater Management Plan. Design considerations include:

- Provision of adequate inlets to accommodate major flows.
- The requirement for surface overflow routes at potential surface ponding locations.
- design in accordance with minor drainage system guidelines.

## 4.13 Storm Sewer Mains

Storm sewer pipes shall be sized to convey the design flow so that when flowing full, the hydraulic gradeline is at the pipe obvert.

Pipe material shall be:

| | |
|---|---|
| Concrete Pipe | CSA A257.2, sulfate resistant |
| PVC Pipe | CSA B182.2 SDR 35 |
| PVC Pipe (Ultra-Rib) | CSA B 182.4 |

**Concrete pipe should only be used for situations where trench depth and loading are a concern.

## 4.14 Storm Pipe Inlet

Stormwater pipe inlets and outfalls shall be constructed such that ground erosion is minimized. To meet this requirement, head walls, end walls, nursery sod, rip rap blanket, gabions or other approved structures may be required in constructing the inlets and outfalls. Ditch inlets to storm sewers shall include bar screens.

## 4.15 Minimum Pipe Diameter

| | |
|---|---|
| Storm Sewers | 300mm |
| Catchbasin Leads | 300mm |
| Roadway Culverts | 600mm |
| Non-Roadway Culverts | 300mm |
| Foundation Drain Main | 200mm |
| Foundation Drain Service | 100mm |

## 4.16 Alignment

Except as indicated for Curved Sewers, horizontal and vertical alignments are to be straight lines between manholes. Elevations are to be recorded.

## 4.17 Locations and Corridors

Sewers shall be located within the road right-of-way in accordance with the Roadway Cross Section Standard Drawings T-3 through to T-13.

Clearance from watermains is as indicated in Section 1.4, Schedule D.

## 4.18 Minimum and Maximum Grade

The slope of the storm sewers should be designed so that the minimum pipe velocity is 0.6m/s when flowing full. Suggested minimum design slopes are indicated below. For catchbasin leads and service connections, minimum grades are as indicated in the following sections. Where steep grades result in velocities exceeding 3m/s, appropriate measures shall be designed and implemented to prevent pipe bedding erosion and movement.

| Sewer Diameter | Minimum Design Slope |
|---|---|
| 200mm (FD) | 0.40% |
| 300mm | 0.22% |
| 375mm | 0.15% |
| 450mm | 0.12% |
| 525mm | 0.10% |
| 600mm and larger | 0.10% |

## 4.19 Curved Sewers

Where straight sewers are not possible or practical, horizontal curves may be permitted using pipe joint deflections as follows:

- minimum radius = 60m
- constant radius throughout curve
- joint deflection not to exceed 75% of maximum recommended by pipe manufacturer
- minimum design velocity = 0.9m/s
- continuous curves between manholes

Curves shall run parallel to the curb or street center line, following the road alignment and within the road right-of-way.

Minimum slopes permitted for various curved sewer sizes are as follows:

| Sewer Size | Minimum Slope |
|---|---|
| 200mm | 0.40% |
| 300mm | 0.25% |
| 375mm | 0.18% |
| 450mm | 0.15% |
| 525mm | 0.13% |
| 600mm or larger | 0.10% |

## 4.20 Pipe Depth

Storm mains shall be installed to provide a minimum depth of cover of 1.8m.

In residential areas, storm mains shall be at a depth to provide the minimum depth of cover over foundation drain services. Where minimum cover cannot be met due to the existing storm system, other frost protection measures are to be reviewed with the City Engineer.

## 4.21 Trench and Bedding

Reference Drawing W-6 Typical Trench Section and Drawing S-1 Trench Bedding Types.

## 4.22 Pipe Joints

Use watertight joints except where storm sewers are part of a subsurface collection/disposal system.

## 4.23 Groundwater Infiltration

In low areas where groundwater concentration may cause surface ponding, reduced soil stability, or cause submergence of other utilities, screened, and filtered manhole inlets or perforated and filtered sections of storm sewer pipe should be provided.

## 4.24 Manhole Design Features

Manholes shall be precast concrete and shall conform to the latest version of ASTM C478. All concrete shall be sulfate resistant.

| | |
|---|---|
| Storm Sewer Pipes ≤ 600mm | 1200mm Manhole |
| Storm Sewer Pipes > 600mm and ≤ 1050mm | 1500mm Manhole |
| Storm Sewer Pipes > 1050mm | Requires specific design |

Reference standard details for installation guidance with respect to various manhole types:

- Drawing S-2 1200mm Manhole for Piping up to 600mm
- Drawing S-3 1200mm Perched Manhole
- Drawing S-4 T-Riser Manhole
- Drawing ST-2 1200mm Catchbasin Manhole

Manholes shall be installed with ladder rungs as per Drawing S-6 Ladder Rungs. Ladder rungs to be offset from inlet and outlet. Aluminum safety platform shall be required in all manholes with a depth of 6.0m (vertical distance from rim to invert) or greater.

Frames and covers shall be of cast iron and capable of withstanding H-20 loading. F-80 manhole covers shall be used in most situations. F-39 covers shall be used in landscaped areas. Manhole covers to always include 4 holes.

All joints shall be designed and constructed to be watertight using an approved watertight sealant.

PVC mains shall be connected to manholes using either a manhole adaptor or an approved pre-benched manhole base as per Drawing S-7 1200mm Manhole Benching.

The maximum change in the direction of flow in any storm sewer manhole shall be 90°.

The maximum drop allowed across a manhole is 0.6m. If the design of the sewer system is such that the difference in elevation between the manhole inlet and outlet exceeds 0.6m, a manhole drop structure as shown on the standard detail drawings will be required.

When greater than one internal drop structure is required in a manhole, the manhole shall be a minimum of 1800mm diameter.

## 4.25 Manhole Locations

Manholes are required at the following locations:

- every change of pipe size
- every change in grade, except as indicated in the Curved Sewers section
- every change in direction, except as indicated in the Curved Sewers section
- downstream end of curved sewers
- upstream end of every sewer main
- every pipe intersection
- every catchbasin location
- 150m maximum spacing

## 4.26 Manhole Hydraulic Details

Crown elevations of inlet sewers not lower than crown elevation of outlet sewer.

Minimum drop of invert elevations across manholes:

| | |
|---|---|
| Straight Run | 30mm drop |
| Deflections | 60mm drop |

Drop manhole and ramp structures shall be avoided where possible by steepening inlet sewers. Where necessary, provide drop structures as follows:

| Invert Difference | Structure |
|---|---|
| Up to 0.25m | Inside Ramp |
| 0.25 to 0.90m | Outside Ramp |
| Greater Than 0.90m | Outside Drop |

Inside drop may be used if approved by the City of Fort Saskatchewan as per Drawing S-5 Manhole Drop Structure.

Hydraulic losses are to be calculated for manholes with significant change of grade or alignment. For high velocity flows or large pipes (> 600mm diameter) detailed analysis is required. For low velocities and smaller pipes, use the following formula:

$$H_L = k \frac{V^2}{2g}$$

Where: $H_L$ = head loss (m)
V = outlet flow velocity (m/s)
g = gravitational acceleration (9.81m/s$^2$)
k = head loss coefficient (1.0 for channeled 90° bends and tees, to 1.5 without channelized benching)

## 4.27 Catchbasins

Catchbasins shall be of sufficient number, have sufficient inlet capacities and adequate catchbasin leads to receive and convey the calculated stormwater flow. The minimum size for catchbasin leads is 300mm diameter.

| Catchbasin | Type of Inlet |
|---|---|
| F-38 | Grated for lane |
| F-51 | Combination for rectangular curb grate or curb opening |
| K-7 or DK-7 | Grated for rolled curb and gutter |
| F-39 | Landscape Areas (park spaces/grass swales/ditches) |

The capacity of a single catchbasin can be calculated using the orifice formula:

$$Q = kCA\sqrt{2gh}$$

Where: Q = inlet capacity (l/s)
k = clogging factor
C = orifice coefficient (0.006)
A = open area (cm$^2$)
g = gravitational acceleration (9.81 m/s$^2$)
h = depth of ponding (cm)

The inlet capacities for the catchbasins in a sump condition are given below. Due to the geometry of these inlets, flow through each individual opening of each grate or curb may act as flow through an orifice or flow across a weir depending on the assumed depth of ponding. Capacity of each inlet is based on the combined capacity of each opening calculated separately.

For Inlet Area, measured in $cm^2$:

| Inlet Type | Grate | Curb | Total | Neck Section Detail |
|---|---|---|---|---|
| F-38 | 1,043$cm^2$ | | 1,043$cm^2$ | Drawing ST-2 |
| F-51 | 1,845$cm^2$ | 1,161$cm^2$ | 3,006$cm^2$ | Drawing ST-3 |
| K-7 | | | 1,248$cm^2$ | Drawing ST-4 |

In order to intercept the clogging factor for the catchbasin inlets, the inlet capacity reduction factors shown below are to be applied to the theoretical inlet capacities presented above. The reduction factors are used to compensate for effects which decrease the capacity of the inlet such as debris plugging, pavement overlaying and variations in design assumptions. The reduction factors to be applied to inlets in sump conditions are:

| Inlet Type | % of Theoretical Capacity |
|---|---|
| Curb Opening | 80% |
| Grated | 50% |
| Combination | 65% |

Catchbasin spacing is to provide sufficient inlet capacity to collect the entire minor flow or major flow, if required, into the pipe system. The City will not allow spacing of catchbasins that result in the "roller coaster" effect on roadways.

Other spacing requirements include:

- Prevent overflow to driveways, boulevards, sidewalks and private property.
- Avoid interference with crosswalks.

Catchbasin and catchbasin manhole sump to be 500mm deep.

All catchbasin bodies shall be a minimum 900mm diameter precast concrete sections conforming to the latest version of ASTM C478 and constructed so as to provide a sump to trap rocks and gravel. All concrete is to be sulfate resistant.

Catchbasin leads shall be non-reinforced concrete pipe ASTM C14 Class 3 or approved PVC pipe.

The maximum surface runoff flow length along the curb and gutter is 120m for collector/ arterial roadways. 150m will be permitted for local roads.

Catchbasin shall be located at intersections in such a manner to not interfere with crosswalks or ramps. They shall be located a minimum of 600mm from the edge of a walkway, sidewalk and/or flare of a curb ramp.

Catchbasin leads shall be installed to provide a minimum depth of cover of 1.5m unless otherwise approved.

All catchbasin leads shall discharge directly into storm sewer manholes.

Minimum grade of catchbasin leads is 1.0%. Maximum length of leads to be 30m.

### 4.27.1 Wick Drain Connections

Wick drains are to be used in all local, collector, and arterial roads and are to be installed and connected to catchbasins as shown in Drawings ST-3 and ST-4. Wick drains should be cut no less than 300mm inside catchbasins and visible to City inspectors.

## 4.28 Service Connections

Each residential unit shall have a foundation drain service connection. A foundation drain service is not required for private sites.

Foundation service is to be 100mm diameter. The minimum depth of cover for foundation drain services shall be 1.8m at the property line. The foundation service shall have a 3.0m horizontal separation from any manhole or catchbasin.

Storm sewer service connections for the connection of onsite storm drainage systems and/or roof drains are to be provided to properties zoned or proposed to be zoned for commercial, institutional, industrial, and multiple residential land uses. When required service locations are known, storm service connections should be installed concurrently with the general area servicing. Otherwise, installation of connections may be deferred until the specific property development is proposed.

Foundation drain service connections to be installed in accordance with Drawing ST-6 Foundation Drain Service Connection and ST-7 Foundation Drain Service House Connection Detail. End of storm service connection to be capped and painted white as per Drawing ST-6.

All storm sewer service lines must extend 300mm beyond the easement or 2.0m from the property line on the private side. The last pipe to the property line shall be a full-length pipe; this includes the pipe segment in the easement and the required 300mm past the easement as per detail W-9 Single Service Connection and W-10 Dual Service Connection.

Roof drainage may discharge to the storm sewer where the new and existing systems are designed to accommodate the direct discharge. The Developer shall provide a capacity analysis to gain approval from the City.

Roof drain service connections are to be installed in accordance with Drawing ST-8 Roof Leader Connection to Storm Service and shall include an air gap and an allowance for runoff across the property if the line is frozen or at capacity.

Roof drains are to discharge to splash pads on landscaped areas.

Where services are required to connect to mains in excess of 4.0m in depth, risers shall be installed and properly plugged. The risers shall be firmly supported and anchored to the trench wall in all cases.

## 4.29 Surface Flow Routing and Paths

All surface flows shall have specially designed routes that are preserved and protected by right-of-ways and are accessible for maintenance. Design criteria includes:

- Where a roadway is used as a major flow path, the road grades are to be designed to accommodate and control the flow at intersections.
- Flooding is not permitted on private property except in flow channels in municipal rights-of-way.

- Overflow routes are required at all sags and low points in roadways and other surface flow routes.
- Major flood routes are required at down-slope cul-de-sacs.

## 4.30 Surface Flow Capacity

Flow capacity of road surfaces and swales can be calculated using the Manning formula. Typical values of the Manning Roughness Coefficient "n" are:

- 0.018 for paved roadway
- 0.03 for grassed boulevards and swales
- 0.04 to 0.10 for irregular or treed channels
- 0.013 for Concrete Swale

Design detail shall include consideration of flow velocities and the potential requirement for erosion control measures.

## 4.31 Road Ditches

The design criteria for road ditches are:

- A Manning's n of 0.03 shall be used for computing flows in grassed ditches.
- Road ditches shall be designed to handle the peak runoff of 1:100-year (Chicago Distribution) storm. The peak 1:100-year water level must be contained within the road ditch. No flooding of the road surface or adjacent property should occur during the 1:100-year storm.
- The minimum road ditch slope shall be 0.75% - the City may approve an exemption from these criteria if suitable justification is provided by the Owner/Applicant.
- Ditch side slopes shall not be steeper than 3:1.
- The maximum 1:100-year flow velocity within a grassed road ditch shall be 1.0 m/s - for higher flow velocities, erosion control must be provided in the ditch.

## 4.32 Culverts and Bridges

Culverts located in natural watercourses or road crossings shall be designed to convey the major flow or greater.

Culverts shall use concrete flared ends and are to be installed in accordance with Drawing ST-9 Culvert and Drawing ST-10 Culvert Backfill with appropriately sized rip rap at either end as shown on Drawing ST-11 Culvert End Rip Rap.

Hand laid rock rip rap shall consist of sound, durable rocks having at least a minimum dimension of 200mm (Alberta Transportation Class 1). The use of recycled concrete rip rap shall require approval from the City.

Aquatic habitat protection requirements must be considered for culverts in natural channels. Approvals are required under the Alberta Water Act and the federal Fisheries Act.

Culvert design is to be in accordance with the procedures outlined in an applicable design manual including but not limited to:

- American Concrete Pipe Association – Concrete Pipe Design Manual

- Corrugated Steel Pipe Institute – Handbook of Steel Drainage and Highway Construction Products

Inlet and outlet structures are required for all major system culverts. Design considerations are to include inlet control and outlet control conditions, energy dissipation and erosion control.

Culverts and channels under bridges for arterial and collector roads are to be designed to convey the 1:200-year peak flow.

## 4.33 Watercourses

Watercourses and flood plains are to be preserved and/or designed to sustain habitat for aquatic and other wildlife as well as to convey storm runoff.

Designers must consider the federal, provincial, and municipal laws, regulations and guidelines noted above and must obtain comments and approvals from the appropriate agencies.

## 4.34 Stormwater Management Facilities

### 4.34.1 Parking Lot Storage

Ponding is allowed in parking lots to store runoff. Ponding is to be located in remote areas of the parking lot, or in grass medians. Maximum ponding depth shall not exceed 150mm.

Detailed lot grading design is required to ensure proper drainage, pedestrian safety and convenience, and major flow paths for storms exceeding the design frequency.

### 4.34.2 Underground Storage

Underground storage facilities include tanks and oversized pipes with outlet controls and may be on-line or off-line. Cross sections and inlet and outlet locations shall be designed to minimize maintenance requirements.

Traffic loads and groundwater pressure should be considered in the structural design of these facilities. Maintenance access provisions are required.

### 4.34.3 Dry Detention Ponds

Dry detention ponds are storage areas designed to temporarily detain excess runoff and limit the peak outflow rate to the maximum allowable discharge rate. Designs that propose containment of runoff due to events more frequent than 1:2-years are to include special provisions to facilitate clean up, i.e., provide base structure to allow for maintenance equipment. Dry ponds may accommodate recreational uses.

Design details, unless indicated otherwise and other than discharge rates, shall be in accordance with current technologies as outlined in the Land Development Guidelines for Protection of Aquatic Habitat (Canada), and Stormwater Management Guidelines for the Province of Alberta and related documents.

The design schematic for a dry pond is generally as shown in Drawing ST-12 Dry Pond. Dry ponds are to be isolated from any downstream infrastructure or water body until issuance of the Construction Completion Certificate (CCC). Water retained in the dry pond during construction shall be allowed to be used for construction activities until issuance of the CCC.

#### Depth of Ponding

The maximum live storage limit in a dry pond shall be 3.0m measured from the invert elevation of the outlet pipe.

#### Side Slopes

Side slope requirements are to be generally as shown in Drawing ST-12 Dry Pond.

The dry pond shall have a minimum side slope of 5:1. side slopes subject to inundation upon filling of the dry pond shall have a maximum slope of 7H:1V within private property and a maximum slope of 5H:1V within public property.

#### Freeboard

The lowest basement footing of any building on a lot adjacent to a Stormwater Management Pond shall be a minimum of 300 mm above the High Water Level and the lowest building opening shall be a minimum of 500 mm above the High Water Level.

#### Inlet and Outlet Structures

Inlet and outlet structures associated with dry ponds shall have grates provided over their openings to restrict access. A horizontal bar orientation, along with a maximum clear bar spacing of 100 mm shall be used for gratings.

Grated outlet structures are to be designed with a hydraulic capacity of at least twice the required capacity to allow for possible plugging. Further, the arrangement of the structures and the location of the grating shall be such that the velocity of the flow passing through the grating does not exceed 1.0 m/s. Appropriate fencing and guard rails are to be provided to restrict access and reduce the hazard presented by headwalls and wing walls.

The inlet and outlet should be physically separated around the perimeter of the dry SWMF. The inlet and outlet should be distanced as far as possible from each other to avoid hydraulic short-circuiting.

#### Dry Pond Bottom Grading and Drainage

The dry pond shall be graded to properly drain all areas after its operation. The pond bottom shall have a minimum slope of 0.7% and a slope of 1.0% or greater is recommended where feasible. Later slopes shall be 1.0% or greater. French drains or similar may be required where it is anticipated that these slopes may not properly drain the dry pond bottom, or where dictated by multiple use or other special considerations.

### 4.34.4 Wet Detention Ponds

The purpose of wet ponds is to temporarily store stormwater runoff in order to promote the settlement of runoff pollutants and to attenuate peak flows to reduce potential downstream impacts, flooding and erosion.

Design details, unless indicated otherwise and other than discharge rates, shall be in accordance with current technologies as outlined in the Land Development Guidelines for Protection of Aquatic Habitat (Canada), and Stormwater Management Guidelines for the Province of Alberta and related documents.

When a choice is necessary between using one large pond as an alternative to two or more smaller facilities, one of which would have an area of less than 2 ha at normal water level, then one pond is to be used. This is to discourage proliferation of large numbers of small ponds and higher maintenance costs.

The design schematic for a wet pond is generally as shown in Drawing ST-13 Wet Pond Profile View and Drawing ST-14 Wet Pond Plan View. Wet ponds are to be isolated from any downstream infrastructure or water body until issuance of the CCC. Water retained in the wet pond during construction shall not be used for any development or construction activities.

### Depth of Ponding

The minimum depth from normal water level to pond bottom shall be 2.5m. Provide a channel with a 3.0m bottom width at a depth of no less than 1.0m between the forebays, permanent pool and outlet pools.

### Side Slopes

Side slope requirements are to be generally as shown in Drawing ST-14 Wet Pond Profile View.

Areas normally or infrequently covered by water, from the design high water level down to a point 1.0m below the normal water level, shall have a maximum slope of 7H:1V. This is to include all overflow areas. Where confined space or extremes of topography dictate, limited areas within overflow areas located on Public utility and Walkway lots may be graded with a slope of 5H:1V, Proposals to amend the slope requirements are approved by the City on a site specific basis.

A maximum slope of 3H:1V or a minimum slope of 5H:1V shall be used from the 1.0 depth point (below the normal water level) to the pond bottom. This is to minimize the area of shallow water when the wet pond is at normal water level, to discourage the growth of unwanted vegetation.

### Freeboard

The lowest basement footing of any building on a lot adjacent to a Stormwater Management Pond shall be a minimum of 300mm above the High Water Level and the lowest building opening shall be a minimum of 500mm above the High Water Level.

### Inlet and Outlet Requirements

Inlets and outlets are to be fully submerged, with the crown of the pipe at least 1.0 m below normal water level. Inlet and outlet pipe inverts are to be a minimum 100 mm above the pond bottom.

The invert elevation of the inlet pipe(s) to the first manhole upstream from the wet pond shall be at or above the normal water level of the wet pond to avoid deposition of sediments in the inlet to the wet pond. To avoid backwater effects in the upstream sewers the obvert of the inlet sewer at the first manhole upstream from the wet pond shall be at or above the wet pond level for the 1:5-year storm. A drop structure upstream from the wet pond is generally required to achieve this. Inlet and outlet control calculations are required to verify the mode of operation of the inlets.

The inlet and outlet shall be physically separated and be located at the perimeter of the facility. The inlet and outlet shall be distanced as far as possible from each other to avoid hydraulic short-circuiting. Settlement time of particles shall be less than the travel time for water in a wet pond.

### Wet Pond Bottom Material

For areas where the ground water table is below the NWL, the wet SWMF bottom and side slopes are to be composed of impervious material with a suitably low permeability (e.g., with a permeability coefficient in the order of 1 x 10-6cm/s).

For areas where the ground water table is expected to be near or above the NWL, the wet pond bottom may be of a pervious material as dictated by geotechnical considerations.

### Maintenance Access Requirements

All-weather vehicle access must be provided to all wet pond outlet controls and works. An all-weather vehicle access route shall also be provided to the edge of all wet SWMFs suitable to carry maintenance vehicles and for use as an equipment access point. Equipment includes vehicles, boats, or barges. The design of equipment access points shall include convenient access from roadways to existing trails leading to the pond. Equipment access route shall be constructed to avoid conflict with inlet/outlet structures and landscaping (trees, benches, waste receptacles and signs). Hard surface equipment accesses are discouraged to prevent public access to the ponds.

## 4.34.5 Constructed Wetlands

Constructed stormwater wetlands are human-made systems, designed, constructed, and operated to emulate natural wetlands or many of their biological processes. They are generally shallow impoundments, planted with emergent rooted vegetation or colonized naturally by volunteer plant species. They may be designed to provide detention storage as well as treatment to improve stormwater quality.

Design details, unless indicated otherwise and other than discharge rates, shall be in accordance with current technologies as outlined in the Land Development Guidelines for Protection of Aquatic Habitat (Canada), and Stormwater Management Guidelines for the Province of Alberta and related documents.

When a choice is necessary between using one large pond as an alternative to two or more smaller facilities, one of which would have an area of less than 2 ha at normal water level, then one pond is to be used. This is to discourage proliferation of large numbers of small ponds and higher maintenance costs.

The design schematic for a constructed stormwater wetland is generally as shown in Drawing ST-15 Constructed Wetland and Drawing ST-16 Wetland Profile View.

### Depth of Ponding

The live storage zone is located between pond normal water level (NWL) and high-water level (HWL), and is sized to contain all runoff directed to the pond during the 1:100-year, 24-hour Huff Distribution design event (127.3mm of precipitation), less water discharged during the event – some design considerations include:

- The greater the vertical height of the live storage zone the less land required for the pond.
- As there are no design standards governing the vertical distance between NWL and HWL, there is flexibility to size ponds in a manner that is impacted by factors such as upstream and downstream vertical constraints, land minimization, aesthetics, geotechnical considerations, and the presence of walk-out basements.

Areas of water below NWL, are known as the dead storage zone, and are intended to remain inundated with water both during and between storm events, with small fluctuations expected because or evaporation, evapotranspiration, and groundwater infiltration.

A variety of water depths, 0.1m to 0.6m with an average permanent water depth of 0.3m, are required to encourage emergent vegetation. Deep water areas, i.e., greater than 2m, are to be limited to less than 25% of wetland surface. Water level fluctuation in excess of 1 m above NWL should be infrequent to prevent killing of the vegetation.

#### Length/Width Requirements

The minimum length to width ratio should provide an effective flow path length at low flow that is three times the relative wetland width to increase the residence time. Incoming water should be well distributed throughout the land and be conveyed as sheet flow to optimize treatment.

#### Side Slopes

Side slope requirements are to be generally as shown in Drawing ST-16 Wetland Profile View.

Slopes shall be 5H:1V or flatter to support larger areas of wetland vegetation. Side slopes around the accessible deep areas in sediment forebay and permanent pool areas shall be a maximum of 7H:1V.

#### Freeboard

The lowest basement footing of any building on a lot adjacent to a Stormwater Management Pond shall be a minimum of 300mm above the High Water Level and the lowest building opening shall be a minimum of 500mm above the High Water Level.

#### Inlet and Outlet Requirements

Inlets and outlets should be located to avoid hydraulic short-circuiting and maximize the flow path. The maximum depth in the inlet and outlet areas is restricted to 3.0m. Inlets and outlets are to be fully submerged, with the crown of the pipe at least 1.0m below normal water level. Inlet and outlet pipe inverts are to be a minimum 100mm above the bottom.

#### Forebay

A forebay is required at each major inlet, to trap suspended solids before stormwater enters the constructed wetland.

#### Outlet Control Structure

The outlet control structure shall be designed to be robust and fixed, with no moving parts, and operate as follows:

- A weir with its crest set at NWL both maintains NWL during dry periods, and provides increased drawdown back to NWL following runoff events, especially at lower pond levels.
- An outlet orifice, located downstream of the NWL weir, is sized to release maximum allowable discharge rates when the water levels in the pond are at HWL, and is located somewhat below the outlet weir for optimum discharge capacity at all pond operating levels.
- An emergency overflow weir is provided at pond HWL to provide increased discharge through the outlet pipe system for brief periods during emergency conditions where the event exceeds the design event, as a means of minimizing the increase in pond level above HWL.

### 4.34.6 Water Quality

Stormwater management facilities can be an effective treatment for sediment control. To provide the necessary runoff quality treatment, SWMF must be sized to provide a minimum 85% removal of TSS for particle sizes greater than, or equal to, 75 µm as stated in the most recent Alberta Environment's Municipal Policies and Procedures Manual. As well, a minimum volume equal to 25mm over the entire catchment area times the overall catchment imperviousness ratio (25mm x catchment area x catchment imperviousness ratio) is required for the permanent pool for wet pond water quality requirements. The more conservative of the two shall govern. A minimum detention of 24 hours must also be provided.

Runoff quality shall be in accordance with the most recent version of Alberta Environment's Standards and Guidelines and Alberta Environment's Municipal Policies and Procedures Manual. Quality treatment facilities include, but are not limited to, oil/grit separators for service stations, silt traps, detention storage facilities, enhanced swales and constructed wetlands. Designs are to comply with the requirements of the City, regional, provincial, and federal statutes and guidelines as noted above.

For new and re-developed areas, all stormwater runoff shall be treated prior to discharge to receiving watercourses.

For new industrial developments, stormwater quality treatment is required prior to discharge into any existing storm drainage system.

The City does not consider dry ponds as a treatment facility for water quality improvement and shall not be accepted unless the Developer provides a wet pond downstream of the dry pond.

Treatment facilities shall include provisions for maintenance equipment access.

4.34.7 Outlet Controls

Outlet controls for storage facilities may be designed using the standard Orifice and Weir equations:

Orifice Equation:

$Q = CA(2gh)^{0.5}$ Where: Q = release rate ($m^3/s$)
C = orifice coefficient (0.62 for sharp or square edge)
A = area of orifice ($m^2$)
g = gravitational acceleration (9.81 $m/s^2$)
h = net head on orifice (m)

Weir Equation:

$Q = CLH^{1.5}$ Where: Q = release rate ($m^3/s$)
C = weir coefficient
L = effective length of weir crest (m)
H = net head on weir crest (m)

Large storage facilities are to include provisions for discharges at rates greater than the design release rate. Rapid drawdown of the water level may be necessary for emergency purposes or to restore the available storage to accommodate subsequent storm events.

Provisions to accommodate higher discharges will involve oversizing the fixed openings and sewers connected to the control structure. Adjustable mechanisms such as slide gates or removable orifice plates can be used to regulate design release rates. The extent of the oversizing will depend on the capacity of the downstream drainage system.

Design of inlet and outlet structures is to include consideration of energy dissipation and erosion control. Safety grates are required over all inlet and outlet openings 500mm or larger. Locks for access hatches are required.

Grated outlet structures are to be designed with a hydraulic capacity of at least twice the required capacity to allow for possible plugging. Further, the arrangement of the structures and the location to the grating shall be such that the velocity of the flow passing through the grating will not exceed 1.0m/s.

4.34.8 Biofiltration Swales

These facilities are intended to provide biofiltration and sediment removal and may be designed to provide detention storage as well as treatment to improve stormwater quality.

Design details, unless indicated otherwise and other than discharge rates, shall be in accordance with current technologies as outlined in the Land Development Guidelines for Protection of Aquatic Habitat (Canada), and Stormwater Management Guidelines for the Province of Alberta and related documents. A typical schematic is shown in Drawing ST-17 Bio-Swale.

Biofiltration swales must be designed by a qualified professional and must take into consideration site suitability and growth environment for vegetation.

Media Layers

- If a mulch layer is used, the mulch shall be long, fibrous non-floatable organic mulch. Non-floating mulch should be composted and a blend of fine and coarse bark and must be aged a minimum of 4-6 months. The depth of the mulch during establishment should be 80mm or as determined by the designer. A compostable netting may be used to stabilize mulch during establishment of vegetation. Mulch is not required if sufficient ground cover is proposed.
- The LID growing soil media shall have a minimum depth of 500 mm unless it is not feasible due to site constraints. The LID soil media specification provides a range of values for each parameter. It is at the discretion of the engineer and the landscape architect to determine the exact value and whether any additional tolerances are allowed outside the standard ranges for a specific project.

  LID soil media specifications:

| Parameter | Values |
|---|---|
| Texture classification | Loamy Sand; Sandy Loam |
| Sand sized particles, larger than 0.05 mm diameter and smaller than 2 mm diameter | 60% - 80% |
| Silt | 10% - 25% |
| Clay | 5% - 15% |
| Silt and clay combined | Maximum 40% |
| Organic matter | 5% - 10% |
| pH Value | 6 - 8 |
| Available Phosphorus | 10 - 50 ppm |
| Saturated hydraulic conductivity, at soils specified compaction and moisture | Minimum 40 mm/hr |

Note: All % are in dry weight.

- The filter layer is 100mm depth with 14mm washed rock with less than 0.1% silt. If used, the granular filter layer around the facility should have a minimum thickness of 100mm with 14mm washed rock and less than 0.1% silt. Where situations permit, a greater depth may be applied.
- The drainage layer is a minimum of 400mm in depth with 25mm - 40mm angular crushed rock containing less than 0.1% silt.

Underdrain Perforated Pipe

- All piping must be smooth, rigid, PVC pipe with a minimum 200mm diameter.
- Each separate piping line must include a manhole or catchbasin to allow for cleaning/flushing of the pipe. Catchbasin style cleanouts may also count as a piping lines catchbasin if they're within 4m of an accessible surface. The maximum space between cleanouts or a cleanout access point (such as a manhole or catchbasin) is 150m if there are no bends in the section of the pipe. If bends are required between the cleanout and cleanout access point, the maximum permitted spacing is 30m.
- There must be 400mm of straight pipe immediately exiting a catchbasin or manhole before there is a bend.

4.34.9 Mechanical Treatment Units and Oil and Grit Separators

It is the responsibility of the Owner/Applicant to meet established quality guidelines. If site discharge does not satisfy the criteria outlined by Alberta Environment, the Owner/Applicant may pursue the implementation of mechanical treatment units and/or oil and grit separators. Design details to be provided by supplier of proprietary system or by designer of equivalent and should be stamped by a Professional Engineer.

The owners of all premises in which vehicles or equipment are:

- Serviced
- Fueled
- Repaired
- Disassembled
- Washed

Or shopping centers with parking areas larger than 1 ha must install an oil, grease, and sand interceptor.

All oil, grease, and sand interceptors shall be of sufficient capacity and appropriate design based on the nature of the premises and shall meet AEP guidelines, City bylaws, or these standards, whichever are more stringent.

All interceptors must be installed either:

a) On all fixtures that may release oil, grease, or sand; or
b) Downstream of all fixtures that may release oil, grease, or sand.

The City will require Oil and Grit Interceptors (OGI) be installed in a new residential subdivision where the site discharges to a natural drainage course without prior treatment.

The City will require OGIs be installed on new or redeveloped commercial, institutional, and industrial sites larger than 0.4 ha. The City Engineer reserves the right to enforce OGIs on any site at their discretion.

Even in the presence of a stormwater management facility prior to release to the natural drainage course, the City may require OGIs to be installed within a development at the discretion of the City Engineer. Development scenarios are evaluated on a case-by-case basis and consider site specific factors including, but not limited to, upstream drainage contributions from collector or arterial roadways, business types, presence or storage hydrocarbons, hours of operation, total parking area, and location within the overall stormwater infrastructure system.

OGIs shall use the hydraulic energy of the conveyed stormwater to separate, trap, and store stormwater pollutants.

OGIs must be capable of trapping fine sand, silt, clay, and organic particles in addition to larger sand and gravel particles, and small floatables.

OGIs shall be capable of removing 85% of the average annual total suspended solids (TSS) load and 95% of the floatable free oil without scouring previously captured pollutants.

The Design shall provide calculations substantiating removal efficiencies and shall include correlation to field monitoring results for the proposed OGI system.

OGIs shall be installed in a location that is accessible for maintenance vehicles. Where remote OGI locations are proposed the City will require a pathway with sufficient width and structural integrity to provide maintenance equipment access.

Nothing in this section exempts the Developer from complying with all applicable municipal, provincial, or federal legislation or standards. The City also reserves the right to request additional treatment if stormwater discharge is deemed unacceptable.

4.34.10 Erosion and Sediment Control

Erosion and sediment control measures are required for land development activities such as clearing, grading, road construction, excavation and stockpiling of excavation and backfill materials.

Design details to be in accordance with current technologies as outlined in Surface Water Quality Guidelines for Alberta and related documents.

Erosion and Sedimentation Control (E&SC) plans are required to define all procedures intended to control such during both the construction and all maintenance periods. The following shall be included in the E&SC plans:

1) Limits of soil disturbance.
2) Construction details (installation, inspection, and maintenance guidance notes and schematics) of all E&SC measures to be installed during the project complete with supporting RUSLE calculations. Details must be specific to each phase of construction and must be indicated when they will be installed and removed. Separate phased drawings may be required.
3) The locations and dimensions of existing storm infrastructure onsite and for the surrounding area (i.e., catchbasins, storm pipes, drainage swales, storm water ponds).
4) Details on how the new storm infrastructure onsite will be isolated from any downstream infrastructure during construction up until the issuance of the CCC.
5) Details on how sediment will be managed between the issuance of the CCC and the Final Acceptance Certificate (FAC) for all new storm infrastructure onsite.
6) Erosion control matting or approved equal on slopes steeper than 4:1, and any other area where excessive erosion may occur.
7) Location and details of stabilized construction entrance to limit tracking of sediment offsite.
8) Stockpiles shall be clearly marked on the drawings. Protection measures for stockpiles shall be provided depending on locations and proximity of sediment transport to surrounding areas.

9) Details for implementation of landscaping and other practices, if required, for permanent site stabilization (i.e., erosion control blankets, turf reinforcement mats, seeding, sodding, retaining walls, riprap, and paving).

10) The following notes should be added directly to all E&SC drawings:

    a. Prior to construction start-up, it is mandatory for the project proponent or prime contractor to schedule a pre-construction meeting to discuss scheduling, roles and responsibilities, stabilized entrances, temporary storage facilities, pollution, and all existing and future E&SC practices to be implemented.

    b. The following information must be on-site and available upon request:

        i. The E&SC report and/or drawings, including any amendments.
        ii. Documentation (including photos and inspection records) detailing implementation and maintenance of E&SC practices.

    c. Inspections of all E&SC practices must be completed and documented at a minimum of every seven (7) days or as outlined in the E&SC Guidelines, as well as at all critical times when erosion and sediment releases could occur (inspections must be completed and documented within 24 hours of significant snowmelt and heavy and/or prolonged rainfall events).

    d. Deficiencies documented during the inspection of E&SC practices must be corrected within fourteen (14) days, and maintenance documented.

    e. Prior authorization is required by the City for pumping or directing impounding surface water and/or groundwater into a storm sewer. Please contact the City Engineering Department for information regarding dewatering.

    f. In the event of unexpected offsite release, incident must be reported to the City within 24 hours of occurrence.

    g. Developers and property owners are responsible for Erosion and Sediment Control until all improvements have been issued a FAC or as outlined in the E&SC Guidelines.

    h. The City reserves the right to require additional E&SC measures or remediations as deemed necessary which may potentially result in extended maintenance period.

All temporary or interim erosion and sediment control measures used during construction shall be removed when no longer needed and prior to FAC.

### 4.34.11 Drainage Pump Stations

Drainage pump station guidelines are not included in this manual.

Where drainage pumping is required, the designer must review the design concept and proposed guidelines with the City Engineer, submit a pre-design report and obtain approval before proceeding with the design.

Approval may be granted by the City for the use of a siphon in place of a lift station.

### 4.34.12 Interim Stormwater Management Facilities

The design for all storm sewer extensions shall include the necessary provisions for further extensions to future developments in accordance with the standards and definitions set out by the City of Edmonton (EPCOR) Stormwater Management and Design Standards.

The design must also account for the interception, conveyance, and storage requirements as necessary to accommodate runoff flows from undeveloped contributory areas for the indefinite future or for an interim period until development of those areas occurs. This shall include infrastructure for temporary pumping and/or flow control. Temporary infrastructure is to be removed and impacted areas restored when no longer required.

## 4.35 Low Impact Development

The City encourages or may require the use of low impact development (LID) facilities. LID facilities can help a development achieve a release rate, water quality, or volume control target. Possible LID facilities include, but are not limited to the following:

- Bioretention Garden
- Bioretention Basin
- Box Planter
- Soil Cell

Design considerations shall comply with the standards presented in the City of Edmonton (EPCOR) Stormwater Management and Design Standards. Other standards or best practices published by a credible organization may be followed or referenced if approved by the City.

All LID facilities must be labelled as LID on drawings.

If the Developer's Engineer can prove a reduction in stormwater runoff volume or a stormwater treatment benefit from implementation of (LID) facilities, the City will consider possible modifications to the overall storm system requirements.

## 4.36 Inspections

Final inspections for issuance of FAC are to be completed a maximum of 60 days prior to eligible expiry of the maintenance period.

### 4.36.1 Storm Sewer

All inspections shall be conducted using closed circuit television (CCTV) camera equipment. The inspections shall be performed in accordance with the standard practices as set forth in NASSCO references.

The captured video shall be in colour and display on screen the Lot and Block numbers of all service connectors. The rate of camera progression shall not exceed 6m per minute. The inspections and reports shall include both the main, and at a minimum, a pan and tilt at each service connection.

The Developer is responsible for cleaning and flushing all lines, catchbasins, and manholes to facilitate CCTV inspections. Sewer lines to be cleaned utilizing low pressure flushing. Sludge, dirt, sand, and other debris resulting from the cleaning operations shall be removed from the downstream manhole of the section being cleaned. Passing material from the section being cleaned to the downstream sewer section shall not be permitted.

The CCTV inspections shall be performed prior to the issuance of the Construction Completetion Certificate (CCC) and within 120 days of the Final Acceptance Certificate (FAC). Manhole and catchbasin sumps must be emptied prior to CCC and FAC inspections. If deficiencies are found during the inspection, the Developer shall be required to correct them before the CCC and/or FAC are issued.

All mains and laterals, including all catchbasin leads, shall be required to undergo a CCTV inspection.

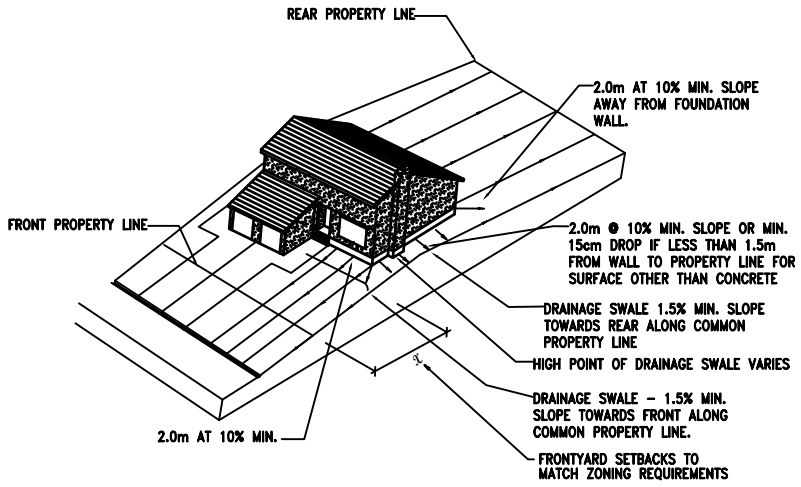
4.36.2 Dry Ponds, Wet Ponds, and Constructed Wetlands

Pond and wetland surveys shall be completed at CCC and FAC to confirm normal water level, water depth, sediment depth, inlet/outlet inverts, and overflows. A complete water quality testing is to be completed to provide required information if the pond or wetland is submerged prior to CCC and FAC inspections. A complete bathymetric survey will also be required for FAC inspections. All survey results are to be provided to the City for review and acceptance prior to issuance of the CCC and FAC certificates.

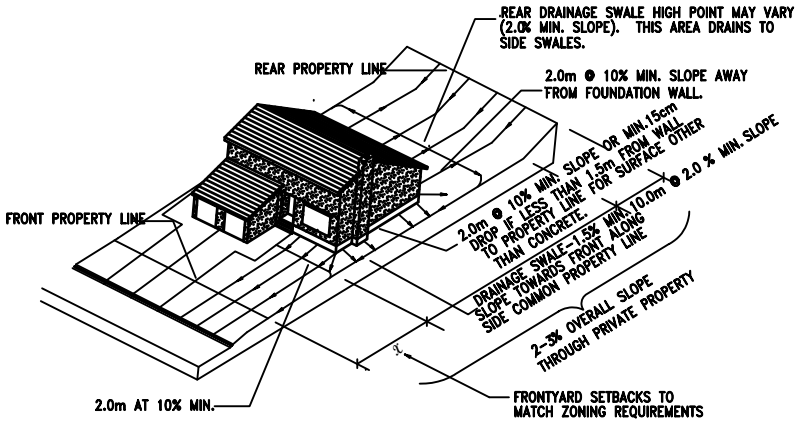
## 4.37 List of Standard Drawings

ST-1 Typical Lot Grading
ST-2 1200 mm Catchbasin Manhole
ST-3 900 mm Catchbasin with Type F-51 Grating and Frame
ST-4 900 mm Catchbasin with Type K-7 Grating and Frame
ST-5 Wick Drain Detail
ST-6 Foundation Drain Service Connection
ST-7 Foundation Drain Service House Connection Detail
ST-8 Roof Leader Connection to Storm Service
ST-9 Culvert
ST-10 Culvert Backfill
ST-11 Culvert End Rip Rap
ST-12 Dry Pond
ST-13 Wet Pond Profile View
ST-14 Wet Pond Plan View
ST-15 Constructed Wetland
ST-16 Wetland Profile View
ST-17 Bio-Swale

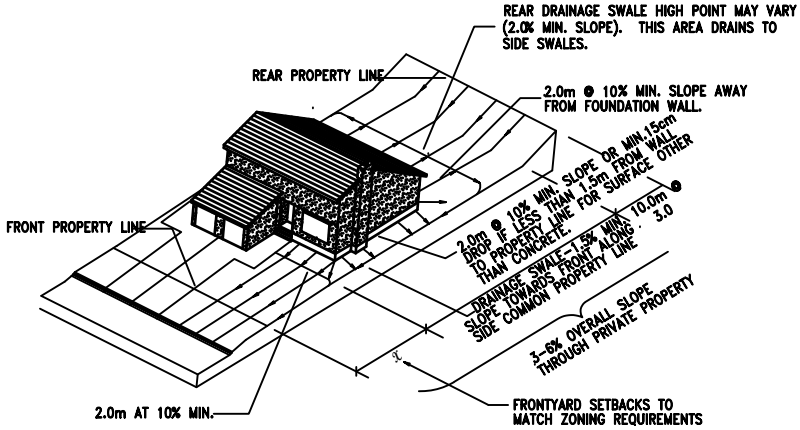
See water section detail W-6 for Typical Trench Section
See water section detail W-9 for Single Service Connection
See water section detail W-10 for Dual Service Connection
See sanitary section detail S-1 for Trench Bedding Types
See sanitary section detail S-2 for 1,200 mm Manhole for Piping up to 600 mm
See sanitary section detail S-3 for 1,200 mm Perched Manhole
See sanitary section detail S-4 for T-Riser Manhole
See sanitary section detail S-5 for Interior/Exterior Manhole Drop Structure
See sanitary section detail S-6 for Ladder Rungs
See sanitary section detail S-7 for 1,200 mm Manhole Benching
See transportation section detail T-18 for Typical Swale Gutters




**1.5% OVERALL SLOPE – LOT TYPE D**
**SPLIT SURFACE DRAINAGE**




**2–3% OVERALL SLOPE – LOT TYPE A**
**REAR TO FRONT SURFACE DRAINAGE**



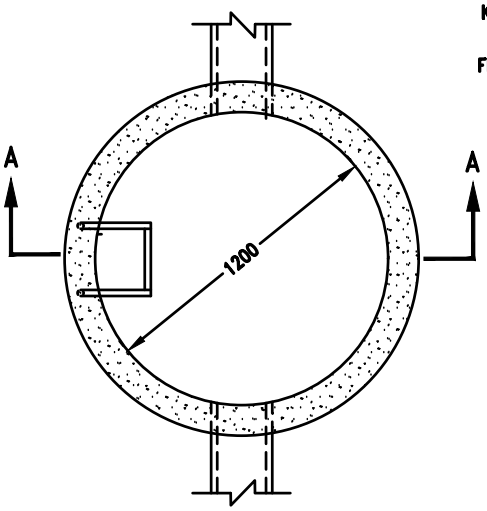

**3–6% OVERALL SLOPE – LOT TYPE B**
**REAR TO FRONT SURFACE DRAINAGE**

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

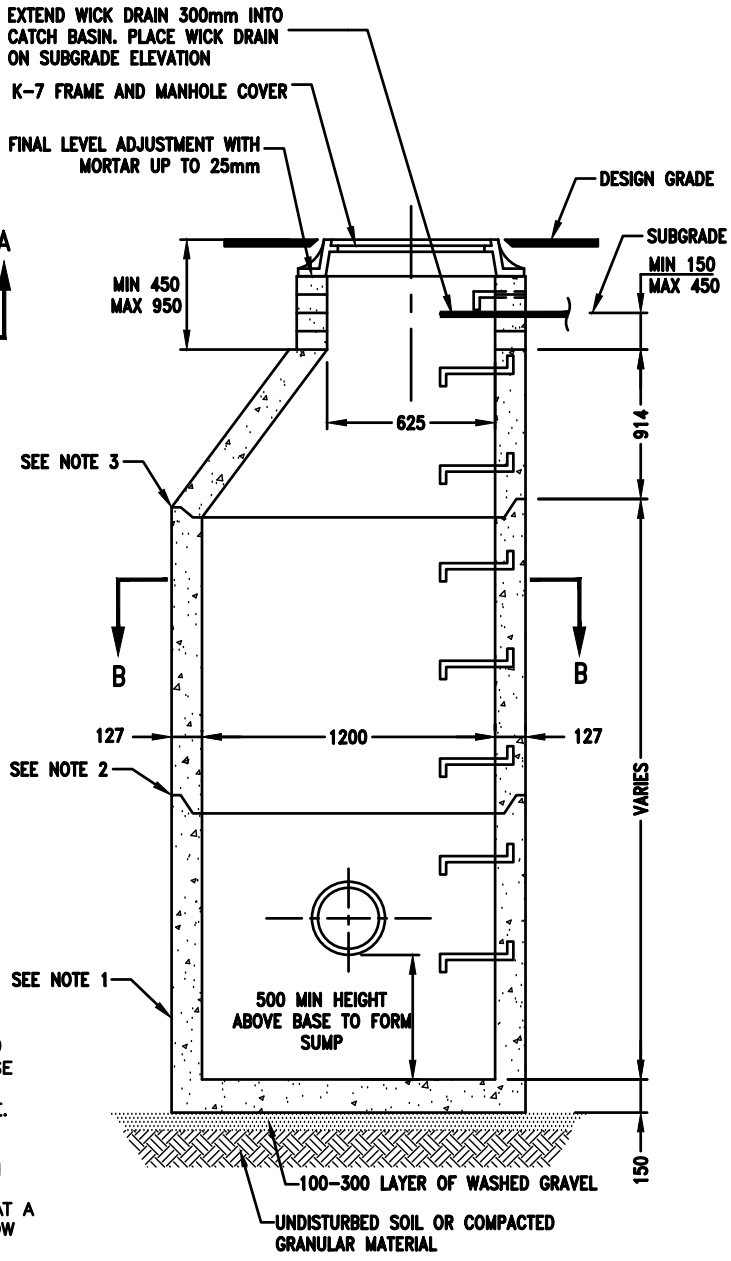
# TYPICAL LOT GRADING

CITY OF FORT SASKATCHEWAN

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–1 |
| NOT TO SCALE | DRAWN: DF | |




SECTION B – B




SECTION A – A

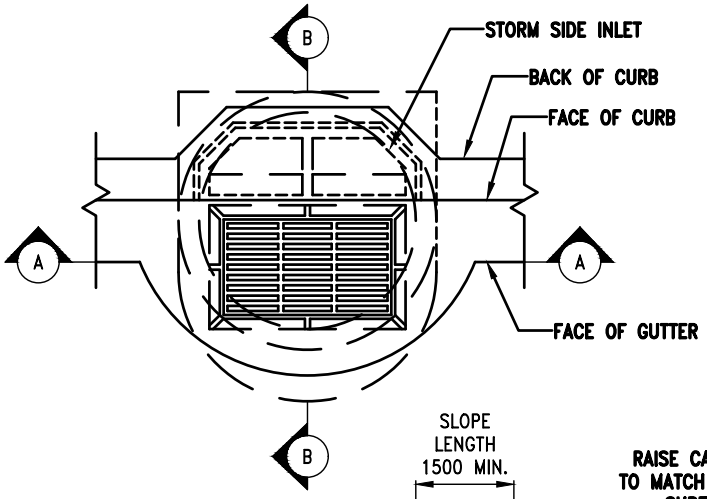
NOTES:

1. CAST-IN-PLACE CONCRETE BASE TO BE TYPE 50 UNIT COULD BE MADE UP FROM TWO ITEMS (BASE AND BARREL).
2. OPPOSITE ORIENTATION OF JOINTS IS ACCEPTABLE.
3. SANITARY MH JOINTS TO BE SEALED WITH A CONFINED O-RING GASKET, ASTM C445.
4. INLET AND OUTLET PIPES TO BE GROUTED FLUSH WITH WALL.
5. SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 400mm APART TO WITHIN 300mm BELOW COVER AND TO WITHIN 300mm OF THE BASE OR BENCHING. STEPS TO BE EPOXY COATED EXTRUDED ALUMINUM OR GALVANIZED METAL.
6. COMPACT BACKFILL AROUND MH TO A MIN. OF 98% STANDARD PROCTOR DENSITY.
7. SEE ST-5 FOR WICK DRAIN DETAIL

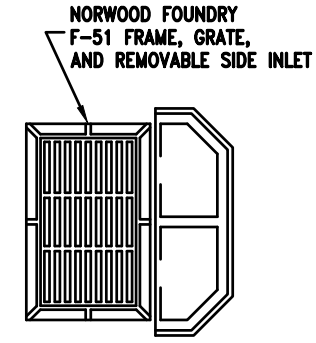
F-38 FRAME AND COVER IN ALLEYS
F-39 FRAME AND COVER IN LANDSCAPED AREAS.
F-51 FRAME AND COVER FOR STRAIGHT FACE CURB
k-7 FRAME AND COVER FOR ROLLED FACE CURB

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

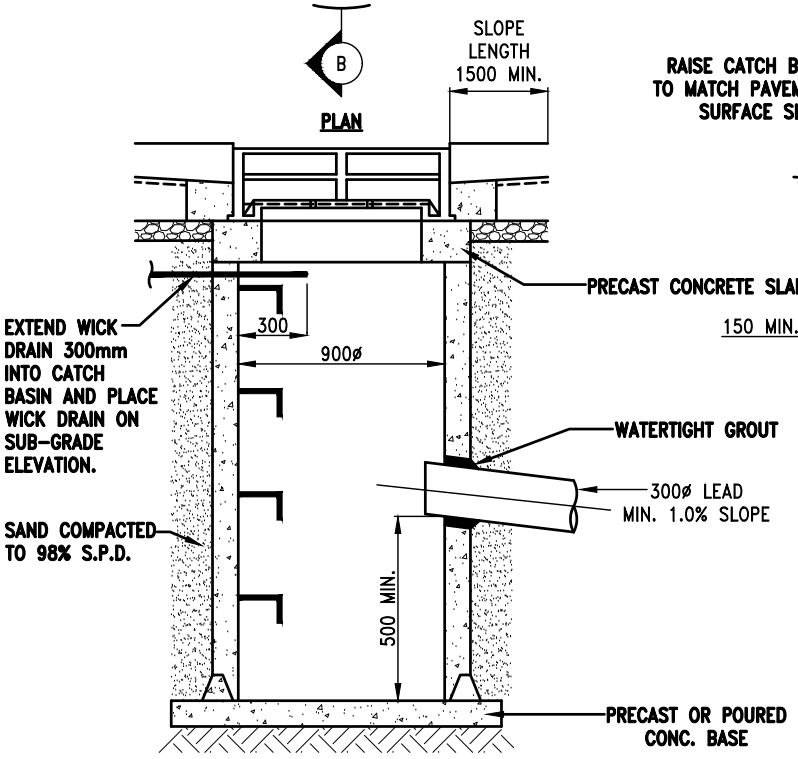
| 1200mm CATCHBASIN MANHOLE | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST-2 |
| NOT TO SCALE | DRAWN: DF | |



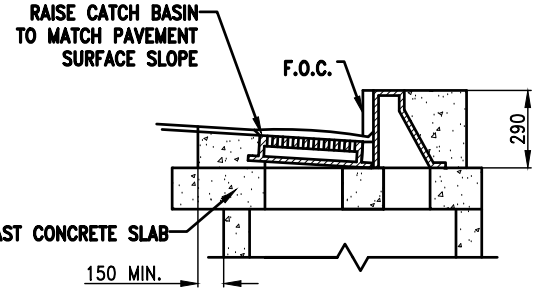

PLAN




PRECAST TOP




SECTION A




SECTION B

**NOTES:**

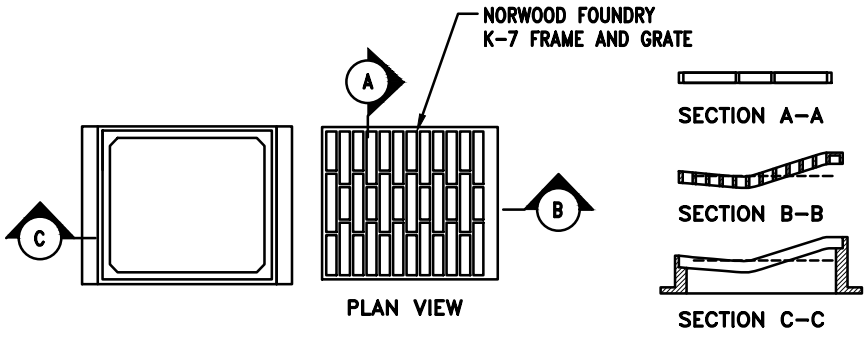
1. SAFETY STEPS TO BE SPACED AT 400 MAX. DISTANCE. FIRST STEP TO BE 150 MAX. BELOW FRAME, LAST STEP TO BE 300 MAX. ABOVE BENCHING.
2. PRECAST CONCRETE COMPONENTS TO MEET CURRENT A.S.T.M. C478 STANDARDS
3. CAST IN PLACE CONCRETE TO BE 25 MPa AT 28 DAYS.
4. ALL JOINTS TO BE SET WITH RUBBER GASKET WITH NON-SHRINK GROUT INSIDE AND OUTSIDE FOR FULL CIRCUMFERENCE. THIS INCLUDES JOINTS BETWEEN GRADE RINGS, GRADE RINGS AND FRAMES, AND BETWEEN GRADE RINGS AND SLAB TOPS.
5. PRECAST CONCRETE BASE THICKNESS AND REINFORCEMENT MUST BE DESIGNED FOR THE SPECIFIC CATCHBASIN DEPTH AND SOIL CONDITIONS.
6. JOINTS BETWEEN GRADE RINGS, GRADE RINGS AND CONES, AND BETWEEN RINGS AND FRAMES MUST BE WATERTIGHT. RAM NECK MATERIAL FINISHED WITH NON-SHRINK GROUT MAY BE USED IF WATERTIGHT JOINTS CAN BE ACHIEVED.
7. WICK DRAINS TO CONNECT TO CATCH BASIN SUCH THAT JOINTS ARE WATERTIGHT.
8. POURED CONC. 30 MPa TYPE 50 CONCRETE.
9. MARK 'T' ON TOP OF SLAB.
10. ALL BACKFILL COMPACTED TO 98% S.P.D.
11. ALL RINGS TO BE GROUTED TO A SMOOTH SURFACE.
12. MINIMUM DEPTH OF COVER ON CATCHBASIN LEAD IS 1.5m.
13. SEE DETAIL ST-5 FOR WICK DRAIN DETAIL

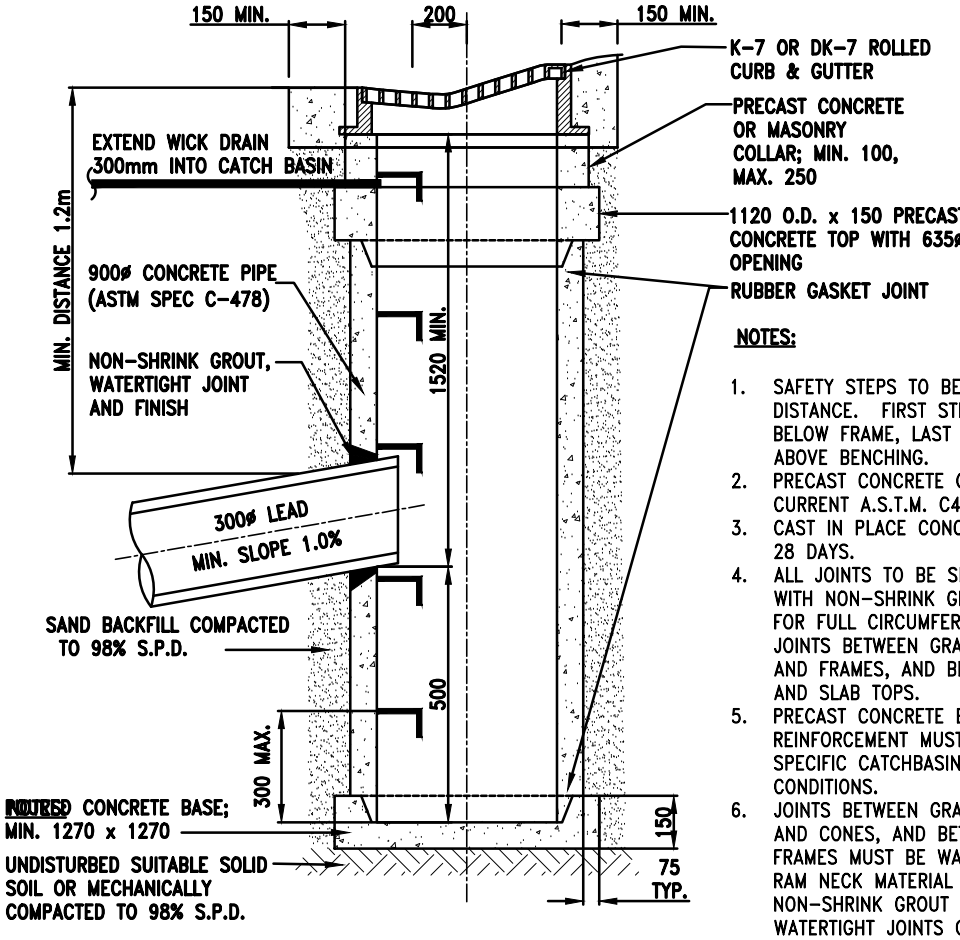
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

# 900mm CATCHBASIN WITH TYPE F-51 GRATING AND FRAME

CITY OF FORT SASKATCHEWAN

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST-3 |
| NOT TO SCALE | DRAWN: DF | |




**NOTES:**

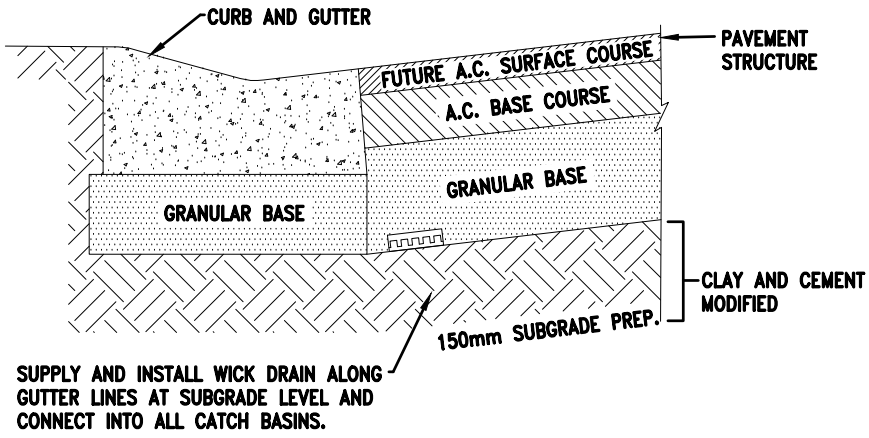
1. SAFETY STEPS TO BE SPACED AT 400 MAX. DISTANCE. FIRST STEP TO BE 150 MAX. BELOW FRAME, LAST STEP TO BE 300 MAX. ABOVE BENCHING.
2. PRECAST CONCRETE COMPONENTS TO MEET CURRENT A.S.T.M. C478 STANDARDS
3. CAST IN PLACE CONCRETE TO BE 25 MPa AT 28 DAYS.
4. ALL JOINTS TO BE SET WITH RUBBER GASKET WITH NON-SHRINK GROUT INSIDE AND OUTSIDE FOR FULL CIRCUMFERENCE. THIS INCLUDES JOINTS BETWEEN GRADE RINGS, GRADE RINGS AND FRAMES, AND BETWEEN GRADE RINGS AND SLAB TOPS.
5. PRECAST CONCRETE BASE THICKNESS AND REINFORCEMENT MUST BE DESIGNED FOR THE SPECIFIC CATCHBASIN DEPTH AND SOIL CONDITIONS.
6. JOINTS BETWEEN GRADE RINGS, GRADE RINGS AND CONES, AND BETWEEN RINGS AND FRAMES MUST BE WATERTIGHT. RAM NECK MATERIAL FINISHED WITH NON-SHRINK GROUT MAY BE USED IF WATERTIGHT JOINTS CAN BE ACHIEVED.
7. WICK DRAINS TO CONNECT TO CATCH BASIN SUCH THAT JOINTS ARE WATERTIGHT.
8. POURED CONC. 30 MPa TYPE 50 CONCRETE.
9. MARK 'T' ON TOP OF SLAB.
10. ALL BACKFILL COMPACTED TO 98% S.P.D.
11. ALL RINGS TO BE GROUTED TO A SMOOTH SURFACE.
12. MINIMUM DEPTH OF COVER ON CATCHBASIN LEAD IS 1.5m.
13. SEE DETAIL ST-5 FOR WICK DRAIN DETAIL

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| 900mm CATCHBASIN WITH TYPE K-7 GRATING AND FRAME | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST-4 |
| NOT TO SCALE | DRAWN: DF | |

**NOTES:**

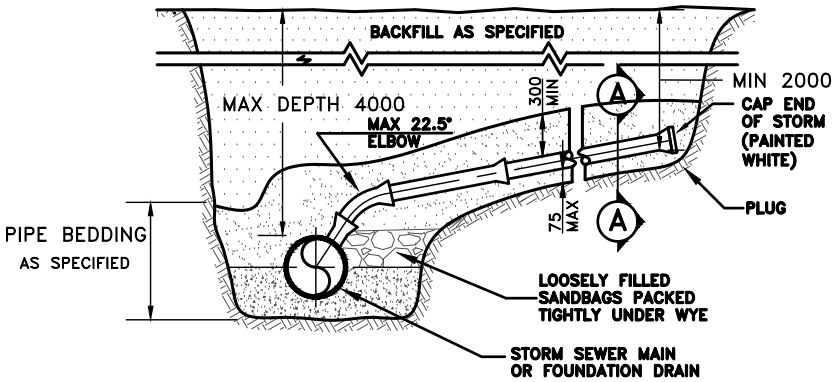
1. WICK DRAINS TO CONNECT TO CATCH BASIN SUCH THAT JOINTS ARE WATERTIGHT.




## WICK DRAIN DETAIL

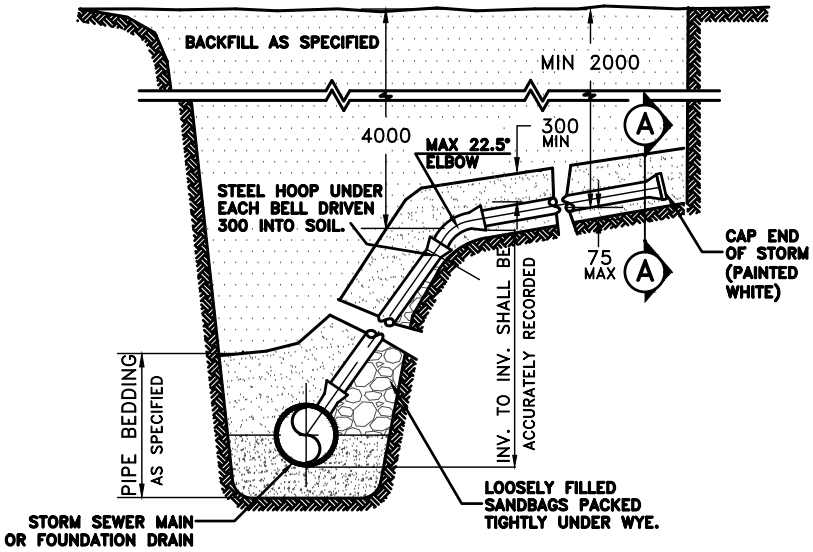
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| WICK DRAIN DETAIL | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST-5 |
| NOT TO SCALE | DRAWN: DF | |

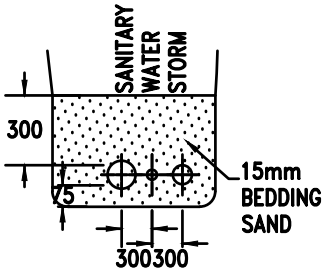



WITHOUT RISER

REFER TO SPECIFICATION FOR WYE OR SERVICE SADDLE.



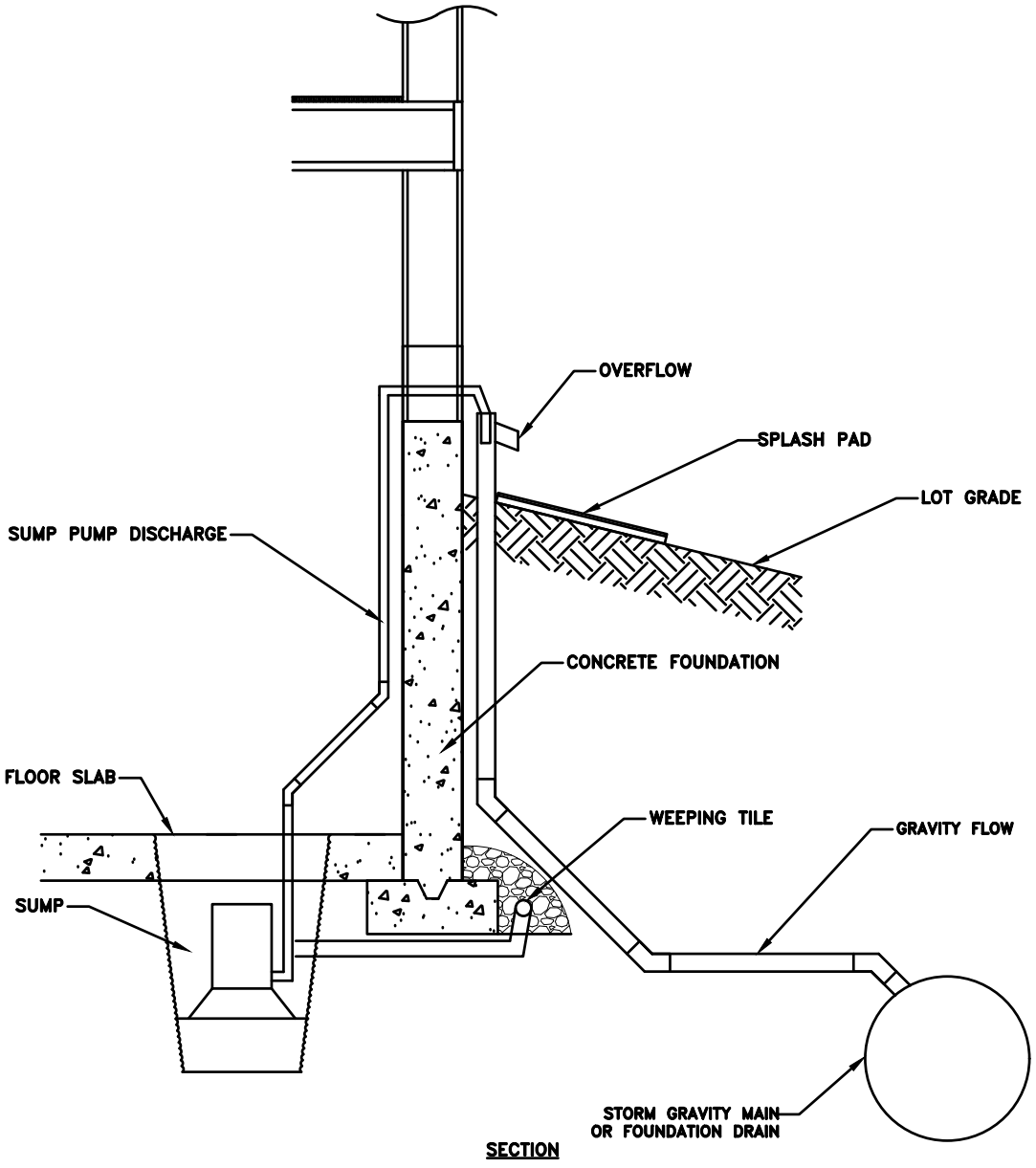

WITH RISER




SECTION A
(FACING PROPERTY)

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| FOUNDATION DRAIN SERVICE CONNECTION | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–6 |
| NOT TO SCALE | DRAWN: DF | |

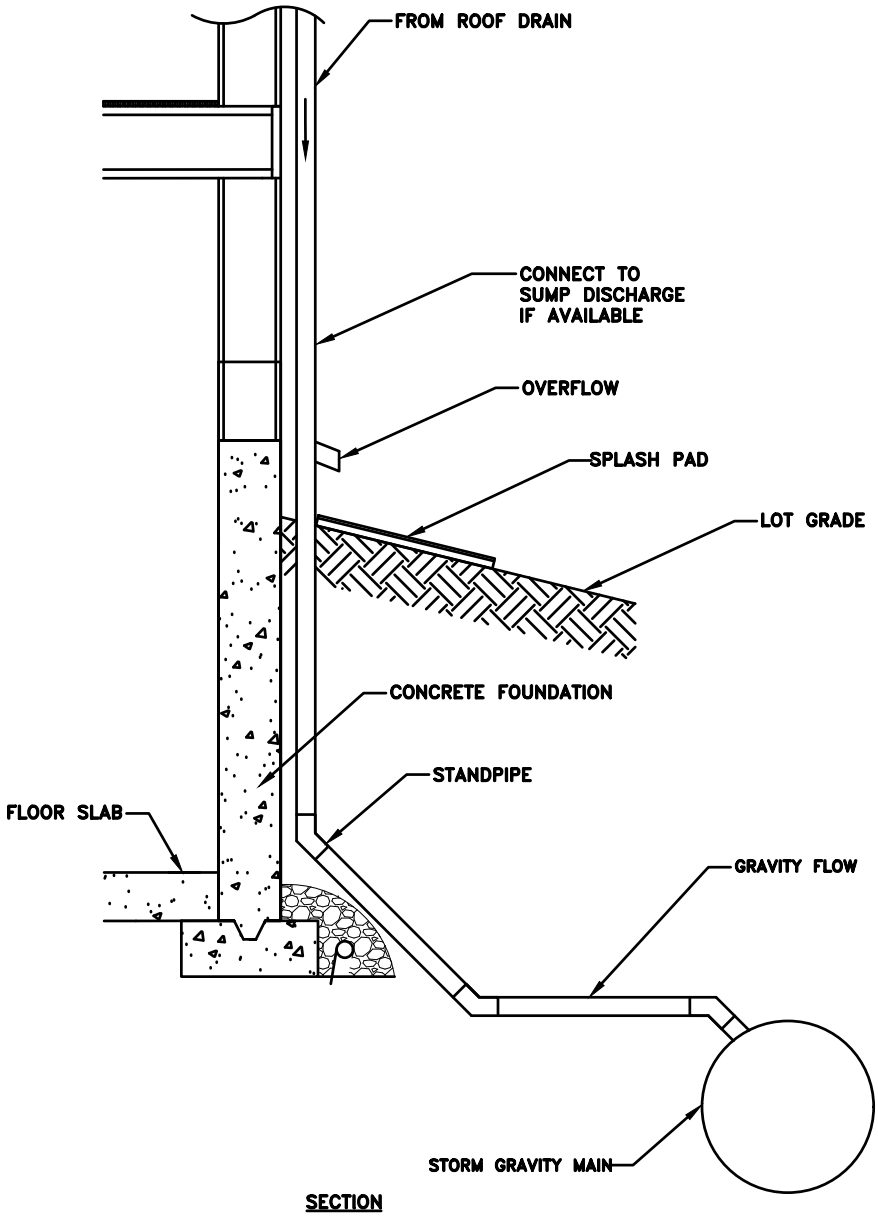



SECTION

NOTES:
1. RECOMMEND HIGH WATER ALARM IN SUMP IN EVENT OF PUMP FAILURE.
2. WEEPING TILE DRAINS INTO SUMP NOT DIRECTLY INTO SEWER.
3. ALL PIPE DIAMETERS AS PER DESIGN STANDARD.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

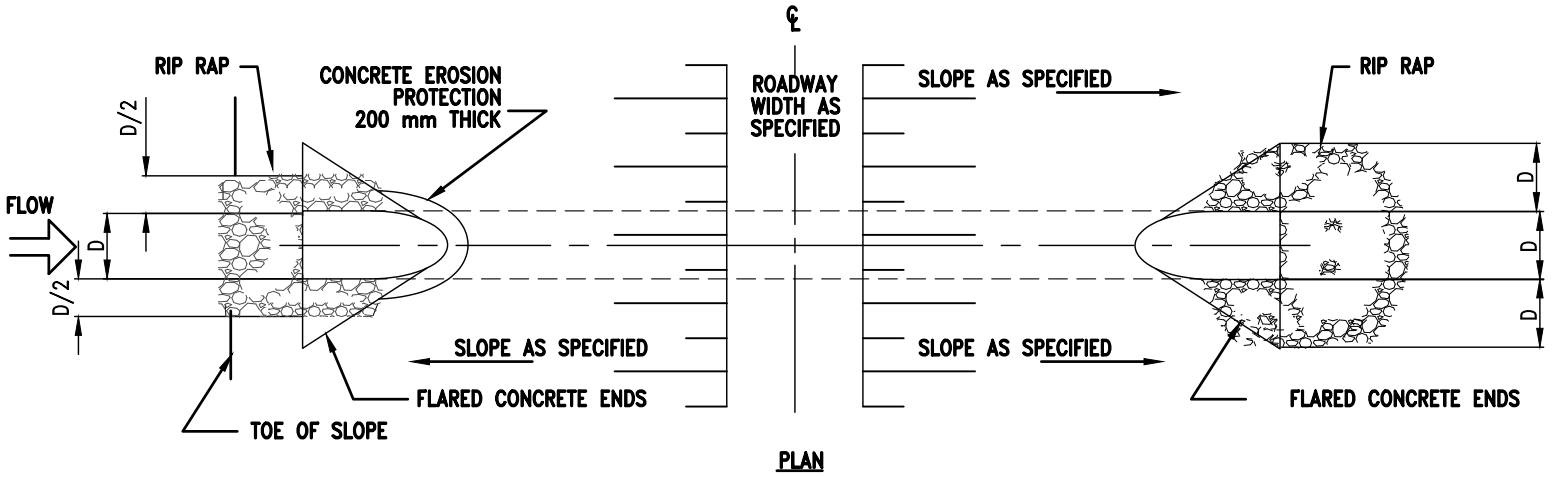
| FOUNDATION DRAIN SERVICE HOUSE CONNECTION DETAIL | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST-7 |
| NOT TO SCALE | DRAWN: DF | |



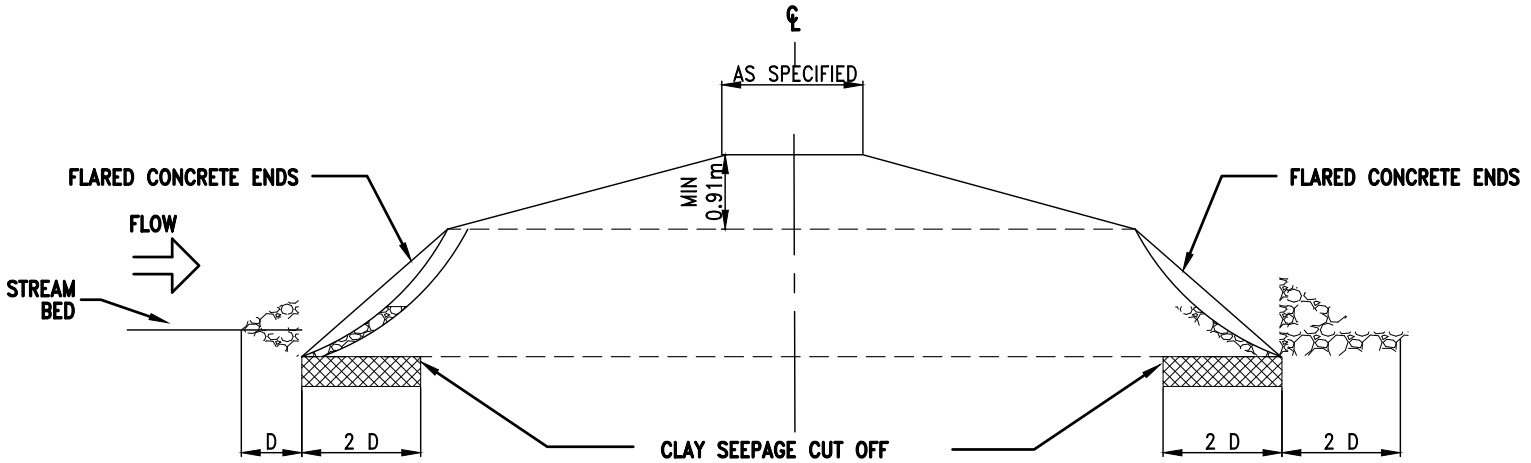

SECTION

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| ROOF LEADER CONNECTION TO STORM SERVICE | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST-8 |
| NOT TO SCALE | DRAWN: DF | |




PLAN

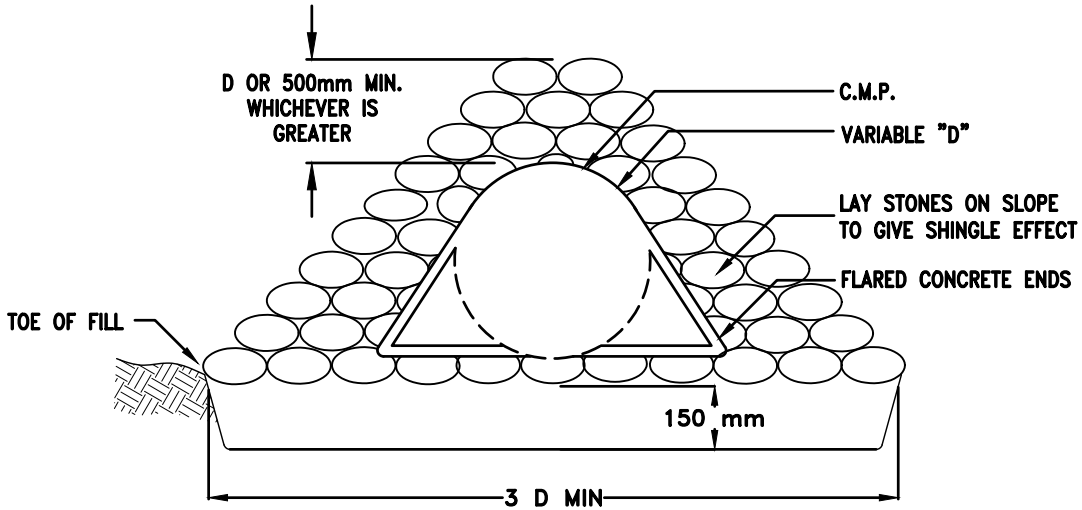



ELEVATION

NOTE:
MINIMUM RIP RAP DIMENSION OF 200mm REQUIRED.
RIP RAP TO BE STONES/ROCK. CONCRETE RIP RAP TO REQUIRE CITY APPROVAL.

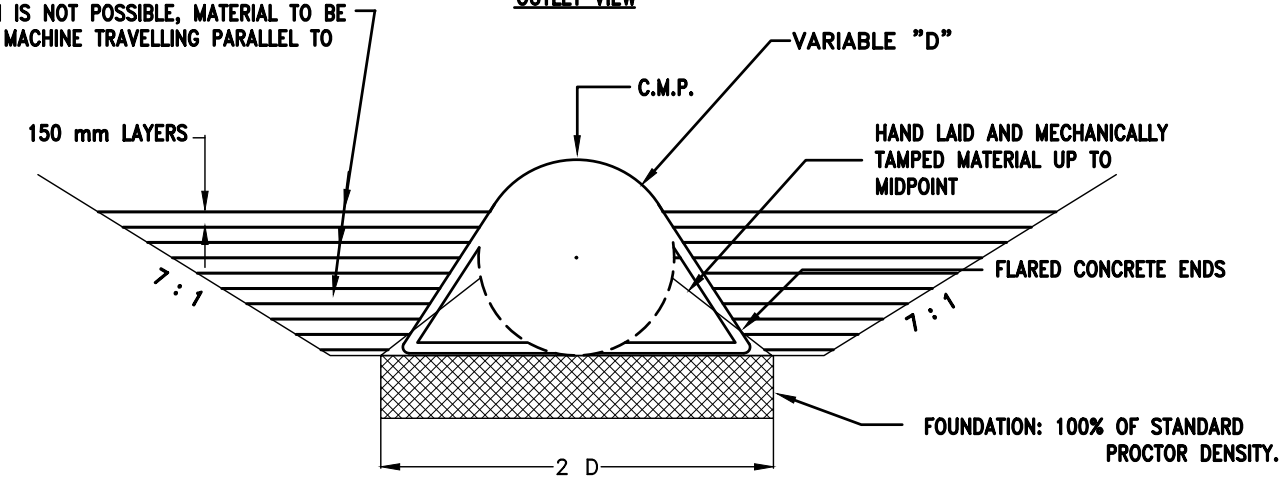
ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| CULVERT | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–9 |
| NOT TO SCALE | DRAWN: DF | |




OUTLET VIEW

BRING UP FILL IN 150 mm LAYERS BOTH SIDES SIMULTANEOUSLY. IN AREAS WHERE MACHINE COMPACTION IS NOT POSSIBLE, MATERIAL TO BE SPREAD BY MACHINE TRAVELLING PARALLEL TO STRUCTURE




BACK FILL DETAILS

NOTE:
MINIMUM RIP RAP DIMENSION OF 200mm REQUIRED.
RIP RAP TO BE STONES/ROCK. CONCRETE RIP RAP TO REQUIRE CITY APPROVAL.

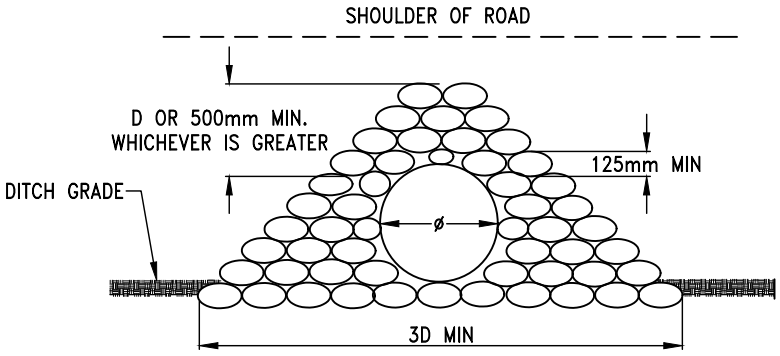
ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

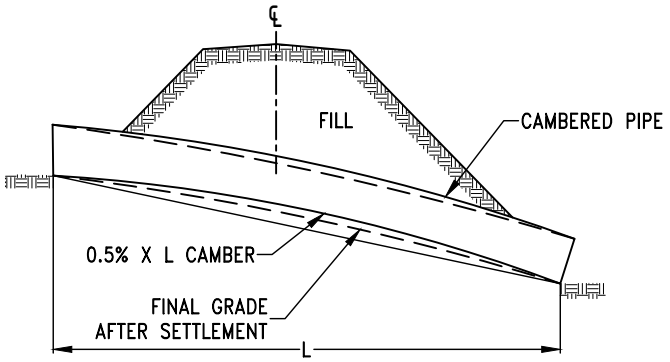
| CULVERT BACKFILL | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–10 |
| NOT TO SCALE | DRAWN: DF | |

PROCEDURE:

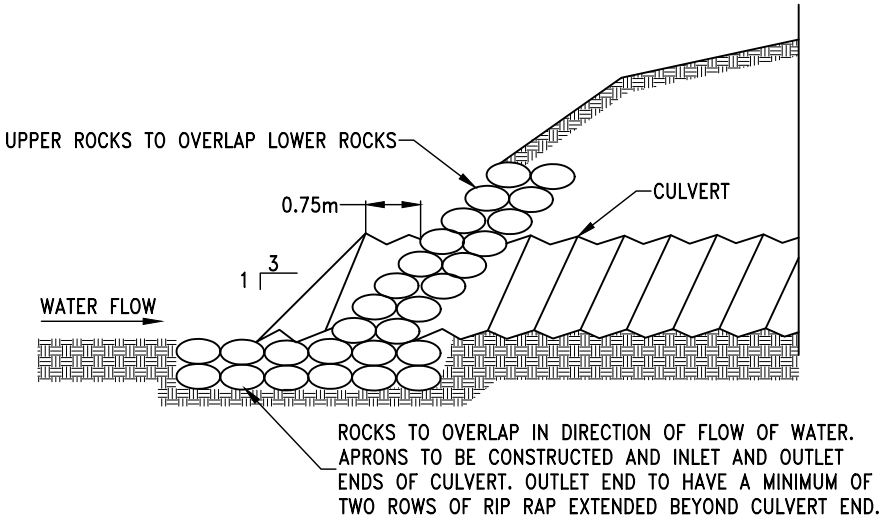
PLACE ROCKS INTO POSITION BY RAMMING AND PACKING AGAINST EACH OTHER TO FORM A CLOSELY MOULDED AND UNIFORM LAYER AVERAGING NOT LESS THAN 125mm IN THICKNESS. PLACE ROCKS IN STAGGERED PATTERN SUCH THAT ANY ROCK (EXCEPT AT THE BOTTOM) WILL REST ON TWO OR MORE OTHER ROCKS.




**INLET AND OUTLET ELEVATION**




**PROFILE**



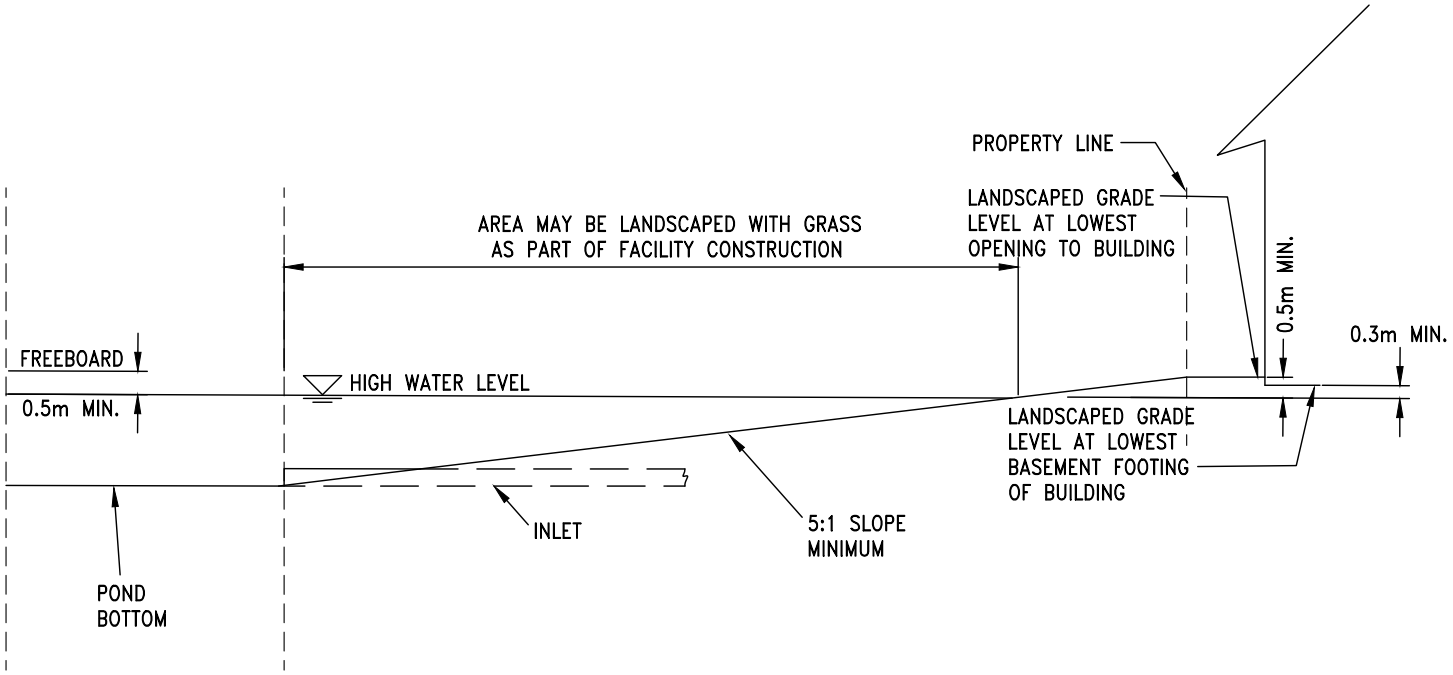

**SIDE ELEVATION**

NOTE:
MINIMUM RIP RAP DIMENSION OF 200mm REQUIRED.
RIP RAP TO BE STONES/ROCK. CONCRETE RIP RAP TO REQUIRE CITY APPROVAL.

FLARED CONCRETE ENDS TO BE USED ON CULVERTS

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

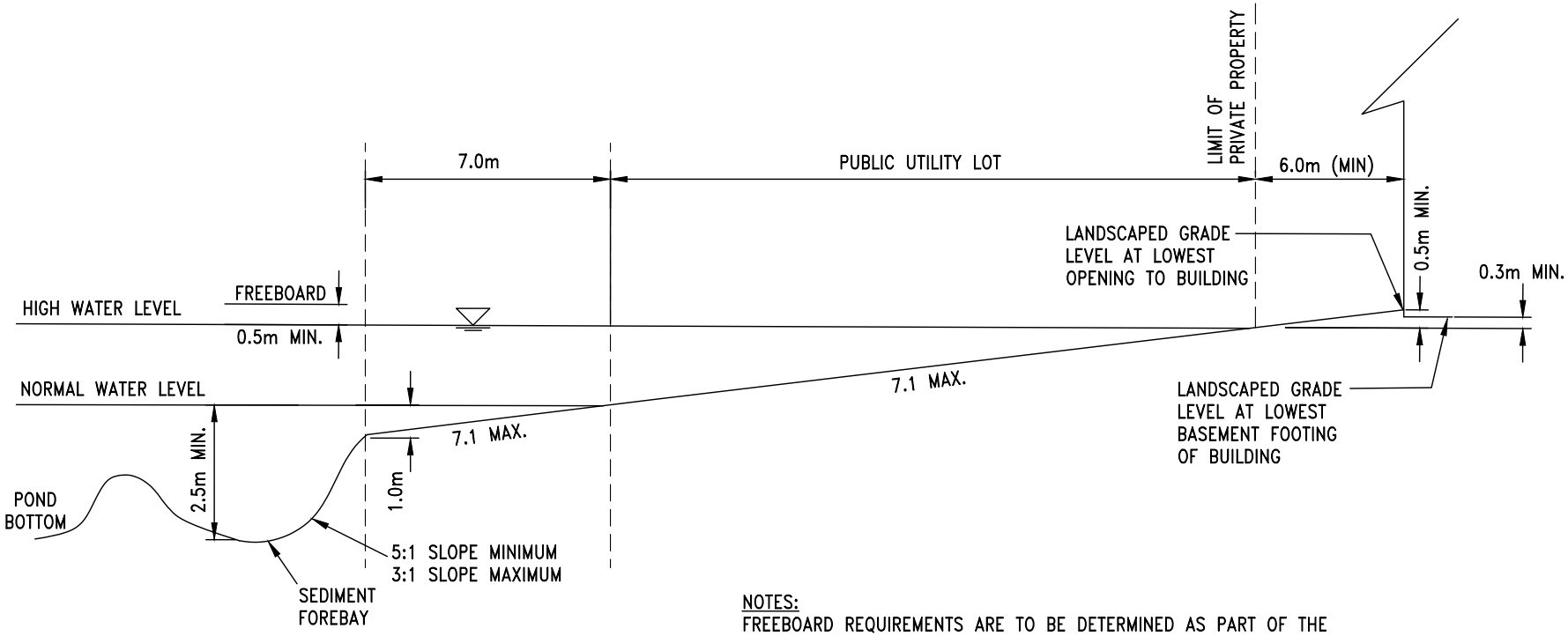
| CULVERT END RIP RAP | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–11 |
| NOT TO SCALE | DRAWN: DF | |




NOTES:
FREEBOARD REQUIREMENTS ARE TO BE DETERMINED AS PART OF THE STORAGE FACILITY DESIGN, AND MAY VARY IN CONSIDERATION OF THE FACILITY DESIGN BASIS.

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

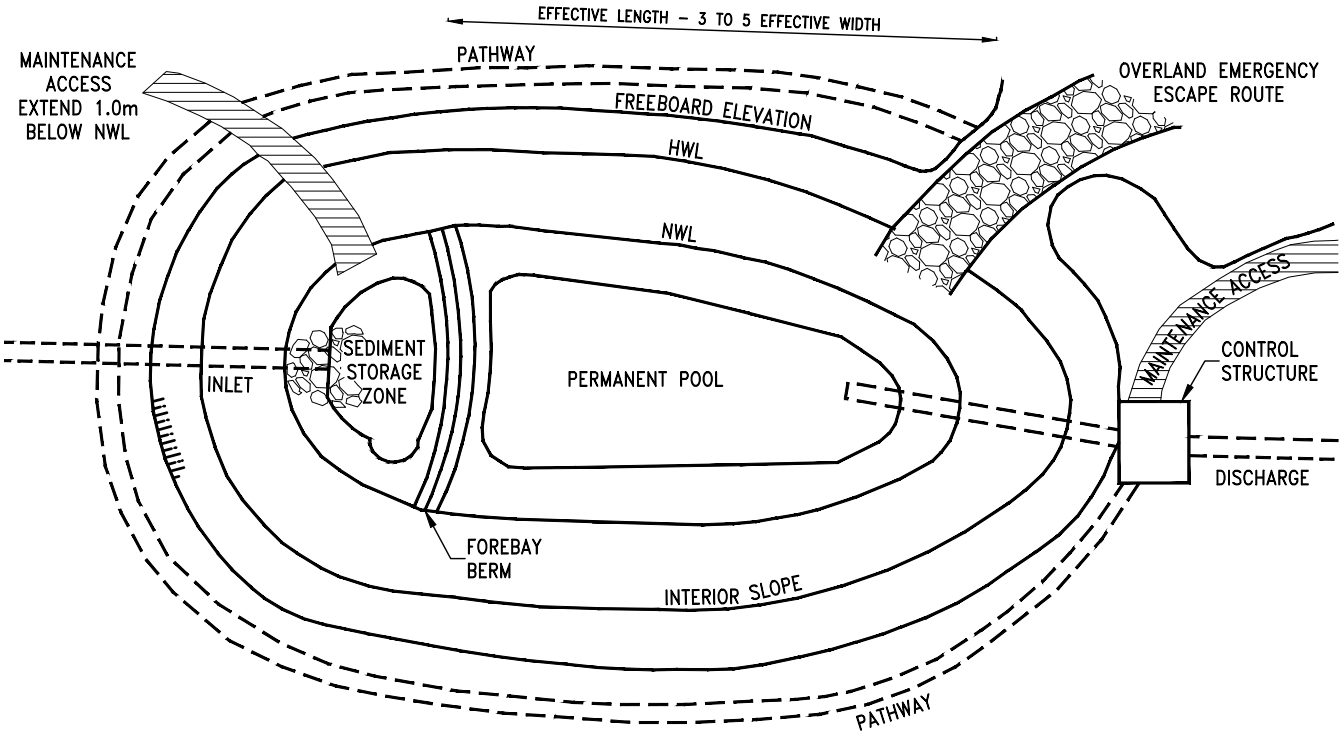
| DRY POND | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–12 |
| NOT TO SCALE | DRAWN: DF | |




NOTES:
FREEBOARD REQUIREMENTS ARE TO BE DETERMINED AS PART OF THE STORAGE FACILITY DESIGN, AND MAY VARY IN CONSIDERATION OF THE FACILITY DESIGN BASIS.

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

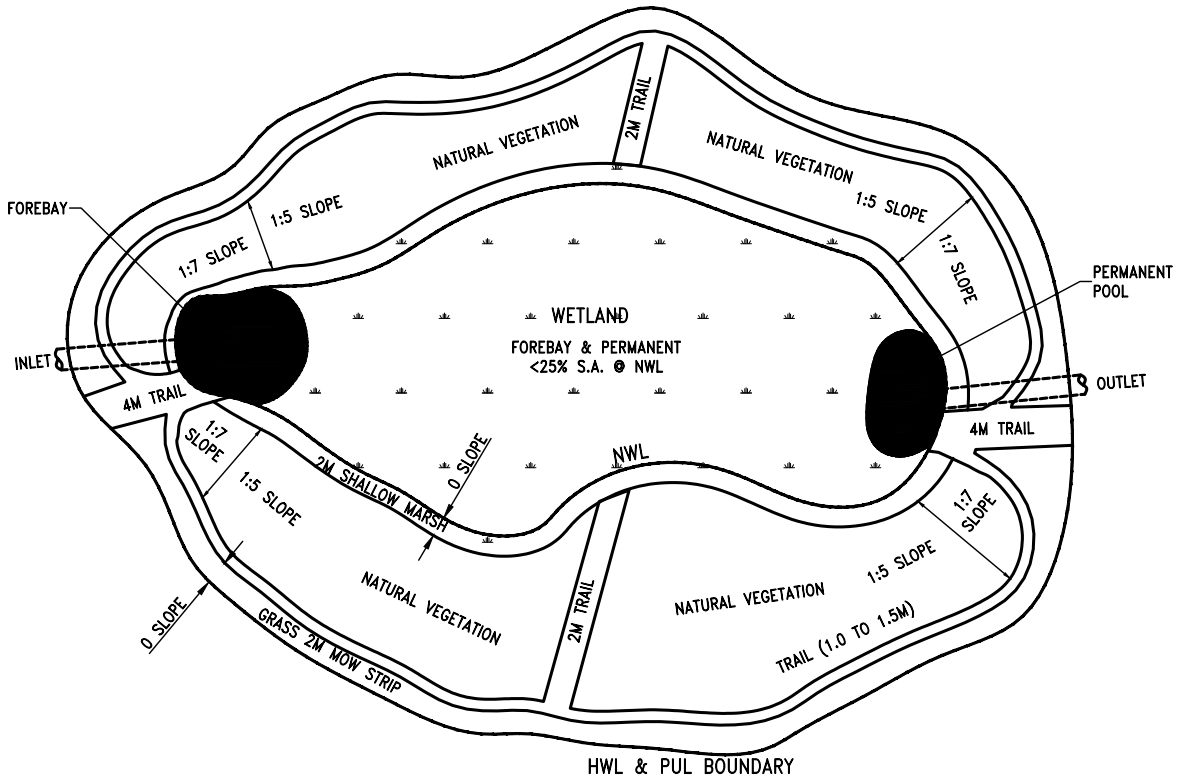
| WET POND PROFILE VIEW | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–13 |
| NOT TO SCALE | DRAWN: DF | |




PLAN VIEW

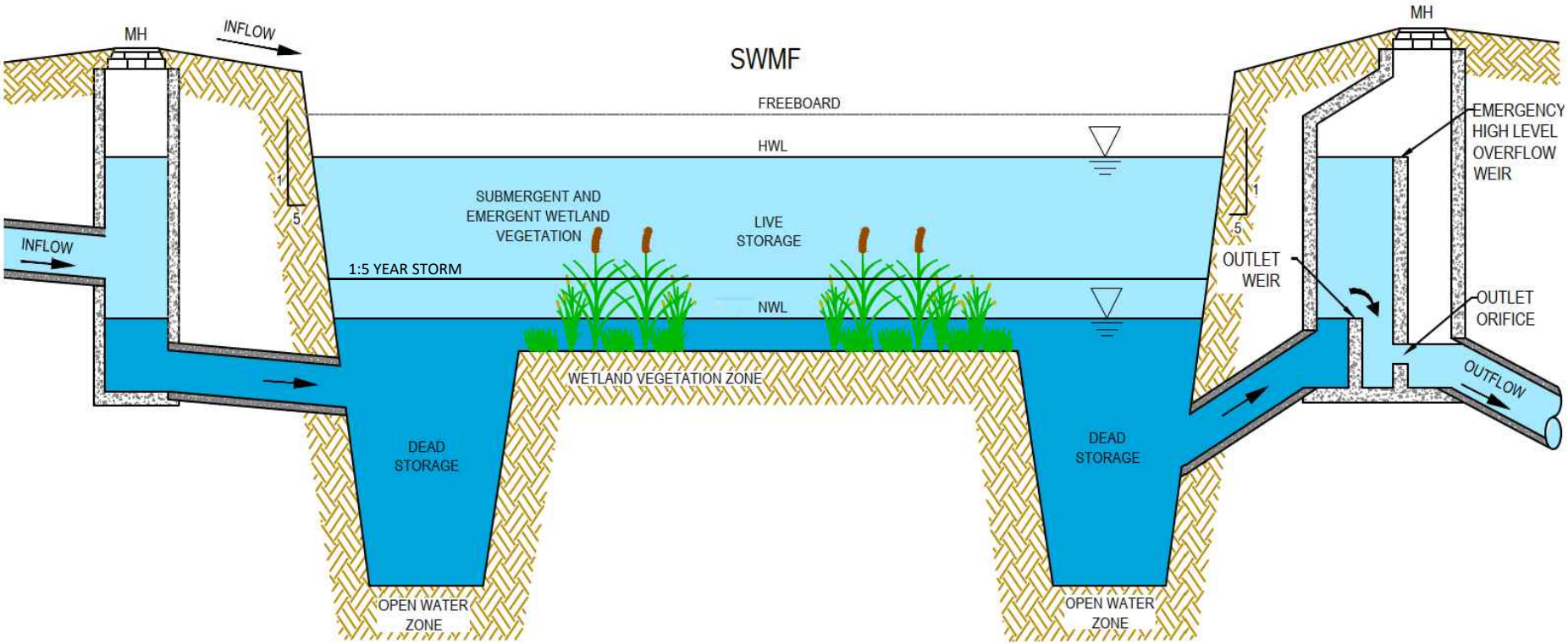
ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED

| WET POND PLAN VIEW | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–14 |
| NOT TO SCALE | DRAWN: DF | |



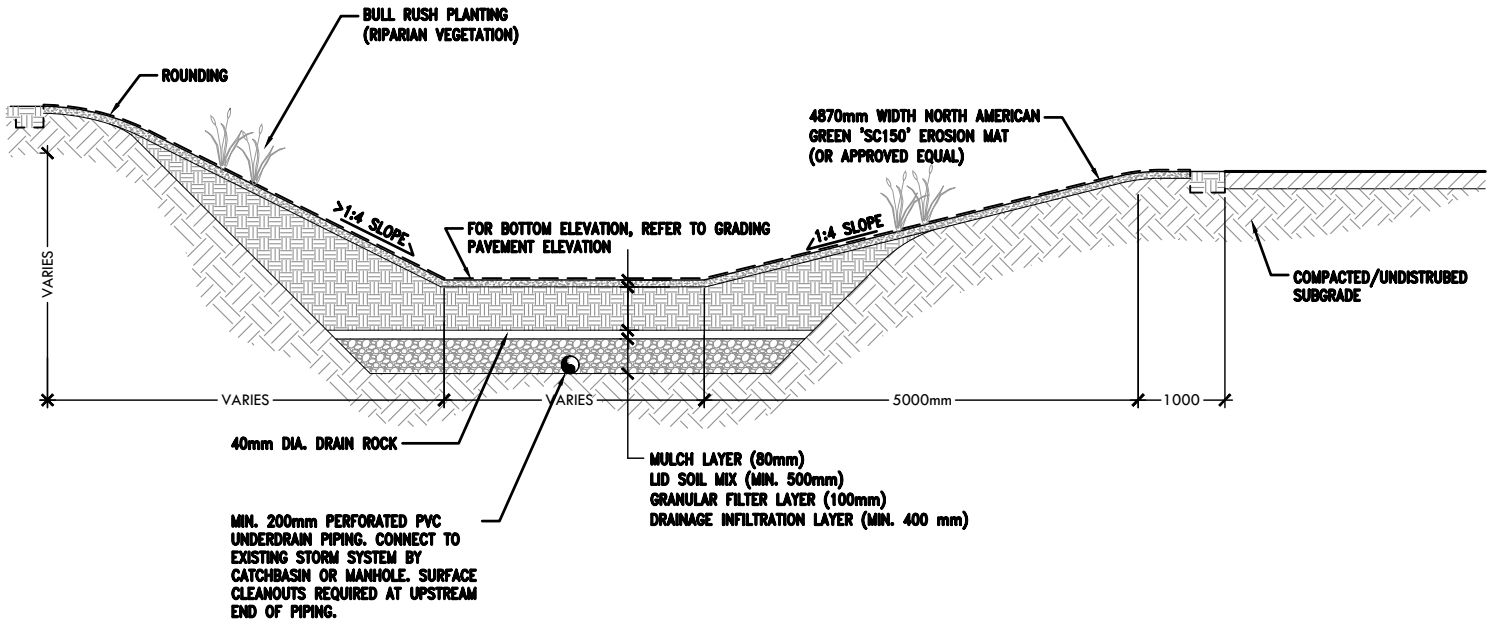

ALL DIMENSIONS IN METERS
UNLESS OTHERWISE NOTED

| CONSTRUCTED WETLAND<br>PLAN VIEW | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–15 |
| NOT TO SCALE | DRAWN: DF | |




ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| WETLAND PROFILE VIEW | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–16 |
| NOT TO SCALE | DRAWN: DF | |




ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| BIO–SWALE | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: DECEMBER 2023 | ST–17 |
| NOT TO SCALE | DRAWN: DF | |

# 5.0 TRANSPORTATION

This section outlines the methodology and design criteria that apply to the design of transportation related systems. These guidelines are not intended to be a substitute for sound engineering knowledge and experience. Transportation system designs shall be prepared under the direction of a qualified professional who has the appropriate experience and is registered with the Association of Professional Engineers and Geoscientists of Alberta (APEGA).

## 5.1 Transportation Design General Principles and Objectives

It is the designer's responsibility to exercise professional judgment on technical matters in the best interests of the City and the public. Standards contained herein are provided to assist in making these judgments but shall not be used as a substitute; these standards do not cover all specific project-related cases.

These standards are based on general site conditions, prevailing and predicted vehicle dimensions and performance, driver behaviour and performance, and current technologies. Designers are advised to use the latest edition or updates of these standards.

The following standard and guideline publications were referred to for the preparation of these transportation design standards and the most current versions should be used for reference:

- Geometric Design Guide for Canadian Roads 3rd Edition, Transportation Association of Canada (TAC),
- Pavement Design and Management Guide, TAC
- Manual of Uniform Traffic Control Devices for Canada (MUTCD) 6th Edition, TAC
- Canadian Guide to Neighbourhood Traffic Calming 2nd Edition, TAC
- A Policy on Geometric Design of Highways and Streets 7th Edition, American Association of State Highway and Transportation Officials (AASHTO), 2018
- Highway Geometric Design Guide, Alberta Transportation
- City of Fort Saskatchewan and Regional bylaws
- Alberta Municipal Government Act
- Alberta Motor Vehicle Act
- Highway Guide and Information Sign Manual (current version)
- Highway Pavement Marking Guide (current version)
- Alberta Transportation Traffic Accommodation in Work Zones manual (current version)

The City of Fort Saskatchewan does not rely exclusively on any one of the above-noted references. The City shall approve the final design based on a combination of the references above and the design standards contained herein. The standards contained in this section are required minimum standards; wherever possible, higher standards should be used. In cases of discrepancies between these standards and the above noted references, these standards will govern; however, the City of Fort Saskatchewan is the final approving authority.

## 5.2 Definitions

Acceleration Lane: An auxiliary lane to enable a vehicle to increase speed and merge with through traffic.

Access Management: The application of roadway design and traffic operations to the location and design of access from the roadway adjacent to the land uses.

Arterial Roadway: A roadway primarily for through traffic as further defined in Section 5.4.2.

Auxiliary Lane: A lane in addition to, and placed adjacent to, a through lane intended for a specific maneuver such as turning, merging, diverging, weaving and for slow vehicles.

Average Annual Daily Traffic (AADT): The total volume of traffic passing a point or segment of a roadway, in both directions for one year, divided by the number of days in the year.

Boulevard: The strip of land paralleling the roadway between the curb and the sidewalk, often planted with trees, grass, and shrubbery.

City Engineer: A professional engineer or designated representative authorized by the City to authorize changes to and variances from these Standards.

Channelization: The separation and direction of traffic movements and pedestrians into defined paths at an at-grade intersection through the use of geometric features, pavement markings and traffic control devices.

Collector Roadway: A roadway on which traffic movement and access have similar importance and provides for traffic movements between arterial and local roadways as further defined in Section 5.4.2.

Cross-Slope: The average grade between the edges of a cross-section element.

Crosswalk: Any part of a roadway specifically intended for pedestrian crossing, which may be so indicated by signs, lines, markings or other devices.

Cul-de-sac: A roadway opened at one end only.

Curb: A structure with a vertical or sloping face along the edge of a lane or shoulder which strengthens or protects the edge, clearly defines the edge, and provides for drainage conveyance.

Curb Drop: The transition length required to decrease the curb height to accommodate a driveway or sidewalk ramp.

Curb Return: The curved section of curb used at intersections or driveways to join tangent sections of curb.

Deceleration Lane: An auxiliary lane to enable a vehicle exiting from a roadway to reduce speed after it has left the through traffic lanes.

Design Speed: A speed selected for the purpose of design which correlates to the maximum safe speed, when conditions are favourable, that the geometric features of the roadway have been designed.

Expressway: A divided arterial roadway for through traffic with full or partial control of access and with some interchanges as further defined in Section 5.4.2.

Freeway: A roadway limited to through traffic, with access only through interchanges.

Gradient: The rate of rise or fall with respect to the horizontal distance.

Horizontal Alignment: The configuration of a roadway as seen in plan view.

Island: A defined area between traffic lanes for control of vehicle movements or for pedestrian refuge.

Lane: A part of the travelled way intended for the movement of a single line of vehicles.

Longitudinal Barrier: A barrier adjacent to the roadway whose primary function is to safely redirect an errant vehicle that may be leaving the normal travel path.

Median: A reserve area, including shoulders, between lanes carrying traffic in opposite directions.

Median Barrier: A longitudinal barrier used to prevent an errant vehicle from crossing the median into hazard.

Outer Separation: The area between the edge of the travel lanes of a roadway and the edge of the travel lanes of an adjacent, parallel roadway.

Pedestrian: Includes all vulnerable users walking and wheeling, including those running; standing; using manual/motorized wheelchairs or scooters; using canes or walkers; pushing strollers or carts; pushing bicycles; and users of various other low-speed forms of human locomotion (e.g., skateboards).

Public Lane (Alley): A narrow minor street, usually without sidewalks, located at the rear of lots for vehicle access to garages or other parking spaces and which also serves as a utility right of way as further defined in Section 5.4.2.

Right of Way: The area of land acquired for or devoted to the provision of a roadway.

Roadside: The area adjoining the outer edge of the roadway to the right of way limits.

Roadside Barrier: A longitudinal barrier used to shield roadside obstacles or non-traversable terrain features. It may occasionally be used to protect pedestrians from vehicle traffic.

Sidewalk or Walkway: A travel way intended for pedestrian use, following an alignment generally parallel to that of the adjacent roadway.

Superelevation: The gradient measured at right angles to the centre line across the roadway from the inside to the outside edge of a curve.

Target Speed: A speed at which the designer intends traffic to operate as reinforced by design choices for a specific purpose or function, sometimes used in conjunction with context sensitive design solution

Throat Length: The provision of sufficient unobstructed on-site driveway length to prevent stopped vehicles from blocking the path of entering vehicles or vehicles travelling along the circulation roadways on site.

Through Lane: A lane intended for through traffic movement.

Traffic Calming: The combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behaviour and improve conditions for non-motorized street users.

Trail: A joint-use travel way intended for both pedestrian and cyclist use, following an alignment generally parallel to that of the adjacent roadway, or through a natural area, park, or storm water management facility.

Vertical Alignment: The configuration of a roadway as seen in longitudinal section.

Warrant: A criterion that identifies a potential need for a transportation measure, such as traffic light, physical barrier, extra lane, street lighting or other requirement.

## 5.3 Transportation Impact Assessment (TIA)

### 5.3.1 Purpose

The Transportation Impact Assessment (TIA) is intended to adequately assess the impacts of any development proposal on the existing and planned transportation system, including pedestrian and bicycle mobility, transit service, and vehicle traffic.

### 5.3.2 Study Requirements

A TIA is required for any proposed site plan or subdivision plan which would be expected to generate 100 or more vehicle trips during the peak hour of the traffic generator or the peak hour of adjacent streets, or over 750 trips in an average day.

Under special circumstances, at the City's discretion or for developments which are projected to either impede general traffic flow, add potential traffic safety concerns, or significantly alter the number of pedestrians, cyclist or transit users, a TIA may still be required even if the vehicle trips generated do not meet the threshold indicated.

A TIA may also be required, at the discretion of the City if:

- high traffic volumes on surrounding roadways affect movement to and from the proposed development.
- there is a lack of existing left turn lanes on the adjacent roadway at the proposed access drive.
- there is inadequate sight distance at access points.
- there is close proximity of the proposed access points to other existing drives or intersections.
- a development includes a drive-through operation.

### 5.3.3 Coordination with the City

Consultants and Engineers preparing TIAs shall discuss proposed development projects with the City Engineer to identify special circumstances. Issues to be discussed include, without limitation, definition of the study area, relevant subarea plans, level of service objectives, maximum design volume objectives, methods for projecting build-out volumes, background traffic conditions, trip generation rates, directional distribution of traffic, modal share, and trip assignment. These terms of reference for the TIA shall be approved by the City prior to study preparation.

5.3.4 TIA Guideline

The following is a guideline outlining the basic contents of a TIA. For additional information on traffic impact assessment refer to the *ITE Transportation Impact Analysis for Site Development* and *the Alberta Transportation Traffic Impact Assessment Guidelines.* The content, structure and focus may be adjusted in coordination with the City on a case by case basis for the lifetime of these designs standards. The long term horizon year will be 20 years subject to confirmation with the City Engineer. Analysis of a longer or shorter horizon (or multiple horizons) may be requested at the City's discretion for area structure plans, redevelopment plans, or other larger traffic generating developments. Roundabout operations should be analyzed wherever signalized or all-way stop controlled intersections are proposed at the discretion of the City Engineer, or where traffic calming, or U-turn movements are required.

1. BACKGROUND
    - Description of proposed development;
    - Description of study area, and study intersections;
    - Location of proposed access points;
    - Identification of peak hours and whether weekends will be used in the impact analysis; and
    - Identification of study horizon years typically includes existing/opening day, and a short and long term horizon year.

2. BASE TRAFFIC CONDITIONS:
    - Description of existing roadway network and intersections adjacent to site and at access points;
    - Traffic volume counts during peak-impact hours; and
    - Description of existing transit, pedestrian and cycling infrastructure in the vicinity of the site.

3. SITE TRAFFIC GENERATION:
    - Development of trip generation rates used and the source of these rates;
    - Traffic generated during peak impact hours; and
    - Discuss potential generation and mode split of transit, pedestrian and cyclist trips, or why it is not applicable.
    - Discuss internal site capture for mixed-use development

4. SITE TRAFFIC DISTRIBUTION:
    - Method used to distribute traffic;
    - Figure(s) or table(s) showing estimated traffic movements by direction; and
    - Methods used for traffic assignment and assumptions for assignment of traffic to network.

5. NON-SITE TRAFFIC PROJECTIONS:
    - Determine forecast traffic volumes for proposed study horizon years (include data to substantiate how the forecasted traffic volumes were determined);
    - Identification of other proposed development in the study area whose future generated traffic volumes should be added to the forecasted traffic volumes; and
    - Assemble off-site traffic volumes to include background growth and any applicable area development to determine the future horizon traffic volumes.

6. TRAFFIC ASSIGNMENTS:
   - Assignment of peak-period traffic to intersections and access points;
   - Figures for existing peak impact hours traffic, site traffic and total traffic volumes;
   - Complete intersection and corridor performance analysis for peak impact hour; and
   - Identify roadway classification.

7. REVIEW OF SITE PLAN:
   - Internal storage at access points;
   - General or detailed parking layout (whichever applies);
   - Pedestrian and cyclist accessibility strategy through the proposed development;
   - If applicable, loading dock locations and access, including design vehicle, with design vehicle turning template; and
   - Identify recommended improvements to the site plan.

8. DISCUSSION OF FUTURE TRAFFIC CONDITIONS AND MITIGATION MEASURES:
   - Identify recommended improvements to the study area roadway network including access point(s), intersection(s) and corridor(s);
   - Discuss mitigation measures for any traffic movement that meets or exceeds a long-term LOS E and/or v/c ≥ 0.90.;
   - Discuss implications for other developments in area; and
   - Discuss mobility of future pedestrians and cyclists in direct area and opportunities for improvement.

## 5.4 Complete Streets

Complete streets are defined as streets that provide safe, accessible and convenient access for all transportation modes including pedestrians, bicyclists, motorists and transit users – of all ages and ability levels.

The Owner/Applicant shall make all reasonable provisions for the accommodation of bicycles, pedestrians and transit users in the planning, design, and construction of new roadways, major reconstruction or maintenance projects, except where pedestrians, bicyclists and/or transit services are prohibited by law from using a given facility or where unsafe.

## 5.5 Roadway Classification

A roadway classification system establishes a hierarchy of roadways that provides for the gradation in function from access to mobility. The characteristics of roadway classifications described in these standards are generally in accordance with the TAC design classification system. Factors such as land use, service function, intersection spacing, traffic volume, traffic flow characteristics, running speed, vehicle type and connection to other roadways; are considered for the roadway classification. The design guidelines presented in this section correspond to the following roadway classification; designs for Expressways and Freeways shall be based on TAC and/or the governing authority (i.e. Alberta Transportation) whichever is more stringent:

- Public Lane (Alley): A narrow minor street, usually without sidewalks, located at the rear of lots for vehicle access to garages or other parking spaces and which also serves as a utility right of way.

- Local Roadway: A roadway with the primary function of providing land access to residential, industrial or commercial land uses. Movement is incidental and primarily to connect to/from collector roadways.

- Collector Roadway: A roadway on which traffic movement and property access (residential, commercial or industrial) have similar importance. Sub-groups of minor and major collectors provide for varying degrees of access control, pedestrian/cycling treatments and intersection spacing/treatments applicable to various mobility conditions. Collector roadways may be required to accommodate transit buses. Collector roadways provides for movements between local and arterial roadways. Major collectors generally include those with volumes over 3,500 vehicles per day and limited front drive accesses, minor collectors generally include those with volumes under 3,500 vehicles per day and higher occurrences of front drive accesses.

- Arterial Roadway: A roadway primarily intended to provide high levels of service for through traffic. Rigid access control and sound access design are essential to preserve its function and ensure safety. Also, sub-groups of minor and major arterials provide for varying degrees of access control, pedestrian/cycling treatments and intersection spacing/treatments applicable to various mobility conditions. Major arterials roadways typically link major development areas including central business district (CBD), large industrial areas, and large shopping districts. Minor arterials typically interconnect residential, shopping, employment and recreational activity areas.

- Expressway: A divided roadway intended for uninterrupted through traffic flow except for widely spaced signalized intersections. Full or partial control of property access should be strictly applied. Grade separation may be required at key intersections. Refer to the Geometric Design Guide for Canadian Roads, TAC.

- Freeway: Refer to the Geometric Design Guide for Canadian Roads, TAC.

## 5.6 Roadway Rights-of-Way and Carriageway Widths

Rights-of-way shall be of adequate width to accommodate the carriageway, sidewalks, bikeways, boulevards, underground utilities, street lighting, etc. in an acceptable manner. Easements will be as required. Right-of-way and carriageway may be amended by mutual agreement. The minimum requirements are presented in Table 5.6.1-1.

Table 5.3.4-1 Road Right of Way and Carriageway Widths

| Roadway Class | Right-of-Way (m) | Carriageway (m) | Typical Cross Section Details Drawing No. |
|---|---|---|---|
| Public Lane (Alley) | | | |
| • Residential | 6.0 | 5.8 | T-1 |
| • Commercial/Industrial | 9.0 | 7.0 | T-2 |
| Local | | | |
| • Residential | 18.0 | 9.0 or 11.0 | T-3, T-4A. T-4B, T-5 |
| • Commercial/Industrial | 21.5 | 10.5 | T-6 |
| Minor Collector | | | |
| • Residential | 24.0 | 11.5 | T-7 |
| • Commercial/Industrial | 23.0 | 12.0 | T-8 |
| Major Collector | | | |
| • Residential | 24.0 | 13.5 | T-9 |
| • Commercial/Industrial | 23.0 | 13.0 | T-10 |

| Roadway Class | Right-of-Way (m) | Carriageway (m) | Typical Cross Section Details Drawing No. |
|---|---|---|---|
| Arterial | | | |
| • Minor Undivided | 33.0 | 15.8 | T-11 |
| • Standard Divided | 33.0 | 16.8 | T-12 |
| • Major Divided | 44.0 | 16.8 | T-13 |

## 5.7 Minimum Requirements

All City roadways shall be designed in conformance with the most current edition of the Geometric Design Guide for Canadian Roads by TAC. The design standards outlined in this section are minimum design standards for the City, and all roadway design shall meet or exceed these standards. Under special circumstances, the City Engineer may approve standards to be applied to roadway design that may exceed the minimum standards in this section based on functional; however, designers still need to ensure safe and efficient operation of the roadway at all times.

## 5.8 Design Speed & Design Vehicle

Selection of the most appropriate design speed should be made on the basis of the intended service function and needs of expected users. All users including motorists, pedestrians, cyclists, and transit riders, should be taken into consideration while selecting the design speed for a given roadway. The selected design speed shall be logical with respect to the character of terrain, anticipated operating speed, adjacent land use and roadway classification system. Differences in design speed from one segment to another should not be more than 20 km/h. The following are current posted speeds within the City:

Table 5.3.4-1 Posted and Design Speeds

| Roadway Class | Posted Speed | Design Speed |
|---|---|---|
| Public Lane (Alley) | 30 kph | 30 kph |
| Local | 40 kph | 40 kph |
| Minor Collector | 40 kph | 40 kph |
| Major Collector | 50 kph | 50 kph |
| Arterial | 50 or 60 kph | 50 or 70 kph |

As shown in the above table, the design speed for a roadway shall be:

- Equal to the posted speed for lower speed roadways, including lanes/alleys, local roads, collectors and arterials where the posted speed is 50 km/h or less.
- Equal to the posted speed + 10 kph for higher speed roadways where the posted speed is more than 50 km/h.

Selection of Design Vehicle is completed by examining vehicle classifications (i.e. passenger car, single unit vehicles, emergency vehicles, bus, tractor-trailer unit etc.), vehicle characteristics (i.e. size, length, turning radii of vehicle) and local roadway conditions (i.e. local, collector, arterial roadways). Generally, the minimum design vehicle for each roadway classification is as follows:

- Residential locals should use emergency vehicles
- Residential collectors should use single unit trucks or buses
- Industrial collectors should use tractor-trailer truck combination (WB-19)

- Arterial roadways and roadways within commercial areas, should consider the minimum turning paths of tractor-trailer truck (WB-19) as the design vehicle.
- Arterial roadways within the downtown area or along streetscape projects should consider a single unit truck or bus as the design vehicle

Refer to Chapter 2.4 of the Geometric Design Guide for Canadian Roads, TAC and Chapter D.5 of the Highway Geometric Design Guide, AT for specific characteristics of vehicles operating in Canada and Alberta.

## 5.9 Horizontal Alignment

Roadway curvatures shall meet the minimum specifications shown below. For additional horizontal alignment parameters refer to the most current edition of the Geometric Design Guide for Canadian Roads, TAC.

Table 5.3.4-1 Horizontal Alignment Requirements

| Horizontal Design Criteria | Residential Local Roadway | Industrial Local Roadway | Minor Collector Roadway | Major Collector Roadway | Arterial Roadway |
|---|---|---|---|---|---|
| Design Speed | 40 kph | 50 kph | 40 kph | 50 kph | 50/60 kph |
| Minimum Curve Radii (m) | 65 | 80 | 80 | 90 | 150/190 |
| Superelevation[1] | No | No | No | Optional | Yes |
| Minimum Curve Length (m) | 60 | 60 | 60 | 60 | See TAC (section 3.2.6) |

[1] For superelevation rates, refer to TAC Geometric Design Guide for Canadian Roads:

- For design speed 60 kph – 80 kph, use Table 3.2.9 (emax = 0.06 m/m)
- For design speed 90 kph or higher, use Table 3.2.6.

## 5.10 Vertical Alignment

Roadway vertical alignments shall meet the specifications shown in Table 5.10-1. For additional vertical design parameters refer to the most current edition of the Geometric Design Guide for Canadian Roads, TAC.

Table 5.3.4-1 Vertical Alignment Requirements

| Vertical Design Criteria | Residential Local Roadway | Industrial Local Roadway | Minor Collector Roadway | Major Collector Roadway | Arterial Roadway |
|---|---|---|---|---|---|
| Design Speed | 40 kph | 50 kph | 40 kph | 50 kph | 50/60 kph |
| Minimum Gradient | 0.60% | 0.60% | 0.60% | 0.60% | 0.60% |
| Maximum Gradient | 6% | 6% | 6% | 6% | 5% |
| Crest Curve, min. K (m) | 5 | 10 | 5 | 20 | 10 - 17 |
| Sag Curve, min. K (m) Headlight Control[1]/ Comfort Control | 10/5 | 20/10 | 10/5 | 20/10 | 20 - 23/ 10 - 12 |

[1] Note: See TAC for explanation of Headlight Control versus Comfort Control.

## 5.11 Public Lane (Alley)

Alleys should be centred on the alley right-of-way wherever possible. A 3.0m fillet shall be constructed at the intersection corners of all alley intersections.

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%.

## 5.12 Cross Section Elements

The urban cross section normally consists of the travel lanes, curb and gutter or shoulder (semi urban or rural), storage lanes (i.e., left turn, right turn), parking lanes, separators (i.e., medians, outer separators) and provisions for pedestrians and cyclists (i.e., walkways, trails, bicycle paths/lanes). The minimum requirements for cross section elements for different roadway classifications are described in the following sections.

### 5.12.1 Travel Lane Width

Travel lane widths shall be in accordance with the most current edition of the City Transportation Master Plan and Geometric Design Guide for Canadian Roads, TAC. Recommended travel lane widths for each roadway class are shown in Table 5.12.1-1, and are measured from the lip of gutter (pavement edge). In retrofit situations, TAC also contemplates reduction of these values under sound engineering judgement in regards to safety, traffic operation, speed and capacity.

Table 5.12.1-1 Travel Lane Widths

| Roadway Class | Travel Lane Width (m) |
|---|---|
| Public Lane (Alley)<br>• Residential<br>• Commercial/Industrial | <br>2.0 – 4.0<br>3.5 |
| Local<br>• Residential<br>• Commercial/Industrial | <br>3.0 – 3.2<br>3.5 - 3.7 |
| Minor Collector<br>• Residential<br>• Commercial/Industrial | <br>3.2 – 3.4<br>3.7 |
| Major Collector<br>• Residential<br>• Commercial/Industrial | <br>3.4<br>3.7 |
| Arterial<br>• Minor (Undivided)<br>• Standard (Divided)<br>• Major (Divided) | <br><br>3.5 – 3.7 |

Dedicated parking lanes shall have a minimum width of 2.45m as measured from the face of curb.

## 5.13 Cross Slope Requirements

The cross slope for roadways in urban areas is generally 2% towards the outside pavement edges, as shown in the typical cross section figures. Cross slope requirements for various cross section elements are:

Table 5.12.1-1 Cross Slope Requirements

| Cross Section Elements | Recommended Cross Slope | Minimum Cross Slope |
|---|---|---|
| Roadway | 2% - 2.5% | 2% |
| Gutter | 10% - 12% | 10% |
| Sidewalk/Walkway/Trail | 2% | 2% |
| Border & Boulevard (turf) | 2% - 4% | 2% |
| Shoulder | 2% - 5% | 2% |

Normally, on super elevated sections, the cross-slope of the shoulder on the low side is normally the same as that of the adjacent travelled lane. However, for the high end, the shoulder should either be super elevated to match with the adjacent travelled lane or sloped away from the travelled lane based on the site specific requirements.

In retrofit situations or at critical locations (such as driveways), the cross slope of any cross-section element may be altered to meet existing control elevations. Use of sound engineering judgment and adoption of best practices are recommended in dealing with such site specific critical situations. Typical cross sections shall be referred to confirm the direction of the cross slope for each element.

## 5.14 Curb & Gutter

All City roadways shall be complete with wide base barrier concrete curb and gutter as indicated on the typical roadway cross sections. Refer to the following for requirements, design and specifications for each type of curb and gutter:

- Drawing T-15 Straight Face 150mm Curb with 250mm Gutter
- Drawing T-16 Straight Face 150mm Curb with 500mm Gutter
- Drawing T-17 Roll Face Curb and Gutter
- Drawing T-18 Typical Swale Gutters
- Drawing T-19 Concrete Curb

A 250mm curb and gutter (Drawing T-15) applies to all arterials and expressways. 500mm curb and gutter (Drawing T-16) is to be used in retrofit situations or where required to extend existing 500mm curb and gutter to a transition point at an adjacent intersection or access.

## 5.15 Sidewalks, Walkways and Trails

### 5.15.1 Classification and Design

Classification and design of sidewalks, walkways and trails will be as per:

- Drawing T-20 1.5m and 2.0m Separate Concrete Sidewalk
- Drawing T-21 Roll Face Monolithic Concrete Sidewalk
- Drawing T-22 Straight Face Monolithic Concrete Sidewalk
- Drawing T-23 Asphalt Trail

### 5.15.2 Requirements

The City requires that all sidewalks within new subdivisions are constructed as separate concrete sidewalks.

Table 5.15.2-1 Sidewalk Requirements

| Roadway Class | Location |
|---|---|
| Local Road at Cul-de-sacs<br>• < 6 lots/properties<br>• 6-18 lots/properties<br>• > 18 lots/properties | <br>1.5m sidewalk on one side (Optional)<br>1.5m sidewalk on one side (Required)<br>1.5m sidewalk on both sides (Required) |
| Local<br>• 11.0m Residential<br>• Other Residential/Commercial/ Retail<br>• Industrial | <br>1.5m sidewalk on one side<br>1.5m sidewalk on both sides<br>1.5m sidewalk on one side |
| Collector<br>• 11.5m Residential<br>• All Other Residential/Commercial/ Retail<br>• Industrial | <br>1.5m sidewalk on one side & 3.0m Asphalt Multi-use Trail on other side<br>1.5m sidewalk on both sides or 1.5m sidewalk on one side & 3.0m Asphalt Multi-use Trail on other side<br>1.5m sidewalk on one side |
| Arterial | 2.0m sidewalk on one side and 3.0m Asphalt Multi-use Trail on other side |

Note: If necessary, within a collector or arterial roadway design adjacent to a retrofit turn bay, use a 2.0m width for monolithic concrete sidewalk type in conjunction with straight face curb and gutter at the discretion of the City.

5.15.3 Widths

Table 5.15.3-1 Sidewalk Widths

| Facility | Adjacent Facility | Type | Material | Width |
|---|---|---|---|---|
| Sidewalk | Local/Collectors | Separate | Concrete | 1.5m |
| Sidewalk | Arterial | Separate | Concrete | 2.0m |
| Sidewalk/Gravel Walkway | Emergency Access | Separate/ Monolithic | Concrete/ Gravel | 3.5m |
| Multi-Use Trail | Collectors/Arterial/SWMF | Separate | Asphalt | 3.0m |
| Gravel Walkway | Top of Bank/SWMF | N/A | Gravel | 1.5m |
| Gravel Trail | TUC | N/A | Gravel | 3.0m |

Sidewalks wider than 1.5m may be required on a case-by-case basis at the discretion of the City Engineer. In cases where utilities are located within the right-of-way, alternate alignments may be required at the discretion of the City Engineer to avoid possible conflicts and maintenance concerns with the utilities. A curvilinear alignment may be considered where walkway rights-of-way exceed 10 m in width.

At sidewalk locations directly adjacent to transit stops or transfer points, the City Engineer may require wider sidewalk sections to provide for adequate passenger storage areas.

Monolithic sidewalks may only be considered in retrofit situations or adjacent to school sites to facilitate on-street pickup and drop-off. Monolithic sidewalk adjacent to school sites shall be a minimum of 2.5m measured from face of curb.

5.15.4 Vertical Alignment

The vertical alignment of sidewalks should generally follow the vertical grades of the associated roadways. Walkways and trails should be integrated with the associated horizontal alignment, drainage and berm construction. Since the sidewalks, walkways and trails are used as self-contained drainage corridors, they should be designed to facilitate positive drainage flow. The normal longitudinal grade of all sidewalks, walkways and trails is recommended at 0.7% and the minimum permitted grade is 0.5%.

Variations from the specifications for the design or construction of improvements shall be submitted to and receive written permission from the City Engineer before beginning construction.

The Owner/Applicant shall submit a detailed grading plan with associated walkway profiles for approval by the City 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 6.0 LANDSCAPING herein.

5.15.5 Concrete Curb Ramps

Concrete curb ramps, generally located at intersection locations or terminating locations of walkways, sidewalks or trails shall conform to the design and specifications as detailed in:

- Drawing T-24 Typical Concrete Curb Ramps

Truncated dome Tactile Walking Surface Indicators (TWSIs) shall be provided at curb ramps in high pedestrian activity locations (locations with pedestrian volumes in excess of 33 pedestrians per hour per direction) and shall conform to the latest City of Edmonton truncated dome standards. Tooled groove TWSIs shall be provided at all other curb ramps.

5.15.6 Utilities

Where sidewalks, walkways and trails cross or are located within an existing major utility or pipeline right-of-way, the Owner/Applicant will be responsible to obtain proper written permission/agreement with the appropriate authority prior to construction. The Owner/Applicant 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.

## 5.16 Medians and Outer Separations

A median is that portion of roadway which physically separates the vehicular travel lanes of traffic in opposing directions. The outer separation is that portion of an arterial roadway which physically separates the outside travel lanes of a roadway from an adjacent service roadway or a collector roadway. Median design widths and auxiliary information related to unique design applications shall conform to the most current edition of the Geometric Design Guide for Canadian Roads, TAC. The following drawings outline the general requirements, design and specifications for proposed concrete and landscaped median applications:

- Drawing T-25 Concrete Slab-On Median
- Drawing T-26 Median – Concrete Infill
- Drawing T-27 Median – Landscaped
- Drawing T-28 Drop Nose Median

Median grassing and outer separations shall be constructed in accordance with Section 6.0 LANDSCAPING herein.

## 5.17 Street Furnishings

Street furniture elements including landscaping, benches and waste receptacles, etc. shall be in accordance with the most current edition of the Geometric Design Guide for Canadian Roads, TAC.

## 5.18 Lighting

Roadway lighting refers to lighting of roadways, lanes sidewalks, walkways and trails. Lighting is generally required in all urban and suburban areas. In other areas, lighting requirements are in accordance with the warrants as indicated in the more current edition of the Guide for the Design of Roadway Lighting, TAC.

Roadway lighting designs shall be prepared under the direction of a lighting design professional with the appropriate experience and credentials, and who is registered with the Association of Professional Engineers and Geoscientists of Alberta.

All lighting davits and luminaires shall conform to Fortis standards and shall be of a type available in the Fortis Street Lighting Catalogue.

The lighting design and other utilities must be shown on the construction plan submitted for City approval and conform to the design standards and specifications of Fortis Alberta. Contact the City Engineer or Fortis Alberta for further information.

## 5.19 Intersections

Geometric design of all intersections shall be in accordance with the most current version of the Geometric Design Guide for Canadian Roads, TAC. Intersections should be analyzed considering safety, efficiency and capacity of the roadway network. The designs shall ensure that pedestrian, bicycle, transit and vehicular concerns are addressed. An intersection analysis procedure should be followed and submitted with the overall design of the roadway network.

### 5.19.1 Intersection Spacing

Intersection spacing is mainly governed by the functional classification of the roadway so that roadways with the highest function will have the least number (greatest spacing) of intersection. The following spacing is recommended in accordance with TAC. Variations to this recommendation require approval of the City Engineer.

Table 5.19.1-1 Intersection Spacing

| Type of Roadway | Minimum Spacing (Unsignalized Intersections) | Minimum Spacing (Signalized Intersections) |
|---|---|---|
| Arterial | 200 m | 400 m |
| Collectors | 60 m | 150 m |
| Local | 60 m | N/A |

### 5.19.2 Angle of Intersection

All City roadways shall intersect at, or nearly at right angle (90°). A maximum variation (+/- 10° degrees) may be considered under special circumstances (see Chapter 9 of the most current edition of the Geometric Design Guide for Canadian Roads, TAC), and requires approval of the City Engineer.

### 5.19.3 Intersection Sight Distances

Intersection sight distances shall meet minimum recommendations as per the most current edition of the Geometric Design Guide for Canadian Roads, TAC.

### 5.19.4 Grades and Cross Slopes

Combined vertical and horizontal alignments, including approaching grades and intersection cross slopes shall be design in accordance with the most current edition of the Geometric Design Guide for Canadian Roads, TAC.

## 5.20 Access Management

The following are basic recommendations for access control key to the functional classification of the roadway. Access management concepts and techniques shall be applied in accordance with the most current edition of the Geometric Design Guide for Canadian Roads, TAC.

### 5.20.1 Two-Way Access (Full Movement)

A full movement access is the most prevalent type of access requested and may be associated with a median break on divided roadways. Full movement access should be limited along divided arterial roadways which primary function is to provide high level of service for through traffic.

In special cases where access must be provided along arterial roadways, and right in/right out is not sufficient, a left in movement may be allowed while restricting the left out (3/4 movement). The left-out movement typically is the most difficult one to make because of conflicting traffic flows. Provision of a full movement access, and associated median break, which reduces the length of an existing left turn bay, should only be considered if it is demonstrated that future intersection operation is not degraded by shortening the existing left turn bay.

### 5.20.2 Two-Way Directional Access (Right-In/Right-Out)

This type of access is used to prevent cross traffic and left turns into and out of a site along an undivided roadway, or to provide a high standard of site ingress/egress. Typical applications of this access type are high intensity multiple-use commercial sites.

Right-in/right-out accesses are most appropriate on collector and arterial roadways where through traffic is trying to be facilitated. Accesses for high traffic generators are of a particular concern because a full movement access tends to operate much like a roadway intersection.

In the proximity to a major intersection, where left turn bays are present, a right-in/right-out type access should be positioned in advance (upstream) of the bay taper for the left turn storage area. This allows drivers exiting a reasonable opportunity to cross through lanes to reach the left turn lane. (See Figure 8.8.2 in the most recent edition of the Geometric Design Guide for Canadian Roads, TAC).

### 5.20.3 Access Location

The table below shows the recommended minimum clearances and spacing of driveways or public lanes along a roadway with operating speed as defined in Table 5.8-1, as per the Geometric Design Guide for Canadian Roads, TAC (current edition should be referenced). Higher spacing standards may be required for higher speeds as warranted by traffic conditions. Minimum spacing from

roadways shall be measured from the back of curb of the cross road to the nearest (leading) back of curb of the access throat. Minimum spacing between accesses shall be measured at the property line (between throat edges).

Table 5.20.3-1 Access Spacing

| Reference Location (measured to edge of access) | Minimum Spacing (m) | | | |
|---|---|---|---|---|
| | Single Family Residential | Other Residential | Commercial | Industrial |
| Local Roadways | | | | |
| • From property line | 1.5[a] | 3.0 | 4.5 | 9.0 |
| • From street corner (traffic signals at cross road) | 15 | 15 | 15 | 15 |
| • From street corner (stop control at cross road) | 6[b] | 15 | 15 | 15 |
| • Between accesses[c] | 2.5 | 10 | 12 | 21 |
| Collector Roadways[f] | | | | |
| • From property line | 1.5 | 3.0 | 4.5 | 9.0 |
| • From street corner (traffic signals at cross road) | 55 | 55 | 55 | 55 |
| • From street corner (stop control at cross road) | 20 | 25 | 25 | 25 |
| • Between accesses[c] | 2.5 | 10 | 12 | 21 |
| Arterial (divided) | | | | |
| • From property line | Not permitted. | 5.0 | 5.0 | 6.0 |
| • From street corner (traffic signals at cross road) | | 110[d] | 110[d] | 110[d] |
| • From street corner (stop control at cross road) | | 35 | 35 | 35 |
| • Between accesses[e] | | 20-25 | 35 | 35 |
| Street Furniture (lights, utilities, trees) | 2.0 (trees)<br>1.5 (other) | 1.5 | 1.5 | 1.5 |

Notes: For 'Reference Location' diagram, refer to Figures 8.8.2 and 8.9.2of Geometric Design Guide for Canadian Roads, TAC (current editions should be referenced).

a. Spacing of 0.0m may be permitted for zero lot line developments.
b. Where the separation distance is larger than the lot width, the lot access shall be placed as far away from the road as possible.
c. Greater spacing often results from maximum recommended driveways based on property frontage.
d. Minimum spacing dependent on roadway classification and characteristic; consideration also needs to be taken in regard to the potential impact to left turn storage length and bay taper. Refer to most current edition of Geometric Design Guide for Canadian Roads, TAC.
e. Spacing shown is along divided Arterial; high traffic turning volumes may warrant greater spacing between driveways along arterial roadways
f. Front drive access to collector roadways is permitted only when no other access is available.

It is to be noted that the minimum distance from the intersecting roadway to an access is more critical on an undivided roadway due to effects of left turning traffic into the site.

5.20.4 Curb Crossing Format

There are two types of curb crossing formats; curb returns and curb drops. The choice of when to use each is dependent upon the roadway classification and the land use type to be served. Curb returns should be used on arterial roadways and with high traffic generating developments (greater than 100 vehicles per hour at the peak hour) on collector roadways. Curb drops are appropriate for local and low traffic generating developments on collector roadways.

Single family residential accesses are to be of the curb drop format, perpendicular to the adjacent curb line and installed as per Drawing T-32 Residential Crossing Separate Sidewalk and Drawing T-33 Residential Crossing Monolithic Sidewalk.

Curb drops for public lanes and commercial crossings are to be perpendicular to the adjacent curb line. As well, curb return crossings for two-way accesses to arterials and high traffic generating development accesses to collectors should also be constructed perpendicular to the adjacent curb line. Refer to Drawing T-31 Commercial, Industrial or Arterial Crossing Separate Sidewalk; Drawing T-32 Commercial, Industrial or Arterial Crossing Monolothic Sidewalk; and Drawing T-33 Commercial, Industrial Crossing No Sidewalk for further details and design information.

5.20.5 Access Width

Driveway access width shall be in accordance with most current edition of the Geometric Design Guide for Canadian Roads, TAC or the Urban Supplement to the Geometric Design Standards for Canadian Roads Manual, TAC. Typical driveway width dimensions are:

Table 5.20.5-1 Access Widths

| Access Type | Residential (m) | Multi-family/ Commercial (m) | Industrial (m) |
|---|---|---|---|
| One-way | 3.0 - 4.5 | 5.0 | 5.0 - 9.0 |
| Two-way | 3.0 - 7.5 | 7.5[1] - 12.0[2] | 10.0 - 15.0[3] |

Notes:
1 Two-way access for passenger vehicles;
2 Two-way access for delivery vehicles (cube vans); and,
3 Two-way access for large trucks and semi-trucks.

5.20.6 Acceleration and Deceleration Lanes

Deceleration and acceleration lanes or auxiliary lanes may be required along major roadways for development access to and from the site to safely accommodate turning traffic and to minimize disruption to through traffic flows on the main roadway. Warrant for installation of auxiliary lanes will be at the discretion of the City Engineer. Basic warrants for an auxiliary lane are:

- Along arterial roadways
- If existing or projected traffic volume along main roadway is 30,000 vehicles per day or 600 vehicles per hour per lane

Design for such access is to be in accordance with Chapter 9.14 of the most current edition of the Geometric Design Guide for Canadian Roads, TAC.

5.20.7 Access Throat Length

Adequate driveway storage capacity or throat length for both inbound and outbound vehicles to facilitate safe, unobstructed, and efficient traffic circulation and movements from the adjacent roadway and within the development shall be provided, except for single-family or duplex residential driveways on local streets. The clear throat length is measure from the end of the driveway curb return radii to the point of first conflict on-site. The storage length is dependent on a number of factors including land use, development size, roadway classification, etc. Refer to the most current edition of the Geometric Design Guide for Canadian Roads, TAC for general guidelines for recommended throat length. For higher traffic generating developments a detailed traffic analysis should be completed to determine the appropriate throat length.

5.20.8 Emergency Access

Primary Access Required: The primary access is considered to be the principal access to a site used by occupants of a development on a daily basis. Primary access to all industrial, commercial, and residential developments shall provide adequate emergency vehicle access. Adequate emergency access is a minimum 6.0m wide unobstructed fire apparatus access roadway with an unobstructed vertical clearance of 5.0m, and meets all applicable standards as set forth in the NFPA 1141: Standard for Fire Protection Infrastructure for Land Development in Suburban and Rural Areas, latest edition of Alberta Fire Code and latest edition of The Alberta Building Code.

Emergency Access Route or Secondary Access Street Requirements: When adequate emergency access is not available from a public street (primary access route), an applicant for construction approval shall construct an emergency access route or a secondary access street in accordance with the latest edition of Alberta Fire Code and the NFPA 1141: Standard for Fire Protection Infrastructure for Land Development in Suburban and Rural Areas.

General cul-de-sac's requirements are as follows:

a. The normal maximum length of a cul-de-sac is 120m from the street curb line to the start of the bulb. Cul-de-sac in excess of 120m and less than 170m will require an additional hydrant. Watermain looping will be required if the cul-de-sac is of more than 120m. Where cul-de-sacs in excess of 120m are proposed, provisions must be made for a 6.0m wide Public Utility Lot (PUL) for emergency vehicle access and water service looping. Emergency vehicle access PUL's shall be developed to a standard acceptable to the City Engineer.
b. Cul-de-sacs with steep grades are to be avoided. If cul-de-sacs cannot be graded to drain towards the intersection, then an outlet for the overland flow must be provided by way of a PUL.
c. The minimum radius of cul-de-sac bulbs is 11m to face of curb.
d. Cul-de-sac road surface is to be crowned except the bulb portion which may be crossfall.

The requirements for secondary development accesses and turnarounds are as follows:

a. Up to 90m Length
    - For private sites, no turnaround required.
    - For public roads, a cul-de-sac is required.
    - No other access required.

b. Between 90m and 120m Length
   - Turnaround required for any dead-end portion of the access route more than 90m long.
   - No other access required
   - For private sites, turnaround can be a "hammer-head" or a parking lot meeting 12.0m centreline roadway radius at corners and 6.0m minimum road width.
   - For public roads, a cul-de-sac is required.

c. Between 120m and 200m Length
   - Emergency access route required
   - For private sites, minimum 6m wide and designed to carry fire apparatus load of 38,556 kg (85,000 lbs)
   - For public PUL connections, minimum 3m hard surface width in 6m right of way designed to carry fire apparatus load of 38,556 kg (85,000 lbs)
   - Emergency access road must connect to public thoroughfare
   - Swing gates or other approved gates may be used to limit access to emergency vehicles only

d. Any of the following are met:
   - Over 200m Length, or
   - Over 100 lots, or
   - Daily volumes in excess of 1000 vehicles per day on any portion of a local roadway
     - Second public access required
     - Full public road standard connecting to public thoroughfare

Parking Restriction on Emergency Access Routes: Curb side parking shall be restricted on emergency access routes (public or private roadways) to provide adequate unobstructed fire apparatus access as follows:

Table 5.20.8-1 Carriage Way Widths and Parking Restrictions

| Roadway Carriageway Width[1] (m) | Parking Restrictions |
|---|---|
| 6.0 | No parking of any kind. No-parking signs shall be posted on both sides of the access route |
| 7.5 | Parking will be permitted on one side of the access route. No-parking signs shall be posted on one side |
| 9.0 | Parking shall be permitted on both sides of the access route |
| One-way access route | One-way access routes are to be a minimum of 6m wide with no parking. No-parking signs shall be posted on both sides of the access road. |

Note: [1] Roadway carriageway width measurement does not include the curb and gutter.

Sidewalks and Walkways Designated for Emergency Access: Where a walkway is designated as an emergency access route by the City, the following requirements apply:

- The walkway shall be centred on the right-of-way (straight alignment) and constructed with 120mm of Portland cement concrete. The walkway width shall be a minimum of 3.5m to allow access by emergency vehicles.
- If planting is proposed for the right-of-way a minimum 4.0m clearance must be provided to allow access by emergency vehicles.

- Swing gates must be placed at each end of the walkway access, as shown within the Landscaping Section drawings. The posts shall prevent non-emergency vehicle access while allowing access for maintenance equipment.
- Standard curbs at the approaches to the sidewalks or walkways are adequate; drop curbs are not required.
- Sidewalk and walkway lighting standards and other furniture must be located so that they would, in the opinion of the City Engineer, not obstruct emergency vehicle access.
- The normal gradient for emergency access walkways shall be 0.7% and the minimum gradient shall be 0.5%.

## 5.21 Transit Requirements

Fort Saskatchewan Transit (FST) currently operates routes locally as well as a commuter service to the City of Edmonton. All development applications shall consider and comment on the accommodation and effect transit services and facilities where applicable.

The Owner/Applicant shall confirm with the City on any transit supportive development characteristics or technical requirements applicable to the proposed development including but not limited to:

- transit supportive strategies (land use/zoning regulations, target densities, etc.)
- on-site parking relaxation
- recommended walking distance to existing or planned nearby facilities
- adjacent bus routes (existing or planned)
- potential incorporation/relocation of bus stops (i.e. spacing, location)
- bus stop dimension/design including (shelter, concrete pad, signage, benches, etc.)
- bus turnaround requirements
- pedestrian/bicycle amenities and directness of bikeways/pathways

Design of Transit facilities shall follow the most current edition of the City of Edmonton Transit Design Standards.

## 5.22 Traffic Control

The design and application of traffic control devices including signage, pavement markings and traffic signals shall be in accordance with the most current edition of the Manual of Uniform Traffic Control Devices for Canada (MUTCD), TAC, and the Alberta Traffic Safety Act, as appropriate.

If signage and pavement markings are required for the proposed development, the Owner/Applicant will be responsible for providing the design and ensuring they are completed by an Engineer with appropriate credentials. The Owner/Applicant shall submit the detailed signage and pavement markings plans for approval by the City Engineer in conjunction with the detailed engineering drawings for all other municipal improvements in the development area. The Owner/Applicant is also responsible for the installation of the signage and pavement markings in conjunction with any improvements required to City infrastructure as a result of the development. with the installation of the City services.

The requirements for stop control should be based on MUTCD warrants, and traffic signals should be confirmed using the most current version of the TAC traffic signals warrant guidelines (Canadian Traffic Signal Warrant Matrix Procedure). Signalization may be required if there are any of the following situations:

- collision concerns
- abnormal left turn volumes
- pedestrian hazards
- insufficient sight distance
- delay problems
- undesirable gaps

In coordination with the City, the Owner/Applicant is responsible for the cost and installation of traffic signals that are a direct result of the traffic generated by the development.

### 5.22.1 Rectangular Rapid Flashing Beacons (RRFBs)

The Manual of Uniform Traffic Control Devices (MUTCD, TEC) and Pedestrian Crossing Control Guide (TAC) provide guidelines for the installation of RRFBs on roadways. Generally, RRFBs should be evaluated in new developments for:

- Mid-block crossings of collector or arterial roadways where traffic volumes will exceed 9,000 vehicles per day
- Intersection crossings of collector or arterial roadways in the vicinity of schools, park sites, or other high pedestrian traffic generating uses

RRFBs should not be utilized for crosswalks across approaches with other traffic controls (i.e., yield control, stop control, traffic signals, roundabouts).

## 5.23 Pavement Markings

The Manual of Uniform Traffic Control Devices (MUTCD) provides guidelines for the design and implementation of various pavement markings on roadways. General pavement markings will be as per:

- Drawing T-34 Pavement Marking Types and Width
- Drawing T-35 Intersection Pavement Markings
- Drawing T-36 Intersection Pavement Markings

All transverse pavement markings for new road construction are to be inlaid thermoplastic. Longitudinal pavement markings may be painted. In staged construction, painted markings are required upon construction completion, inlaid thermoplastic required upon final acceptance.

Pavement marking arrows shall be provided as required per the latest edition of the Manual of Uniform Traffic Control Devices for Canada (MUTCD-C), TAC.

## 5.24 Traffic Calming

Traffic calming measures are required on all new collector roadways. Implementation of other traffic calming measures will be determined on a case-by-case basis. Any proposed traffic calming measures must be identified and approved as part of a Neighbourhood Area Structure Plan or appropriate approval process.

The design of traffic calming measures should consider key factors, including but not limited to:

- weather, particularly winter conditions
- topography
- existing roadway classification and design standards (i.e. traffic volumes, roadway widths, operating speed, etc.)
- drainage
- existing utilities
- on-street parking conditions
- access/driveway locations near intersections
- transit, truck, service and emergency vehicle requirements
- designated cycling routes
- construction and maintenance requirements
- visibility in winter conditions

The Canadian Guide to Traffic Calming 2nd Edition (TAC) provides guidelines for planning, design and implementation of traffic calming measures on Canadian roadways. At minimum, traffic calming or improved pedestrian crossings (curb bulb outs, raised crosswalks, etc.) shall be provided at known and anticipated major crossing points, such as midblock crossings, intersection trail crossings, and crossings at or adjacent to parks and school spaces. This may include local and collector roadways. Traffic calming at residential collector intersections may also be required at the discretion of the City. Additional traffic calming measures may also be considered as outlined in TAC's Canadian Guide to Traffic Calming, such as vertical deflections, lateral deflections, constrictions, entrance features, or other means to alter driver behaviours and improve conditions for residents and vulnerable users.

## 5.25 Pavement Design

The first submission of engineering drawings shall be accompanied by a geotechnical report, complete with borehole logs. The report shall specify the roadway structures required and all assumptions used in the roadway structure design, including California Bearing Ration (CBR) values, design traffic loading and pavement design life. Typically, all the roadways within City limits, regardless of their classification, shall be designed considering 20 years life span unless otherwise directed by the City. In case of staged construction, the life span for a given roadway shall be considered after the final stage of paving.

No changes to the approved mix design shall be made without written approval from the City. The City may seek advice from an independent consultant for the suitability of the mix design for a given roadway.

Paved roadways shall be designed in accordance with the 1993 AASHTO Guide for the Design of Pavement Structures method of pavement design. Design parameters such as traffic count, percentage of trucks, subgrade modulus, etc., are to be provided to the City. The City reserves the right to request the Owner/Applicant to engage a geotechnical engineering agency to carry out CBR tests on the subgrade prior to paving, to confirm adequacy of design.

Staged construction for asphalt work is preferred with the final lift of asphalt placed during the construction season prior to Final Acceptance Certificate (FAC). Refer to the Subdivision and Development Servicing Standards and Construction Specifications for more information.

Minimum pavement structures should follow:

Table 5.22.1-1 Minimum Pavement Structures

| Roadway Class | Stage 1 | | Stage 2 |
|---|---|---|---|
| | Minimum ACP Thickness (mm) | Minimum GBC Thickness (mm) | Minimum ACP Thickness (mm) |
| Public Lane (Alley)<br>• Residential<br>• Commercial/Industrial | <br>75<br>125 | <br>250<br>325 | <br>Non-Staged<br>Non-Staged |
| Local<br>• Residential<br>• Commercial/Industrial | <br>65<br>100 | <br>200<br>350 | <br>35<br>40 |
| Minor Collector<br>• Residential<br>• Commercial/Industrial | <br>75<br>110 | <br>275<br>350 | <br>35<br>40 |
| Major Collector<br>• Residential<br>• Collector/Industrial | <br>75<br>150 | <br>350<br>350 | <br>35<br>40 |
| Arterial<br>• Minor (Undivided)<br>• Standard (Divided)<br>• Major (Divided) | Requires traffic evaluation. | | |

The following Tables indicate the range of inputs for use in the AASHTO 93 Design guide for City of Fort Saskatchewan.

Table 5.22.1-2 Recommended Subgrade Modulus

| Soil Type (As determined through Investigation) | Subgrade Modulus $M_R$ (MPa) |
|---|---|
| High Plastic Clay (Ci, CH) | 30 |
| Low Plastic Clay (CL, MH) | 40 |

Table 5.22.1-3 Recommended Reliability

| Design ESALS ($x10^6$) | Reliability % |
|---|---|
| <0.1 | 75 |
| 0.1-5.0 | 85 |
| 5.0 to 10.0 | 90 |
| >10.0 | 95 |

Table 5.22.1-4 Recommended Layer Coefficients

| Material | Layer Coefficient |
|---|---|
| Asphalt Concrete (Surface and Base Course) | 0.40 |
| Asphalt Stabilized Base Course (Foamed Asphalt) | 0.28 |
| Granular Base Course | 0.14 |
| Granular Subbase Course | 0.10 |

Table 5.22.1-5 Recommended Drainage Coefficient

| | |
|---|---|
| Drainage Coefficient (Granular Base) | 1.0 |

Table 5.22.1-6 Recommended ESAL Values for Road Classifications

| Roadway Design | Design ESAL Value* |
|---|---|
| Residential Local Roadway | $3.6 \times 10^4$ |
| Residential Minor Collector (Truck Route with No Bus) | $1.8 \times 10^5$ |
| Residential Major Collector (Truck and Bus Route) | $3.6 \times 10^5$ |
| Light Industrial & Commercial | $1.0 \times 10^6$ |
| Light Industrial and Commercial Collector | $3.0 \times 10^6$ |
| Arterial | Requires Traffic Evaluation |
| Major Arterial | Requires Traffic Evaluation |

*Note: ESAL values should always be verified before design.

Table 5.22.1-7 Recommended Serviceability

| | Serviceability Index |
|---|---|
| Initial | 4.2 |
| Terminal | 2.5 |

Table 5.22.1-8 Recommended Standard Deviation

| Pavement Type | Overall Standard Deviation |
|---|---|
| Asphalt | 0.45 (new Construction) 0.49 (Overlays) |
| Concrete | 0.35 (new Construction) 0.39 (Overlays) |

## 5.26 Drainage Design

Stormwater Management and drainage design is integral to the design of all transportation components, and shall conform to City standards. Refer to Section 4.0 Storm Drainage herein for Drainage Design Guidelines.

For all roadways, catchbasins must not be placed with a curb ramp or curb ramp flare.

## 5.27 Noise Attenuation

A Noise Impact Assessment (NIA) is required for all low-density residential land uses where the rear amenity area backs or abuts onto an expressway. The NIA shall be prepared under the direction of a noise professional with the appropriate experience and credentials and is registered with the Association of Professional Engineers and Geoscientists of Alberta.

Noise abatement (berms, wall, fences, etc.) will be required for new developments where noise levels exceed 65 dBA $L_{eq}24$ at full roadway buildout.

## 5.28 Boulevard Alterations

Boulevard alterations shall be approved by the City Engineer. Alterations shall maintain the required access spacings identified in Section 5.20.3.

## 5.29 Guardrail and Barriers

All guardrail and roadside barrier systems shall be design in accordance with the latest version of the Alberta Transportation Roadside Design Guide.

## 5.30 Construction Specifications

See next page

## 5.30 Construction Specifications

### 5.30.1 CLEARING AND GRUBBING

All work shall be done within the limits of rights-of-way and permanent and working easements, and shall include the complete disposal of all buildings, fences, vegetation and other debris.

All work shall be in accordance with existing Provincial and City fire; public safety, and environmental regulations and laws, and be done in accordance with the "approved" drawings and specifications.

Work shall not disturb nesting birds or other wildlife. Development shall abide by all Alberta Environment standards and guidelines and carry out all mandates as set forth such as performance and documentation of nesting checks.

## 5.30.2 EARTHWORK

*5.30.2.1 Topsoil Stripping and Stockpiling*

Topsoil shall be stripped to its full depth on all road rights-of-way and excavation areas, and stockpiled for use in final grading and/or landscaping. Stripped topsoil shall be separated from other classes of excavation and kept free from contaminants.

For City contracts, topsoil shall be conserved and reused within the project work area. Excess topsoil shall not be disposed of without written authorization from the City Engineer.

*5.30.2.2 Common Excavation*

All excavation shall occur within the limits of the proposed work to the lines, grades and dimensions as shown on the contract drawings or noted in the contract documents, unless directed otherwise by the City Engineer. Surplus or unsuitable material shall be disposed of at a site approved by the City Engineer.

*5.30.2.3 Embankment Construction*

1. Fill material shall be placed in maximum 150 mm (loose) successive uniform layers, each compacted to a minimum of 98% Standard Proctor Density at optimum moisture content unless stated otherwise. Where required, the area receiving fill material will be cleared and grubbed, unsuitable material removed and the area scarified prior to placing fill material. Only material approved by the City Engineer shall be used.
2. Testing shall occur at a minimum of one density test for each 1000 m2 of compacted lift, or as otherwise approved by the City Engineer, using ASTM D1556, ASTM D2167 or ASTM D2922. For comparison, the maximum density is determined according to ASTM D698 Method A. If a test is below the required density the area represented by the test shall be reworked at the Contractor's expense to the depth of the lift, moisture content adjusted if necessary and compacted to the specified density.

*5.30.2.4 Borrow*

Where a sufficient quantity of suitable fill material is not available from excavation on the site, additional fill may be borrowed from other sources. In no case shall City-owned areas be undercut for borrow. All borrow material locations are to be approved by the City Engineer to ensure there are no conflicts with future development.

*5.30.2.5 Grade Tolerance*

1. All graded surfaces shall meet a grade tolerance of ±25mm from designated grade elevations unless otherwise approved by the City Engineer. Crossfalls and ditch bottoms shall be graded to allow for a positive flow of water, with a minimum transverse slope of 1%. High areas shall be trimmed to within the tolerance. Low areas shall be scarified, filled with approved material, compacted to the required density and graded to within tolerance.
2. On finished surfaces, localized high and low points or other obstructions that inhibit drainage, will not be accepted.

*5.30.2.6 Equipment*

All proposed routes for hauling equipment other than trucks must be approved by the City Engineer prior to commencement of the work. Rubber-tired motor scrapers shall not be used to haul over improved streets. Traffic must be controlled by flagmen and sufficient warning signs to ensure the safety of the public when any travelled roadway is being entered or crossed by hauling equipment to the satisfaction of the City. Road closures and detours must be submitted to and approved by the City a minimum of 48 hours prior to scheduled work. Haul routes must be kept free and clear of debris or construction materials and dust abatement shall be performed to the satisfaction of the City Engineer. Trucks shall be loaded in such a manner that no spillage occurs.

### 5.30.3 SUBGRADE PREPARATION

*5.30.3.1 General*

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

*5.30.3.2 Quality Assurance*

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.
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, concrete monolithic walk, private, commercial and alley crossings and asphalt walks/bikeways and a minimum of 97.0% of the maximum density for each 150 mm lift of subgrade under concrete separate walks, curb ramps, slabs, and walk made of concrete pavers, brick pavers, or granular materials.
3. Testing Frequency: the quality assurance laboratory will take a minimum of one field density test for each 1 000 m2 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 City Engineer.
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 5.5.5 – Proof Rolling or the City Engineer's recommendations.

*5.30.3.3 Products*

Only compacted clay subgrade soil or suitable in-situ soils shall be used with no deleterious material as approved by the City Engineer.

*5.30.3.4 Subgrade Preparation*

1. Soil shall be loosened to the 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.
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. If the City Engineer determines that it is not practical to dry an otherwise suitable soil, the City Engineer may order soil stabilization to Section 5.5.4 - Cement Stabilized Subgrade.
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.

*5.30.3.5 Field Quality Control and Grade Tolerance*

1. The finished surface of subgrade shall meet the following tolerances:
   a. 6mm maximum variation above designated elevation
   b. 25mm maximum variation below designated elevation

   The grade shall not be uniformly high or low.
2. When grade tolerances are exceeded, the Contractor shall, at their expense:
   a. Trim high spots and refinish surface to within tolerance.
   b. Add approved material to low areas, scarify and blend to full subgrade depth, re-compact 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. 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 re-compacted to the required density at the Contractor's expense. If the area is not retested but is reworked and re-compacted the area shall be tested at normal testing frequencies.

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

*5.30.3.6 Protection Of Finished Work*

1. Do not permit vehicular traffic over the prepared subgrade.
2. If flooding 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. 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.

### 5.30.4 CEMENT STABILIZED SUBGRADE

*5.30.4.1 General*

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

*5.30.4.2 Quality Assurance*

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.
2. Required Density: a minimum of 100.0% of the maximum density for each 150 mm lift of stabilized subgrade.
3. Testing Frequency: the quality assurance laboratory will take a minimum of one field density test for each 1 000 m2 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 City Engineer.
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 5.5.5 – Proof Rolling or the engineer's recommendations.

*5.30.4.3 Products*

1. Cement: Cement shall conform to CSA A3000, A3001-03, Type GU – General use hydraulic cement.
2. Water: Water may be obtained from City fire hydrants or other municipal water sources. Other water sources are subject to the City's approval.
3. Cement Spreader: Must be capable of spreading cement uniformly.
4. Mixing Equipment: Must be designed for and capable of mixing the full depth of the subgrade in one pass, subject to the City's approval.

*5.30.4.4 Stabilization*

1. Subgrade areas to be stabilized will be indicated on the plans or designated by the City Engineer.
2. Subgrade areas shall be pre-graded and shaped to the designated grade and cross section.
3. 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.
4. Contain cement dust within site area. Do not spread cement during or when there is imminent danger of high winds or rain.
5. Spread and blend cement into soil at a minimum rate of 10 kg/m2 of 150 mm compacted depth, or as directed by the City Engineer, but in no case should the cement exceed 30 kg/m2. In the event that it is determined, in the field that more than 30 kg /m2 is required it is recommended that the situation be examined by a representative from a qualified geotechnical engineering firm and approved by the City to determine the requirements moving forward.
6. Add sufficient water to the blended soil and cement to best achieve the required compaction. Mix until homogeneous.
7. Spread the mixture uniformly in lifts of 150 mm compacted thickness. Compact each lift to the required density.
8. Complete mixing, compaction and finishing on the same day.
9. Water may be lightly sprayed with a pressurized distributor for surface finishing.
10. 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.
11. Material should not be frozen at the time of stabilization.

*5.30.4.5 Field Quality Control*

1. The finished surface of the stabilized subgrade shall meet the following tolerances:
   a. 6mm maximum variation above designated elevation
   b. 25mm maximum variation below designated elevation

   The grade shall not be uniformly high or low.
2. When grade tolerances are exceeded, the Contractor shall, at their expense:
   a. Trim high spots and refinish surface to within tolerance.
   b. Add approved material to low areas, scarify and blend to full subgrade depth, re-compact 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. 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 re-compacted to the required density at the Contractor's expense. If the area is not retested but is reworked and re-compacted the area shall be tested at normal testing frequencies.
4. The Contractor shall assume the risk of uncovering and reworking the subgrade if it is covered before the City has accepted test results thereof.

*5.30.4.6 Protection Of Finished Work*

1. Do not permit vehicular traffic over the prepared subgrade.
2. If flooding 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. 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.

### 5.30.5 PROOF ROLLING

*5.30.5.1 General*

This section includes the verification of the stability and uniformity of the subgrade compaction. This procedure shall be performed in the presence of the City Engineer. Actual requirements for representation on the project site for the proof rolling operation will be site dependent.

*5.30.5.2 Execution*

1. The vehicle used to perform the Proof rolling shall conform to the following:
   a. A tandem axle, dual wheel dump truck, a water truck, or a grader.
   b. Tire pressure shall be no less than 90 percent of the manufacturer's recommended maximum inflation.
   c. The minimum gross weight of the loaded truck shall be 24,800 kg. A weigh scale slip shall be available to confirm the truck weight and be provided to the Engineer by the Contractor upon request.
2. 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 City Engineer to measure any deflections and/or areas of rutting.
3. Operate the proof roll in a pattern so that all areas are loaded with at least one pass of the proof rolling vehicle.
4. After proof rolling, check the subgrade for conformance to the plans, and correct all surface irregularities. Re-shape the subgrade to specified tolerances.

*5.30.5.3 Evaluation*

1. There shall not be any discernable rutting during the proof roll. Permanent rutting shall be considered a failure and will require the subgrade to be reworked and recompacted.
2. There shall not be any discernable deflection (pumping) of the subgrade during the proof roll. Any deflection shall be considered a failure and will require the subgrade be reworked and recompacted.
3. Rutting and/or deflections must be reviewed by a representative from a qualified geotechnical engineering firm who is to provide recommendations as to how to meet density and performance requirements.

## 5.30.6 GRANULAR MATERIALS

*5.30.6.1 General*

This section includes designated classes, gradation and physical requirements of aggregate, production and supply of aggregate, and quality assurance.

*5.30.6.2 Quality Assurance*

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 5.5.6.1, and 5.5.6.2. The Contractor shall provide a daily estimate of production tonnage to the quality assurance laboratory.
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.
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 City Engineer. Alternatively, the contractor may elect to remove the suspect gravel from the jobsite and provide aggregate from a different source.

*5.30.6.3 Submittals*

1. At the City Engineer's discretion, provide copies of scale certificates to the City Engineer prior to use.
2. At the City Engineer's discretion, each truckload of aggregate weighed in shall have a ticket filled out and submitted to the City Engineer.
3. Quality Control Plan
    a. Submit a minimum of one sieve analysis per 500 tonnes of aggregate for stockpile or 500 tonnes of aggregate shipped directly from the crusher to the jobsite to the City of Fort Saskatchewan. 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.
    b. Evaluation of Tests:
        i. 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.
        ii. The preceding evaluation will be repeated for subsequent series of 8 consecutive tests.

*5.30.6.4 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.

*5.30.6.5 Products*

Aggregates shall conform to the requirements in Tables 5.5.6.1, 5.5.6.2, and 5.5.6.3.

**Table 5.30.6.1 Aggregate Gradation Specifications for Designations 1-3**

| Designation | 1 | | | 2 | 3 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Class | 10 | 10 | 20 | 20 | 20 | 25 | 40 | 63 | 80 |
| Application | 10mm-HT | 10mm-LT | 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 | | | 97 - 100 | 100 | 100 | 82-97 | 60 -90 | 50 -70 | 40 -81 |
| 16 000 | | | 83 – 97 | - | 84 -95 | 70-93 | 55 -85 | 44 -65 | 32 -76 |
| 12 500 | 100 | 100 | 70 – 92 | 60 -96 | 60-90 | 60-86 | 50 -80 | 38 -60 | 30 -70 |
| 10 000 | 97-100 | 97-100 | 61 - 84 | - | 50–84 | 52-79 | 44 -74 | - | - |
| 8 000 | 70-94 | 80-94 | 52 – 77 | | | | | | |
| 6 300 | 45-85 | 65-85 | 44 – 70 | - | - | - | - | 23 -47 | - |
| 5 000 | 32-75 | 50-75 | 38 – 65 | 36 -75 | 37- 62 | 35-64 | 32 -62 | 20 -45 | 25 -50 |
| 2 500 | 23-55 | 35-55 | 26 – 52 | | - | - | - | - | - |
| 2 000 | - | - | - | 24 -54 | 26- 50 | 24-50 | 20 -50 | 14 -38 | 19 -42 |
| 1 250 | 16-45 | 25-45 | 18 – 41 | 20–43 | 19- 43 | 19-43 | 17 -43 | 12 -34 | 15 -38 |
| 630 | 11-36 | 20-36 | 13 – 31 | 14–34 | 14- 34 | 14-34 | 12 -34 | 10 -28 | 10 -32 |
| 400 | - | - | - | 11 -29 | 11- 28 | 10-27 | 10 -28 | 8 -24 | 7 -27 |
| 315 | 8-26 | 14-26 | 9 – 22 | 9 –26 | 10- 25 | 9–24 | 8 -25 | 7 -22 | 6 -24 |
| 160 | 5-15 | 7-15 | 6 – 14 | 6 -20 | 6 -18 | 6–18 | 5 -18 | 4 -17 | 3 -18 |
| 80 | 3-8 | 4-8 | 3 - 7 | 2 -10 | 2–10 | 2–10 | 0 -10 | 0 -10 | 0 -10 |

**Table 5.30.6.2 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 - 95 | 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 5.30.6.3 Aggregate Properties**

| Designation | 1 | | 2 | 3 | | | |
|---|---|---|---|---|---|---|---|
| Class | 10 | 20 | 20 | 20 & 25 | 40 | 63 | 80 |
| Application | 10mm-HT & 10mm-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 5.5.8 SGC Hot Mix Asphalt Concrete for requirements.

*5.30.6.6* *Equipment*

1. Crushers shall be capable of producing aggregate as specified.
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.
3. At the City Engineer's discretion, scale tickets forms are to be supplied by the Contractor to truckers. Scale ticket forms are to be approved by the City.
4. Metric Sieves: CAN/CGSB 8.2 M sieve sizes shall replace ASTM E11 sieves as per Table 5.5.6.4.

**Table 5.30.6.4 Metric Sieves**

| CAN/CGSB-8.2-M Sieves (µm) | 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 |

*5.30.6.7 Execution*

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.

2. Preparation

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

3. Hauling Aggregate from Stockpiles
   a. Upon request of the City, provide haul tickets confirming material within stockpile and amount hauled. Have loaded trucks weighed and provide weigh tickets to the City.
   b. Deliver aggregate to the jobsite and discharge at the designated location.

## 5.30.7 GRANULAR BASE COURSE

*5.30.7.1 General*

This section includes: the spreading and compacting of imported aggregate into a base or sub-base, the scarifying, shaping and compacting of existing granular base or sub-base, and the windrowing of existing gravel, preparing the subgrade and spreading and compacting granular base or sub-base.

*5.30.7.2 Quality Assurance*

1. Maximum Density

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

2. Testing Frequency

   The quality assurance laboratory will take a minimum of one field density test on a compacted granular lift for each 1 500 m2 of road, 1 000 m2 of alley, or 500 m2 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 C.

3. 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.

**Table 5.30.7.1 Granular Base Course Density Requirements**

| Compacted Granular Base Course | Required Percentage of Maximum Density |
|---|---|
| under roads, curb and gutter | 100% |
| under commercial or alley crossings | 100% |
| under concrete walk, transit pads | 97% |
| under walk portion of monolithic walk | 100% |
| under curb ramps | 100% |
| under private crossings | 97% |
| under median or island strips | 97% |
| under shared used paths | 100% |

*5.30.7.3 Products*

1. Granular Materials shall conform with section 5.5.6 Aggregate, Designation 3, classes as indicated on the Drawings.
2. Equipment: Graders, rollers and other equipment of adequate design and capacity to produce a granular base or subbase as specified.

*5.30.7.4 Execution*

1. Preparation
   a. The prepared subgrade shall be inspected by the City before placing the granular course.
   b. 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.

2. New Granular Base or Subbase Course
    a. Deposit aggregate and spread uniformly in lifts not exceeding 150 mm thickness when compacted.
3. Segregation:

    If segregation occurs:
    a. In Class 20 aggregate: blade the lift and mix thoroughly before final spreading and shaping to crown and grade.
    b. In Class 63 or Class 80 aggregate: remove and replace the segregated material.
4. Existing Gravel on Suitable Subgrade
    a. 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.
    b. 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.
    c. Spread and shape to crown and grade in lifts not exceeding 150 mm when compacted.
5. Existing Gravel on Subgrade to be Re-worked
    a. 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.
    b. When directed by the City Engineer, excavate and remove unsuitable subgrade soil and backfill with approved material to Section 5.5.6 – Granular Materials.
    c. Prepare 150 mm subgrade to Section 5.5.3- Subgrade Preparation or Section 5.5.4 - Cement Stabilized Subgrade.
    d. If subgrade is found to be too low, scarify and blend with approved imported fill and compact in 150 mm lifts to Section 5.5.3 - Subgrade Preparation or Section 5.5.4 - Cement Stabilized Subgrade.
    e. If subgrade is found to be too high, remove excess soil, scarify to 150 mm depth and compact to Section 5.5.3 - Subgrade Preparation or Section 5.5.4 - Cement Stabilized Subgrade.
    f. Repeat steps a-e on the other half of the road or alley.
    g. After reworking the subgrade, prepare gravel for compaction.
6. Compaction
    a. Bring the moisture content of the aggregate to near optimum and have the compaction tested within 48 hours of concrete or asphalt placement.
    b. 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 re-compacted to the required density. If the area is not retested but is reworked and re-compacted the area shall be tested as per normal testing frequencies.
    c. 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.
7. Field Quality Control
    a. Check finished surface of granular base to ensure that it meets the following tolerances:
        i. Surface Tolerance:

            15 mm maximum variation under 3 m straightedge.
        ii. Grade Tolerance:

            6 mm maximum variation above designated elevation and

15 mm maximum variation below designated elevation.

b. When Tolerance Exceeded
   i. Trim high spots and refinish surface to within tolerance.
   ii. Add approved aggregate to low areas, scarify, blend, re-spread and re-compact to required density and refinish surface. Alternatively, compensate low areas with extra thickness of subsequent granular base course.

8. Subsequent Paving Course
   a. Do not permit vehicular traffic on the compacted granular base before paving.
   b. If the granular base floods, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches.
   c. Repair any damage, including freezing, to the granular base course and retest for density before paving or concrete pour.

## 5.30.8 SGC HOT-MIX ASPHALT CONCRETE

*5.30.8.1 General*

This section includes: the production of a hot mixture of asphalt cement, aggregate, and/or other materials, for paving, and the requirements for submittals, materials, mix design, quality control, quality assurance, and mix production.

*5.30.8.2 Definitions*

1. Asphalt Cement Content

   The amount (percentage) of asphalt cement in the SGC hot-mix, as determined in Clause 5.5.8.3 Quality Assurance, and is the value upon which any unit price adjustments will be based.
2. 10mm – High Traffic (10mm – HT): Mix used primarily for paving residential collector roadways and selected arterial roadways.
3. 10mm – Low Traffic (10mm – LT): Mix used for paving local residential roadways and alleyways.
4. 20mm – Base (20mm-B): Base course for expressways, arterials, industrial/commercial roadways and collector roadways.
5. Bailey CA-CUW: Coarse Aggregate (CA) Chosen Unit Weight (CUW) of combined aggregate as defined by the “Bailey Method”.
6. Bailey CA-LUW: Bailey method CA – Loose Unit Weight (LUW).
7. Bailey CA-RUW: Bailey method CA – Rodded Unit Weight (RUW).
8. Bailey FA-LUW: Bailey method Fine Aggregate (FA) – LUW.
9. Bailey FA-RUW: Bailey method FA – RUW.
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.
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
12. 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, and requires approval of the City.
13. SGC Specimens: Test specimens prepared using the Superpave Gyratory Compactor (SGC) at a specified number of design gyrations ($N_{design}$) 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.

*5.30.8.3 Submittals*

1. Asphalt Cement Data
   a. 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.

b. 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.

2. SGC Mix Design

a. Submit a SGC mix design, carried out by an independent laboratory, to the City 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 City. 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 City;
- Number of design gyrations ($N_{design}$) in the SGC;
- Number of maximum gyrations ($N_{maximum}$) 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.

b. The review of the submitted SGC mix design will not begin until all of the information required in Clause 5.5.8.3.2-SGC Mix Design has been provided.

c. 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.

3. Plant Scale Certificate
   a. Provide a copy of the plant scale certificates to the City at least 10 days prior to any SGC hot-mix production.
4. Job Mix Formula
   a. Submit with the SGC hot-mix mix design the proportions of materials and plant settings to be used include the following:
      i. 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.
      ii. 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).
5. Quality Control Plan
   a. Before commencing SGC hot-mix production, submit a quality control plan to the City for review and approval. The quality control plan is to including the following recommended tests and frequency, as a minimum.
   b. Submit test results, as requested, to the City for review.

c. 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.

d. 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.

6. Aggregates
   a. 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.
   b. Submit results to the City within 72 hours of the completion of testing. Do not use aggregate until test results have been reviewed and accepted by the City Engineer.

*5.30.8.4 Quality Assurance*

1. Inspection and Testing
   a. In addition to field inspections by the City Engineer, the City will conduct plant inspection and materials sampling and testing described in the following paragraphs.
2. Asphalt Plant
   a. 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.
3. Asphalt Cement
   a. Quality assurance sampling and testing of the asphalt cement shall be performed by 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 otherwise determined by the City. It is the contractor's responsibility to inform the City of the delivery of asphalt Cement to their facility for sampling.
   b. If non-complying material is identified, the paving program may be suspended for 24 hours, as directed by the City Engineer, during which time the Contractor, the City Engineer, and City 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 City.

c. 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 City Engineer with complying material by the Contractor at no cost to the City.

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

e. 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.

4. Production Mix Analysis

a. 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.

b. 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.

c. 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.

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

5. Job Mix Formula

a. The City 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 City Engineer until successful results are obtained by the City.

*5.30.8.5 Quality Control*

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.

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 the City.

*5.30.8.6 Materials*

1. Asphalt Cement: 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 this specification as Table 6.1.8 and Table 6.1.9. 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 City.

2. *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.

3. The SGC hot-mix combined aggregate gradation requirements shall be as follows:

**Table 5.30.8.1 SGC Hot Mix Aggregate Gradation Requirements**

| 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 | |

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

**Table 5.30.8.2: Virgin Coarse Aggregate Physical Properties (> 5.0 mm) at the mix design gradation**

| Property | Test Method | Requirement |
|---|---|---|
| LA Abrasion, % loss,<br>Charge C ( 10mm-LT 7 10mm-HT<br>Charge B (20mm-B) | AASHTO T 96 | 30.0% Maximum |
| Soundness (5 Cycles), %loss<br>$MgSO_4$ | AASHTO T 104 | 16.0 Maximum |
| Detrimental Matter, % | Alberta Infrastructure TLT 107 | 2.0 Maximum |

**Table 5.30.8.3: Virgin Fine Aggregate Physical Properties (< 5.0 mm) at the mix design gradation**

| Property | Test Method | Requirement |
|---|---|---|
| Soundness (5 Cycles), % loss<br>MgSO4 | AASHTO T 104 | 16.0% Maximum |
| Plasticity Index | AASHTO T 90 | Non-Plastic |

5. 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.
6. 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.

**Table 5.30.8.4: Crushed-Face Count in Mix**

| 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 |

7. 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:

**Table 5.30.8.5: Mineral Filler Gradation Requirements**

| Sieve Size (µm) | Percent Passing (by Mass) |
|---|---|
| 600 | 100 |
| 300 | 92 – 100 |
| 80 | 60 – 100 |

*5.30.8.7 Equipment*

1. Asphalt Plant
   a. 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.
   b. Provide free and safe access for the City Engineer to verify proportions, settings, and temperatures, and to take samples of asphalt, aggregate, and mixture.
   c. 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.
   d. 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 City Engineer to ensure their accuracy. Plant production shall not proceed until plant calibrations and recalibrations have been reviewed by the City Engineer on site. Notify the City Engineer at least 24 hours before plant calibrations are made or altered.

*5.30.8.8 Mix Design*

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.

**Table 5.30.8.6: Mix Design Requirements**

| Mix Type | Requirement | | |
|---|---|---|---|
| | **10mm – HT** | **10 mm – LT** | **20mm – B** |
| **Selected Parameters** | | | |
| Number of Gyrations<br>$N_{design}$<br>$N_{maximum}$ | 100<br>160 | 75<br>115 | 100<br>160 |
| Density at $N_{maximum}$ ($\%G_{mm}$) | 98.0 Max | 98.0 Max | 98.0 Max |
| Bailey CA-CUW | 60 to 85 Max - Fine Graded<br>>95 to 105 Max – Coarse Graded | 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. 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 City of Edmonton or an independent laboratory. 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.
3. Modifications to the SGC hot-mix mix design procedure or criteria are as follows:
   a. Metric sieves in accordance with CGSB Specification 8-GP-2M shall be used.
   b. PG asphalt cement content shall be reported based on the total mass of the mix.
4. Job mix Formula

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

*5.30.8.9 Execution*

1. Production of Mix
    a. 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.

    b. Production Rate

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

    c. Aggregate in Stockpile
        i. 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.
        ii. 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.
        iii. If one or more of the SGC hot-mix properties are not met, the City will order suspension of mix production until the Contractor has demonstrated to the City’s satisfaction that corrective measures have been taken to produce a mix that meets the requirements of this Section.

**Table 5.30.8.7: 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:** | D1754 | 4.0 | | | 4.0 | | |
| **Ratio of Absolute Viscosity of Residue from Thin-Film Oven Test to Original Absolute Viscosity, maximum:** | D2171 | | | | | | |
| **Ductility, 25°C, cm, maximum** | D113 | 100 | | | - | | |
| **Ductility, 15.6°C, cm, minimum** | | - | | | 100 | | |

**Table 5.30.8.8: AASHTO M320 Table 2**

| 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•sm test temp, °C | 135 | | | | | | | | | | | | | | | | | | | | |
| Dynamic shear, T 315:[c] G*/sinδ[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*/sinδ[d], min 2.20 kPa test temp @ 10 rad/s, °C | 46 | | | 52 | | | | | | | 58 | | | | | 64 | | | | | |
| **Pressurized Aging Vessel Residue (R 28)** | | | | | | | | | | | | | | | | | | | | | |
| PAV again temperature, °C[f] | 90 | | | 90 | | | | | | | 100 | | | | | 100 | | | | | |
| Dynamic shear, T 315: G*/sinδ[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 |

Notes:

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 R35.

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 negative (mass loss) change.

f. The PAV aging temperature is based on anticipated climatic conditions and is one of three temperatures, 90°C for climates requiring PG 52-xx and below, 100°C for climates requiring PG 58-xx to PG 70-xx, or 110°C for climates requiring PG 76-xx and above. Normally, the PAV aging temperature is specified based on the PG grade. However, when the binder is being used in a different climate due to grade bumping or needed for softer binder due to blending, the PAV aging temperature may be specified as 100°C when used in climates requiring PG 58-xx to PG70-xx, or 110°C when used in climates requiring PG 76-xx and above.

g. For verification of grade, at a minimum perform T 313 at the test temperature and at the test temperature minus 6°C ant 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 per R 49. If the failure stress exceeds the induced thermal stress, the asphalt binder is deemed a “PASS” at the specification temperature.

**Table 5.30.8.9: AASHTO M320 Table 2 (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•sm 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 again 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 |

Notes:

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 R35.

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 negative (mass loss) change.

f. The PAV aging temperature is based on anticipated climatic conditions and is one of three temperatures, 90°C for climates requiring PG 52-xx and below, 100°C for climates requiring PG 58-xx to PG 70-xx, or 110°C for climates requiring PG 76-xx and above. Normally, the PAV aging temperature is specified based on the PG grade. However, when the binder is being used in a different climate due to grade bumping or needed for softer binder due to blending, the PAV aging temperature may be specified as 100°C when used in climates requiring PG 58-xx to PG70-xx, or 110°C when used in climates requiring PG 76-xx and above.

g. For verification of grade, at a minimum perform T 313 at the test temperature and at the test temperature minus 6°C ant 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 per R 49. If the failure stress exceeds the induced thermal stress, the asphalt binder is deemed a “PASS” at the specification temperature.

## APPENDIX 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:

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

### 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:

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

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 Asphalt Cement |

## 5.30.9 SGC HOT-MIX ASPHALT PAVING

*5.30.9.1 Definitions*

1. QA: A Certified Quality Assurance Laboratory or the City.
2. Overlay: paving over an existing pavement for rehabilitation purposes and not as part of staged paving.
3. Staged Paving: paving where a lift or lifts that form part of the total pavement structure are deferred to a future date.
4. SGC Density: the Superpave Gyratory Compactor (SGC) shall be used to prepare laboratory formed specimens at $N_{design}$ 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.

*5.30.9.2 Quality Assurance*

1. Thickness Cores

   QA will:

   a. Take a minimum of one core per 1,000 m2 of SGC hot-mix asphalt pavement and determine the thickness of the mat, for each stage of paving.
   b. For a staged paving project, 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.
   c. For non-staged paving projects, the thickness tolerances as per Table 5.5.16.5 shall apply.
   d. 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.

2. Asphalt Cement Content and Density Specimen Sampling and Testing

   QA will:

   a. 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.
   b. 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).
   c. Obtain one core from compacted mat representing 1,000 m2 and test for density.
   d. 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.
   e. Representative Cores: A single core is initially taken representing the quantity of SGC hot-mix in not more than 1,000 m2 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.

3. Rutting Susceptibility Specimen Sampling and Testing (Where Specified)

   QA will:

   a. 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 52oC. 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

b. 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.

4. Tensile Strength Ratio (TSR) Specimen Sampling and Testing (Capital Program)

   QA will:

   a. 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.

*5.30.9.3 Materials*

1. SGC Hot-Mix Asphalt Concrete – shall adhere to Section 5.5.8 SGC Hot Mix Asphalt Concrete
2. Tack Coat – Shall conform to Section 5.5.11 Liquid Asphalt Coats

*5.30.9.4 Equipment*

1. Trucks for Transporting Mix:
   a. 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. Paver:
   a. 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.
3. Rollers:
   a. 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.
4. Hand Tools:
   a. Rakes, lutes, tampers, straightedges, levels, and other hand tools as necessary to complete the work shall be available.

*5.30.9.5 Execution*

1. Good Paving Practice
   a. 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.

b. 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.

c. 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.

2. Preparation

a. The City 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 City Engineer. Surface shall be true to line and grade within tolerance, firm, dry, and free of loose and deleterious material.

b. For new construction or as directed by the City 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.

3. Multiple Lift Paving

a. Apply tack coat to the previous lift before placing a lift, unless permitted otherwise by the City Engineer. Clean the exposed surface before tacking.

b. Preparation for Overlay or for Succeeding Stage Paving

i. Sweeping and Cleaning: Sweep the existing pavement surface with an approved mechanical sweeper. Remove all residual debris and accumulations of deleterious material.

ii. Surface Milling: If specified, grind the existing surface to specified depth according to Section 5.5.10– Pavement Cold Milling

iii. Tack Coat: When the existing surface has passed inspection by the City Engineer, apply tack coat to Section 5.5.11 – Liquid Asphalt Coats.

iv. 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 City Engineer

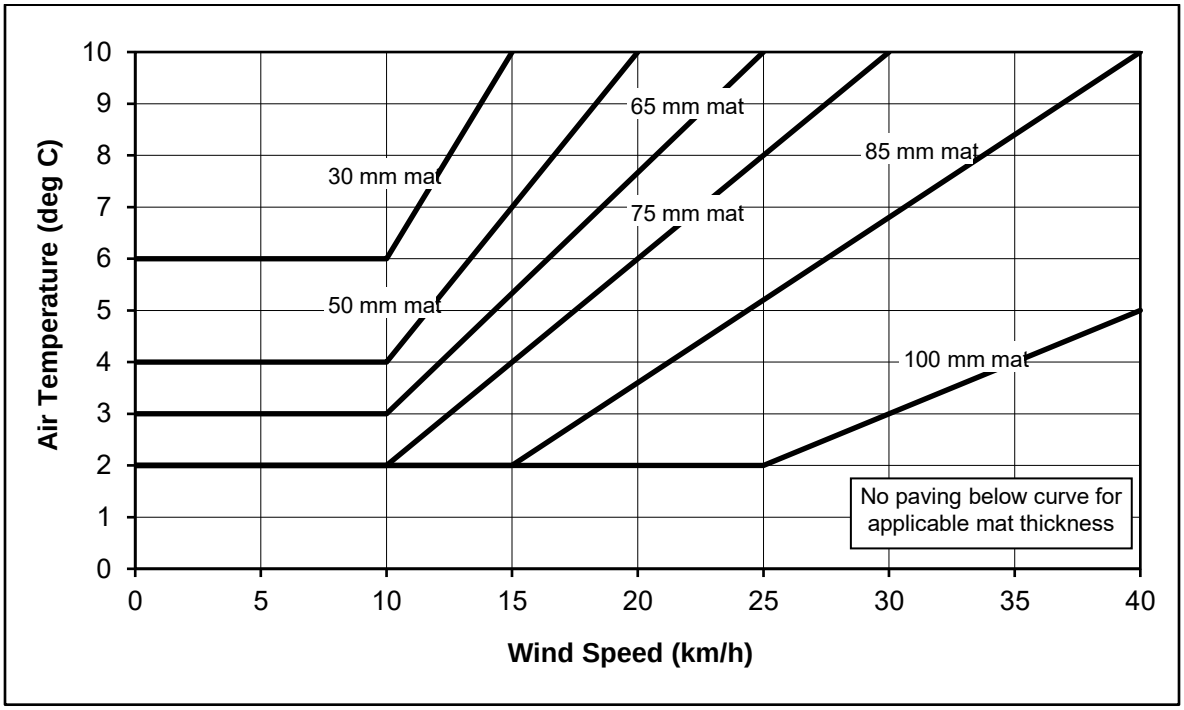
v. Asphalt Levelling Course: The City Engineer will designate those areas having 20 mm or greater depressions for levelling course application. Spread the levelling course of SGC hot-mix with a paver one lift at a time, not exceeding 60 mm compacted thickness, and compact to required density.

4. Weather Limitations

a. 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 City Engineer.

b. No paving is permitted when air temperature and wind speed conditions are below the applicable mat curve in Figure 5.5.9.1, unless waived by the City Engineer.

**Figure 5.30.9.1 Air Temperature and Wind Limitations on Paving**




5. Transportation of SGC Hot-Mix
    a. Transport the SGC hot-mix 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.
    b. 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.
    c. Maintain trucks clean of mud and other material that could contaminate the paving area.
    d. Discharge SGC hot-mix into the paver hopper without spilling and without the truck box bearing down on the hopper.
    e. If the unit for payment is tonnes, no payment will be made for SGC hot-mix tonnage unless the City Engineer is provided with a copy of the corresponding asphalt mix load ticket immediately upon arrival at the site.
6. Spreading
    a. 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.
    b. Ensure that mix compaction temperature meets the asphalt cement manufacturer's requirements, as measured in the mat, immediately behind the paver.
    c. Spread the SGC hot-mix uniformly in one or more lifts, or as directed by the City 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.
    d. 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.
7. Segregation
    a. If segregation of mix material occurs, the City Engineer will immediately suspend spreading

until the cause is determined and corrected.

b. 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.

8. Hand Spreading
   a. Hand spread SGC hot-mix in small areas not accessible to paver, and where permitted by the City Engineer.
   b. 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.
   c. Heat hand tools to prevent asphalt sticking. Do not overheat tools to prevent damaging of the SGC hot-mix.
   d. Before rolling, check surface with template or straightedge, and correct irregularities.
9. Compaction
   a. 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.
   b. 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 City Engineer when requested.
   c. 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.
   d. Complete final rolling before the mat surface temperature reaches 40$^{o}$C as determined with an infrared thermometer. If a second lift of asphalt is required, the surface temperature of the first lift should be no more than 30oC at the time of placement of the second lift.
   e. For small areas inaccessible to rollers, use an approved vibratory plate compactor or hand tamper to thoroughly compact the SGC hot-mix.
   f. If compaction or finish rolling difficulties occur, suspend paving operations, redesign the mix and obtain City Engineer's approval of a trial batch before resuming paving.
10. Joints
    a. Transverse Joint
       i. Plan length of spread to provide for a minimum 1 m offset of transverse joints in successive lifts and adjacent mats.
       ii. 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.
    b. Longitudinal Joint
       i. 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 City Engineer, the joint may be located at the centre of a travel lane.
       ii. Plan width of spread to provide for a minimum 150 mm offset (in a dovetail pattern) of longitudinal joints in successive lifts.
       iii. Create a longitudinal joint while the temperature at the edge of the first of two adjacent mats is above 80$^{o}$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.
       iv. 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 ensure bonding while the mix at the joint is about 80°C.

v. If a hot longitudinal joint as described in above 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.

vi. Should the longitudinal joint treatment indicated in above 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

vii. The finished longitudinal joint shall be thoroughly compacted and shall meet surface tolerances.

*5.30.9.6 Mix Production and Paving Tolerances*

1. Aggregate Gradation Tolerance

   The variation from the approved job-mix aggregate gradation shall not exceed the limits in Table 5.5.9.1.

**Table 5.30.9.1: Aggregate Gradation Tolerance**

| | % Passing by Mass | |
|---|---|---|
| **Sieve Size (µm)** | **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 |
| 2500 | ± 3.0 | ± 2.5 |
| 1250 | ± 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 |

2. Asphalt Content Field Mix Tolerance: Allowable variation from approved design asphalt content shall be ±0.3 percent by mass of mix.
3. Tolerance for Air Voids in Field Mix:

**Table 5.30.9.2: 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 |

4. Minimum Film Thickness in Field Mix:

**Table 5.30.9.3 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. |

5. Voids Filled in field Mix:

**Table 5.30.9.4 Voids in Field Mix**

| Mix Type: | 10mm – HT | 10mm – LT | 20mm – B |
|---|---|---|---|
| Voids Filled, %: | 70 – 80 | 73 – 85 | 65 – 75 |

6. Mixing Temperature Tolerance:
   a. The allowable variation from the design mixing temperature shall be ± 10°C.
7. Mixture Handling Tolerance:
   a. In accordance with Section 5.5.9.5.6;
8. Smoothness Tolerances:
   a. Maximum variation under 3 m straightedge as follows:
      Longitudinal (in the direction of travel): 3 mm.
      Transverse (across the direction of travel): 6 mm.
      (straight crossfall)
9. Grade: ±6 mm maximum variation from designated grade elevations.
10. Texture: Finished surface shall be free of visible signs of poor workmanship such as, but not limited to:
    a. Segregation, as demonstrated through sandy spots or excessively open spots (areas of water bleeding from the mat),
    b. Areas exhibiting excess or insufficient asphalt cement, as demonstrate through fat spots or open textured spots,
    c. Improper matching of longitudinal and transverse joints,
    d. Dimpling, roller marks, cracking, or tearing.
11. If surface and grade tolerances are exceeded, or if surface texture is not met, grind down and resurface defective areas as directed by the City Engineer.
12. Thickness Tolerance:
    a. Deficient Thickness: If average core thickness is deficient that area of asphalt pavement will be assessed a pay factor according to Table 5.5.9.5 to be applied to the price of the quantity of SGC hot-mix in that mat area.
    b. Excess Thickness: Asphalt pavement with excess thickness may be accepted with no extra payment, if surface and grade tolerances and texture are met.

**Table 5.30.9.5 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 |

13. Density Tolerance
    a. 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.

**Table 5.30.9.6: Density Requirements**

| 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 |
| 94% | Paving on FDR locations where 10mm-HT is utilized |
| 93% | Alley paving. |
| 93% | Paving on FDR locations where 10mm-LT is utilized |
| 93% | Rehabilitation overlay (mill and overlay locations) |
| 93% | Asphalt walk/bikeway. |

b. 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 5.5.9.7 to be applied to the price of the quantity of SGC hot-mix in that mat area.

**Table 5.30.9.7: 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 | | |

14. APA Tolerance (Where Required)
    a. 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 5.5.9.8 to be applied to the price of the quantity of SGC hot-mix in that mat area.

**Table 5.30.9.8: 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 |

15. Asphalt Cement Content Tolerance
    a. The allowable variation from the approved design asphalt content shall be ± 0.30 Percent by mass of mix.
    b. Deficient Asphalt Cement Content: If the asphalt cement content, as determined by City indicates low or high asphalt cement content, the represented area of mat may be accepted subject to a pay factor according to Table 5.5.9.9 and is to be applied to the unit price of the 250 tonnes or equivalent area of hot-mix in the mat.

**Table 5.30.9.9: Asphalt Cement Content Pay Factor**

| 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 |

16. Asphalt Cement Content Appeal Mechanism (Capital Projects)
    a. In the event of a Deficient Asphalt Cement Content result the following Asphalt Cement Content Appeal Mechanism will be allowed by the City of Fort Saskatchewan:
        i. The original core location shall be confirmed by the City;

ii. The City 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 City Engineer.

iii. The asphalt cement content test result from the re-core will supersede the original QA result.

iv. If the asphalt cement content of the re-core is within the penalty range the penalty will be calculated in accordance with Table 5.5.9.9 Asphalt Cement Pay Factors for the quantity of asphalt represented by the test. No further re-coring is allowed.

v. 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.

vi. 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 City Engineer.

17. Asphalt Cement Content Appeal Mechanism (Development Agreement):

a. In the event of a Deficient Asphalt Cement Content result the following Asphalt Cement Content Appeal Mechanism will be allowed by the City of Fort Saskatchewan and shall be paid for by the Contractor:

i. The original core location shall be confirmed by City Engineer, the Quality Assurance agency and the City Inspector.

ii. 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 City Engineer.

iii. The asphalt cement content test result from the re-core, along with the original test result, shall be submitted to the City of Fort Saskatchewan for review. The result from the asphalt cement content test from the re-core will supersede the original QA result.

iv. If the asphalt cement content of the re-core is within the penalty range the penalty will be calculated in accordance with Table 5.5.9.9 Asphalt Cement Pay Factors for the quantity of asphalt represented by the test. No further re-coring is allowed.

v. 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.

vi. 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 City Engineer.

18. TSR Tolerance

a. Deficient TSR (Capitol Program): If the TSR result, as determined by the City, of field samples is below 80.0 percent (for laboratory prepared samples of field mix), the following actions will be taken by the City:

i. First occurrence; the contractor will receive a warning letter from the City indicating the deficient TSR value.

ii. 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 City. During this period of time the Contractor, the City Engineer, and the City 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 5.5.9.10, or removal and replacement at no cost to the City. If suspended, the paving program shall only continue upon approval by the City.

**Table 5.30.9.10: 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 |

*5.30.9.7 Cleanup*

1. Leave site clean and free of debris and surplus materials.
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 City Engineer. Remove barricades and signs when no longer needed.

## 5.30.10 PAVEMENT COLD MILLING

*5.30.10.1 General*

This section includes cold milling or grinding of existing asphalt or concrete pavement surfaces.

*5.30.10.2 Products*

1. 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.

*5.30.10.3 Equipment*

1. Cold Planer: Self-propelled; capable of milling 4,000 m2 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. All equipment shall be suitably muffled to conform to the City of Fort Saskatchewan's Community Standards Bylaw C1-21 Part 4 – Noise Control.

*5.30.10.4 Execution*

1. Traffic Safety
   a. Provide signed advance warning of cold milled areas opened to traffic before paving, as follows:
      i. **'**Bump' - all transverse milled edges and edges at exposed utility structures.
      ii. 'Uneven Pavement' - all longitudinal milled edges, and edges within pedestrian crosswalk areas.
   b. Ramp vertical edges created by milling operations according to the following tables. Material used in ramping must be approved by the City Engineer and must be maintained until removal prior to paving.

**Table 5.30.10.1: 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<br>600 | At start of milled area (down ramp)<br>At end of milled area (up ramp) |
| > 50 | ≥ 60 | 600<br>1200 | At start of milled area (down ramp)<br>At end of milled area (up ramp) |

**Table 5.30.10.2: 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 |

**Table 5.30.10.3: Patch Milled Edges**

| Length of Milled Area (m) | Speed Limit (km/h) | Length of Ramp (mm) | Location of Ramp |
|---|---|---|---|
| 0 - 15 | < 60 | 600<br>600 | At start of milled area (down ramp)<br>At end of milled area (up ramp) |
| 0 - 15 | ≥ 60 | 600<br>1200 | At start of milled area (down ramp)<br>At end of milled area (up ramp) |

*5.30.10.5 Preparation*

1. Sweep the pavement surface with a mechanical sweeper to remove debris and dirt accumulations. Remove any standing water from the pavement surface.

## 5.30.11 LIQUID ASPHALT COATS

*5.30.11.1* *General*

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.
2. Asphalt tack coat: the supply and application of liquid asphalt to provide a bond between existing asphalt or concrete surface and the overlying asphalt course.

*5.30.11.2* *Submittals*

1. Submit refinery data to the City of Fort Saskatchewan prior to first use and as requested by the City Engineer

*5.30.11.3* *Quality Assurance*

1. The quality assurance laboratory may take and test samples of liquid asphalt used weekly from each source. Material not meeting specifications shall be replaced.

*5.30.11.4* *Materials*

1. Liquid or Emulsified Asphalt: types and grades as indicated below and conforming to related properties in Tables 5.5.7.2 and 5.5.7.3.

**Table 5.30.11.1: Liquid or Emulsified Asphalt Types and Grades**

| | Liquid Asphalt Type & Grade | Application Rate litres/m² | 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. Dilute SS-1 emulsified asphalt with an equal amount of water.

*5.30.11.5* *Equipment*

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. 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.

*5.30.11.6* *Execution*

1. Common Requirements
   a. Prepare surface to be coated to the applicable Section. Have the surface inspected by the City before coating.
   b. Protect adjoining curb, gutter, walk, slabs, barrier, poles and other surfaces not intended for coating, from splattering or overspray. Remove any splattering stains.
   c. 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 City Engineer.
   d. Spray liquid asphalt to a uniform coat. Do not spray excessively to create ponding. Hand spray areas missed by or inaccessible to the distributor.
   e. Prime Coat
   f. Apply prime coat while the soil cement surface is still moist.

g. Do not allow traffic on prime coat within 6 hours of application or until the prime coat has cured.

2. Tack Coat
   a. Do not apply tack coat unless the surface is dry and free of dust and other material that could reduce the bond.
   b. Apply tack coat only to an area that can be paved in the next 24 hours.
   c. Minimize construction traffic on the cured tack coat. Reapply the tack coat if damaged by traffic.

**Table 5.30.11.2: Specifications for Medium Curing Asphalt**

| ASPHALT GRADE | ASTM TEST | MC-30 | |
|---|---|---|---|
| REQUIREMENTS | | Min | 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

3. General Requirements: The asphalt shall not foam when heated to the application temperature range.
4. The asphalt shall be produced by the refining of petroleum and shall be uniform in character

**Table 5.30.11.3: Specifications for Anionic Emulsified Asphalt**

| ASPHALT GRADE<br>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.
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.

## 5.30.12 RECYCLED ASPHALT PAVING

*5.30.12.1* *Quality Assurance*

1. Refer to Section 5.5.8– SGC Hot-Mix Asphalt Concrete.

*5.30.12.2* *Materials*

1. Reclaimed Asphalt Pavement (RAP): Rap is salvaged, milled, pulverized, broken, or crushed asphalt pavement removed from an existing pavement.
2. Virgin Aggregate: New aggregate to Section 5.5.8 – SGC Hot-Mix Asphalt Concrete.
3. Aggregate in Recycled Asphalt Mix: to Section 5.5.8 – 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 | 9-13 | 7-16 | 8-16 |
| 80 | 4-9 | 4-9 | 4-9 |

4. Asphalt Cement: The extracted blended asphalt cement shall meet the PG requirements as detailed in Section 5.5.8 – SGC Hot-Mix Asphalt Concrete.

*5.30.12.3* *Mix Design and Proportioning*

1. Submit a recycled asphalt mix design to Section 5.5.8 – SGC Hot-Mix Asphalt Concrete for the specified mix type based on the following maximum content:

**Table 5.30.12.1: Maximum RAP Content per Recycled Asphalt Mix Design**

| 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 |

2. The Contractor shall, with the mix design, furnish PG test results from the virgin binder, the binder extracted from the individual RAP materials and PG test results indicating that the binder in the mix resulting from the blending of the RAP materials meets the grade specified in the contract.

*5.30.12.4* *Asphalt Plant*

1. In addition to the requirements of Section 5.5.8 – SGC Hot-Mix Asphalt Concrete, the mixing plant shall be capable of receiving and mixing the proportions of RAP, virgin aggregate and asphalt cement as designed.
2. The mixing plant shall be capable of thorough degradation and heating of RAP particles and blending with virgin aggregate and asphalt cement to produce a homogeneous mix at the point of discharge.

*5.30.12.5* *Equipment*

1. Cold Planer: to Section 5.5.10 - Pavement Cold Milling.
2. Haul Vehicle: capable of receiving milled material directly from the cold planer and hauling directly to a stockpile.

3. Weigh Scale: shall meet the following requirements:
   a. Inspected and certified by Weights and Measures Inspection Services of Canada Consumer and Corporate Affairs as often as directed by the City Engineer, with the inspection certificate exhibited as required.
   b. Of sufficient size and capacity for weighing any haul vehicle in one operation with all wheels on the platform.
   c. Scale house to be provided complete with furnishings, subject to the approval of the City Engineer.
4. Mechanical Sweeper: capable of removing loose material and debris from the milled surface
5. Asphalt Shingle Grinder: capable of receiving and processing asphalt shingles meeting the end product size requirements listed.

*5.30.12.6* *Execution*

1. Reclaiming Asphalt Pavement
   a. Cold Milling: Mill the designated pavement with a cold planer to Section 5.5.10 - Pavement Cold Milling, supplemented as follows:
   b. Sweeping before Milling: Before milling, sweep the pavement surface with a mechanical sweeper to remove debris and dirt accumulations that may contaminate the millings.
   c. Operate the planer in a manner that will minimize tearing and breaking of the underlying and adjacent pavement.
   d. Water Use: Carefully control the amount of water used in milling. Moisture in the RAP is of critical importance during hot-mix production.
   e. Load milled material directly from the planer into the haul vehicle.
   f. Sweeping after Milling: Immediately sweep the milled surface clean with a mechanical sweeper following the planer by not more than 100 m.
   g. 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.
   h. 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.
   i. Traffic Hazard: Promptly repair, to the City Engineer's satisfaction, any distress in the newly milled surface which could become a hazard to vehicular traffic.
   j. Minimize contamination of the RAP with granular, clay and other deleterious materials at all times.
2. Stockpiling RAP
   a. 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.
   b. Drainage: Choose a site that has positive surface drainage away from the base of the stockpile.
   c. Stockpile Base: Must have adequate strength to support the anticipated volume of RAP in the stockpile.
   d. Particle Sizes: RAP being stockpiled shall meet the following gradation, or must be crushed to obtain the required gradation.

**Table 5.30.12.2: Stockpiles RAP Gradation**

| Sieve Size (mm) | Total % Passing by Mass |
|---|---|
| 125 | 100 |
| 80 | 99 - 100 |
| 40 | 95 - 100 |

e. Ensure that the RAP is not disturbed after stockpiling. The RAP shall remain loose and un-compacted. No equipment shall be permitted to operate on the stockpile.

*5.30.12.7* *Production of Recycled Asphalt Mix*

1. Production: Produce recycled asphalt mixture in accordance with the approved mix design and to Section 5.5.8 – SGC Hot-Mix Asphalt Concrete.

*5.30.12.8* *Paving*

1. Paving Operation: to Section 5.5.9 – SGC Hot-Mix Asphalt Paving.
2. Substitute Mix: Provide at least 24 hours' notice to the City Engineer if recycled asphalt hot-mix cannot be produced as intended.
3. Tolerances: to Section 5.5.9 – SGC Hot-Mix Asphalt Paving

## 5.30.13 FULL DEPTH RECLAMATION USING FOAMED ASPHALT

*5.30.13.1 Definitions*

1. Full Depth Reclamation Using Foamed Asphalt:
   a. 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;
   b. FDR shall be performed by utilizing a recycling machine to pulverize, 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.
   c. Pulverize and reuse materials in the upper layers of the existing roadway structural section;
   d. Adjust the gradation of the existing materials by the addition of imported aggregate base (Admixture Aggregate) if and where necessary;
   e. 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
   f. Place and compact to achieve a new structural section,; all as shown on the plans, as specified in the Standard Specifications and these special provisions, unless otherwise directed by the City Engineer.

*5.30.13.2 Quality Assurance*

1. Maximum Density: the dry unit mass of a sample at optimum moisture content as determined in the laboratory according to ASTM D1557
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.
3. Testing Frequency: the quality assurance laboratory will take a minimum of one field density test for each 1 000 m2 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.

*5.30.13.3 Materials*

1. Cementitious Stabilizing Agent: Cement to, CSAA3001Type GU, General Use cement shall be the only cementitious stabilizing agent employed in the full depth foam in-place Recycling process
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.
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: PG 58-28 to AASHTO M320, Table 2 which is included in these specifications as Table 5.5.8.5 and Table 5.5.8.6.
4. Water: May be obtained from City fire hydrants according to the General Requirements. Other water sources are subject to the City Engineer's approval.
5. Admixture Aggregate: 20mm aggregate to be incorporated into the existing road structure to ensure adequate fines for stabilization shall meet the following gradation:

**Table 5.30.13.1: Gradation Requirements for Admixture Aggregate**

| 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 |

*5.30.13.4* *Foamed Bitumen Mix Design*

1. Submit to the City 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. 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 for 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.
3. The mix design sample shall be a representative sample of the roadway being rehabilitated and shall be obtained using the anticipated recycling equipment.

*5.30.13.5* *Foamed Bitumen Mix Design Criteria*

1. Aggregate Gradation: The combined/pulverized material should meet the following gradation:

**Table 5.30.13.2: Aggregate Gradation for the Combined/Pulverized Material**

| 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. Cement Content: minimum 1.0% by mass of dry aggregate used for tendering mix design requirement governs.
3. Bitumen: Minimum 2.6% by mass of dry aggregate used for tendering mix design requirement governs.
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 un-soaked specimens. The soaked specimens should be placed under water at 25o C ± 1o C for 24 hours. Remove the specimens from the water and surface dry the

specimen prior to performing ITS testing. The ratio of un-soaked to soaked Tensile Strength (TSR) must be a minimum of 50%

5. The final design shall be based on a foamed bitumen content that provides:
   a. Optimum bulk Density
   b. Optimum dry strength properties
   c. Optimum wet strength properties
   d. Optimum resistance to moisture penetration

*5.30.13.6* *Equipment*

1. Reclaimer/Stabilizer: a roadway structure pulverizing machine with the following characteristics, and subject to the Engineers approval:
   a. A minimum power capacity of 600 horsepower;
   b. A milling drum that rotates upward into the direction of advance with a minimum cut width of 2.0 m;
   c. 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;
   d. 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.
   e. 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;
   f. 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;
   g. 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;
   h. An inspection (or test) nozzle shall be fitted at one end of the spraybar that produces a representative sample of foamed bitumen;
   i. An electrical heating system capable of maintaining the temperature of all bitumen flow components above 1500C;
   j. 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. 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.
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:
   a. A thermometer to show the temperature of the bottom third of the tank;
   b. A rear feed valve, with a minimum internal diameter of 75mm, capable of draining the contents of the tank when fully opened;

c. All-round cladding to retain heat;
d. A calibrated dipstick marked at intervals of no more than 100 litres, for measuring the contents of the tank.

*5.30.13.7 Execution*

1. Preparation
   a. Roadway areas to be reclaimed will be indicated on plans or designated by the City Engineer.
   b. Ensure that any conflicts with underground utilities in the zone of reclamation are resolved prior to pulverization.
   c. 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.
   d. The contractor is responsible for the removal of all standing water.

*5.30.13.8 Unsuitable Weather Conditions*

1. Wet Weather: No full depth foam reclamation work shall be performed during wet conditions, nor started without completing before wet conditions set in.
2. Cold Weather: No full depth foam reclamation work shall be performed if the ambient pulverized roadway material temperature is below 00C other than finishing and compaction operations.
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.
4. Time Limitations: 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 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:

**Table 5.30.13.3: Time Limitations**

| Stabilizing Agent | Time Limit |
|---|---|
| GU Cement | 3 Hours |
| Bitumen Emulsion | Before the emulsion breaks |
| Foamed Bitumen | 24 Hours if kept moist |

*5.30.13.9 Production Plan*

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:
2. 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. The sequence and length of each cut to be recycled before starting on the adjacent or following cut;
4. 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;
5. The proposed water addition for each cut;
6. The quantity and location where aggregate base is to be imported;
7. The amount and type of stabilizing agent, or agents, to be applied to each cut;

8. The proposed quality control testing program; and
9. Any other information that is relevant for the intended work.

*5.30.13.10 Pulverization*

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.
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. 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 City Engineer to allow use of the roadway prior to further processing.

*5.30.13.11 Addition of Water and Stabilizing Admixtures*

1. Add stabilizing admixtures to the reclaimed base course as specified or as directed by the City Engineer.
2. Cement: as detailed in Section 5.5.13.3 Cementitious Stabilizing Asphalt of these Specifications.
3. Bituminous stabilizers: as detailed in Section 5.5.13.3 – Bituminous Stabilizing Agent of these Specifications.
4. 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.

*5.30.13.12 Overlap of Longitudinal Joints*

1. Premark cut lines on the road surface designating the width of each cut in a section of the roadway.
2. To ensure complete recycling across the full width of the roadway, longitudinal joints between successive cuts shall overlap a minimum of 150mm.
3. Pre-marked 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 pre-marked 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.
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.

*5.30.13.13 Continuity of Stabilized Layer*

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:
2. Carefully marking the exact location at which each cut terminates, this mark shall coincide with the position of the centre of the pulverizing drum at the point at which the supply of stabilizing agent ceased.
3. Start the next successive cut at least 0.5m behind this mark to ensure continuity.

*5.30.13.14 Subgrade Instability*

1. Where subgrade instability is encountered during the recycling process, the subgrade shall be:

2. Excavated and removed to a depth of 600mm; and
3. 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.

*5.30.13.15 Grading and Compaction*

1. To Section 5.5.3 – Subgrade Preparation and Section 5.5.7– Granular Base Courses.
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. Rolling shall commence as soon as it is practical, and follow the predetermined sequence specified in “Test Sections” of these specifications.

*5.30.13.16 Watering, Finishing and Curing*

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:
2. Surface Laminations;
3. Segregation of fine and course aggregate;
4. Corrugations or any other defects that may adversely affect the performance of the layer.
5. 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.

*5.30.13.17 Test Sections*

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:
2. Demonstrate that the equipment and processes and produce recycled layers to meet the requirements specified in these provisions;
3. 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;
4. Determine the sequence and manner of rolling necessary to obtain the minimum compaction requirements.
5. The test section shall be at least 100m in length of a full lane-width.
6. 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.

*5.30.13.18 Field Quality Control*

1. Check the finished surface of the reclaimed base course to ensure it meets the following tolerances:
   a. Grade: 6 mm maximum variation above design elevation.
      6 mm maximum variation below design elevation.
2. When Tolerance Exceeded:
   a. Trim high areas and refinish surface to within tolerance.
   b. Add recycled material to low areas, scarify and blend to full reclamation depth, re-compact to required density, and refinish surface.
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 re-compacted to the required density. If the area is not retested but is reworked and re-compacted the area shall be tested at normal testing frequencies.

*5.30.13.19 Protection of Finished Work*

1. Do not permit vehicular traffic over the recycled material until permitted by the City Engineer.
2. If the recycled material floods, drain immediately by natural flow or by pumping to catch basins, manholes, or ditches.
3. Maintain protection of the recycled material until paved with hot-mix asphalt concrete. Repair recycled material if damaged.

**Table 5.30.13.4: 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:** | D1754 | 4.0 | | | 4.0 | | |
| **Ratio of Absolute Viscosity of Residue from Thin-Film Oven Test to Original Absolute Viscosity, maximum:** | D2171 | | | | | | |
| **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.

**Figure 5.30.13.1 Specifications for Asphalt Cement Absolute Viscosity**

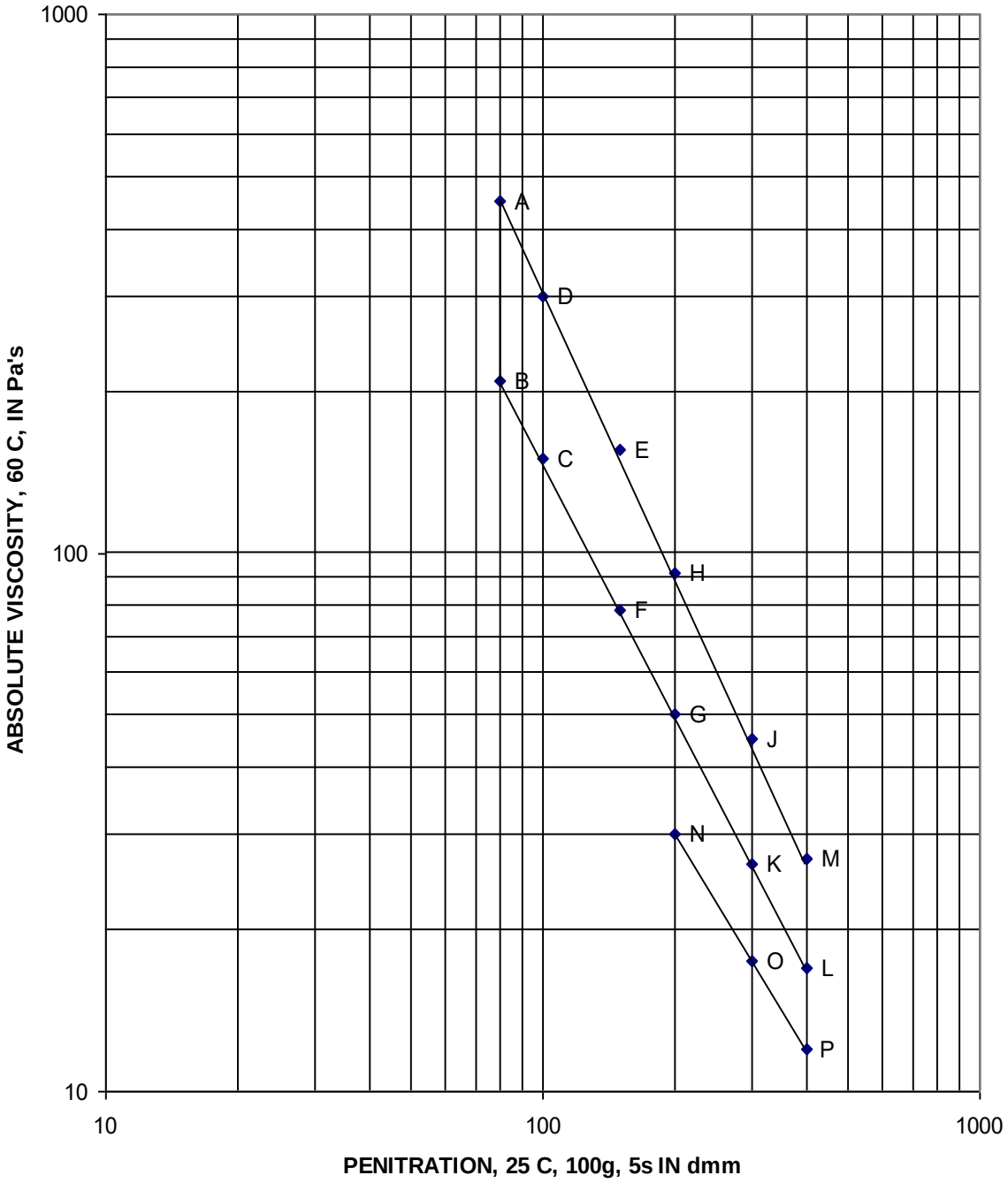
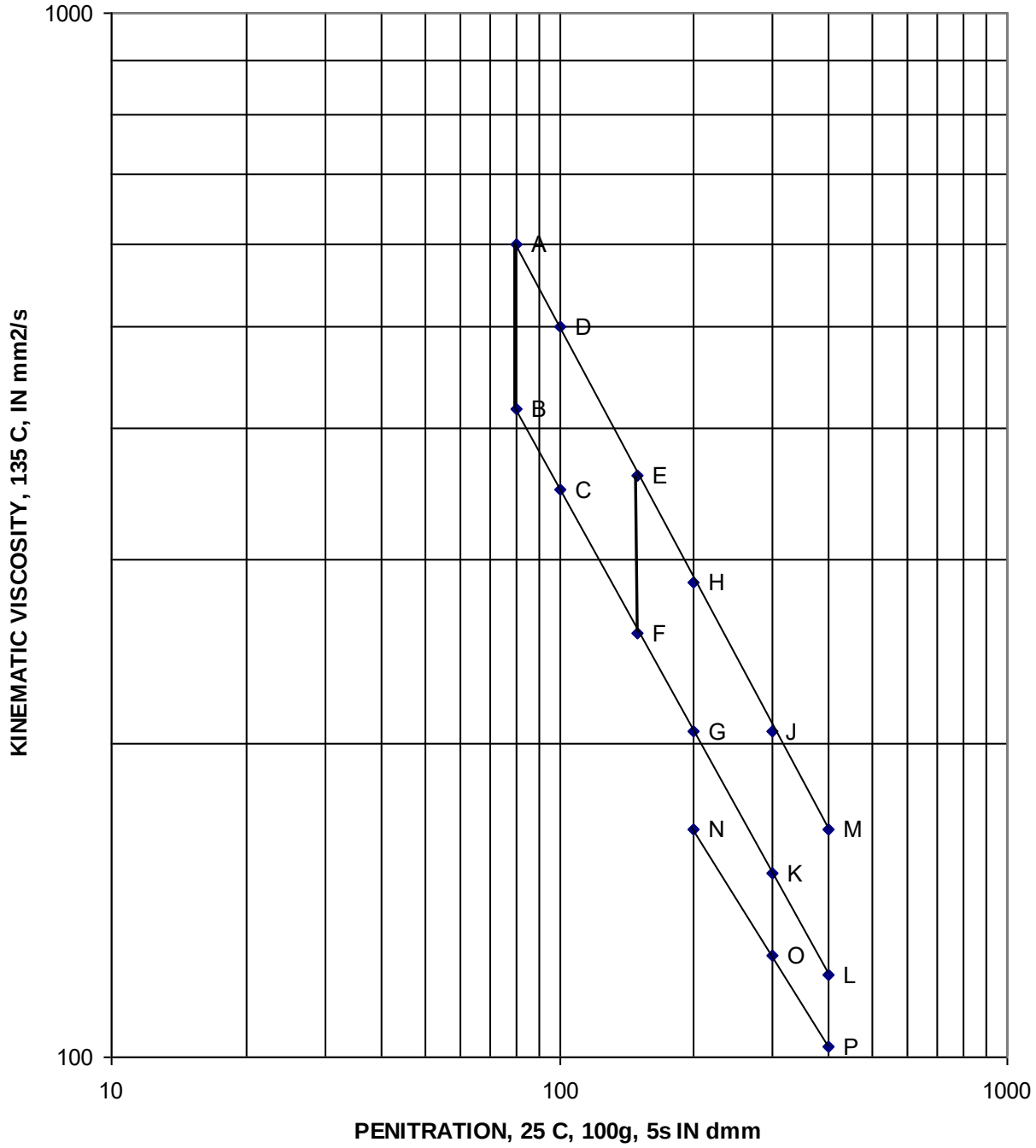


**Figure 5.30.13.2 Specifications for Asphalt Cement Absolute Viscosity**



### 5.30.14 CEMENT CONCRETE

*5.30.14.1 Submittals*

1. Submit the cement manufacturer's mill test reports to the City, monthly or as requested by the City.
2. Submit physical fly-ash test reports to the City, monthly or as requested by the City.

*5.30.14.2 Quality Assurance*

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.
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.
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.
4. Quality assurance testing shall be performed by a technician certified by CSA or ACI.
5. Slump Tests
   a. Methods: to CSA-A23.2-1C and CSA-A23.2-5C.
   b. 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 City Engineer.
6. Air Content Tests
   a. Methods: to CSA-A23.2-1C and CSA-A23.2-4C or CANCSA-A23.2-6C.
   b. 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 City Engineer.
7. Air-Void Examination
   a. Method: to ASTM C457, modified point-count traverse method at 100X magnification.
   b. Sample: a 100 mm diameter core drilled from hardened concrete.
   c. 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.
   d. 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.
8. Strength Tests
   a. Methods: Compressive strength test specimens shall be cast and cured in accordance with 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 CSA A23.2-9C.
   b. Test Frequency: Standard tests for strength will be conducted at a frequency of not less than one strength test for each 60m3 of concrete or fraction thereof, for each class of concrete produced in any one day from each individual plant/supplier.
   c. Definition of a Strength Test: to CSA A23.1.
   d. For standard strength tests, either 150mm x 300mm cylinders, 125mm x 250mm cylinders, or 100mm x 200mm cylinders may be used.
   e. Required Strength: The result of each compressive strength test shall equal or exceed the specified minimum compressive strength.

*5.30.14.3 Concrete Materials*

1. Cement: to CSA-A3000, A3001-03 of the following types.
   a. Type GU – General use hydraulic cement
   b. Type HE - High early-strength hydraulic cement
   c. Type HS – High sulphate-resistant hydraulic cement
2. Aggregate: to CSA-A23.1, testing shall include but not be limited to: unconfined Freeze-thaw in course aggregate, MgSO4 soundness loss, petrographic examination, alkali-aggregate reactivity, and ironstone content.
3. Water: to 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 City.
4. Air-Entraining Admixture: to ASTM C260.
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.
6. Fly Ash: to CSA-A3000, A3001-03 pozzolan type F or Cl.

*5.30.14.4 Production of Concrete*

1. Produce concrete to clause 5.2, CSA-A23.1 and conforming to the approved mix design requirements of Section 5.5.16 - Concrete for Roadways.

*5.30.14.5 Execution*

1. Inspection of Formwork and Reinforcement
   a. 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.
   b. Provide 48 hours' notice and obtain the City's approval before placing concrete.
   c. Ensure that reinforcement, formwork, inserts or accessories are securely fastened and will not be disturbed during concrete placement.
   d. Verify that all items to be embedded in concrete are in place.
   e. 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.
2. Delivery of Concrete
   a. Deliver concrete to the job site to CSA-A23.1, as supplemented or modified below.
   b. Rotating Drum Trucks: Transport concrete using only equipment with mixing or agitating capability.
   c. Rotate the drum on the job site at mixing speed for 3 minutes immediately before discharge.
   d. The minimum load size to be delivered to site is 3 cubic meters.
   e. Re-tempering with Water: Do not add water after the initial introduction of mixing water at the plant except as follows:
      i. When the slump at the point of initial discharge is less than specified
      ii. Introduce additional water into the drum mixer in an amount not exceeding 12 litres/m3, to bring the slump to within specified limits.
      iii. Rotate the drum a minimum of 30 revolutions at mixing speed until the required uniformity of concrete is attained.
      iv. Do not subsequently add any further water to the load.

v. If a load of concrete is re-tempered with water and the resulting slump exceeds the specified maximum slump, that load of concrete will be rejected.

vi. If the need for re-tempering with water becomes persistent or continuous, the City Engineer or his representative may refuse to accept concrete loads that have been re-tempered with water.

f. 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.

g. Re-tempering with Air-Entraining Admixtures is only permitted under the following conditions:

i. Re-tempering 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 re-tempering 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.

ii. The quality assurance technician shall perform an air content test on each load of concrete re-tempered with air-entraining admixtures and shall immediately provide the test results to the City Engineer.

iii. Guidelines for re-tempering with air-entraining admixtures

**Table 5.30.14.1: Re-Tempering Guidelines 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 |

iv. When re-tempering with air-entraining admixtures, the supplier will be given one opportunity to meet the specified air content.

v. When initial load requires re-tempering, the quality assurance technician shall perform an air content test to verify air content on subsequent loads until such time air content is acceptable.

vi. If the need for re-tempering with air-entraining admixtures becomes persistent or continuous, the City Engineer or his representative may refuse to accept concrete loads that have been re-tempered with air-entraining admixtures.

vii. The use of de-air entraining admixtures is not permitted.

viii. A load of concrete will be rejected if it is re-tempered with air-entraining admixtures and the resulting air content exceeds the specified maximum air content.

ix. A load of concrete that is rejected at the jobsite may not be re-tempered at the concrete plant with cement, aggregate, sand or admixtures and subsequently returned to the jobsite.

x. On site mix adjustments with cementitious materials, sand aggregate or any chemical admixtures other than air-entraining admixtures and superplasticizers will not be permitted.

h. 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.

i. 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.

j. 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.

k. Delivery Record: At the City Engineer's discretion, provide the City 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 City Engineer.

3. Placing Concrete

a. Handle, deposit and consolidate fresh concrete to CSA-A23.1 and as supplemented below.

b. 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.

c. Ensure that reinforcement and formwork are thoroughly clean and wetted before placing concrete.

d. Do not place concrete during rain or when there is imminent danger of rain or if the weather, in the opinion of the City Engineer, is not suitable.

e. Place hot and cold weather concrete to CSA-A23.1. Ensure that the procedures used are approved by the City Engineer.

f. Pour concrete continuously and as rapidly as possible between predetermined construction joints to the approval of the City Engineer.

g. Locate construction joints in accordance with the details shown on the drawings.

h. Consolidate concrete in accordance with CSA-A23.1.

i. Concrete cover over reinforcing steel shall be to CSA-A23.1.

4. Finishing

a. Perform the initial and final finishing of the plastic concrete surfaces to CSA-A23.1 and as supplemented below.

b. 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.

c. Protect the Work from rain to avoid excessive moisture on the unfinished surface and to prevent pitting to the finished surface if still plastic.

d. Concrete finishing shall be performed by or under the direction of certified Journeyman concrete finishers.

5. Curing

a. Curing exposed concrete surfaces using a specified curing compound applied with a pressurized spray nozzle. Curing compound shall be applied within 5 to 15 minutes after completion of the finishing process and cover the entire exposed surface with an unbroken and uniform film.

## 5.30.15 CONCRETE SIDEWALK, CURB AND GUTTER, AND SLABS

*5.30.15.1* *Quality Assurance*

1. Slump, Air Content, Nuclear Density Tests, Air-Void Examination, Strength Tests and Acceptance Criteria to Section 5.5.14 - Cement Concrete.

*5.30.15.2* *Materials*

1. Concrete: Class A or Class C, to Section 5.5.14 - Cement Concrete and Section 5.5.16 - Concrete for Roadways.
2. Joint Sealant, Preformed Joint Filler, Curing Compound and Probe Hole Grout
3. Reinforcement Bars, Tie Bars, Dowels, Welded Steel Wire Fabric

*5.30.15.3* *Execution*

1. Types of Construction

   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 City Engineer.

   a. 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.

   b. Walk

      Construct walk on a granular base course.

   c. 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.

   d. Curb Ramps

      Curb ramps are an incline built monolithically into curb cut and walk. Construct curb ramps on a granular base course.

   e. 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.

   f. 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.

   g. Median or Island Strip

      Construct median or island strips on a granular base course between curbs in the median or island.

   h. Slab-on Median or Island

      Construct slab-on medians or islands on the existing pavement surface.

2. Preparation

   Verify that the prepared subgrade or base is ready for concrete placement and repair any deterioration or damage.

   a. Cut behind Curb

      Compact soil to Section 5.5.3 - Subgrade Preparation and trim to within 25 mm of the back of curb.

b. 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 5.5.7 – Granular Base Courses.

3. Hand Forming
   a. Place forms as below.
   b. Use flexible forms to construct curves of less than 40 m radius.
   c. Place a minimum 50 m of forms before a concrete pour to allow checking for true line and grade.
   d. The City Engineer will not allow the use of forms that are out of shape, dented, rough, or otherwise unsuitable.
4. Placing Reinforcement
   a. Place reinforcement of the type, size and spacing as detailed on drawings or as required by City Engineer.
5. Placing Concrete
   a. Place concrete to Section 5.5.14 - Cement Concrete and Section 5.5.16 - Concrete for Roadways and as supplemented below.
   b. Use 50 mm pencil vibrators for curb and gutter and approved vibrating screeds for walk and slabs.
   c. 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.
   d. 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.
6. Slipforming
   a. Slipform concrete to as below.
   b. 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.
7. Finishing
   a. Finish concrete to Section 5.5.14 - Cement Concrete and Section 5.5.16 - Concrete for Roadways and as supplemented below.
   b. Tool all edges and joints to a width of 50 mm and round edges to a 6 mm radius unless indicated otherwise.
   c. Apply a brush final finish longitudinally along curb and gutter and transversely on walk and slabs.
   d. Name Plate

      Stamp the Contractor's name and year of construction in the plastic concrete on:

      i. The top of the curb in each block or at 200 m intervals, whichever is less and
      ii. The walk at the end of each block on an extension of a property line.
8. Crack-Control Joints
   a. Formed or tooled to Section 5.5.16- Concrete for Roadways and as supplemented below.
   b. Joint Size

      3 mm to 5 mm wide at the following depths:

      i. For curb and gutter: 50 mm minimum to a maximum of 25% of the gutter depth.

ii. For walk and slabs: 25 mm minimum to a maximum of 25% of the walk or slab thickness.

iii. Joint Spacing: 3 m maximum.

iv. 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.

9. Transverse Construction Joints
   a. Place to Section 5.5.16 - Concrete for Roadways and as supplemented below.
   b. Use 10M deformed tie bars at 300 mm spacing and extending 300 mm minimum into both sides of the joint.
   c. Vary joint spacing near the end of a concrete pour as follows:
   d. If a concrete pour ends within 300 mm of a required joint location, average the spacing of last two joints.
   e. If a concrete pour ends within 800 mm of a required joint location, average the spacing of last 3 joints.
10. Longitudinal Construction Joints
   a. Place according to Section 5.5.16 - Concrete for Roadways and as supplemented below.
   b. Use 10M deformed tie-bars at 1 m spacing and extending 300 mm minimum into both sides of the joint.
11. Joints Abutting Existing Curb
   a. Form a 10 mm wide by 30 mm deep slot between the back of curb and the walk or slab.
   b. Fill the slot with a specified joint sealant.
12. Isolation Joints
   a. Construct to Section 5.5.16 - Concrete for Roadways.
13. Protection and Curing
   a. Protect and cure concrete to Section 5.5.16 - Concrete for Roadways.
14. Backfilling
   a. 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 City Engineer.

   b. 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.

   c. 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 City Engineer. Tamp with mechanical tampers a minimum 300 mm width along the slab edge to a minimum 92% of maximum density.

   d. 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.

*5.30.15.4 Field Quality Control*

1. Walk or Slab Surface Tolerances
   a. 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%.
2. Gutter Surface and Curb Top Tolerances
   a. Maximum variation under a 3 m straightedge: 6 mm.
3. Grade of Gutter Lip and Walk/Slab Tolerances
   a. Maximum variation from designated elevation at any station as established from the survey stake: ±6 mm.
   b. 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.
4. Lip of Gutter Alignment Tolerances
   a. Maximum deviation: ±12 mm in 30 m.
5. When Tolerances Exceeded: If any of the tolerances above are exceeded, remove or correct the concrete work in question as directed by the City Engineer.
6. Walk, Median Strip, Slab-on, Ramps or Crossing Thickness:
   a. 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 m2 of concrete walk or crossing. If the average core thickness is deficient that area will be assessed a pay factor according to Table 5.5.15.1.

**Table 5.30.15.1: 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 |

   b. 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.

*5.30.15.5 Rejected Concrete Work*

1. Remove and replace rejected concrete work by full segments or slabs between crack control or construction joints.

*5.30.15.6 Protection of Finished Work*

1. Protect finished work from damage. Repair if damaged.
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.

## 5.30.16 CONCRETE FOR ROADWAYS

*5.30.16.1 Submittals*

1. Submit a mix design for each designated class of concrete to City, 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.)
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 coarse aggregate, MgSO4 soundness loss and alkali-aggregate reactivity evaluation.
3. Submit the results of ironstone determination to the City, at least once per week.
4. Submit physical fly-ash test reports to the City, monthly or as requested by the City.

*5.30.16.2 Quality Assurance*

1. To Section 5.5.14 - Cement Concrete

*5.30.16.3 Quality Control*

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 City 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 re-tempering of the mix.
2. Quality control testing initiated by the supplier shall be performed by a CSA or ACI certified technician.

*5.30.16.4 Materials*

1. Cement: To Section 5.5.14 Cement Concrete
2. Aggregate: To Section 5.5.514 Cement Concrete, and as supplemented below:
   a. Petrographic Analysis: To be performed by a qualified laboratory to CSA-A23.2-15A.
   b. 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 City of Fort Saskatchewan. Do not use aggregate until the corresponding results have been reviewed by the City 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 City Engineer.
3. Water: To Section 5.5.14 Cement Concrete
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.
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.
6. Curing compound: to ASTM C309, Type 2, class B, white pigmented, resin based, liquid membrane-forming compound.
7. Evaporation Retarder: The concrete evaporation retardant must be a commercially available monomolecular film compound. Currently there is no ASTM designation for this product, however the manufacturer must certify the evaporation retardant has no adverse effect on the cement hydration process or the concrete and that it reduces surface moisture evaporation from the concrete when performing concrete operations in direct sun, wind, high temperatures, or low relative humidity.

8. Preformed Joint Filler: to ASTM D1751.
9. Joint Sealant: to ASTM D1190, Sika 2c or approved equivalent.

*5.30.16.5* *Mix Design*

1. Application of concrete classes:
   a. Class A: One course exposed pavements, commercial and residential alley crossings.
   b. Class B: Unexposed pavement base.
   c. Class C: All exposed road associated works including curb and gutter, sidewalks, walkways, private crossings, swales, medians, New Jersey barriers and parapet walls.
   d. Class D: Structural pile foundations.
   e. Class E: Exposed retaining walls.
2. Mix design criteria for each class of concrete:

**Table 5.30.16.1: 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/m³) | 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 | 80 ± 20 | 5.5 - 8.0 | 20 | 0.45 | 335 | HS* |
| E | 30 | 80 ± 20 | 5.5 - 8.0 | 20 | 0.45 | 300 | HS* |

**Table 5.30.16.2: 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/m³) | 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 City Engineer

3. Class C concrete: shall attain the minimum compressive strength corresponding to the percentage of entrained air in the plastic concrete as follows.

**Table 5.30.16.3: Class C Concrete Compressive Strength Requirement**

| 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 |

4. High Early Strength Concrete: For special situations or conditions the City Engineer may require that the specified 28-day compressive strength be met in 7 days.
5. 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.
6. 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 m3 of concrete.
7. For class E concrete the following mix conditions shall apply:
   a. A minimum ratio of supplementary cementitious materials to total mass of cementitious materials of 0.15, and
   b. A minimum sand content of 45% by total weight of aggregate.
   c. Slump may be increased using an approved superplasticizer to 120 mm for a mix with GU cement and 90± 30 mm for mixes where high early strength is a requirement.
8. Application of concrete classes:
   a. Class A: One course exposed pavements, commercial and residential alley crossings.
   b. Class B: Unexposed pavement base.
   c. Class C: All exposed road associated works including curb and gutter, sidewalks, walkways, private crossings, swales, medians, New Jersey barriers and parapet walls.
   d. Class D: Structural pile foundations.
   e. Class E: Exposed retaining walls.
9. Seasonal concrete mix requirements:
   a. 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 is permitted.
   b. Summer Mixes

      From May 16 to September 30: no more than 10% of the specified minimum cement content may be replaced with fly ash.
   c. Fall Mixes

      From October 1 to October 15: no replacement of the minimum cement content with fly ash is permitted and type HS cement may not be used.
   d. Cold Weather Mixes

      From October 16 to the end of the construction season, or as defined by the City Engineer: meet the requirements for cold weather concrete in below.
10. 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 CSA A23.1. High early strength concrete (as defined in CSA A23.1 shall attain a minimum compressive strength of 30.0 MPa in 7 days and shall be provided with cold weather protection to 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.

11. For slipformed (machine placed) concrete, limit slump as follows:
    a. 20 ± 10 mm for curb, curb and gutter and concrete median barrier, and
    b. 30 ± 10 mm for walk, monolithic walk and pavement.
12. Type HE or Type HS cement may be substituted for Type GU cement, except as limited in Section 5.5.16 – Class E Concrete.
13. Class A, C and E concrete may be subjected to air-void examination.
14. 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.
15. 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.
16. Concrete production may not proceed until the City has approved the applicable mix design.

*5.30.16.6 Execution*

1. Placing
    a. Place concrete to Section 5.5.14 Cement Concrete.
2. Finishing
    a. Finish concrete to Section 5.5.14 - Cement Concrete, and as supplemented below:
    b. 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. Joints
    a. Construct joints as required in each type of construction to the following standards as applicable.
    b. 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:
    c. 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.
    d. 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.
    e. 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.
    f. 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.
    g. 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 City 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.

4. Protection and Curing
   a. Protect freshly placed concrete from freezing, premature drying, temperature extremes, adverse weather conditions, and physical disturbance to clause 7.4, CSA-A23.1, and as supplemented below.
   b. Cold Weather Protection: Concrete shall be protected from freezing for a minimum of 7 days after placement or for the time necessary to achieve 75% of the specified 28-day compressive strength.
   c. Membrane Curing: Cure exposed concrete surfaces using a specified curing compound applied with a pressurized spray nozzle. Curing compound shall be applied within 5-15 minutes 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 m2 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.
   d. Moist Curing: Use where specified or directed by the City 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.
   e. Surface Sealant: An approved sealing solution shall be sprayed on all exposed concrete surfaces in accordance with the manufacturer's recommendations. The concrete shall be dry and swept clean prior to the application of the sealant.

*5.30.16.7* *Field Quality Assurance*

1. The contractor and the concrete supplier shall assist the field technician in obtaining samples for quality assurance testing.
   a. The contractor shall suspend pouring operations after sampling until the results of the field quality tests are known.
2. Inadequate Protection and Curing

   For concrete where the surface temperature is measured to be below 0ºC the concrete may be accepted subject to a pay factor according to Table 5.5.16.4.

**Table 5.30.16.4: Cold Weather Protection Pay Factors**

| 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 |

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 re-tempering with water is permitted by the City Engineer. If the second test fails, the City Engineer may reject that load of concrete including removal of the portion already poured. When the slump exceeds the maximum allowable, no retesting of the concrete will be allowed
4. Deficient Air Content
   a. For any load of concrete, if the tested air content is outside the specified limits, the City Engineer will require one of the following:

b. 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 City Engineer proof that the load of concrete meets the required spacing factor as determined from air void examination performed by a qualified laboratory to CSA A23.2, failing which the Contractor shall remove and replace all concrete represented by the failed test.

c. Air content below 5.0%: Concrete poured from the load shall be removed and the rest of the load shall be discarded.

d. 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.

e. If the measured air content is below the specified minimum air content, then the contractor may elect to re-temper with air entraining admixtures to Section 5.5.14 - Cement Concrete.

f. When Air Void Examination Is Required:

   i. The quality assurance laboratory will drill cores from the hardened concrete for air void examination to Section 5.5.14, 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.

g. Where concrete has been rejected and is to be removed for not meeting the spacing factor requirement in Section 5.5.14 - Cement Concrete, 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 5.5.14 - Cement Concrete. The test results shall be submitted to the City Engineer.

5. Deficient Strength:

   a. 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 5.5.16.5. If strength deficiencies persist, the City Engineer will require changes in the concrete mix design for the remainder of the work.

**Table 5.30.16.5: Concrete Strength Pay Factors**

| 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 |

b. Optional core strength test:
    i. The Contractor has the option at the Contractor's expense of providing evidence of strength by coring and testing to 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 City Engineer.
    ii. The average strength of the 3 cores shall equal 100% of the specified cylinder strength; if the concrete fails to meet 100% of the specified cylinder strength, then the concrete represented by the testing will be subject to the pay factors of Table 5.5.16.5 on the basis of the cylinder strength tests.
c. Optional core strength test results shall be submitted to the City Engineer.

## 5.30.17 CONCRETE BASE

*5.30.17.1* *Quality Assurance*

1. Slump, air content and strength tests and acceptance criteria: to Section 5.5.16 - Concrete for Roadways.

*5.30.17.2* *Materials*

1. Concrete: class B, to Section 5.5.16 - Concrete for Roadways.
2. Tie bars, reinforcement if required, preformed joint filler and curing compound: to Section 5.5.14 - Cement Concrete and Section 5.5.16 - Concrete for Roadways.
3. Granular Backfill: to Section 5.5.3 – Granular Materials, Designation 3 Class 20A.

*5.30.17.3* *Equipment*

1. Slipform Paver: 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.

*5.30.17.4* *Execution*

1. Preparation
   a. Have prepared subgrade or sub-base inspected by the City prior to placing concrete.
   b. Repair and retest disturbed subgrade or sub-base and remove debris and loose material from the surface.
2. Hand Forming and Placing Concrete
   a. Place forms, reinforcement if required and concrete to Section 5.5.14 - Cement Concrete, Section 5.5.16 - Concrete for Roadways as supplemented in this section.
   b. 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. Slipforming
   a. Place concrete by slipform paver as supplemented below.
   b. Remove excess mortar that may accumulate on slipformed vertical edges.
   c. 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.
4. Finishing
   a. Finish concrete to Section 5.5.14 - Cement Concrete and Section 5.5.16 - Concrete for Roadways.
   b. Continually check the concrete surface while it is still plastic to ensure that surface and grade tolerances are met. Immediately correct excessive variations.
5. Joints
   a. Crack-Control Joints: formed or tooled, to Section 5.5.16 - Concrete for Roadways; at 6 m maximum spacing.
   b. Isolation and Construction Joints: to Section 5.5.16 - Concrete for Roadways.
6. Protection and Curing
   a. Protect and cure concrete to Section 5.5.16 - Concrete for Roadways
7. Backfill Along Alley Edges
   a. 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.
   b. Backfill other areas along alley edges with 150 mm of lightly tamped topsoil shaped to match adjacent landscaped areas.

*5.30.17.5 Field Quality Control*

1. Surface: Maximum variation under a 3 m straightedge:
   a. Parallel to the direction of travel: 6 mm.
   b. Transverse to the direction of travel: 6 mm.
2. Grade: ±6 mm maximum variation from designated elevation.
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 m2 of concrete base.
   a. Deficient Thickness: If the average core thickness is deficient, that area of concrete base will be assessed a pay factor according to Table 5.5.17.1

**Table 5.30.17.1: 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 |

   b. 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
4. Rejected Concrete Base
   a. Remove and replace rejected concrete base by full slabs between transverse and longitudinal joints.
5. Asphalt Surfacing
   a. Asphalt surfacing to Section 5.5.9 - 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.
   b. 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.
   c. 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.

*5.30.17.6 Opening to Traffic*

1. Do not open finished pavement to traffic until directed by the City.
2. When opening to traffic, leave pavement clean and free of debris and remove signs and barricades no longer required.

## 5.30.18 FILLCRETE

*5.30.18.1 Content*

1. This section includes the production and supply of unshrinkable fill (fillcrete) to be used for trench backfill.

*5.30.18.2 Submittals*

1. Submit a mix design to the City, 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 City Engineer.
2. The supplier shall notify the City, and shall resubmit a mix design whenever there is a change in materials, sources, or proportions.
3. If requested, the supplier shall provide proof that the proportions in the mix design will produce fillcrete of the quality specified.
4. No fillcrete shall be produced until the applicable mix design has been approved.

*5.30.18.3 Quality Assurance*

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.
2. Quality assurance sampling and testing for slump, air content and compressive strength shall be performed as follows:
   a. Slump Tests:
      i. Methods: to CSA-A23.2-1C and CSA-A23.2-5C.
      ii. 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 City Engineer.
   b. Air Content Tests:
      i. Methods: to CSA-A23.2-1C and CSA-23.2-4C.
      ii. 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 City Engineer.
   c. Strength Tests:
      i. Methods: to CSA-A23.2-3C and CSA-A23.2-9C.
      ii. 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 City Engineer.

*5.30.18.4 Materials*

1. Cement: to CSA-A3001 of the following types.
   a. Type GU – General use hydraulic cement
   b. Type HE - High early-strength hydraulic cement
   c. Type HS – High sulphate-resistant hydraulic cement
2. Fine Aggregate: to CSA-A23.1
3. Water: to clause 4.2.2, 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.
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 City Engineer.
5. Fly Ash: to CSA-A3001 pozzolan type F

*5.30.18.5 Mix Design*

1. Supply fillcrete in accordance with the following Table 5.5.19.1:

**Table 5.30.18.1: Fillcrete Requirements**

| Compressive Strength at 28 Days (MPa) | Slump (mm) | Entrained Air (% by volume) | Maximum Aggregate Size (mm) | Minimum Cement ($kg/m^3$) |
|---|---|---|---|---|
| Minimum - 0.15<br>Maximum - 0.40 | $100 \pm 25$ | 6.0 - 8.0 | 5 | 30 |

*5.30.18.6* *Execution*

1. Production and Delivery
   a. Fillcrete shall be produced in accordance with CSA-A23.1 and shall conform to the approved mix design.
   b. 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
2. Production Facilities
   a. The supplier shall maintain a minimum stockpile of 100 tonnes of cement powder at the production plant site at all times.
   b. Suppliers shall have a computerized batching system that provides computer printed reports and load tickets. Hand written loading times will not be accepted.
   c. Plant scale certification shall be maintained to CSA-A23.1.
3. Protection of Finished Work
   a. Protect fillcrete from freezing or other adverse weather conditions for a minimum of 24 hours after placement.
   b. Fillcrete that is exposed to significant infiltration of water within 24 hours of placement must be removed and replaced.
   c. 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 5.5.7 - Granular Base Course, a minimum of 24 hours after fillcrete placement.

*5.30.18.7* *Field Quality Control*

1. Required Strength
   a. The result of each compressive strength test shall be within the specified compressive strength range.

### 5.30.19 SEAL COATS AND FOG COATS

1. "Seal coats" shall consist of a surface treatment composed of a single application of bituminous material on an existing bituminous surface immediately followed by covering with aggregate.
2. When a seal coat is applied without cover then it shall be referred to as a "Fog Coat". Fog coat shall be a light application of slow-setting asphalt emulsion diluted with water. The emulsion is diluted with an equal or greater amount of water and sprayed at the rate of 0.45 to 0.70 litres/square metre. Fog coating may be used to renew old asphalt surfaces.

*5.30.19.1 Application*

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

   All dust, dirt and foreign matter will be carefully swept from the surface of the pavement for the full width to be seal-coated immediately prior to the application of the binder.
3. Asphaltic Binder

   The selected bituminous material shall be uniformly applied on the properly prepared surfaces at a rate specified by the City Engineer and within the following ranges:
   a. Fog Coat - 0.23 to 0.70 litres/square meter, with a distributor having special fog nozzles for the purpose of applying a light spray.
   b. Sand Seal - 0.50 to 1.4 litres/square metre.
   c. Chip Seal - 0.90 to 1.8 litres/square metre.

*5.30.19.2 Materials*

1. Bituminous Material
   a. The liquid asphalt used for seal coating shall be rapid curing or emulsified asphalt; the actual grade and type shall be determined to suit the surface condition and shall be approved by the City.
   b. Temperatures of applications shall fall within the following ranges:

| Rapid Curing Asphalt | Emulsified Asphalt |
|---|---|
| R.C. 30 - (50 - 70°C) | R.S. 1k - (15 - 50°C) |
| R.C. 70 - (75 - 90°C) | R.S. 2k - (15 - 50°C) |
| R.C. 250 - (100 - 110°C) | |

2. Mineral Aggregate
   a. Chip Seal
      i. Chip seal aggregate shall be free from soft shale, organic or other deleterious matter and shall have at least one crushed face.
      ii. When tested by means of laboratory sieves, it shall meet the following gradation:

| Sieve Size Passing | Cumulative % by Weight |
|---|---|
| 10 mm | 100 |
| Retained on Sieve | 95 - 100 |

      iii. The maximum amount of moisture content in the chips shall be 1% for an R.C. asphalt and 3% for an R.S. asphalt.
   b. Sand Seal
      i. When tested by means of laboratory sieves, the following gradation:

| Sieve Size Passing | Cumulative % by Weight |
|---|---|
| 5,000 | 100 |
| 400 | 0 – 15 |
| 63 | Less than 2 |

ii. The maximum amount of moisture content in the sand shall be 2% for an R.C. asphalt and 5% for an R.S. asphalt.

c. Application of Mineral Aggregates

i. The application of bituminous material shall not proceed until a supply of aggregate sufficient to cover the entire application is immediately available for covering the bitumen in less than five (5) minutes. The bitumen application shall be promptly covered with specified mineral aggregate at a rate of 5.5 to 11.0 kg/m2 for sand, and from 8.0 to 16.0 kg/m2 for chips.

ii. Special care must be taken in the spreading of mineral aggregates in order that the uniformity of cover will be secured. If, in the opinion of the City Engineer, uniform distribution of the aggregate is not being obtained the cover aggregate shall be alternately drag boomed and rolled until it is uniformly bonded over the full width of the application.

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

d. Rolling

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

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

e. Traffic

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

## 5.30.20 INTERLOCKING "UNI-STONE" BLOCKS

*5.30.20.1* *Materials*

1. Concrete Paving Blocks

   Conforming to ASTM Specification C936, "Solid Concrete Interlocking Paving Units", with particular requirements as follows:

   a. Cement: Type 50 Portland cement conforming to CAN3-A5-M77.
   b. Aggregates: Normal density aggregates, conforming to CAN3-A23.1-M77.
   c. Air-entraining Agent: Conforming to CAN3-A23.1-M77.
   d. Tolerance: Manufactured blocks shall be true to shape and shall not differ from manufacturer's standard dimensions by more than ± 2 mm in length and width and ± 3 mm in thickness.
   e. Shape: Type A: Block is dentated and interlocks on all four faces, resists joint spreading in either direction, and can be laid in a herringbone pattern (According to manufacturer's specific shape, subject to City's approval). The City may also specify or accept shapes other than Type A.
   f. Colour: As required; subject to City's approval.

2. Bedding Sand

   Clean, sharp sand free of deleterious soluble salts and other contaminates likely to cause efflorescence, graded as follows:

| Sieve Size Passing | Cumulative % by Weight |
|---|---|
| 10,000 | 100 |
| 5,000 | 95 – 100 |
| 2,500 | 80 – 100 |
| 1,250 | 50.85 |
| 630 | 25 - 60 |
| 400 | 10 – 30 |
| 160 | 5 - 15 |
| 63 | 0 - 10 |

3. Joint Sand

   Sharp sand free of deleterious soluble salts and other contaminants likely to cause efflorescence and reduced skid resistance, and graded as follows:

| Sieve Size Passing | Cumulative % by Weight |
|---|---|
| 2,500 | 100 |
| 1,250 | 85 – 100 |
| 400 | 25 – 60 |
| 160 | 12 – 30 |
| 63 | 10 – 15 |

4. Edge Restraint

   As shown on plan or as approved by the City. This can be concrete curb, gutter, curb and gutter, walk, existing structure, pressure treated lumber, or other approved method of preventing movement of edge blocks.

5. Other Materials

   Weed barrier, insulation, and other materials specified or shown on plan, subject to approval by the City.

*5.30.20.2* *Construction*

1. Pavement Structure

Construct the pavement according to the cross-section shown on the plans or drawings. Accordingly, the pavement structure will consist of the prepared subgrade; a granular base/sub-base, and the interlocking concrete blocks laid on a bedding of sand. A weed barrier or insulation material may also be specified. The sidewalk shall be designed so that full bricks are utilized for the width of the sidewalk and the requirement for cut bricks is minimized.

2. Subgrade/Base/Sub-base Preparation
   a. Grade and prepare the subgrade/base/sub-base according to sections G 4.0 and 5.0, extending to the rear face of edge restraints.
   b. The finished surface shall not deviate by more than 15 mm from the bottom edge of a 3 m straightedge laid in any direction, and shall be on a correct grade or not more than 10 mm below grade.
   c. Under no circumstances shall further construction proceed until the subgrade has been inspected and approved by the City.
3. Laying of Paving Blocks
   a. Place paving blocks on the screened sand bed (30 mm thick minimum) to the pattern shown on the plans or as approved by the City. Maintain the laying pattern taking care to leave joints between adjacent units not exceeding 3 mm wide.
   b. Lay full units first in each row commencing from a straight starting edge. Fill edge gaps with edge units, or cut infill pieces using suitable equipment to produce true fitting, even edges without cracks or chips.
   c. Use boards overlaying the laid blocks for foot and other traffic to prevent disturbance of units prior to tamping. Ensure that the sand bed is not disturbed during construction.
   d. Using an approved mechanical flat plate vibrator, tamp the laid blocks to bring the paving surface to correct grade, eliminate lipping between adjoining units, and consolidate the sand bedding. Remove and replace any units structurally damaged during compaction.
   e. Where a structure is to carry heavy loads, use a pneumatic-tired roller, for compaction, as directed and approved by the City.
   f. Proceed with compaction as closely as possible following laying, up to one metre of the laying face. Leave all work to within one metre of the laying face fully compacted at the completion of each day's laying.
   g. After compaction, prior to terminating work on each day and prior to allowing construction traffic, brush jointing sand across the pavement, and vibrate to completely fill the joints. Sweep off surplus material and leave the pavement surface clean.
4. Finished Pavement Tolerances

| | |
|---|---|
| Maximum deviation from specified grade | = +10 mm |
| Maximum deviation under a 3 m straightedge | = 8 mm |
| Maximum differential level between 2 adjacent units | = 2 mm |

5. Defects - Remove and replace defective and damaged materials and repair defective work at no additional cost to the City.

### 5.30.21 ASPHALT PATHWAYS

The asphalt and base materials, mixing, spreading, and compaction shall conform to the City of Fort Saskatchewan's Standards and Specifications for subgrade preparation (Section 5.5.3), granular base course (Section 5.5.7) and asphalt pavement (Section 5.5.9) for all of the work required.

### 5.30.22 BOULEVARD AND MEDIAN GRASSING

Refer to Section H for details.

## 5.30.23 TRAFFIC CONTROL DEVICES

*5.30.23.1* *Traffic Signs*

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

1. Materials
   a. Signs

      Signs made of treated ferrous and non-ferrous metal and waterproof, resin-bonded plywood are suitable for use in permanent signs (certain other wood-fibre materials, when properly fabricated, are also acceptable). Wooden boards may be used for large signs and for temporary and seasonal signs.

   b. Sign Panels

      Information signs shall be constructed with high intensity reflective panels. Regulatory and Hazard signs shall be constructed with diamond grade reflective panels.

2. Sign Posts

   Where applicable, it is encouraged that all signs be placed on existing supports used for other purposes such as traffic signals or streetlights. If signposts are required, they shall be made of galvanized metal (schedule 40), 60 mm in diameter and 3.65 m in length with a quick-fix breakaway coupling installed 50 mm from finished grade. In grassed/residential areas, signs should be installed using schedule 40 pipe, 60 mm in diameter, 3.65 m in length, with 100 mm x100 mm tabs welded 300 mm above bottom of post.

   a. Fasteners

      Stainless steel fasteners shall be used to attach signs to their supports. Bottom of sign to be a minimum of 2.0 metres from finished ground surface for urban areas and 1.5m from finished ground surface in rural areas. Self-tapping screws are not permitted.

3. Installation and Maintenance

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

*5.30.23.2* *Pavement Markings*

1. Pavement markings are traffic control devices placed on driving surfaces to delineate and clarify traffic and pedestrian movement by regulating, warning, and conveying information to individuals without diverting attention from the roadway.
2. The most frequently used traffic marking materials are traffic marking paint and thermoplastic material.
3. Pavement markings shall conform to the following:
   a. Colour

      Yellow (solid) lines will be used to delineate the separation of opposing traffic flows. White lines will be used to delineate the separation of traffic flows in the same direction. All transverse pavement markings are to be white in colour.

   b. Pattern

      Broken longitudinal lines are to indicate that lane changing is permitted and solid longitudinal lines indicate that lane changing is not permitted. The line to gap ratio for separator lines is to be 3m:6m. Lateral pavement marking may be parallel or "zebra" lines and are to be used

to indicate the limits of the drivers' right-of-way concerning stopping, pedestrian crosswalks, no parking areas and the like.

Please see the "Uniform Traffic Control Devices for Canada" manual which details the requirements for pavement markings.

*5.30.23.3* *Temporary Signage*

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

### 5.30.24 STREET LIGHTING

1. All street lighting layout and location of the buried and/or the overhead lines shall be approved by the City. The location, type and frequency of street lights shall be such as to provide the minimum lighting levels as designated by the franchise utility company and in conformance with the Roads and Transportation Association of Canada guidelines.
2. Wherever possible, streetlight cables shall be installed underground. Cables crossing all roadways or driveways shall be placed in direct-burial-type rigid plastic pipe using one pipe per individual cable unless noted otherwise.
3. Only corrosive resistant street light poles complete with fixtures and concrete pedestals shall be used unless approved otherwise.
4. Streetlights shall be so located as to not interfere with proposed driveways, lanes, and motorist's lines of vision and shall be located in line with the extension of common property lines wherever possible.
5. The City may recommend the provision of electrical outlets on light posts.

## 5.30.25 COMMUNITY MAILBOXES (SUPER MAILBOXES)

Prior to the installation, erection, relocation, or removal of any Community Mailboxes within the City of Fort Saskatchewan, written approval shall be obtained from Canada Post. These boxes shall be placed in the most aesthetic manner possible while addressing concerns of safety and municipal and franchise utility operations. They shall conform to the following criteria for site selection:

### *5.30.25.1 Design Criteria*

Sighting considerations should address concerns regarding visual intrusion, traffic and pedestrian conflicts, traffic lines of sight, buried services, proximity to intersections, access to abutting, properties and site maintenance. Specific requirements for the Community Mailboxes are:

1. Where there is a monolithic sidewalk at a site, or where right of way permits, the box shall be installed directly behind the walk, facing the roadway. Where separate walk exists with a sufficiently wide boulevard between the walk and roadway, the box shall be installed directly in front of the walk, facing the walk. Where no sidewalk exists, the box shall be installed facing the roadway.
2. A minimum setback of 2.0 m while still within the public right-of-way. Easement must be obtained if insufficient space exists.
3. No island or centre median site locations are permitted.
4. The curb is not to be lowered to accommodate wheelchair or other such access.
5. All locations are to be recorded on the appropriate as-built record drawing(s).
6. The access is to be a minimum of 2.0 m in width and constructed of poured-in-place unreinforced concrete, a reinforced concrete pad, or interlocking brick and shall be as long as required to reach the site. The pad is to be a minimum of 125 mm in depth with a maximum slope of 1:12.

### *5.30.25.2 Materials*

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

### *5.30.25.3 Installation*

1. All installations shall be accomplished as quickly and with the least amount of disruption as possible.
2. Subgrade Preparation - The subgrade shall be finished to conform to the required section, grade and density prior to the placement of the pad.
3. Forming - All forms shall be well staked and braced to the established line and grade.
4. Placing concrete - Concrete shall be placed only after the sub-base and forming have been inspected and approved by the City Engineer.
5. Precast Pads - Such pads shall be constructed to the sizes and dimensions shown on the approved drawings and conform to CSA Std. A251. and contain reinforcing steel as noted on the attached "Pre-Cast Foundation - Type A" Figures G.2.16 and G.2.17.
6. Levelling - The boxes shall be installed to the requirements noted on Standard Drawings.
7. A toll-free emergency telephone number for Canada Post shall be affixed to the box or otherwise made available on a 24-hour basis.

## 5.30.26 MISCELLANEOUS

*5.30.26.1 Culverts*

1. General
   a. Culverts shall be placed so that the minimum distance from the finished grade of the roadway to the top of the pipe shall be not less than one-half the diameter of the pipe or a minimum of 1 metre unless approved otherwise.
   b. A trench shall be excavated to the required depth and grade with the bottom shaped to conform to the bottom of the pipe to ensure a firm and uniform bearing over the entire length of the culvert. If the material in the bottom of the excavation is unsuitable, the trench shall be dug below the grade as ordered, and backfilled with approved granular material and thoroughly tamped, or otherwise compacted, to ensure an unyielding foundation.
   c. Where the trench is in solid rock or other hard material, it shall be excavated to a depth of at least 100 mm below the grade established for the bottom of the pipe, and this additional excavation shall be backfilled with suitable material in such manner as to ensure a uniform bearing for the length of the culvert.
   d. Selected backfilling material, properly graded and free of frozen lumps, etc., shall be placed under and around the pipe and thoroughly tamped or otherwise compacted in place. The trench shall be completely filled, and the pipe covered to a depth of at least 300 mm with hand placed and properly compacted material before the construction of the embankment over the culvert proceeds.
   e. If a trench is not required, the culvert pipe shall be laid true to line and grade, on a bed that is uniformly firm throughout its entire length, and the backfilling around and over the pipe shall be completed as specified in the preceding paragraph.
   f. When using corrugated pipe, the pipe shall be laid in the trench with the separate sections firmly joined together and with outside laps of circular joints pointing upstream and with longitudinal laps on the side. Corrugated pipe shall be so handled as to prevent damage to the pipe. In no case shall pipe culverts be dragged on the ground.
2. Removing Existing Culverts and Structures

   Where it is necessary to remove any existing culvert or structures from the grade or right-of-way, the Developer shall carefully remove and pile or place the materials as directed by the City Engineer.
3. Rip-Rap

   Embankments, the ends of culverts, and ditch bottoms may be protected by rip-rap as directed when required by the plans or as ordered by the City Engineer.
   a. Hand Laid Rip-Rap

      Hand laid rip-rap shall be sound, durable stones and in no case measure less than 150 mm. The stones shall be placed with their beds at right angles to the slope, with larger stones used in the bottom courses, and the smaller stones at the top. They shall be laid in close contact so as to break joints, and in such manner that the weight of the stone is carried by the earth and not by the adjacent stones. The spaces between the larger stones shall be filled with spalls, securely rammed into place. The finished work shall present an even, right, and reasonably plain surface, varying not more than 75 mm from the required contour.
   b. Random Rip-Rap

      Random rip-rap, graded so that the smaller stones are uniformly distributed throughout the mass, shall be dumped randomly over the areas until the required depth is attained. The occasional manual handling of rocks or stones shall in no manner be construed to transform the classification of random rip-rap into that of hand laid rip- rap.

*5.30.26.2* *Vehicular Barriers*

1. Vehicular barriers should be constructed at the following locations:
   a. across the end of a lane cul-de-sac which abuts a roadway;
   b. across the end of a walkway which terminates in a lane;
   c. along a lane which parallels an adjacent roadway;
   d. near permanent bodies of water;
   e. at areas showing a large difference in grade separation;
   f. bridge abutments;
   g. retaining walls; or
   h. as a longitudinal divider on narrow medians.
2. While vehicular barriers are designed to reduce the hazard of errant vehicles leaving the highway surface, they themselves must also be considered as hazards. Their purpose is to shield those hazards which cannot be eliminated. Installation is warranted only where the severity of an accident without the barrier is greater than that of a collision with the traffic barrier itself.
3. W-Beam Guardrail
   a. Materials
      i. Posts and Blocks shall be in accordance with Alberta Transportation Standards and be of the following dimensions:

| | |
|---|---|
| Posts | 200 x 200 x 1,800 mm (minimum)<br>200 x 150 x 1,800 mm (minimum) |
| Blocks | 200 x 200 x 350 mm<br>200 x 150 x 350 mm |

      ii. Guardrail and Anchor Block Hardware - Guardrail shall be Amo "Flex-Beam", 2.7 mm thick galvanized steel. Bolts, nuts and washers shall be hot-dipped galvanized medium steel of 50 mm diameter.
      iii. Concrete shall be Type 50 and have a minimum compressive strength of 30 MPa at 28 days.
   b. Installation
      i. Posts shall be set plumb to a height, line and grade adjusted to give the entire guardrail installation a uniform and pleasing appearance in line and grade. The top, bottom and centre of the W-Beam rail shall bear on each block and laps shall be in the direction of the traffic flow. Bolts shall be tightened with exposed threads buried and shall not extend beyond the nuts by more than 13 mm.

*5.30.26.3* *Fencing*

Uniform wood fencing and gates shall be constructed in accordance with the Standard Drawings for fencing and shall be constructed adjacent to and at the following locations:

1. arterial roadways;
2. parks and playfields;
3. public walkways and utility lots;
4. school sites;
5. City owned lands;
6. multiple family sites;
7. institutional sites; and
8. other areas as required by the City.

*5.30.26.4* *Backfilling Utility Trenches On City Rights-Of Way*

All ditches, trenches, and cuts on City right-of-ways shall be done with a minimal amount of disturbance. The backfill must be an approved material placed in uniform lifts not exceeding 300 mm (loose depths) to a density of not less than 97% of the Standard Proctor Density. No excavation shall be closed until compaction has been approved by the City.

## 5.30.27 CONSTRUCTION COMPLETION AND FINAL ACCEPTANCE CERTIFICATES (CCC & FAC)

*5.30.27.1 Construction Completion Certificate (CCC)*

1. Application
   a. Prior to applying for CCC, the Developer Representative must fully inspect all work completed and ensure that all construction techniques and materials conform to the approved drawings, specifications and all Municipal, Provincial and Federal standards, bylaws, guidelines, Acts and Legislation.
   b. All applicable items in the CCC checklist in Appendix I shall be completed.
   c. A CCC request must be submitted to the City.
2. Inspection
   a. The Developer Representative shall be responsible for taking notes and providing copies of all documentation to attendees of each inspection.
   b. A copy of a standard inspection form can be found in Appendix I
   c. Copies of all forms must be distributed digitally to the City within two weeks of any inspection. At the completion of a passing CCC inspection with the City inspector, the Developer Representative must complete and submit a construction completion certificate, along with all required attachments.

*5.30.27.2 Warranty and Maintenance Period*

1. During the maintenance period, the Developer is responsible for the maintenance of the Municipal Improvement in accordance with signed Development Agreement.
2. The Developer shall repair any damage or deficiency within 30 days of written notification from the City. The Developer is exempt from repairing any items identified as an exception in the Development Agreement.
3. The maintenance period start date is not affected by these repairs. If not repaired, the City may draw on the security to correct deficiencies

*5.30.27.3 Final Acceptance Certificate (FAC)*

1. General
   a. Final inspection will be made prior to the end of the warranty period.
   b. The City Inspectors must be notified of the inspection. Attendance is at the Inspector's discretion but is recommended in most cases and mandatory for Paved Roads. An inspection report must be submitted to the City prior to any repairs.
2. Record Drawings
   a. At CCC or conditional CCC, the Developer Representative must provide record drawings showing at minimum grading and elevation for servicing inverts at property line
   b. No more than 60 days after CCC inspection, the Developer Representative must provide record drawings for any stage of development.
   c. As-builts shall include an accurate record of all improvements as constructed or changed during the course of the maintenance period. Any approved design information that was altered since drawing approval will be struck through and replaced with field verified data. All changes will be shown in red text.
   d. The Applicant must provide digital submission of drawings in Adobe PDF and final approved drawings in AutoCAD compatible format.
   e. In addition to the information required for detailed drawings, record drawings shall include, at minimum, the following additional information:
      - date of construction completion;
      - date which as-built drawings were completed;

- name of contractor(s);
- construction start and completion dates; and
- all street names and addresses for properties within the scope of work.

f. Upon review and acceptance of record drawings by the City, the Developer Representative shall convert red line markups to black and prepare project record drawings.

g. After verification by the professional member, the Developer Representative shall provide one copy of the record drawings in AutoCAD compatible format and one set of signed .pdf files of all drawings.

h. FAC inspection requests will not be accepted until which time any final record drawings have been accepted by the City.

3. Application
   a. Prior to applying for FAC, the Developer Representative must fully inspect all work completed and ensure that all construction techniques and materials conform to the approved drawings, specifications and all Municipal, Provincial and Federal standards, bylaws, guidelines, Acts and Legislation.
   b. The City requires that all aspects of development included in detailed drawings per phase and in accordance with the development agreement be inspected at the same time.
4. Inspection
   a. The Developer can request a pre-FAC inspection by the City within 90 days of the maintenance expiry date.
   b. Final FAC inspections can be requested 60 days prior to the expiration of the CCC warranty date.
   c. The Developer or Developer Representative must provide a representative to attend all inspections.
   d. At the completion of a passing FAC inspection with the City inspector, the Developer Representative must complete and submit a final acceptance certificate, along with all required attachments.

*5.30.27.4 Concrete Acceptance Specifications*

1. At Construction Completion Certificate (CCC), concrete shall be replaced at the discretion of the City Engineer if:
   a. Cracks:
      i. Causes a loss in crossfall and/or profile (zero tolerance).
      ii. Greater than 1 Sidewalk panel in length.
   b. Spalled Concrete:
      i. Loss of surface mortar and/or aggregate resulting in surface depressions exceeding 10mm in depth
   c. Gouges:
      i. Gouges affect the functionality of the concrete.
      ii. Mark at CCC for replacement at FAC:
         - Two or more gouges exist in a single section of the concrete.
         - A single gouge represents more than an area of 35 mm x 35 mm of curb and gutter.
         - A single gouge has a depth more than 6mm in a single section concrete.
   d. Vertical Displacement:
      i. There is a vertical displacement greater than 5 mm.
   e. Joint Separation:
      i. Two panels of concrete have a joint separation greater than 15 mm.
   f. Ponding:

i. Ponding occurs on any walking surface (zero tolerance)
ii. Any settlement or workmanship causing water retention in front of driveways, curb ramps, alley crossings, commercial crossings, or bus stops

g. Undermining:
i. Undermined concrete is to be removed and replaced by full panel sections.

h. Crossfalls:
i. If there is a dish or hump in 2 panels of sidewalk (6m) greater than ± 6mm
ii. If the crossfall for the concrete work does not fall within the acceptable range as defined in Table 5.5.27.1.

**Table 5.30.27.1 Crossfall Requirements**

| Design Standard | Deficiency |
|---|---|
| Sidewalk Crossfall<br>(ensure draining towards road) | < 1.0%<br>> 4.0% |
| Gutter Crossfalls | < 4.0%<br>> 15.0% |
| Curb ramp Crossfalls | < 2.0%<br>> 8.0% |
| Alley and Commercial Crossings | < 2.0%<br>> 8.0% |

i. Profile Deficiencies:
i. Any dimension varies from the curb and gutter profile details which impact longitudinal drainage or create ponding.

2. At Final Acceptance Certificate (FAC), concrete shall be replaced at the discretion of the City Engineer if:

a. Cracks:
i. Random cracks or more than one crack between and two construction joints.
ii. Cracks with chipped or spalled edges.
iii. Longitudinal cracks.
iv. Are greater than 1.2 mm in width (the width of a dime).

b. Spalled Concrete:
i. Loss of surface mortar and/or aggregate affects more than 5% of the surface area. This applies to walk panels, and 3.0 m curb and gutter sections.

c. Mortar Flaking:
i. Loss of surface mortar and/or aggregate affects more than 5% of the surface area. This applies to walk panels, and 3.0 m curb and gutter sections.

d. Gouges:
i. Replace gouges identified at CCC
ii. Two or more gouges exist in a single section of the concrete.
iii. Gouges affect the functionality of the concrete.
iv. A single gouge represents more than an area of 35 mm x 35 mm of curb and gutter.
v. A single gouge has a depth more than 6mm in a single section concrete.

e. Vertical Displacement:
i. There is a vertical displacement greater than 5 mm.

f. Joint Separation:
i. Two panels of concrete have a joint separation greater than 10 mm.

g. Ponding:
   i. Ponding occurs on any walking surface (zero tolerance)
   ii. Any localized deflective displacement (settlement) exceeding 6 mm over 3 m.
   iii. Any settlement or workmanship causing water retention in front of driveways, curb ramps, alley crossings, commercial crossings, or bus stops
h. Disfigurement:
   i. Disfigured by extraneous means including but not limited to 3rd party damage and builder damage.
i. Linear Grade Deficiencies:
   i. Existing grade varies from design grade by +/- 0.2% and which negatively impact drainage or result in ponding
   ii. Any localized deflective displacement (settlement) exceeding 6 mm over 3 m.
j. Undermining:
   i. Undermined concrete is to be removed and replaced by full panel sections.
k. Crossfalls:
   i. If the crossfall for the concrete work does not fall within the acceptable range as defined in Table 5.5.27.1.

3. General Concrete Repair Requirements
   a. Concrete sections are to be removed at contraction, expansion, or surface joints. If warranted, a 1.5 m minimum length of curb and gutter section may be replaced.
   b. Existing landscaping must be adjusted to match repaired concrete sidewalks and/or curb and gutter. Landscaping repairs to match existing condition and maintain proper grades from private property to road right of way.
   c. Curb ramps and crossings may be repaired to the nearest control joint if deficiency exists in only half of curb ramp or crossing.
   d. Additional damage done to adjacent concrete and/or asphalt during the removal process shall be re-cut prior to repair of the deficiency.
4. Concrete Sidewalks Repair Requirements
   a. Existing walks and driveways must be adjusted to match concrete sidewalks. The City may require the replacement of existing private walks or driveways to provide a satisfactory tie-in.
   b. When replacing separate sidewalks, positive drainage from the front of walk to the curb must be maintained throughout the boulevard. A minimum of 2% is required.
   c. Where monowalk panel deficiencies, the entire monowalk - including curb and gutter – must be replaced. No flag sections are permitted at CCC. If both adjacent panels are in need of repair, the middle concrete panel must also be removed and replaced. A panel is defined as the section between two crack control joints. Flag Sections will only be permitted at FAC after the final lift has been placed to a maximum of 2 panels.
5. Curb and Gutter Repair Requirements
   a. Where curb and gutter deficiencies exist, the entire mono-curb, gutter, and walk shall be replaced.
   b. Curb and Gutter repairs that are less than or equal to 3 m in length may be face formed against adjacent asphalt. This method is only acceptable if the asphalt edge is straight and has no chips or cracks.

*5.30.27.5* *Asphalt Acceptance Specifications*

1. At Construction Completion Certificate (CCC) and Final Acceptance Certificate (FAC), asphalt shall be replaced if:
   i. The asset is not built in accordance with the approved Engineering Drawings or City Specifications.

ii. The asset does not function as intended.
iii. Any of the following asphalt deficiencies exist:
iv. Any deficiency is defined as a safety hazard by the Inspector.

a. Cracking
   i. Asphalt that is defined as a deficiency includes:
      - Open asphalt joints causing unacceptable riding quality
      - Alligator cracking
      - Longitudinal cracking
      - Cracking that is detrimental to the road structure or causes unacceptable riding quality

b. Rutting
   i. Any Rutting will be defined as a deficiency.

c. Potholes
   i. Any potholes will be identified as a deficiency.

d. Ponding
   i. There is zero tolerance for ponding on asphalt

e. Aggregate loss/Raveling/Segregation
   i. Any areas of significant segregation will be identified as a deficiency.

f. Grade Deficiencies
   i. Asphalt must be repaired if:
      - Existing grade varies from design grade by ± 0.2%
      - Any localized deflective displacement (settlement) exceeding 6mm over 3m.

2. General Asphalt Repair Requirements
   a. Asphalt repairs are to be rectangular or square and a minimum of 1.2 m wide (excluding Asphalt Trail).
   b. Surface repairs must be ground and prefilled prior to a full depth overlay.
      - Arterial and collector roads to be ground a minimum of 50 mm.
      - Residential roads to be ground a minimum of 35 mm.
   c. Edges of existing asphalt to be ground or cut vertically. No feathering of patches is allowed. If there is base failure evident or settlements greater than 75 mm in the asphalt structure remove and replace base structure as recommended by a Geotechnical Engineer and approved by the City.
   d. If the asphalt surface is segregated, the use of an approved slurry seal may be used provided the deficiency is clean of dirt and debris. This method is only acceptable for non-staged paving improvements.
3. Road Repair Requirements
   a. To repair asphalt surface failure, cut out failed road structure and replace. If the cut area is less than full lane width, grinding is required to the full width of the lane.
   b. Localized areas of settlement which cause ponding shall be repaired by grinding from the center of the road to the lip of the gutter.
   c. Grind existing asphalt adjacent to gutter lines and joints to allow for a minimum of 35 mm of asphalt. Grinding shall extend a minimum of 1.5 m into the roadway from lip of gutter.
   d. Manholes, valves, vaults, and other fixtures to be adjusted to asphalt design grade (± 6 mm) prior to paving.
4. Asphalt Trail/Alley Repair Requirements
   a. The full width of an asphalt trail or alley is to be removed and/or replaced where deficiencies exist.

### 5.30.28 APPENDIX I: Construction Completion Certificate and Final Acceptance Certificate Checklist

# SUBMISSION CHECKLIST

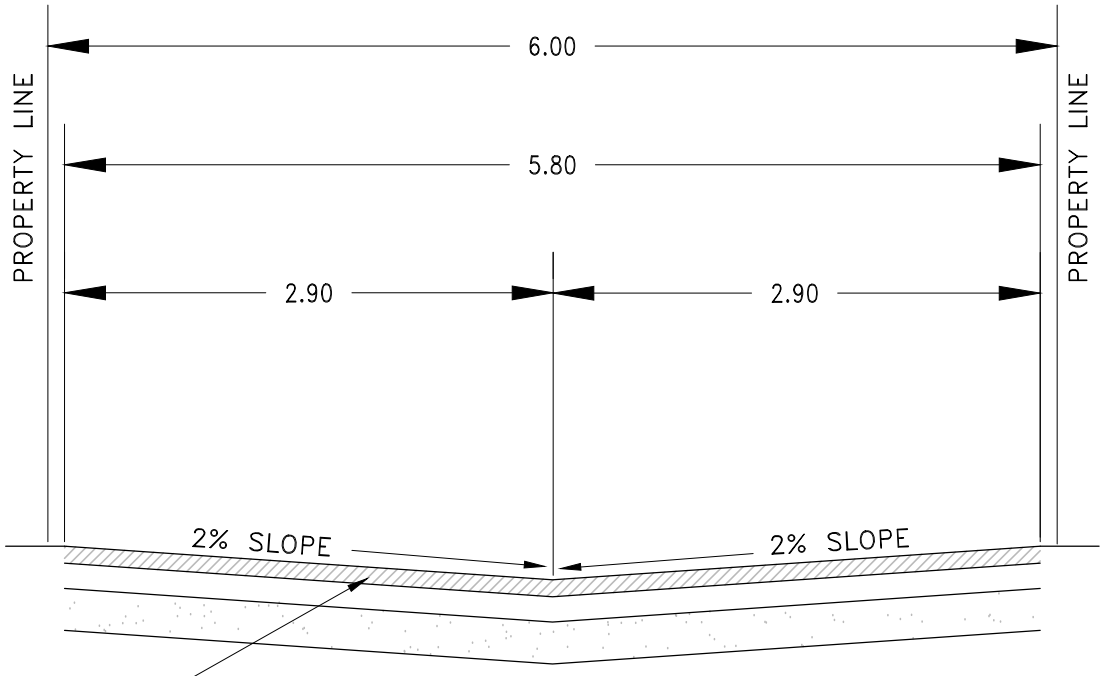
Please ensure all of the following are submitted, failure to do so will result in the Construction Completion Review being returned to you for completion prior to review.

| | | ✓ |
|---|---|---|
| **Testing Summary** | | |
| Underground | Trenching, Pipe Bedding, Backfilling and Compaction Density Tests | |
| | Hydrant Flow Test | |
| | Watermain Hydrostatic/Leakage Test | |
| | Watermain Bacteria/Chlorine Test | |
| | Storm Sewer Television and Photographic Inspection | |
| | Sanitary Sewer Television and Photographic Inspection | |
| | Forcemains Hydrostatic/Leakage Test | |
| Surface | Roadway Excavation, Backfill & Compaction Density Tests | |
| | Roadway Excavation, Backfill & Compaction Proof Rolling | |
| | Aggregate: General Granular Sub-base and Granular Base sieve analysis | |
| | Aggregate: General Granular Sub-base and Granular Base Density Tests | |
| | Aggregate: General Granular Sub-base and Granular Base Proof Rolling | |
| | Asphaltic Concrete Paving Mix Design | |
| | Asphaltic Concrete Paving Core Results | |
| | Asphaltic Concrete Paving Marshall | |
| | Concrete Curbs & Gutters, Walks, Medians, Driveways & Swales, General Concrete, Slip Formed Concrete Mix Design | |
| | Concrete Curbs & Gutters, Walks, Medians, Driveways & Swales, General Concrete, Slip Formed Concrete Slump, Air, Strength Tests | |
| Landscape | Topsoil Analysis: On-site Sources | |
| | Topsoil Analysis: Contractor Supplied | |
| **Inspection Reports** | | |
| | Underground CCC Inspection | |
| | Surface CCC Inspection | |
| | Landscaping and Fencing CCC Inspection | |
| | Underground FAC Inspection | |
| | Surface FAC Inspection | |
| | Landscaping and Fencing FAC Inspection | |
| **Surface Penalty** | | |
| | Surface Penalty Calculation | |
| | City of Fort Saskatchewan payment receipt (if applicable) | |
| **Progress Claim** | | |
| | Progress Claim Certificate | |
| **CCC and FAC Documents** | | |
| | Underground CCC | |
| | Surface CCC | |
| | Landscaping and Fencing CCC | |
| | Underground FAC | |
| | Surface FAC | |
| | Landscaping and Fencing FAC | |
| **Security** | | |
| | Security Calculation | |
| | Letters of Credit | |
| **Asbuilts** | | |
| | Electronic Drawings in Adobe PDF and AutoCAD Compatible Format | |

**Project Engineer (print)** **(sign)** **Date**

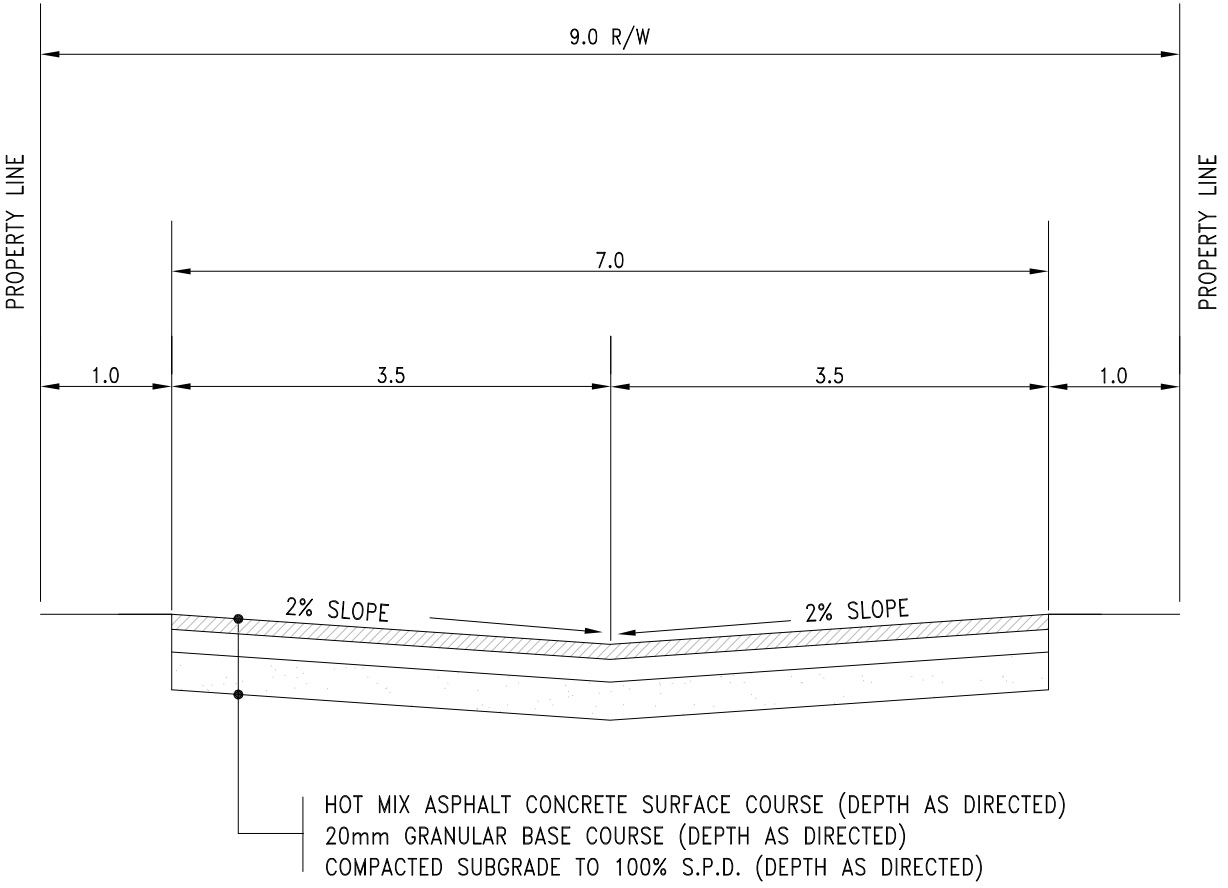
## 5.31 List of Standard Drawings

T-1 Alley - Residential
T-2 Alley - Commercial/Industrial
T-3 18m Right of Way – 9m Local Residential
T-4A 18m Right of Way – 11m Local Residential (Walk One Side)
T-4B 18m Right of Way – 11m Local Residential (Walk One Side) Alternative Easements
T-5 18m Right of Way – 11m Local Residential (Walk Both Sides)
T-6 21.5m Right of Way – 10.5m Local Industrial
T-7 24m Right of Way – 11.5m Minor Collector Residential
T-8 23m Right of Way – 12m Minor Collector Industrial
T-9 24m Right of Way – 13.5m Major Collector Residential
T-10 23m Right of Way – 13m Major Collector Industrial
T-11 33m Right of Way – 15.8m Minor Undivided Arterial
T-12 33m Right of Way – 16.8m Standard Divided Arterial
T-13 44m Right of Way – 16.8m Major Divided Arterial
T-14 Cul-de-Sac
T-15 Straight Face 150mm Curb With 250mm Gutter
T-16 Straight Face 150mm Curb With 500mm Gutter
T-17 Roll Face Curb and Gutter
T-18 Typical Swale Gutters
T-19 Concrete Curb
T-20 1.5m and 2.0m Separate Concrete Sidewalk
T-21 Roll Face Monolithic Concrete Sidewalk
T-22 Straight Face Monolithic Concrete Sidewalk
T-23 Asphalt Trail
T-24 Typical Concrete Curb Ramps
T-25 Concrete Slab-On Median
T-26 Median – Concrete Infill
T-27 Median – Landscaped
T-28 Drop Nose Median
T-29 Residential Access Crossing Separate Sidewalk
T-30 Residential Access Crossing Monolithic Sidewalk
T-31 Commercial/Industrial Crossing Separate Sidewalk
T-32 Commercial/Industrial Crossing Monolithic Sidewalk
T-33 Commercial/Industrial Crossing No Sidewalk
T-34 Pavement Marking Types and Width
T-35 Intersection Pavement Markings #1
T-36 Intersection Pavement Markings #2
T-37 Typical Overlay
T-38 5m Bus Sop (No Shelter)
T-39 9m Bus Stop (With Shelter)
T-40 Mono Walk Bus Stop (With Shelter)
T-41 Sign Installation Detail
T-42 High Entry Angle Right Turn



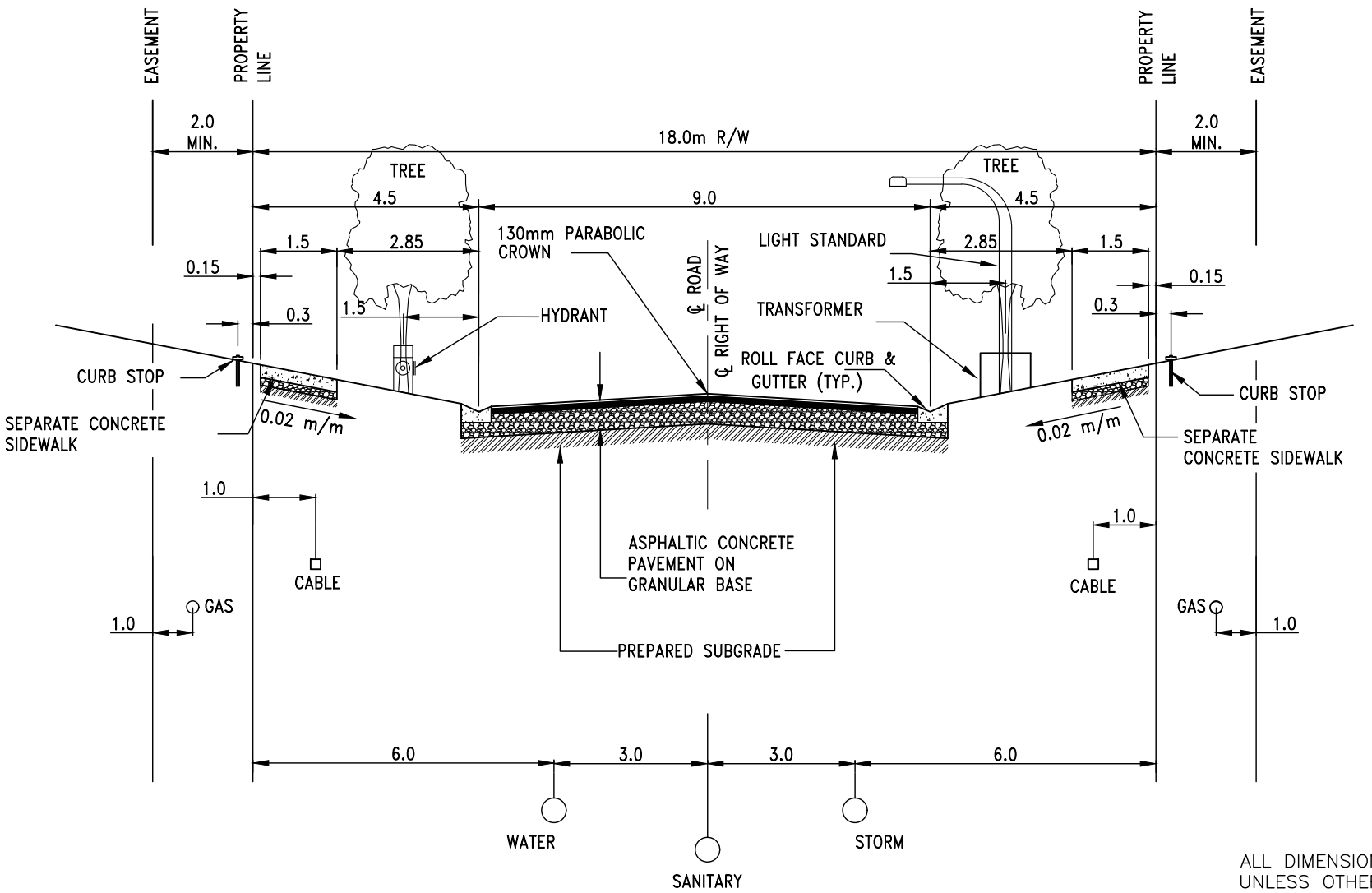

NOTES:
- UTILITIES MAY BE INSTALLED IN ALLEY AT THE DISCRETION OF THE CITY
- ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.

| ALLEY – RESIDENTIAL | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T – 1 |
| NOT TO SCALE | DRAWN: EWN | |




NOTES:
- UTILITIES MAY BE INSTALLED IN ALLEY AT THE DISCRETION OF THE CITY
- ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.

| ALLEY – COMMERCIAL/INDUSTRIAL | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–2 |
| NOT TO SCALE | DRAWN: EWN | |

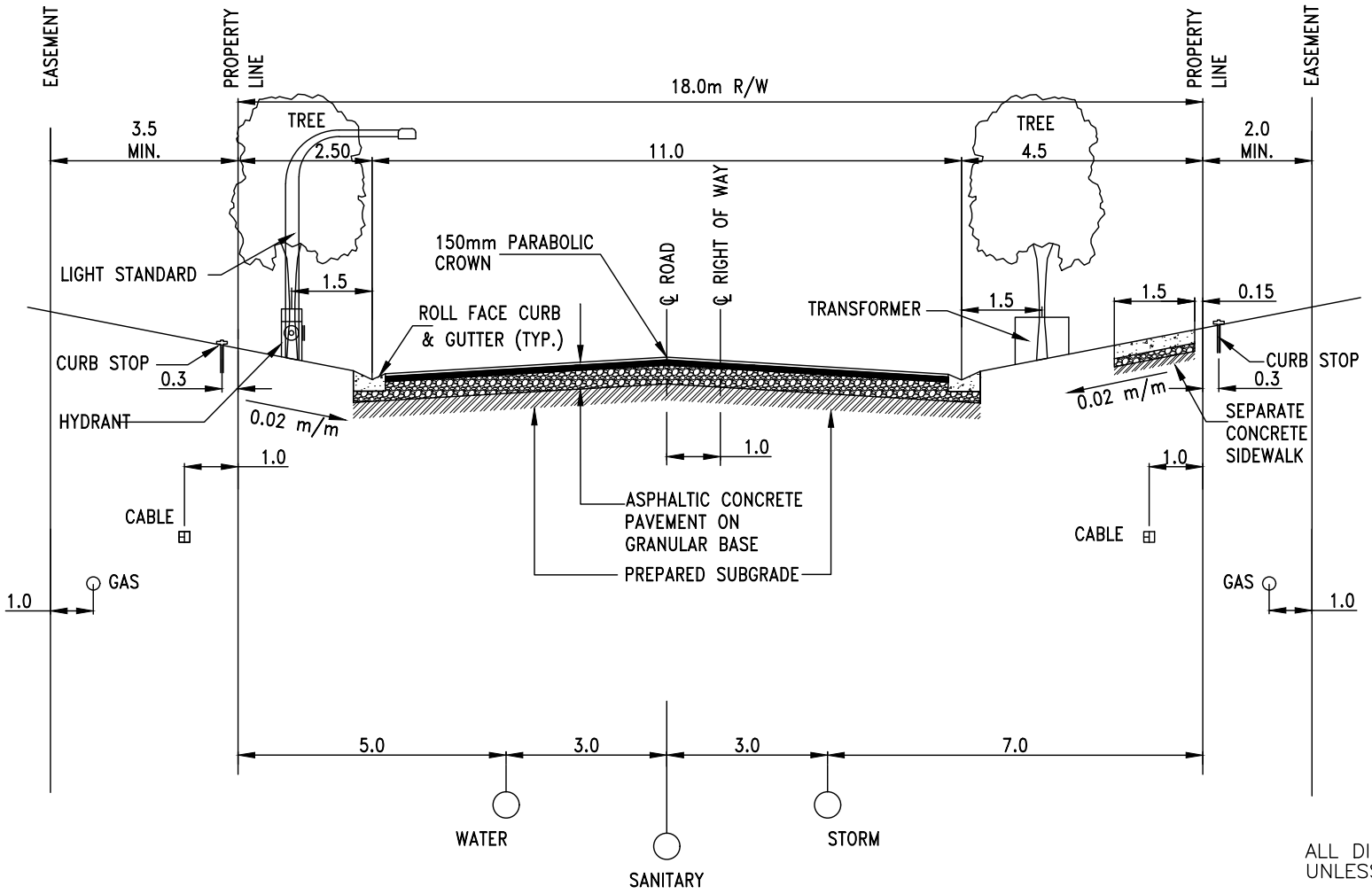



ALL DIMENSIONS IN METRES
UNLESS OTHERWISE NOTED

- FOR LOTS GREATER OR EQUAL TO 14 METERS FRONTAGE
- LOTS WITH LESS FRONTAGE CAN USE DETAIL T–4, T–5.
- CONTRACTOR/CONSULTANT TO REVIEW ALL RELATED SPECIFICATIONS AND STANDARDS FOR INFRASTRUCTURE SHOWN IN THIS SECTION.
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWERPOLES, STREETPOLES, TRANSFORMER BOXES, AND ALL OTHER STRUCTURES SHALL MAINTAIN A MIN. OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES

# 18m RIGHT OF WAY
# 9m LOCAL RESIDENTIAL

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: C | DATE: DEC 2024 | T–3 |
| NOT TO SCALE | DRAWN: EWN, DF | |




ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED

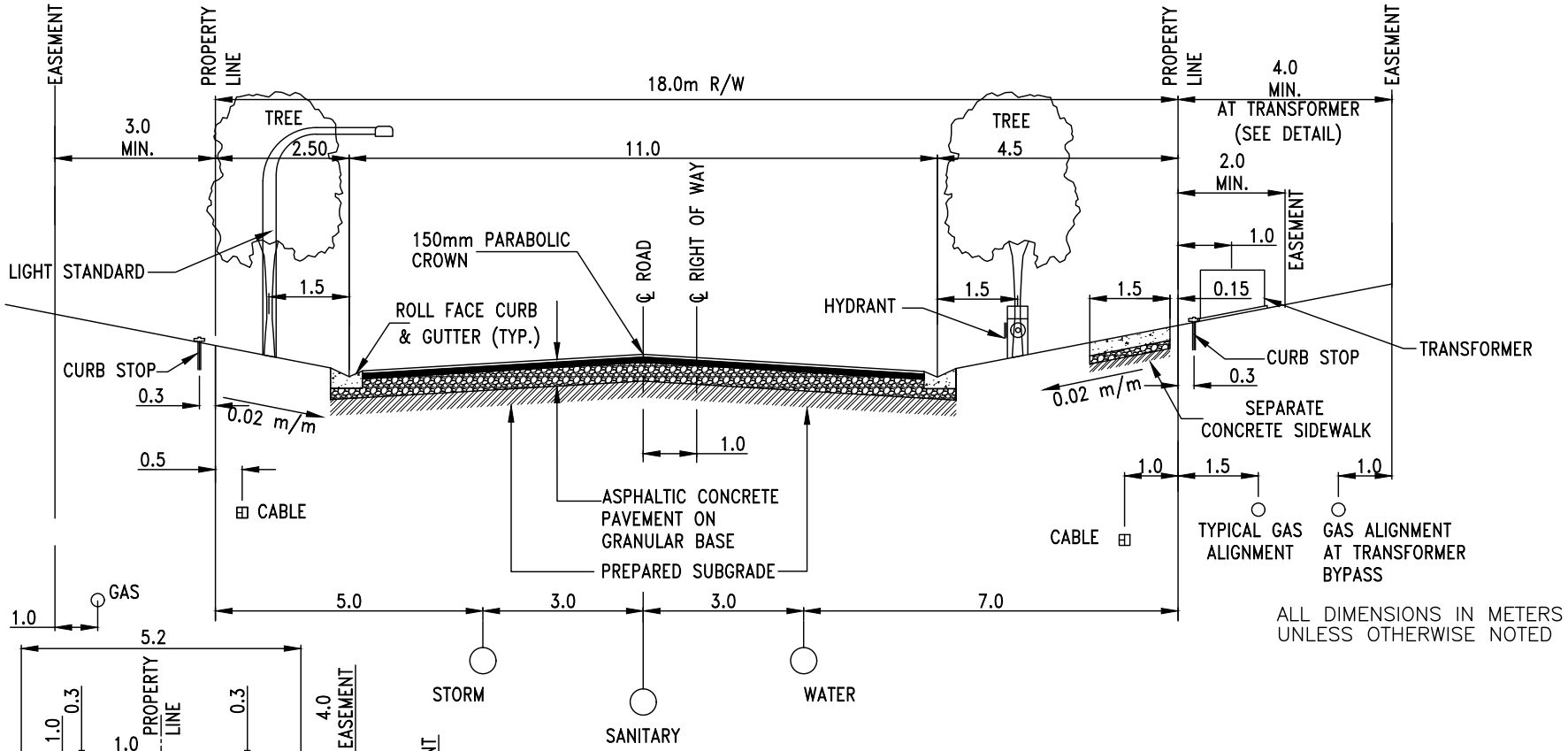
- FOR LOTS LESS THAN 14 METERS FRONTAGE.
- LOTS WITH GREATER FRONTAGE CAN USE DETAIL T–3 WITH 9 METER ROAD WIDTH.
- FOR LOTS LESS THAN 14 METERS WITH CONCRETE SIDEWALK REQUIRED ON BOTH SIDES OF ROAD SECTION USE DETAIL T–5.
- CONTRACTOR/CONSULTANT TO REVIEW ALL RELATED SPECIFICATIONS AND STANDARDS FOR INFRASTRUCTURE SHOWN IN THIS SECTION
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWERPOLES STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER SURFACE STRUCTURES SHALL MAINTAIN A MIN OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES

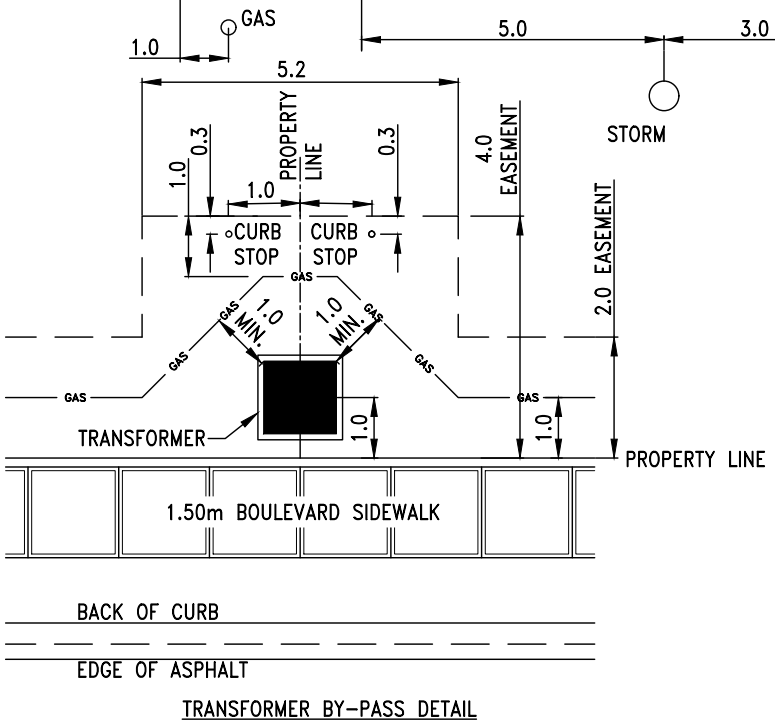
# 18m RIGHT OF WAY
# 11m LOCAL RESIDENTIAL

CITY OF FORT SASKATCHEWAN STANDARD DETAIL

DWG. NO. T–4A

| | |
|---|---|
| REVISION NUMBER: C | DATE: DEC 2024 |
| NOT TO SCALE | DRAWN: EWN, DF |




TRANSFORMER BY-PASS DETAIL

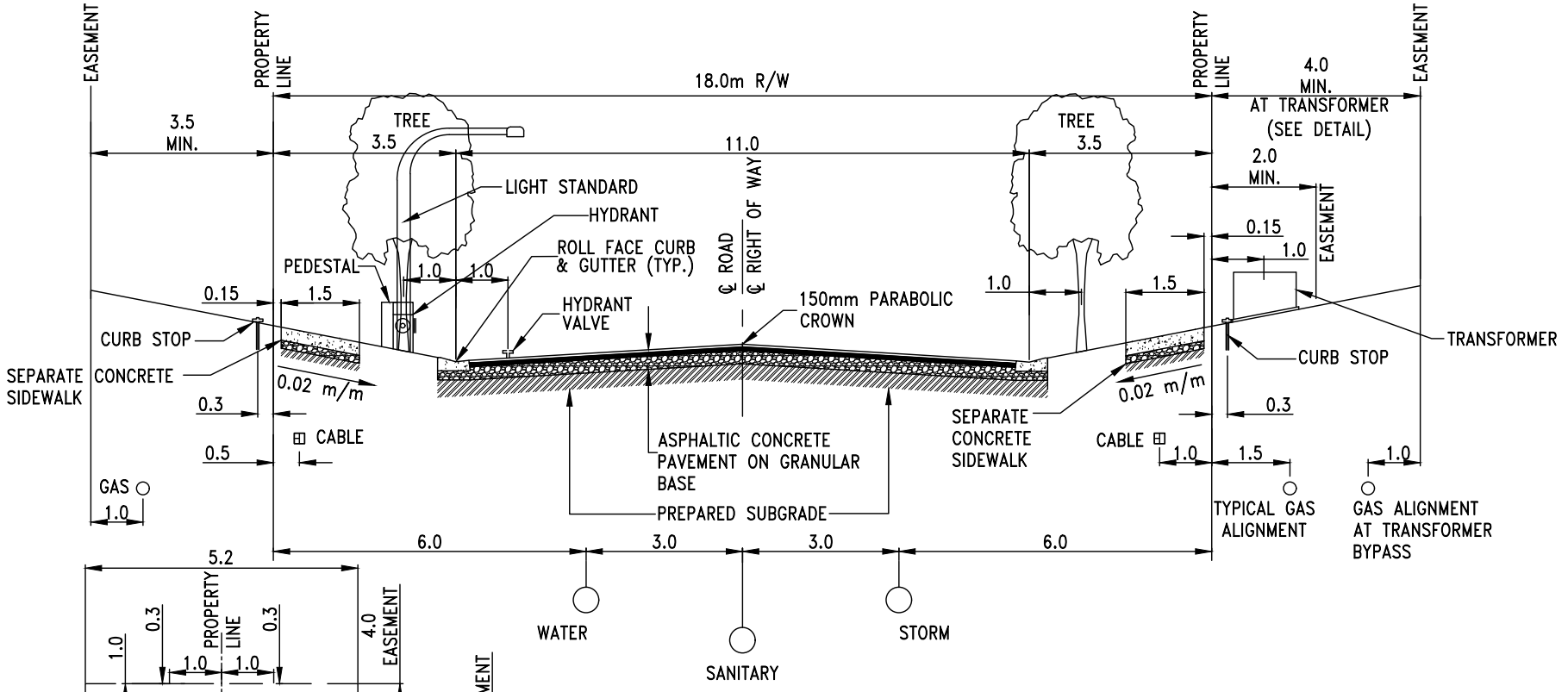
- FOR LOTS LESS THAN 14 METERS FRONTAGE.
- LOTS WITH GREATER FRONTAGE CAN USE DETAIL T-3 WITH 9 METER ROAD WIDTH.
- FOR LOTS LESS THAN 14 METERS WITH CONCRETE SIDEWALK REQUIRED ON BOTH SIDES OF ROAD SECTION USE DETAIL T-5.
- CONTRACTOR/CONSULTANT TO REVIEW ALL RELATED SPECIFICATIONS AND STANDARDS FOR INFRASTRUCTURE SHOWN IN THIS SECTION
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWERPOLES STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER SURFACE STRUCTURES SHALL MAINTAIN A MIN OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES

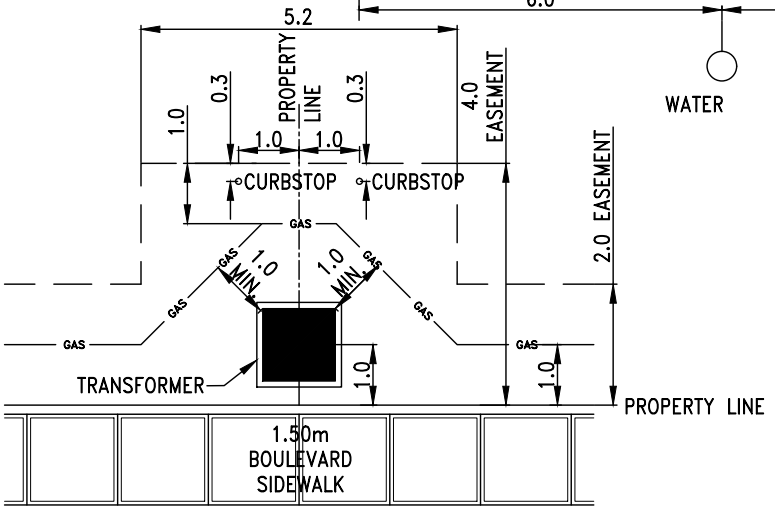
# 18m RIGHT OF WAY
# 11m LOCAL RESIDENTIAL
# ALTERNATIVE EASEMENTS

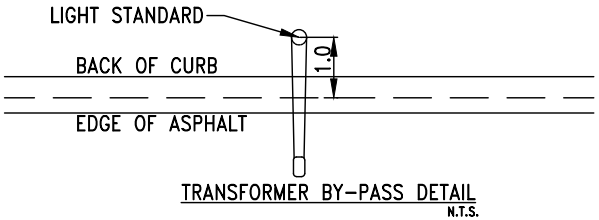
CITY OF FORT SASKATCHEWAN STANDARD DETAIL

DWG. NO. T-4B

| | |
|---|---|
| REVISION NUMBER: C | DATE: DEC 2024 |
| NOT TO SCALE | DRAWN: EWN, DF |



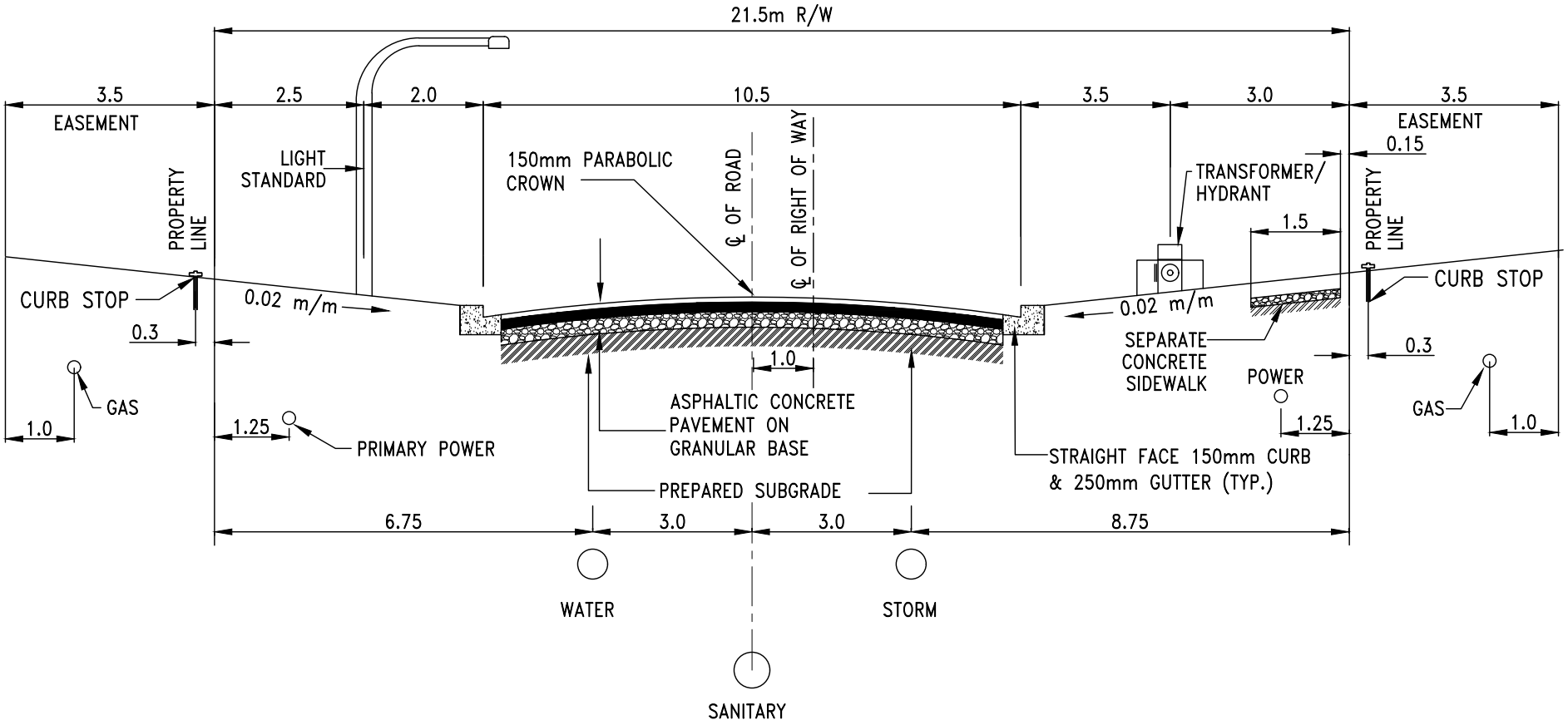

TRANSFORMER BY-PASS DETAIL
N.T.S.

- FOR LOTS LESS THAN 14 METERS FRONTAGE
- LOTS WITH GREATER FRONTAGE CAN USE DETAIL T-3 WITH 9 METER ROAD WIDTH
- FOR LOTS LESS THAN 14 METERS WITH CONCRETE SIDEWALK REQUIRED ON ONE SIDE OF ROAD SECTION USE DETAIL T-4 (TRANSFORMER WITH IN BOULEVARD)
- CONTRACTOR/CONSULTANT TO REVIEW ALL RELATED SPECIFICATIONS AND STANDARDS FOR INFRASTRUCTURE SHOWN IN THIS SECTION
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWER POLES, STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER SURFACE STRUCTURES SHALL MAINTAIN A MIN, OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES.

ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED

# 18m RIGHT OF WAY
# 11m LOCAL RESIDENTIAL

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: C | DATE: DEC 2024 | T-5 |
| NOT TO SCALE | DRAWN: EWN, DF | |

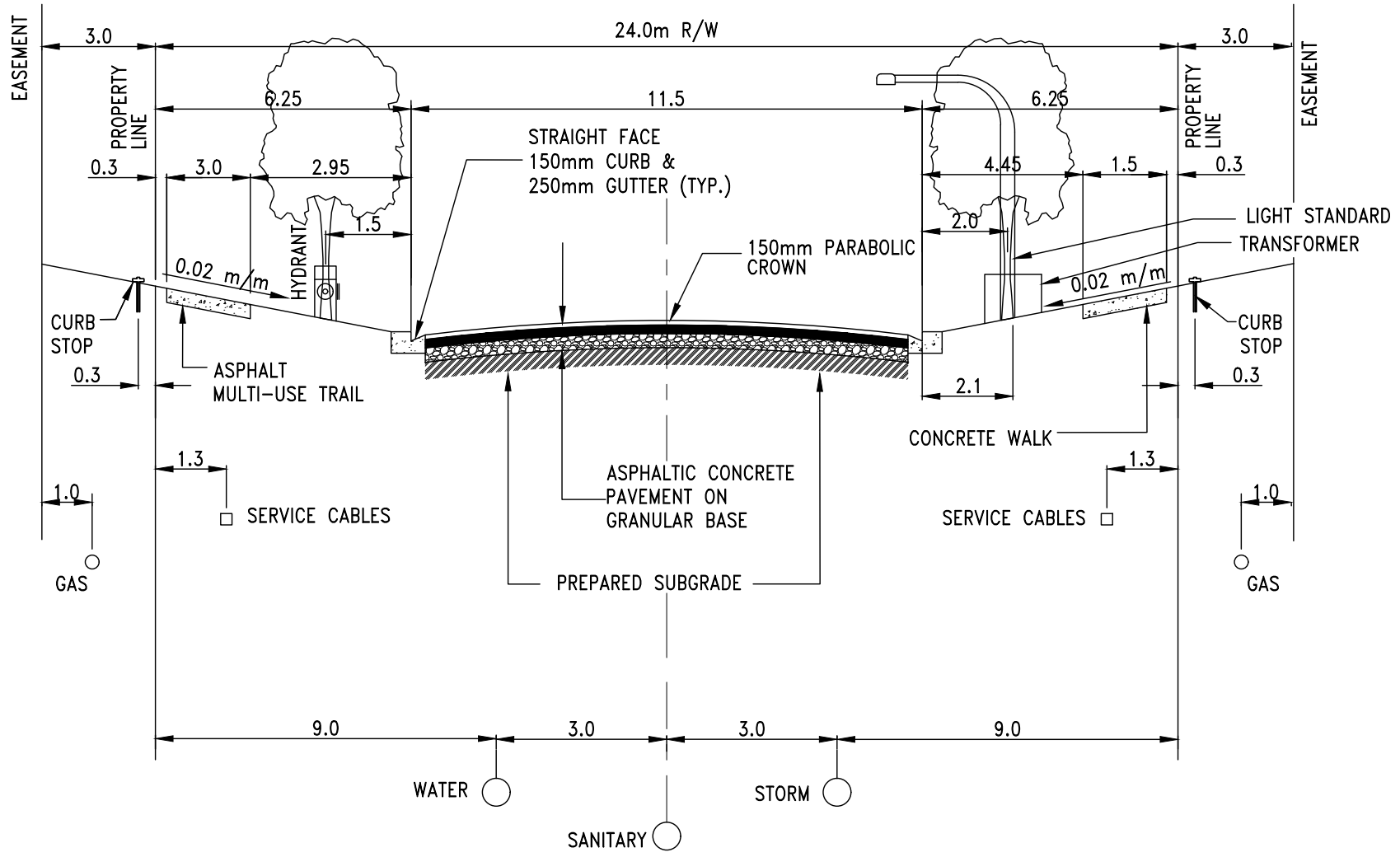



NOTE:
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWER POLES, STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER SURFACE STRUCTURES SHALL MAINTAIN A MIN. OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES

ALL DIMENSIONS IN METERS
UNLESS OTHERWISE NOTED

# 21.5m RIGHT OF WAY
# 10.5m LOCAL INDUSTRIAL

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: C | DATE: DEC 2024 | T–6 |
| NOT TO SCALE | DRAWN: EWN, DF | |

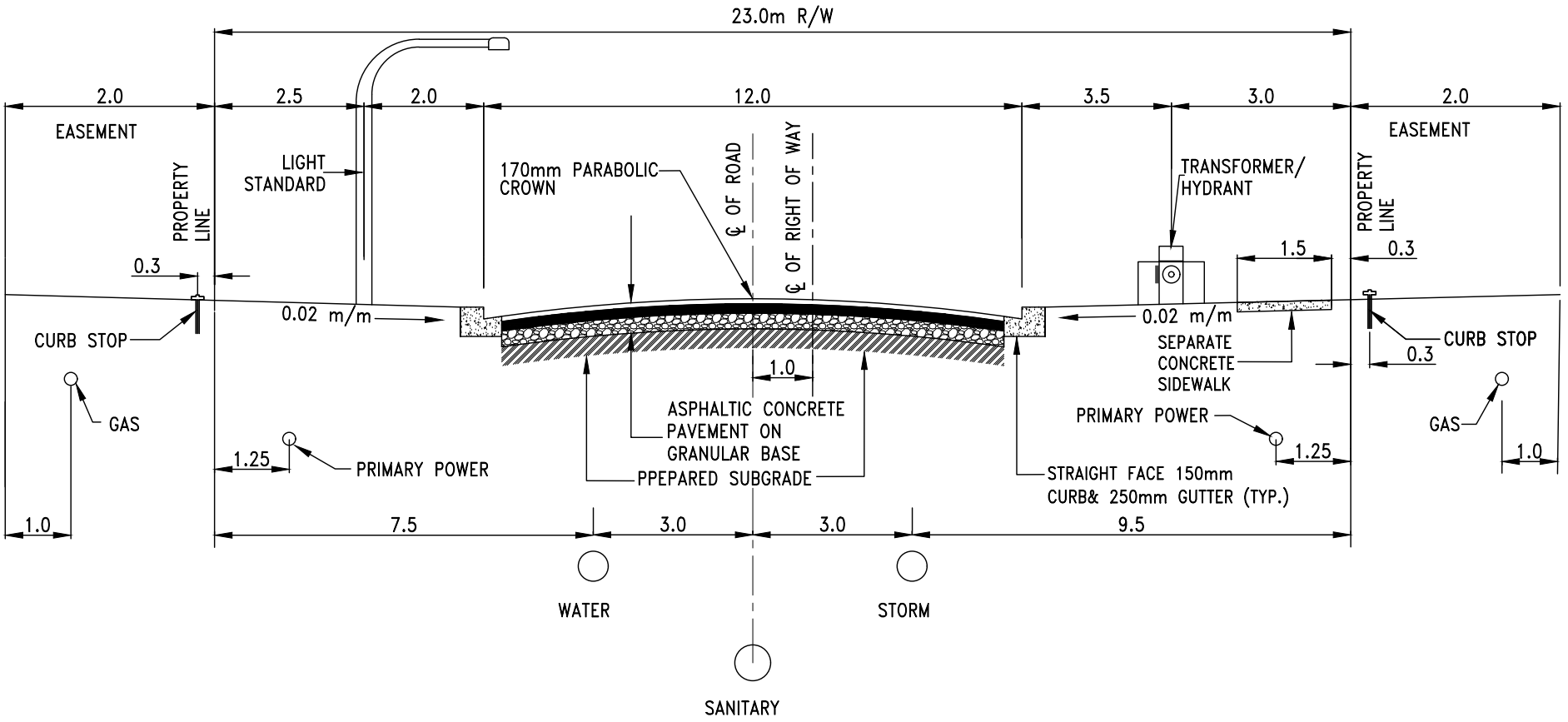



NOTE:
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS
- POWER POLES, STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER SURFACE STRUCTURES SHALL MAINTAIN A MIN. OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES

ALL DIMENSIONS IN METERS
UNLESS OTHERWISE NOTED

# 24m RIGHT OF WAY
# 11.5m COLLECTOR RESIDENTIAL

| | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: C | DATE: DEC 2024 | T-7 |
| NOT TO SCALE | DRAWN: EWN, DF | |

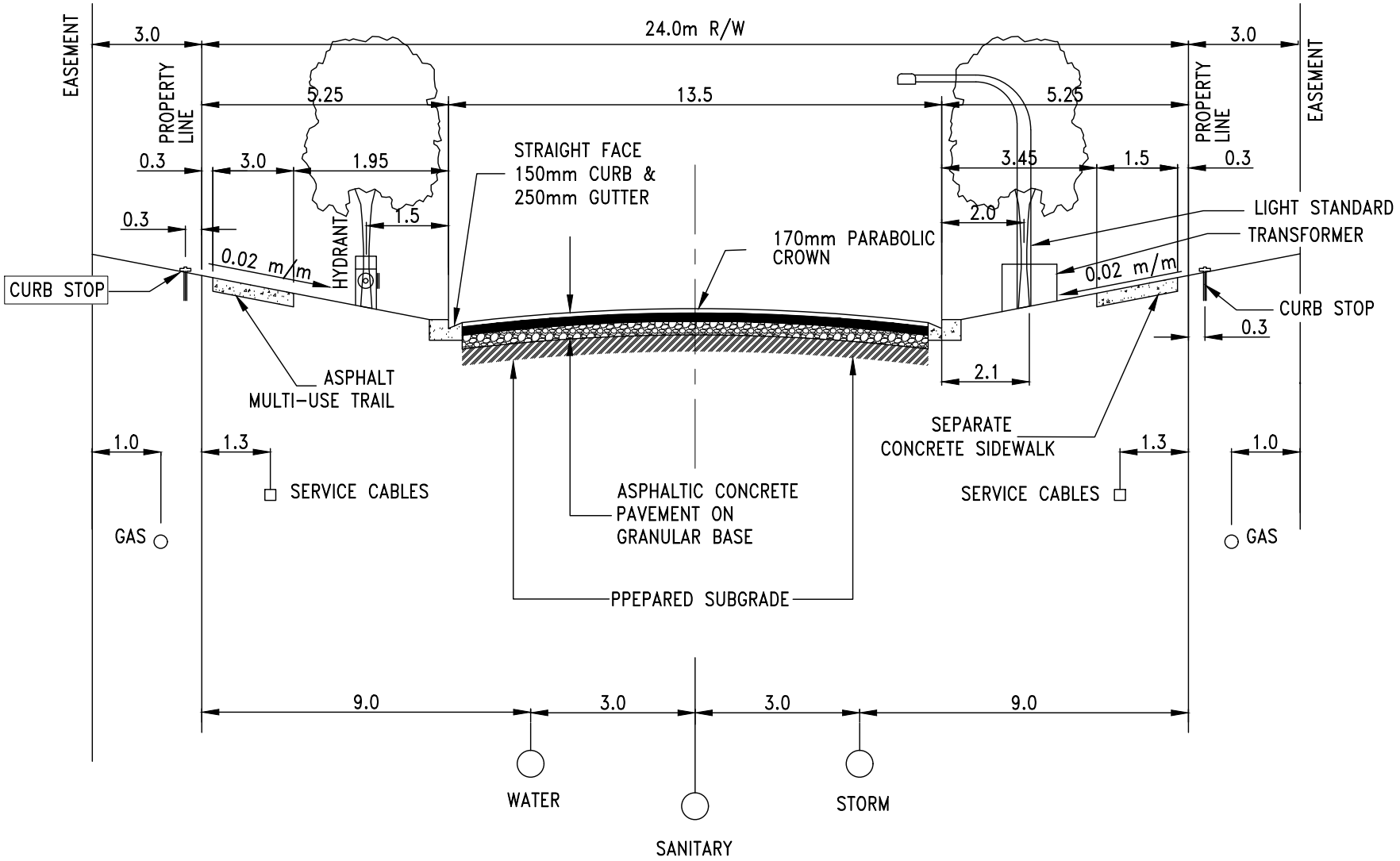



NOTE:
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWER POLES, STREETLIGHT POLES, TRANSFORMER BOXES. AND ALL OTHER SURFACE STRUCTURES SHALL MAINTAIN A MIN. OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES

ALL DIMENSIONS IN METERS
UNLESS OTHERWISE NOTED

# 23m RIGHT OF WAY
# 12m COLLECTOR INDUSTRIAL

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: C | DATE: DEC 2024 | T-8 |
| NOT TO SCALE | DRAWN: EWN, DF | |

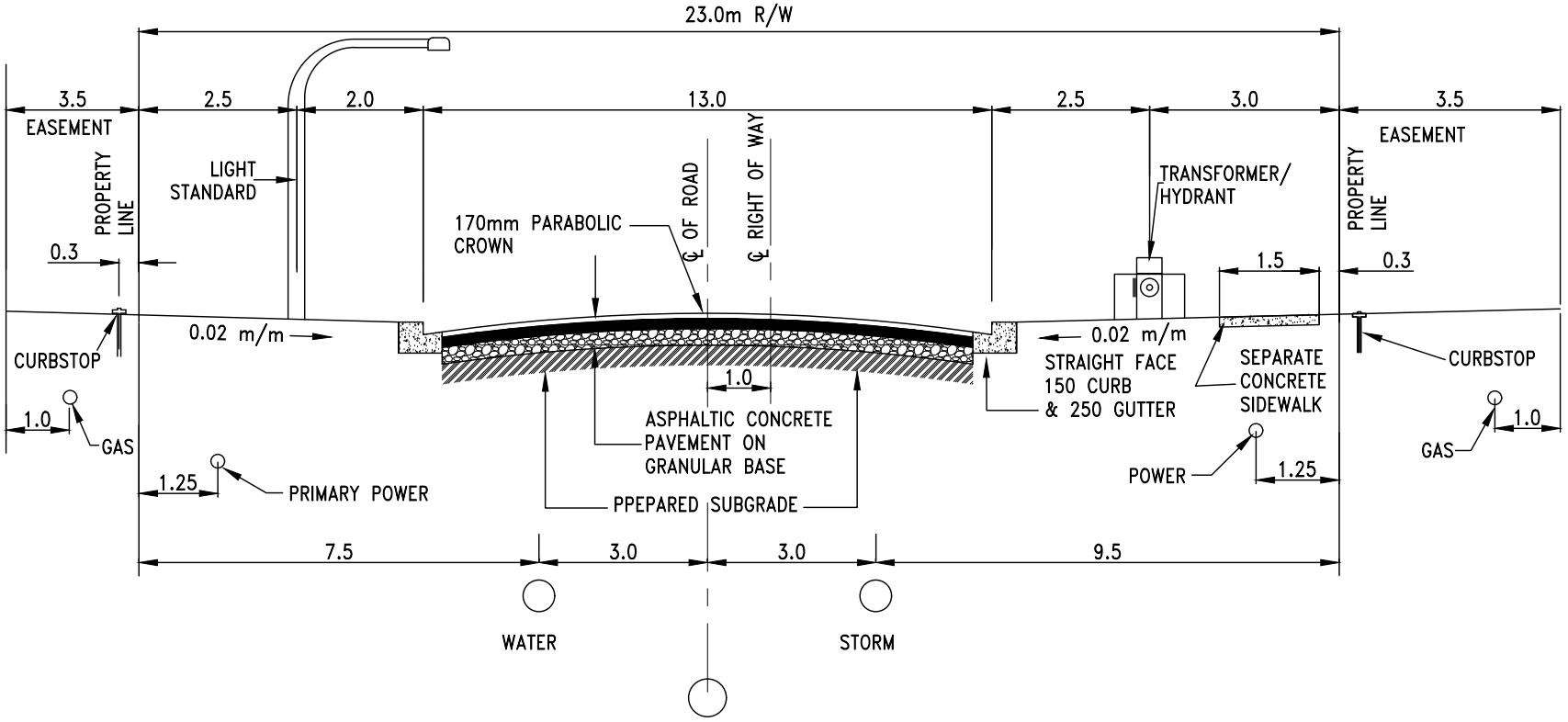



NOTE:
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWER POLES, STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER STRUCTURES SHALL MAINTAIN A MIN OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES

ALL DIMENSIONS IN METERS
UNLESS OTHERWISE NOTED

# 24m RIGHT OF WAY
# 13.5m COLLECTOR RESIDENTIAL

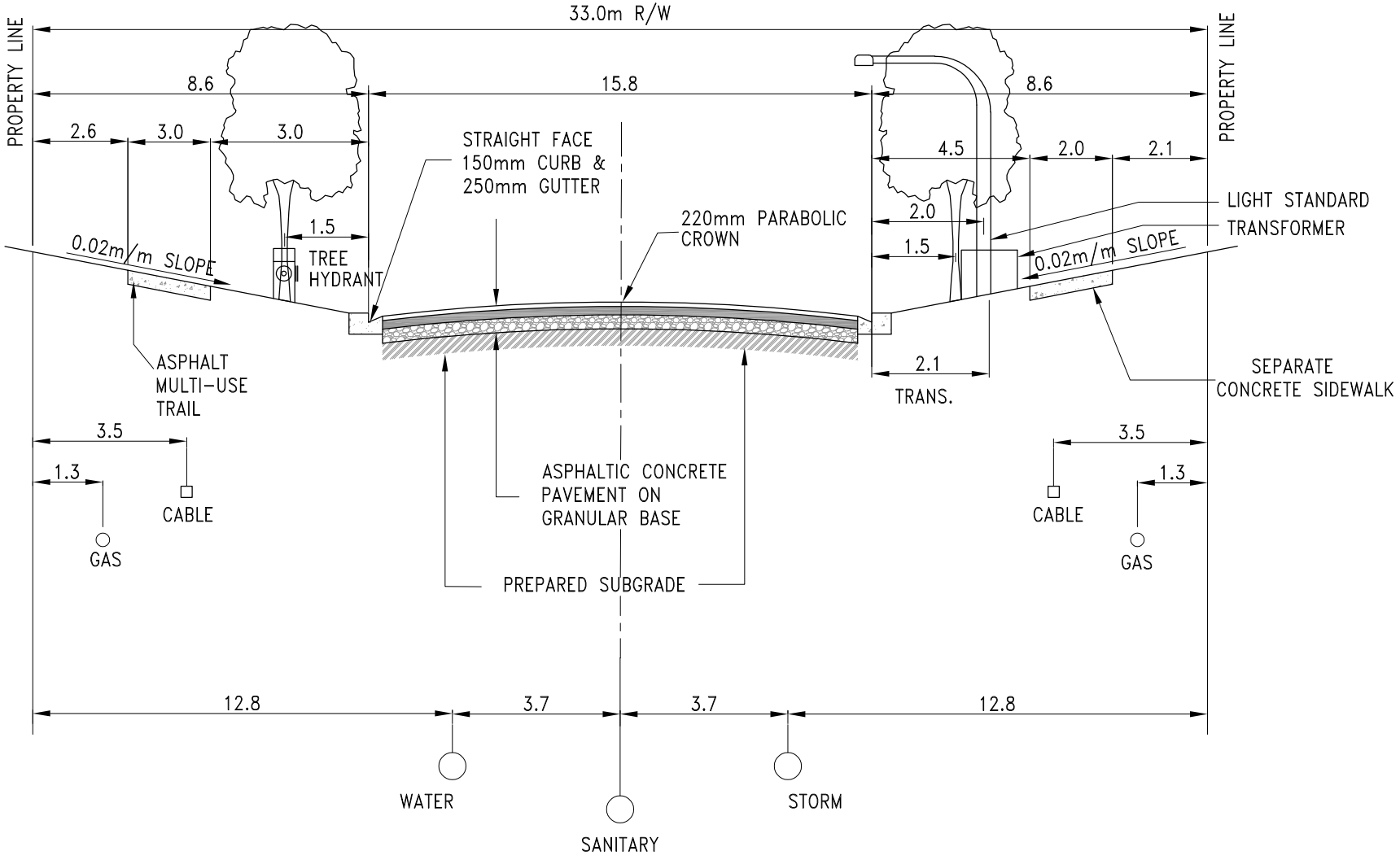
| | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: C | DATE: DEC 2024 | T-9 |
| NOT TO SCALE | DRAWN: EWN, DF | |




NOTE:
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWER POLES, STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER STRUCTURES SHALL MAINTAIN A MIN. OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES.

ALL DIMENSIONS IN METERS
UNLESS OTHERWISE NOTED

| 23m RIGHT OF WAY<br>13m COLLECTOR INDUSTRIAL | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: C | DATE: DEC 2024 | T–10 |
| NOT TO SCALE | DRAWN: EWN, DF | |



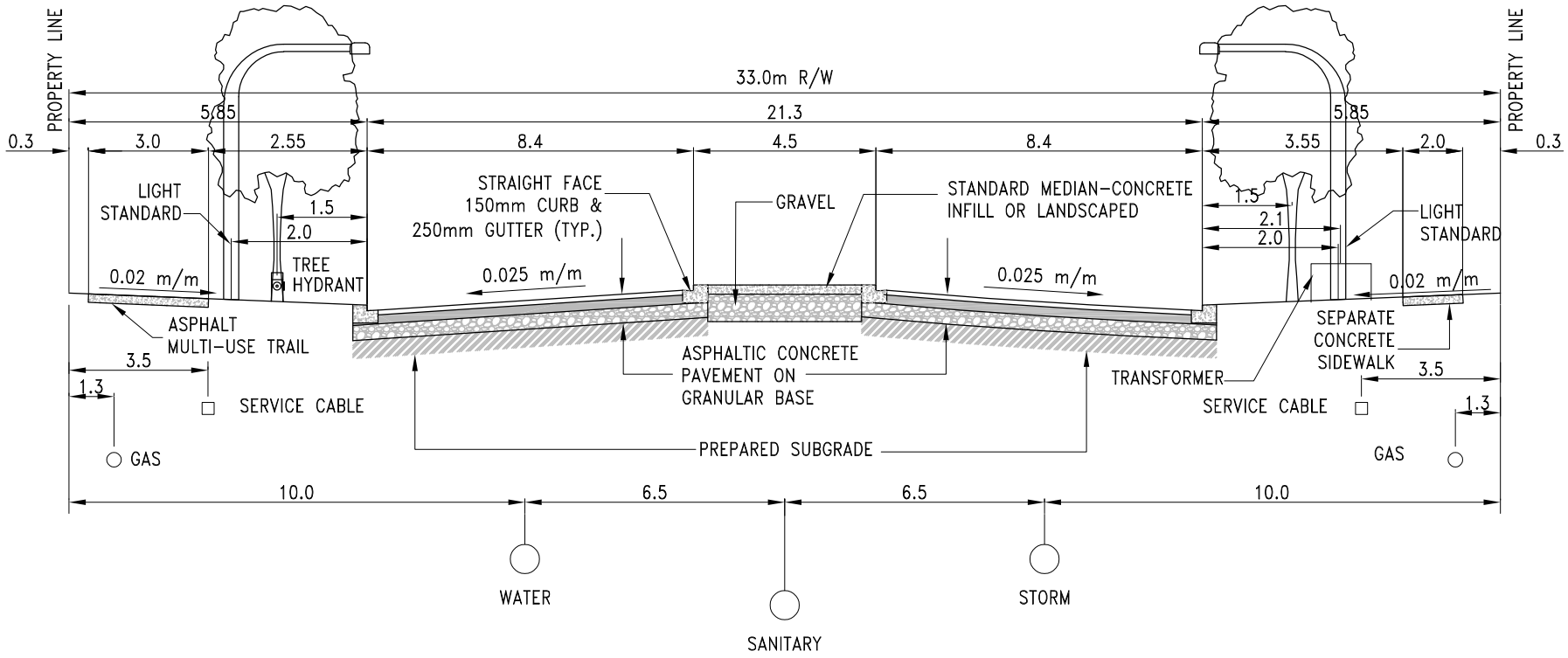

NOTE:
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWER POLES, STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER STRUCTURES SHALL MAINTAIN A MIN. OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

# 33m RIGHT OF WAY
# 15.8m MINOR UNDIVIDED ARTERIAL

CITY OF FORT SASKATCHEWAN

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: B | DATE: APRIL 2022 | T-11 |
| NOT TO SCALE | DRAWN: EWN | |



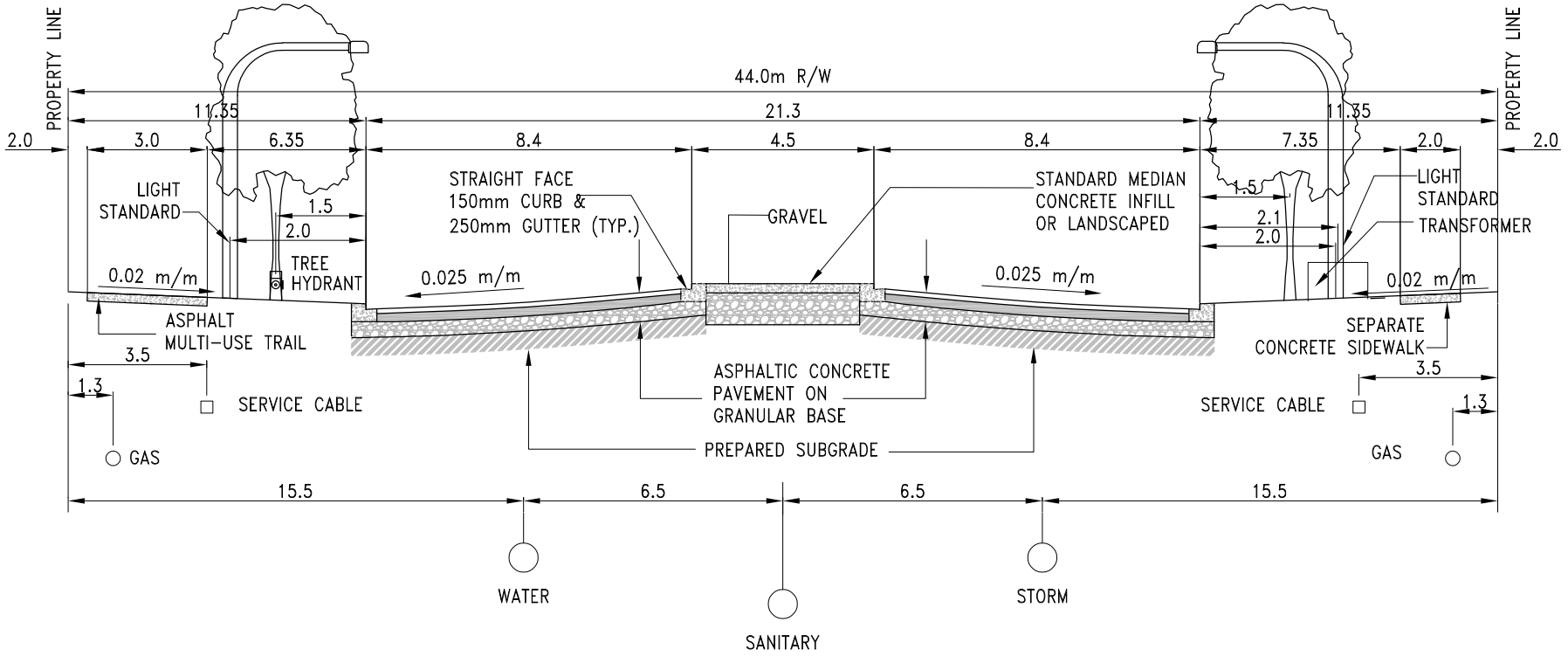

NOTE:
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS
- POWER POLES, STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER STRUCTURES SHALL MAINTAIN A MIN. OF 3.00M CLEARANCE FOR HYDRANT AND SERVICES

ALL DIMENSIONS IN METRES
UNLESS OTHERWISE NOTED

# 33m RIGHT OF WAY
# 16.8m STANDARD DIVIDED ARTERIAL

CITY OF FORT SASKATCHEWAN

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: B | DATE: APRIL 2022 | T–12 |
| NOT TO SCALE | DRAWN: EWN | |



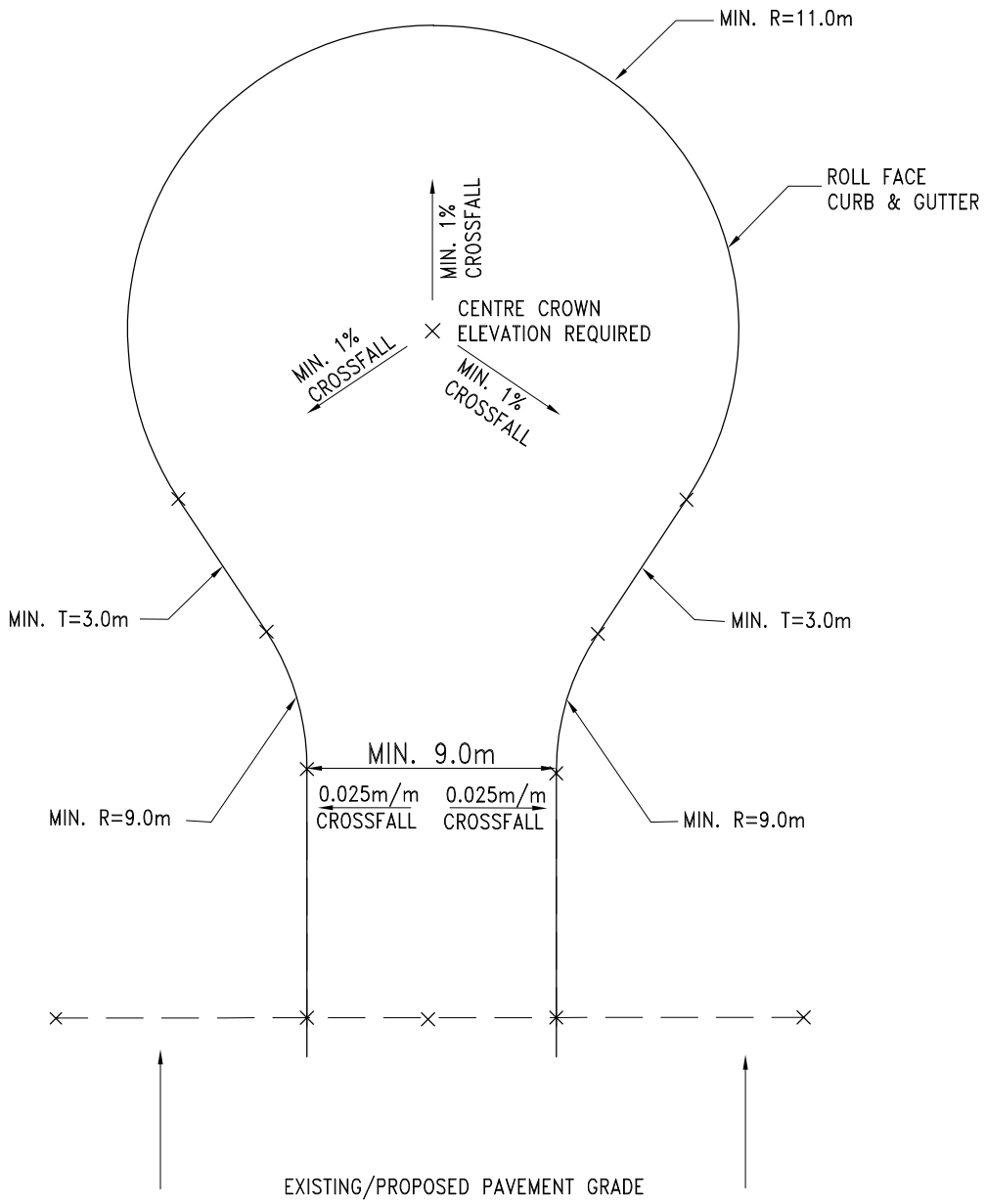

NOTE:
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWER POLES, STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER STRUCTURES SHALL MAINTAIN A MIN. OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES

ALL DIMENSIONS IN METRES
UNLESS OTHERWISE NOTED

# 44m RIGHT OF WAY
# 16.8m MAJOR DIVIDED ARTERIAL

CITY OF FORT SASKATCHEWAN

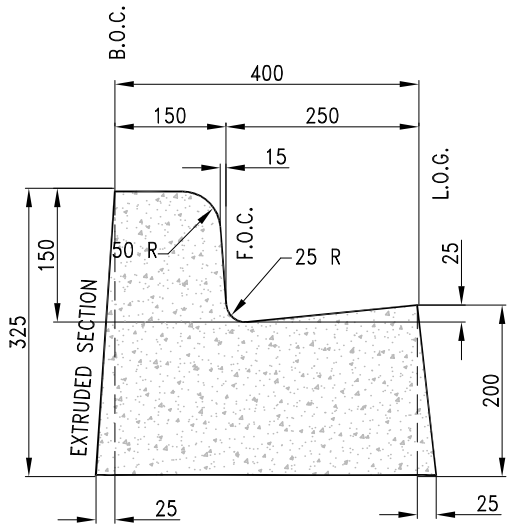
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: B | DATE: APRIL 2022 | T-13 |
| NOT TO SCALE | DRAWN: EWN | |



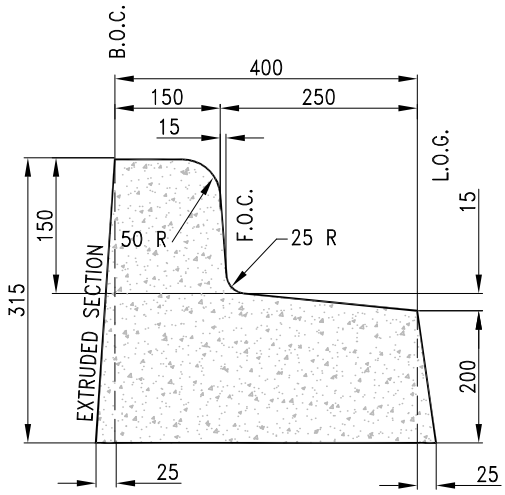

NOTE:
1. ELEVATIONS TO BE PROVIDED FOR 'X' TICK MARKS SHOWN
2. MIN. 0.8% LONGITUDINAL GRADE REQUIRED ALONG CUL-DE-SAC AND CURB RADII
   -EXISTING CURBLINE SHOWN FOR LIP OF GUTTER

ALL DIMENSIONS IN METERS
UNLESS OTHERWISE NOTED

| CUL-DE-SAC | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T-14 |
| NOT TO SCALE | DRAWN: EWN | |




150mm CURB & 250mm GUTTER

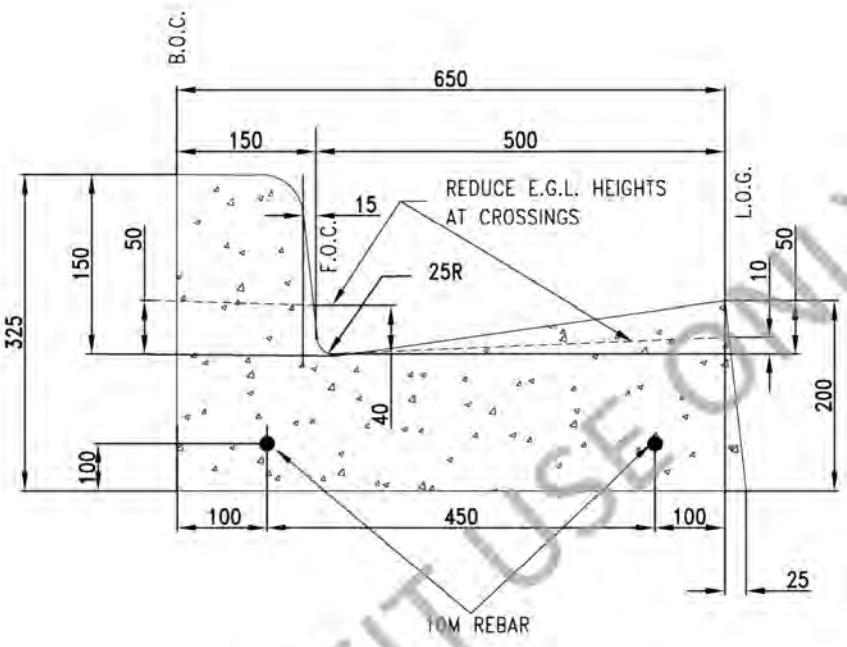



150mm CURB & 250mm REVERSE GUTTER

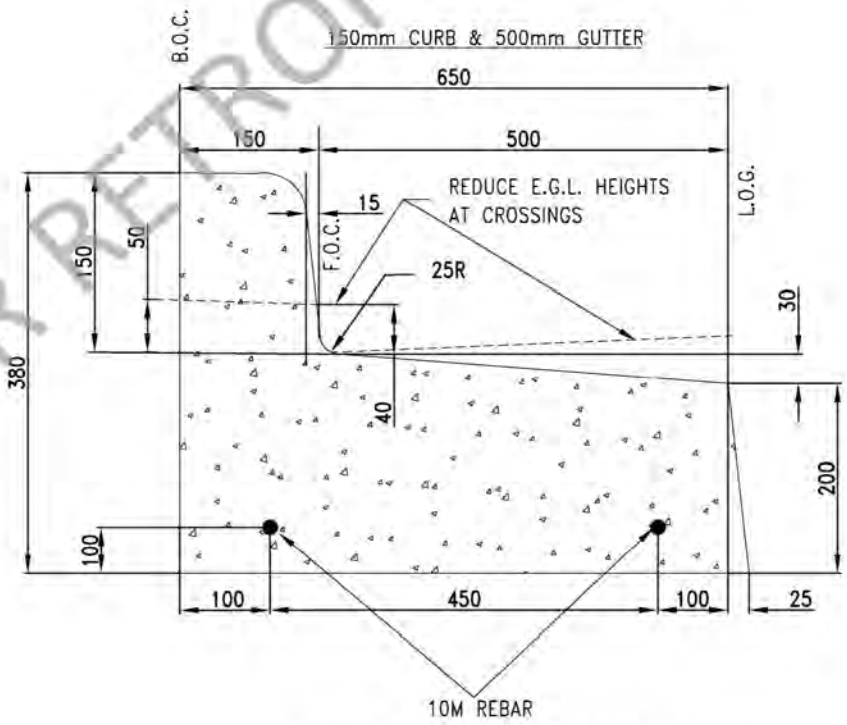
NOTE:
1. 28 DAYS CONCRETE STRENGTH–30MPa

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| STRAIGHT FACE 150mm CURB WITH 250mm GUTTER | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–15 |
| NOT TO SCALE | DRAWN: EWN | |




150mm CURB & 500mm GUTTER




150mm CURB & 500mm REVERSE GUTTER

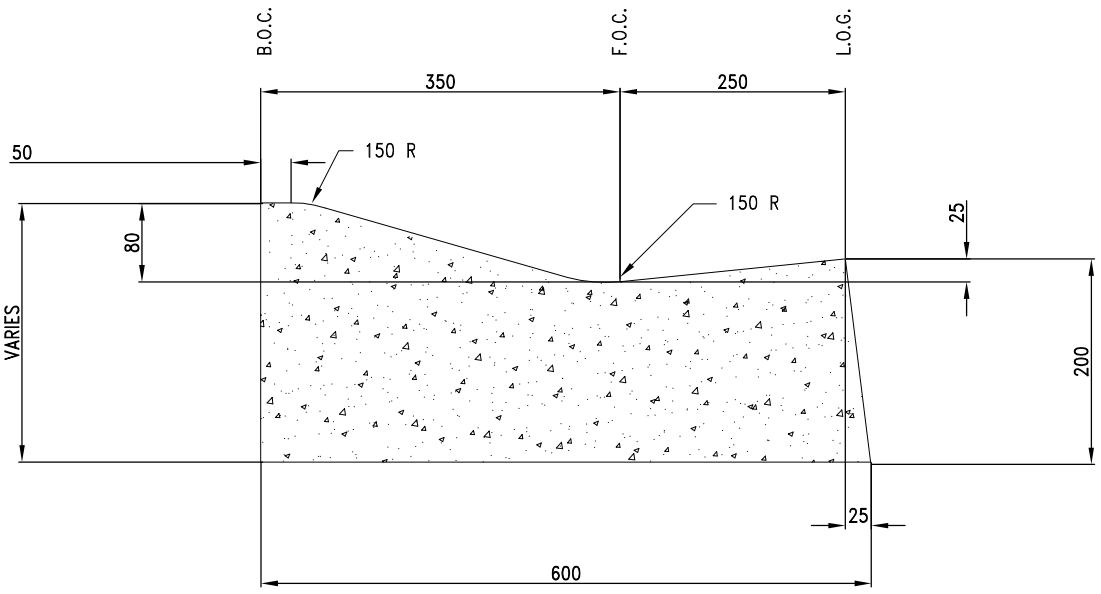
NOTES:

1. REINFORCING BARS ARE REQUIRED AT CONSTRUCTION JOINTS AND FUTURE TIE-IN LOCATIONS.
2. REINFORCING BARS SHALL EXTEND INTO CONCRETE A MINIMUM OF 300mm.
3. 28 DAYS CONCRETE STRENGTH – 30 MPa.



ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

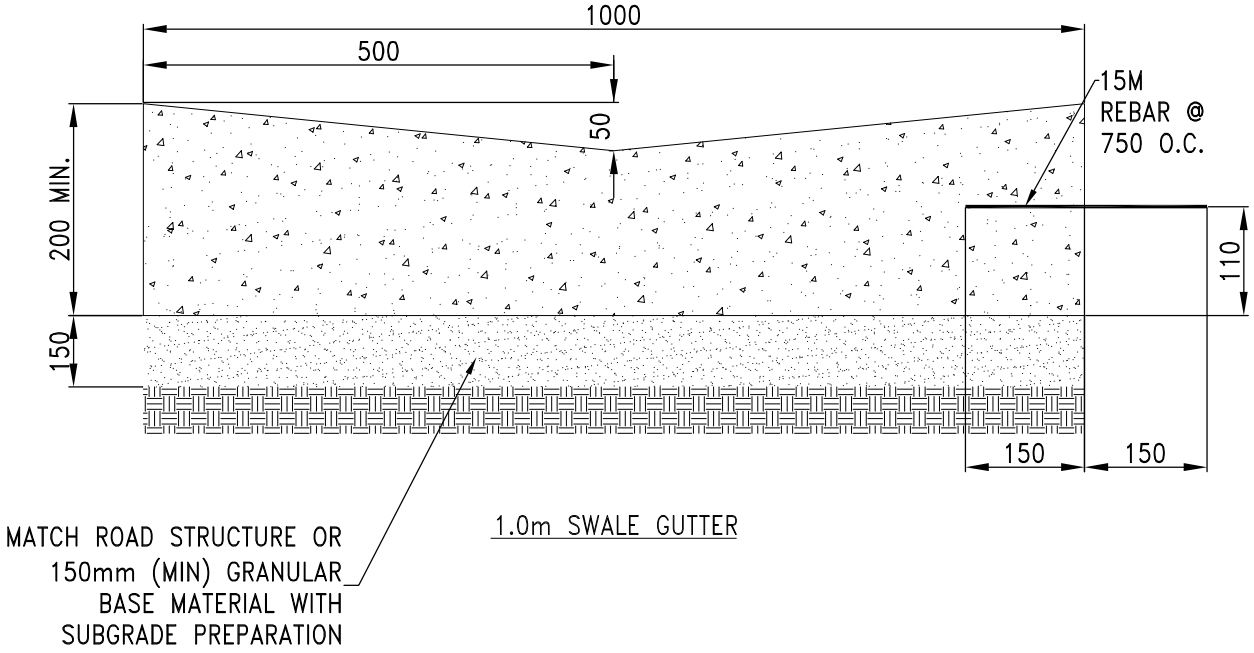
| STRAIGHT FACE 150mm CURB WITH 500mm GUTTER | | FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T-16 |
| NOT TO SCALE | DRAWN: EWN | |

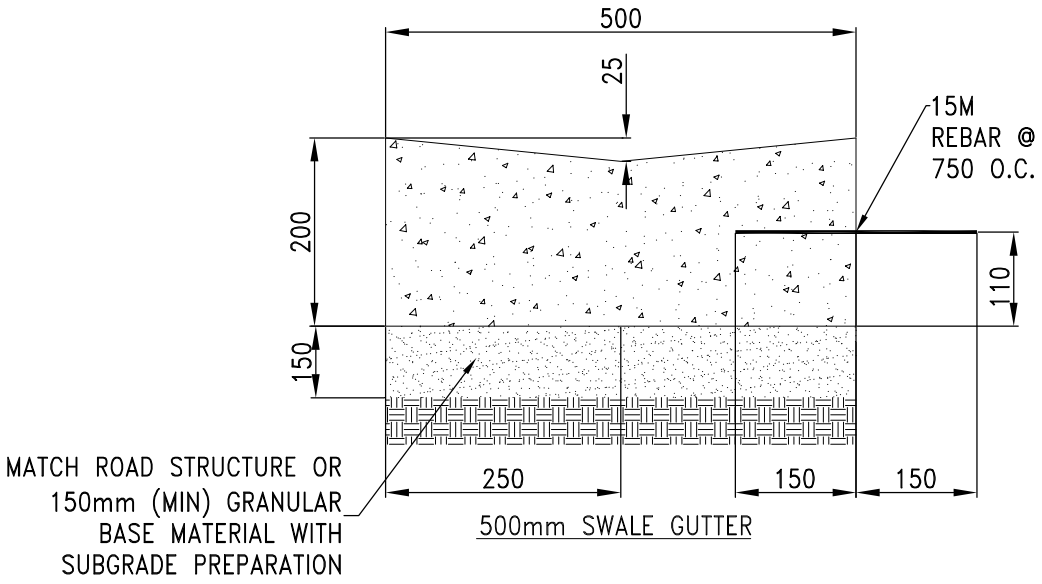



NOTES:
1. 28 DAYS CONCRETE STRENGTH–30MPa

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| ROLLED FACE CURB & GUTTER | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–17 |
| NOT TO SCALE | DRAWN: EWN | |



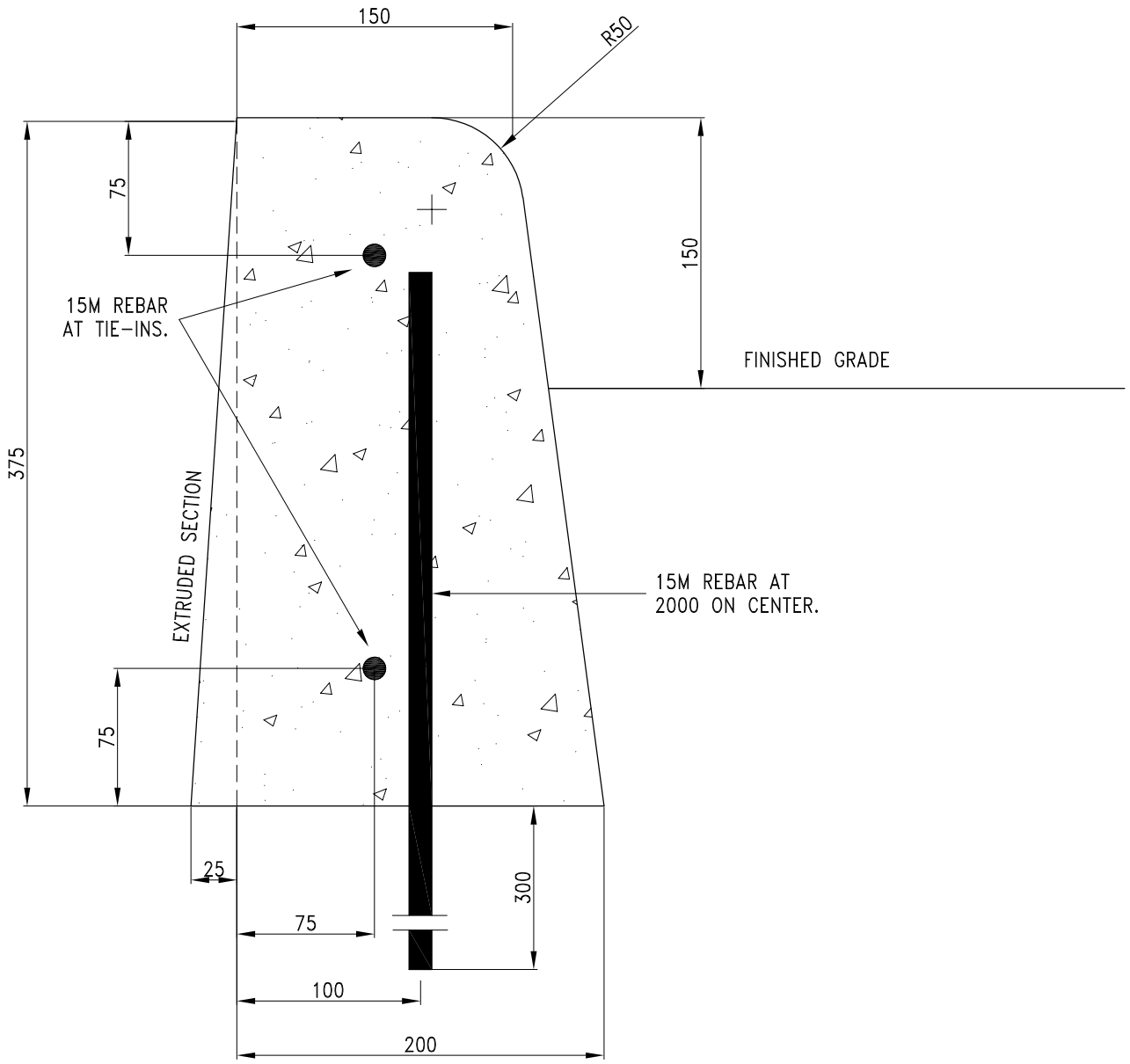




NOTES:

1. 28 DAYS CONCRETE STRENGTH–30MPa
2. SWALE GUTTERS MAY BE UTILIZED FOR BACK OF LOT DRAINAGE CONVEYANCE
3. SWALES ACROSS INTERSECTIONS MUST BE INSTALLED ALONG THE CURB LINE OF THE MAJOR ROADWAY

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

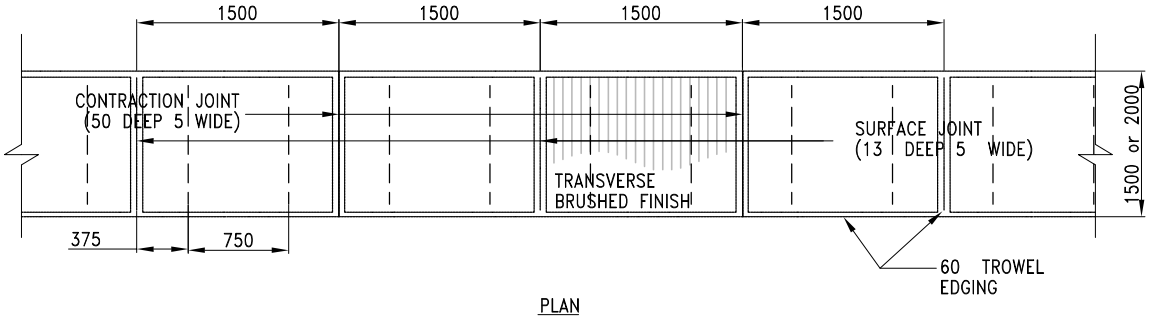
| TYPICAL SWALE GUTTERS | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–18 |
| NOT TO SCALE | DRAWN: EWN | |



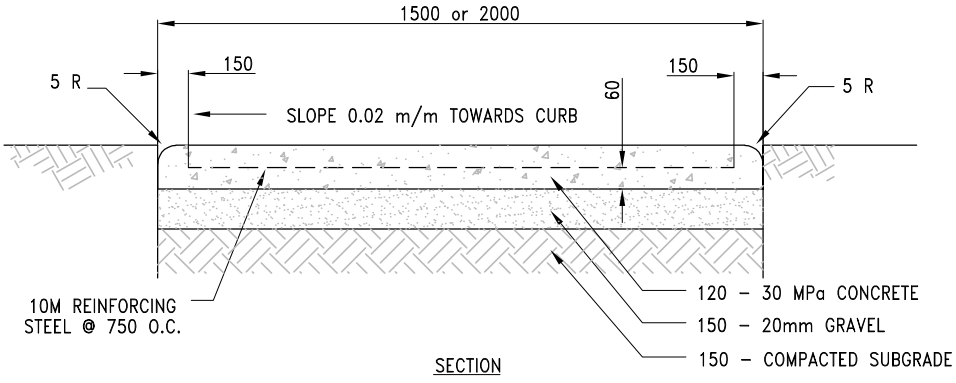

NOTES:
1. 28 DAYS CONCRETE STRENGTH–30MPa

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

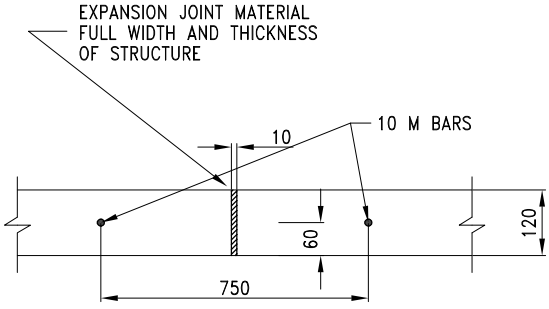
| CONCRETE CURB | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–19 |
| NOT TO SCALE | DRAWN: EWN | |




PLAN




SECTION



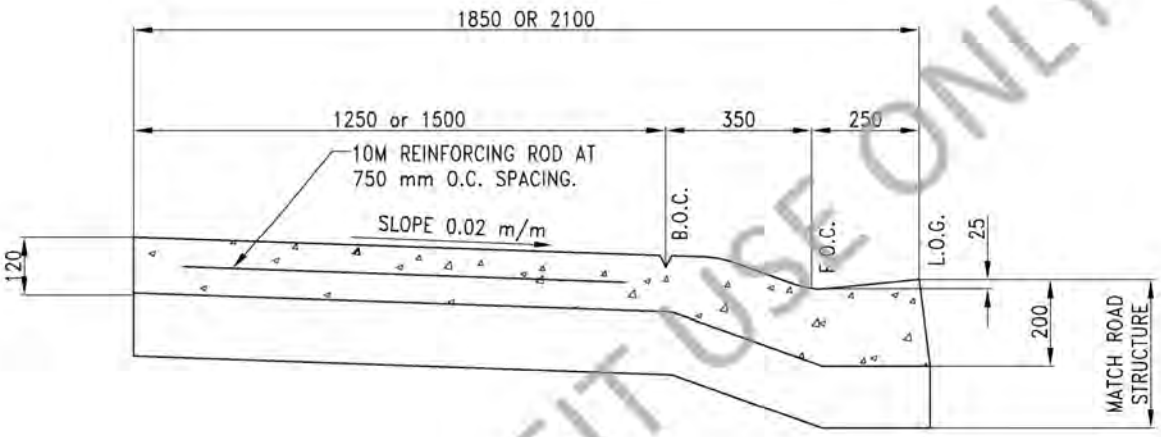

EXPANSION JOINT

NOTE:

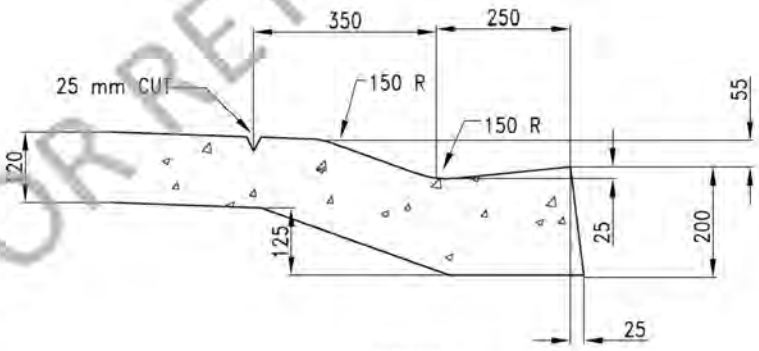
1. ELEVATION OF FRONT OF SIDEWALK TO BE SET SUCH THAT A MINIMUM SLOPE OF 0.01m/m WITH RECOMMENDED SLOPE OF 0.02m/m TO 0.04m/m IS MAINTAINED ACROSS BOULEVARD BETWEEN FRONT OF WALK AND TOP OF CURB.
2. 28 DAYS CONCRETE STRENGTH–30MPa
3. SPECIFICATIONS ARE TO MINIMUM STANDARDS. CONSIDERATION MUST BE GIVEN TO ADDRESS ACTUAL SOIL CONDITIONS AND ASSESS THE NEED FOR GRAVEL BASE, THICKER SLAB, REINFORCEMENT OR SUB–DRAINAGE SYSTEM.
4. CROSS SLOPE OF SIDEWALK TO BE SET SUCH THAT A MINIMUM SLOPE OF 0.01m/m, AND A RECOMMENDED SLOPE OF 0.02m/m TOWARDS THE CURB IS MAINTAINED.

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| 1.5m and 2.0 SEPERATE CONCRETE SIDEWALK | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–20 |
| NOT TO SCALE | DRAWN: EWN | |




TYPICAL SECTION




DETAIL

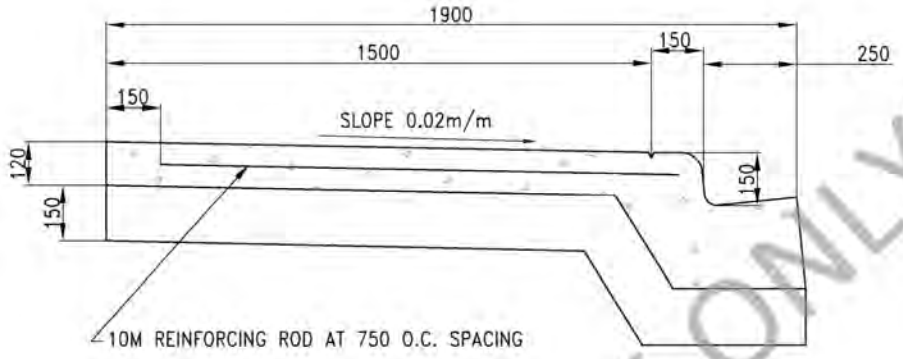


NOTES:

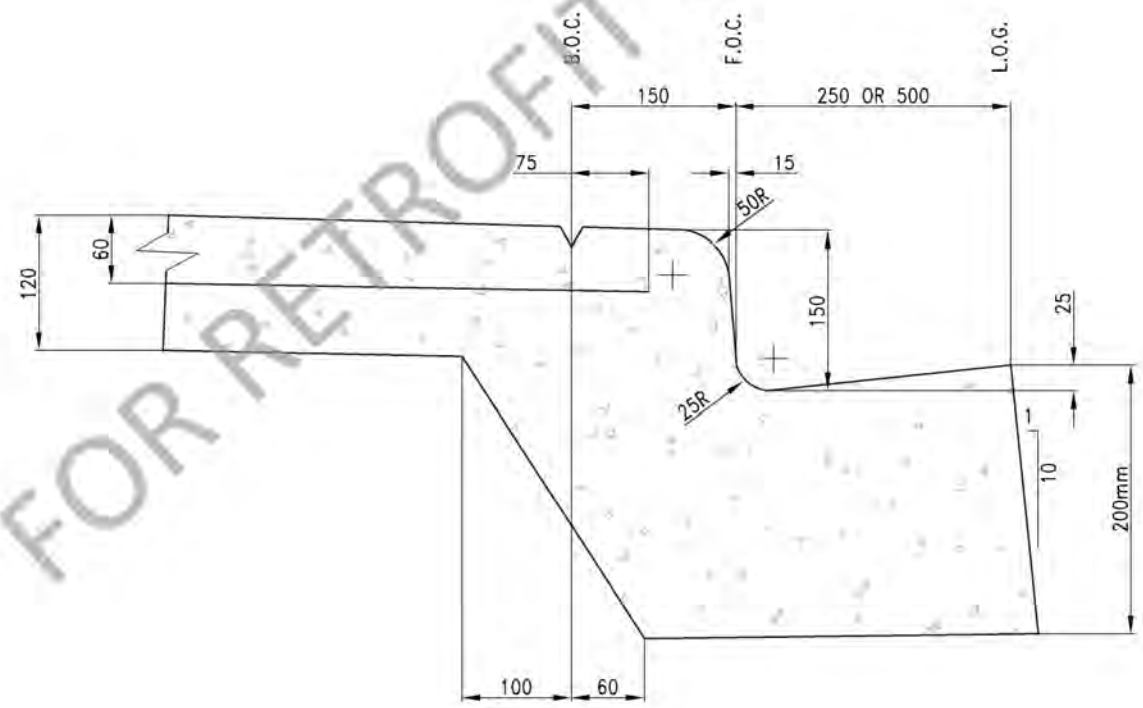
1. USE FOR ROADWAY CLASSIFICATIONS – LOCAL OR COLLECTOR OR AS DIRECTED BY THE ENGINEER
2. STRAIGHT FACE 150mm WITH 250mm GUTTER MAY BE USED IN PLACE OF ROLLED CURB AND GUTTER OR AS PER DIRECTED BY ENGINEER
3. 150mm THICK 20mm CRUSH GRANULAR MATERIAL COMPACTED TO 100% S.P.D. REQUIRED.
4. 150mm THICK COMPACTED SUBGRADE REQUIRED
5. 28 DAYS CONCRETE STRENGTH–30MPa
6. SPECIFICATIONS ARE TO MINIMUM STANDARDS. CONSIDERATION MUST BE GIVEN TO ADDRESS ACTUAL SOIL CONDITIONS AND ASSESS THE NEED FOR GRAVEL BASE, THICKER SLAB, REINFORCEMENT OR SUB–DRAINAGE SYSTEM.
7. CROSS SLOPE OF SIDEWALK TO BE SET SUCH THAT A MINIMUM SLOPE OF 0.01m/m, AND A RECOMMENDED SLOPE OF 0.02m/m TOWARDS THE CURB IS MAINTAINED

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| ROLL FACE MONOLITHIC CONCRETE SIDEWALK | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–21 |
| NOT TO SCALE | DRAWN: EWN | |




TYPICAL SECTION




DETAIL

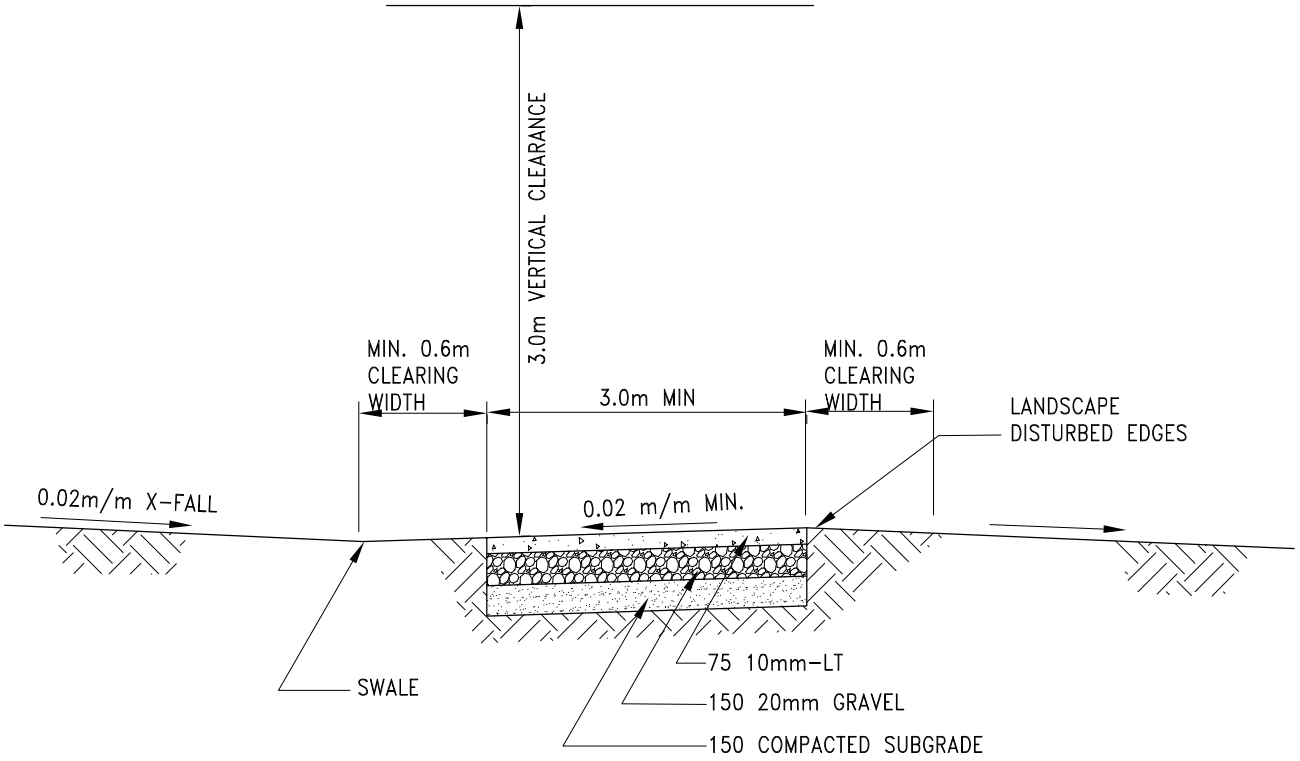


NOTES:

1. USE FOR ROADWAY CLASSIFICATIONS – LOCAL, COLLECTOR, OR AS DIRECTED BY THE ENGINEER.
2. DEPTH OF GUTTER FACE TO MATCH ROAD STRUCTURE.
3. 150mm THICK 20mm CRUSH GRANULAR MATERIAL COMPACTED TO 100% S.P.D. IS REQUIRED.
4. 150mm THICK COMPACTED SUBGRADE IS REQUIRED
5. 28 DAYS CONCRETE STRENGTH–30MPa
6. CROSS SLOPE OF SIDEWALK TO BE SET SUCH THAT A MINIMUM SLOPE OF 0.01m/m AND A RECOMMENDED SLOPE OF 0.02m/m TOWARDS THE CURB IS MAINTAINED
7. SPECIFICATIONS ARE TO MINIMUM STANDARDS. CONSIDERATION MUST BE GIVEN TO ADDRESS ACTUAL SOIL CONDITIONS AND ASSESS THE NEED FOR GRAVEL BASE, THICKER SLAB, REINFORCEMENT OR SUB–DRAINAGE SYSTEM

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| STRAIGHT FACE MONOLITHIC CONCRETE SIDEWALK | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–22 |
| NOT TO SCALE | DRAWN: EWN | |

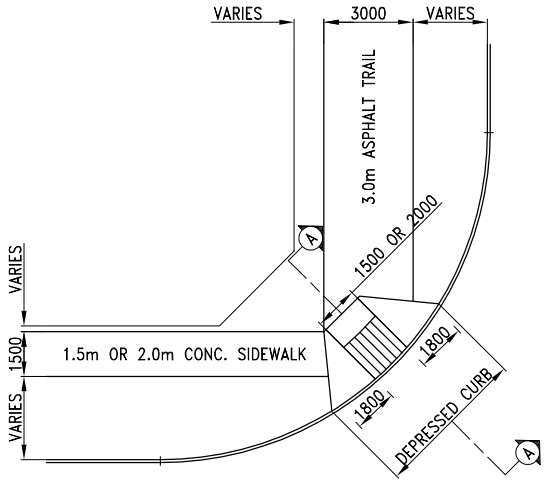



NOTE:

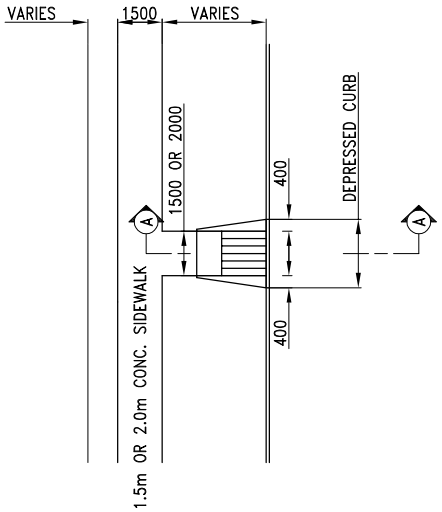
1. GEOTECHNICAL ENGINEER TO PROVIDE TRAIL STRUCTURE
2. SPECIFICATIONS ARE TO MINIMUM STANDARDS. CONSIDERATION MUST BE GIVEN TO ADDRESS ACTUAL SOIL CONDITIONS AND ASSESS THE NEED FOR GRAVEL BASE, PAVEMENT STRUCTURE OR SUB-DRAINAGE SYSTEM
3. CROSS SLOPE OF SIDEWALK TO BE SET SUCH THAT A MINIMUM SLOPE OF 0.01m/m, AND A RECOMMENDED SLOPE OF 0.02m/m TOWARDS THE DRAINAGE SWALE IS MAINTAINED
4. SHEET FLOW TO BE DIRECTED AWAY FROM TRAIL OR OTHER ACCOMMODATIONS REQUIRED TO KEEP SUBGRADE DRY

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

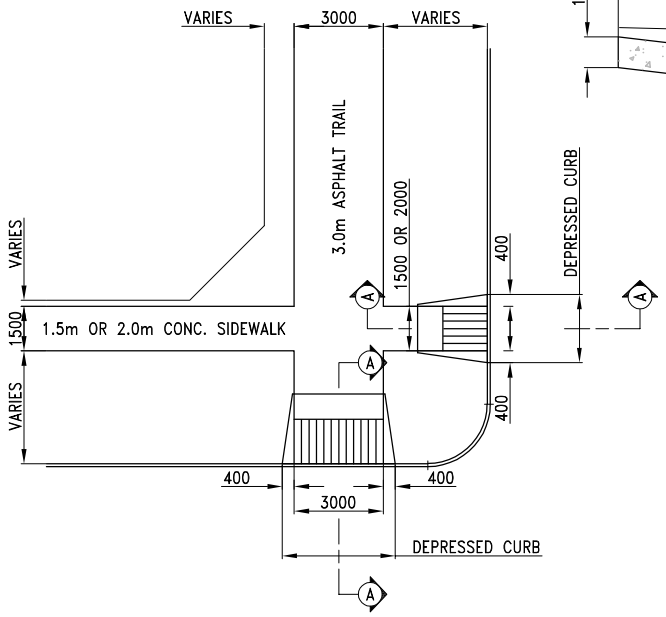
| ASPHALT TRAIL | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T-23 |
| NOT TO SCALE | DRAWN: EWN | |



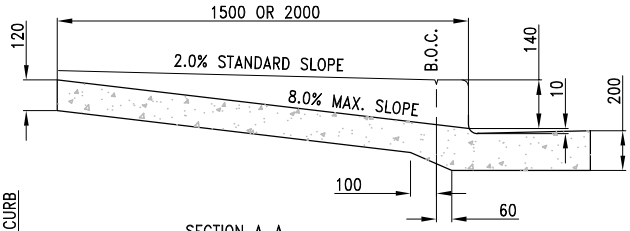

PLAN – SINGLE CURB RAMP




PLAN – MIDBLOCK CROSING

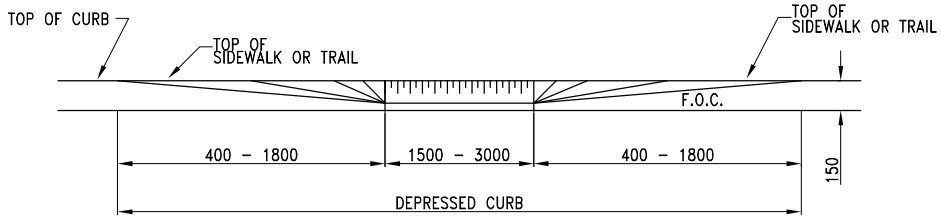



PLAN – SEPARATE CURB RAMPS




SECTION A–A

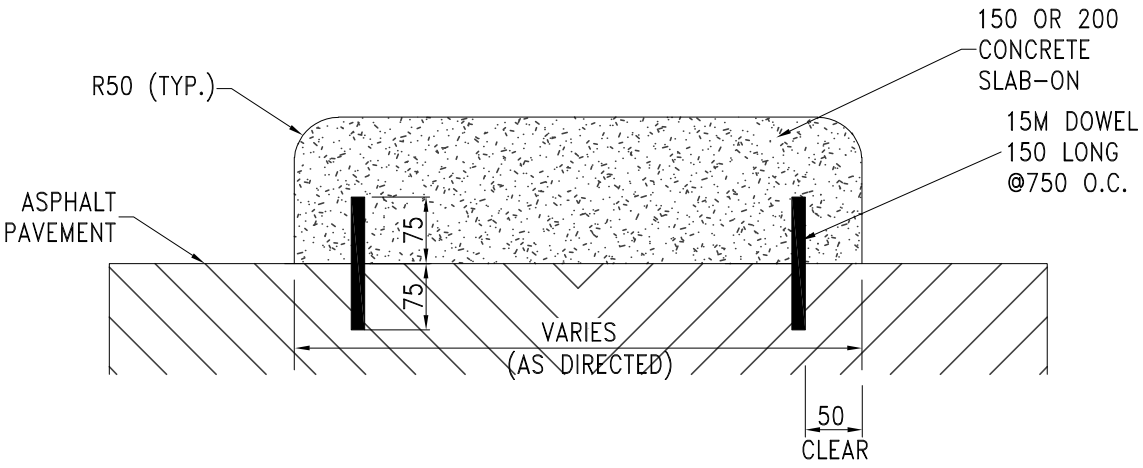
NOTES:
1. TOOLED GROOVES 5mm WIDE X 10mm DEEP, BROOM FINISH. GROOVE SPACING 150mm O.C. ADJACENT TO CURB.
2. WHEN REQUIRED, TRANSITION FROM STRAIGHT FACE CURB TO ROLLED FACE CURB AT CURB RAMP.
3. CURBS AND RAMPS TO BE POURED MONOLITHICALLY.
4. WIDTH OF RAMP MUST EQUAL WIDTH OF WALK (MIN 1.5m. MAX 3.0m) EXCEPT "TYPE A"
5. 28 DAYS CONCRETE STRENGTH–30MPa
6. IF ASPHALT TOPLIFT IS DEFERRED, PLACE ASPHALT RAMP FOR THE WIDTH OF CURB RAMP, AND EXTENDING MINIMUM 1M INTO ROAD.
7. USE REINFORCING BARS OR MESH




FRONT VIEW

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

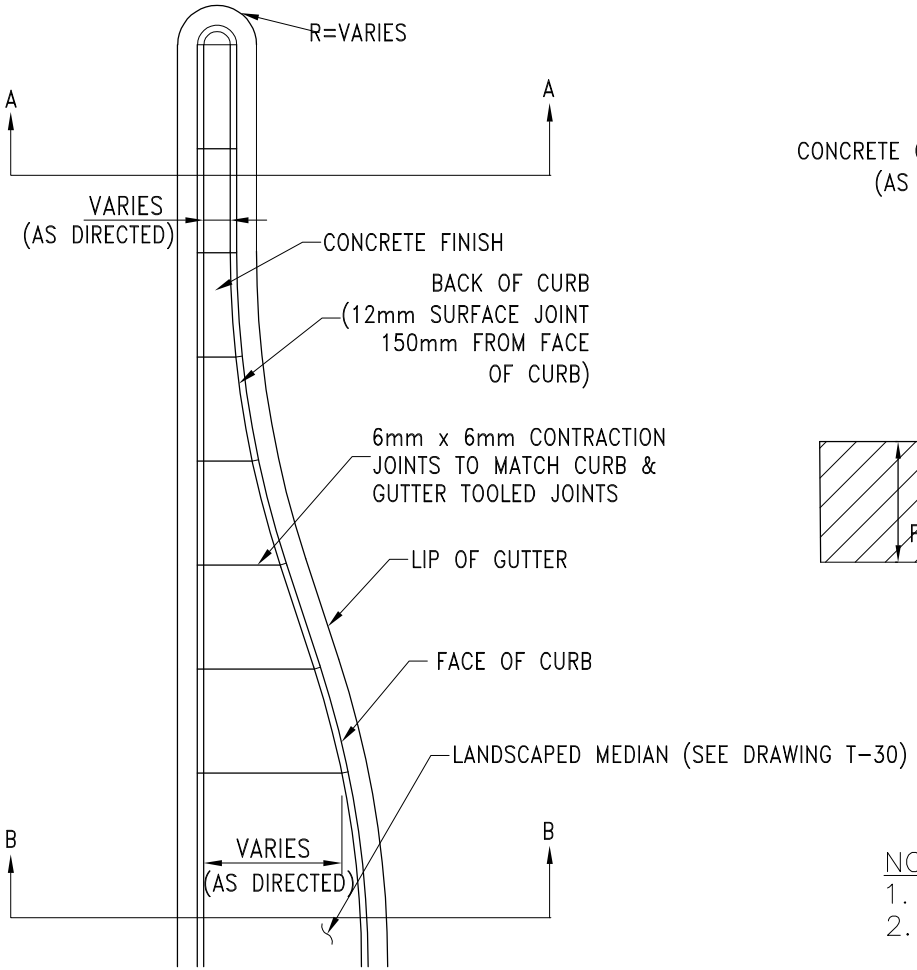
| TYPICAL CONCRETE CURB RAMP | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–24 |
| NOT TO SCALE | DRAWN: EWN | |



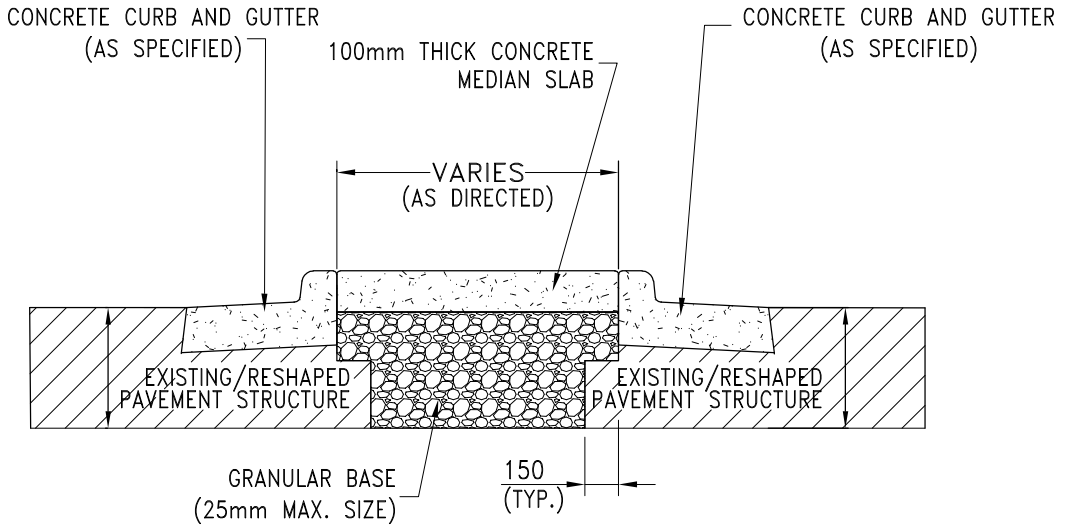

NOTES:
1. 28 DAYS CONCRETE STRENGTH-30MPa

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| CONCRETE SLAB-ON MEDIAN | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T-25 |
| NOT TO SCALE | DRAWN: EWN | |




MEDIAN SECTION

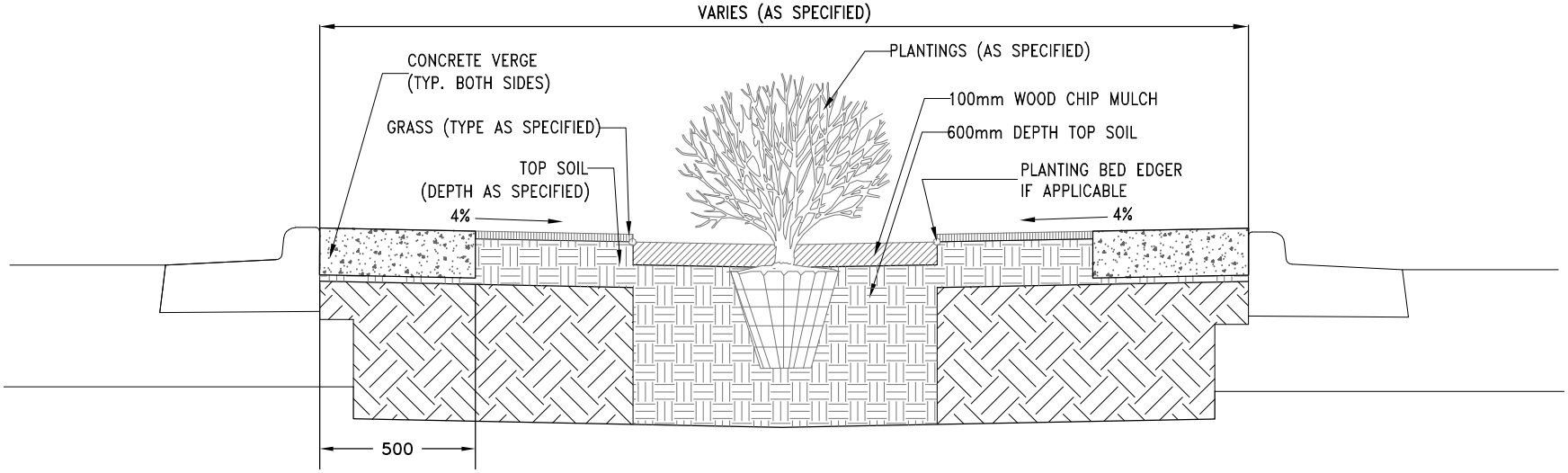



SECTION A-A

NOTE:
1. 28 DAYS CONCRETE STRENGTH-30MPa
2. SEE LANDSCAPED MEDIAN DRAWING T-30 FOR SECTION B-B TYPICAL

ALL DIMENSIONS IN METERS
UNLESS OTHERWISE NOTED.

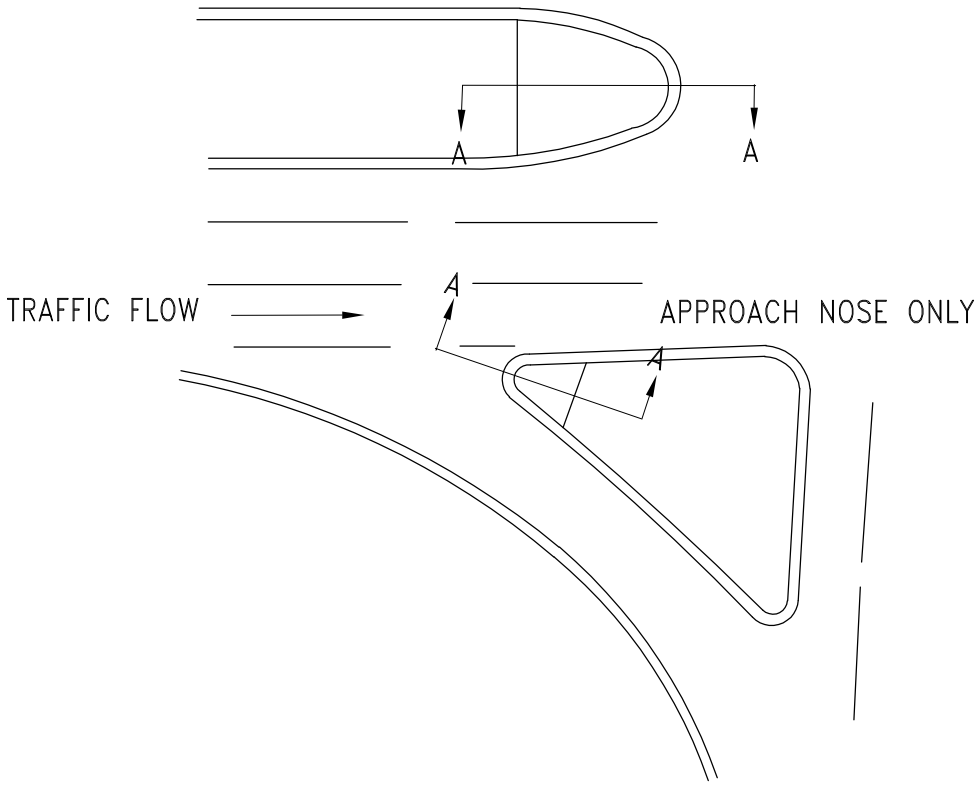
| MEDIAN - CONCRETE INFILL | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T-26 |
| NOT TO SCALE | DRAWN: EWN | |

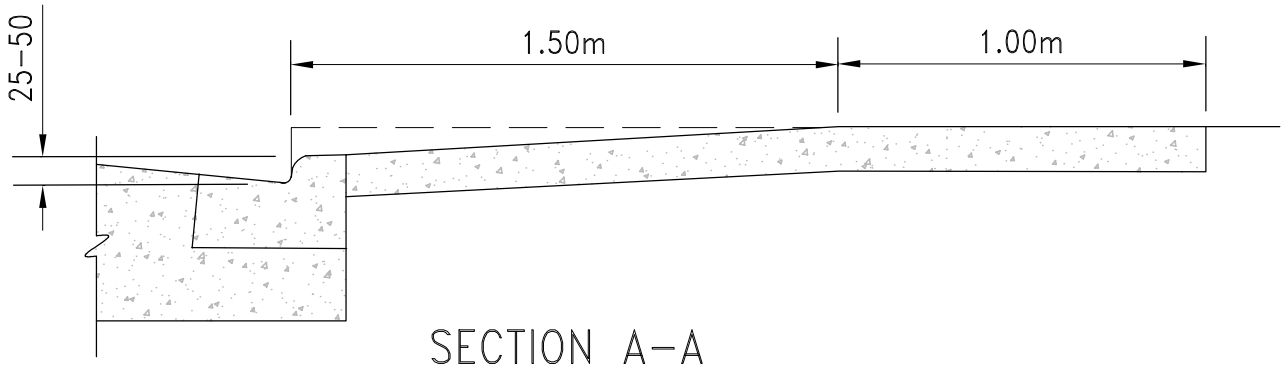



SECTION B–B

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED.

| MEDIAN – LANDSCAPED | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–27 |
| NOT TO SCALE | DRAWN: EWN | |

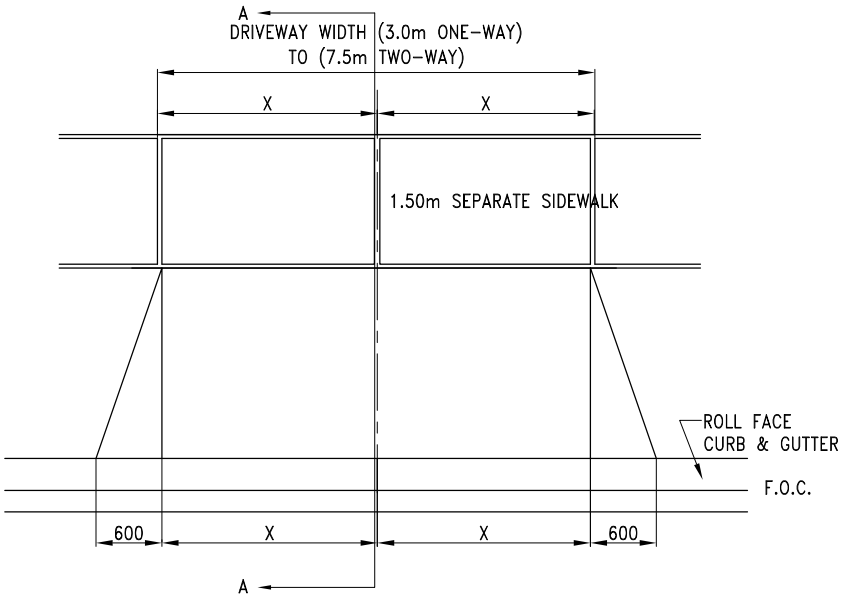


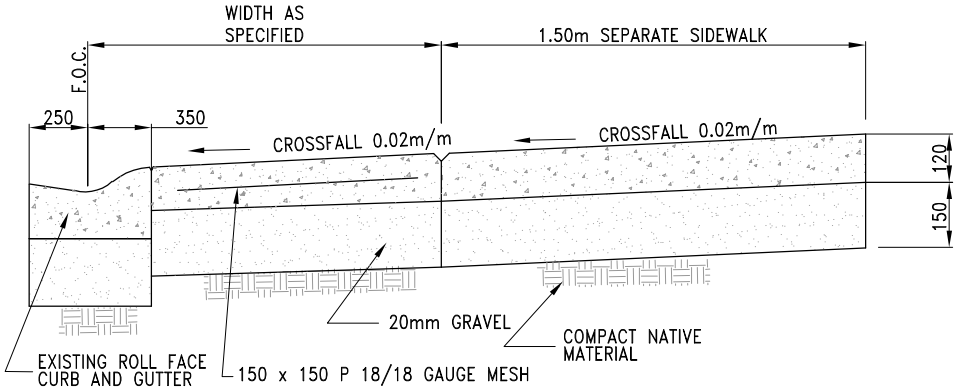

SECTION A-A

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| DROP NOSE MEDIAN | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T-28 |
| NOT TO SCALE | DRAWN: EWN | |




PLAN

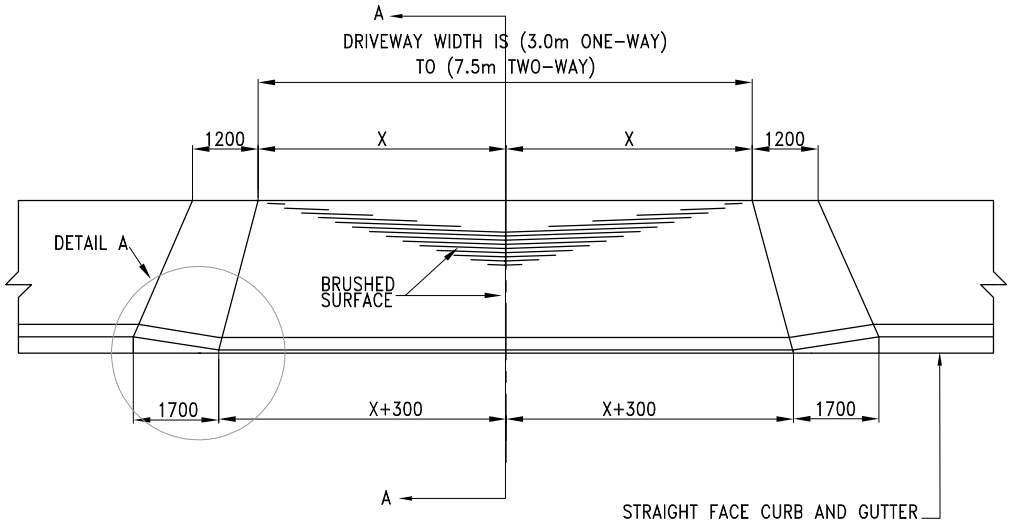



SECTION A-A – ROLL FACE

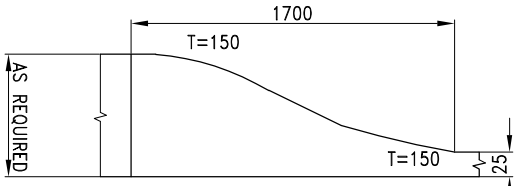
NOTES:
1. WIDTH OF "X" TO BE DETERMINED IN FIELD OR AS DIRECTED BY THE ENGINEER
2. 28 DAYS CONCRETE STRENGTH–30MPa

ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

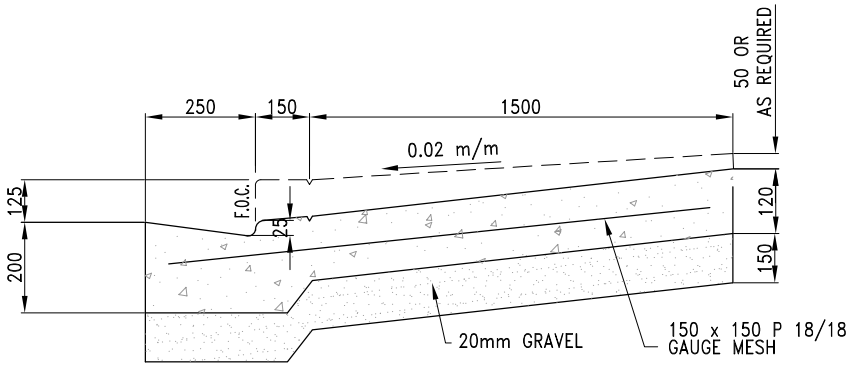
| RESIDENTIAL ACCESS CROSSING SEPARATE SIDEWALK | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–29 |
| NOT TO SCALE | DRAWN: EWN | |




PLAN




DETAIL A – CURB DROP FRONT VIEW

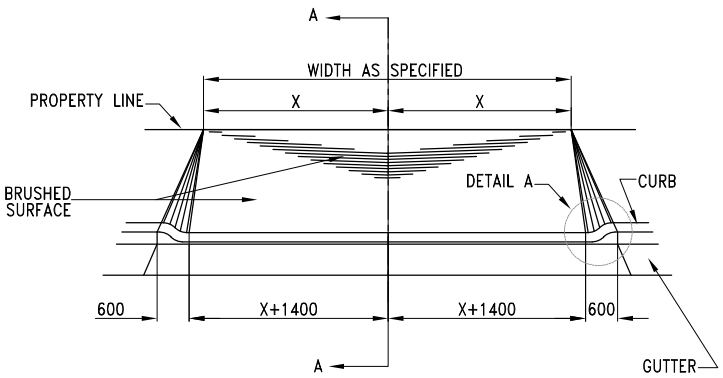



SECTION A–A – STRAIGHT FACE

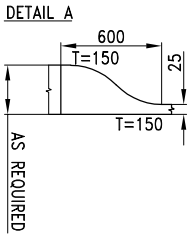
NOTES:
1. WIDTH OF "X" TO BE DETERMINED IN FIELD OR AS DIRECTED BY THE ENGINEER
2. 28 DAYS CONCRETE STRENGTH–30MPa

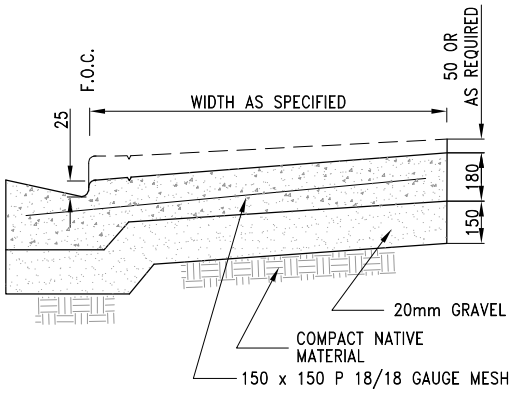
ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE NOTED

| RESIDENTIAL ACCESS CROSSING MONOLITHIC SIDEWALK | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–30 |
| NOT TO SCALE | DRAWN: EWN | |

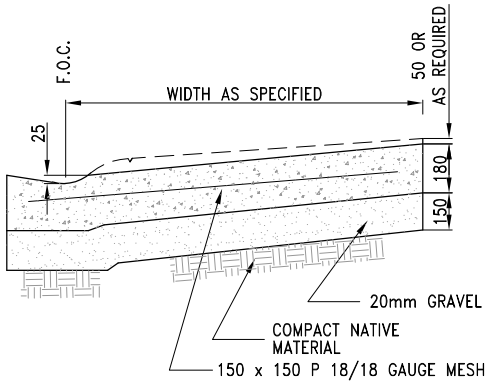



PLAN




SECTION A–A – STRAIGHT FACE

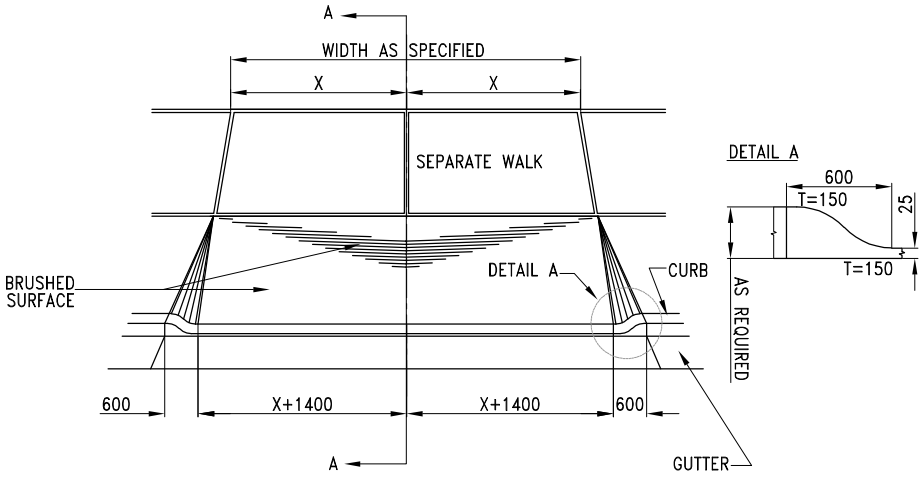



SECTION A–A – ROLL FACE

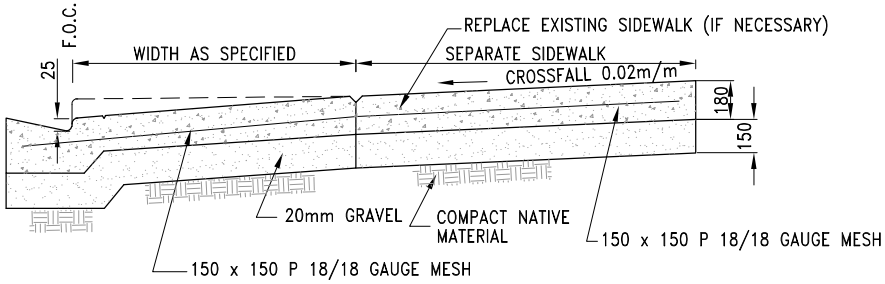
NOTES:
1. WIDTH OF "X" TO BE DETERMINED IN FIELD OR AS DIRECTED BY THE ENGINEER
2. 28 DAYS CONCRETE STRENGTH–30MPa

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

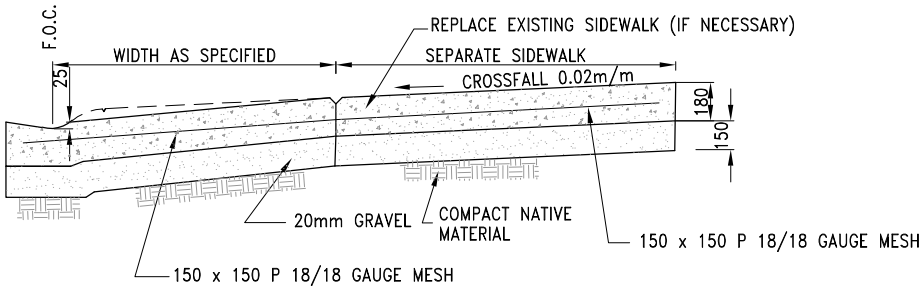
| COMMERCIAL/INDUSTRIAL CROSSING NO SIDEWALK | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: A | DATE: APRIL 2022 | T–31 |
| NOT TO SCALE | DRAWN: EWN | |




PLAN




SECTION A-A – STRAIGHT FACE

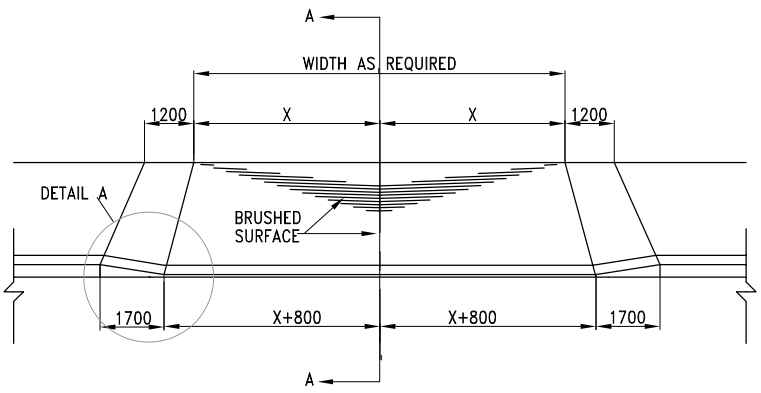



SECTION A-A – ROLL FACE

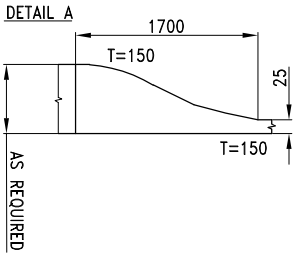
NOTES:
1. WIDTH OF "X" TO BE DETERMINED IN FIELD OR AS DIRECTED BY THE ENGINEER
2. 28 DAYS CONCRETE STRENGTH–30MPa

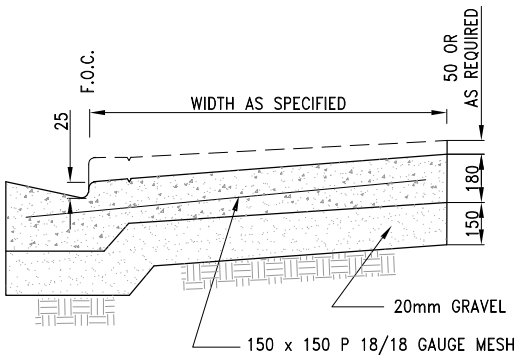
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| COMMERCIAL/INDUSTRIAL CROSSING SEPARATE SIDEWALK | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–32 |
| NOT TO SCALE | DRAWN: EWN | |

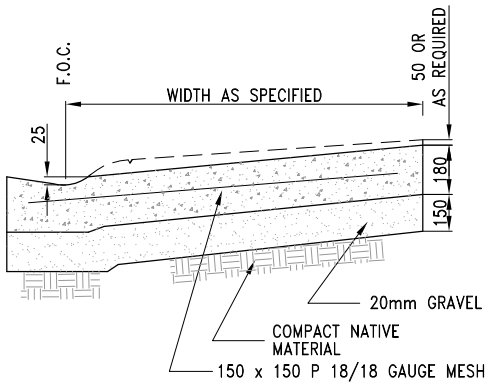



PLAN




SECTION A–A – STRAIGHT FACE

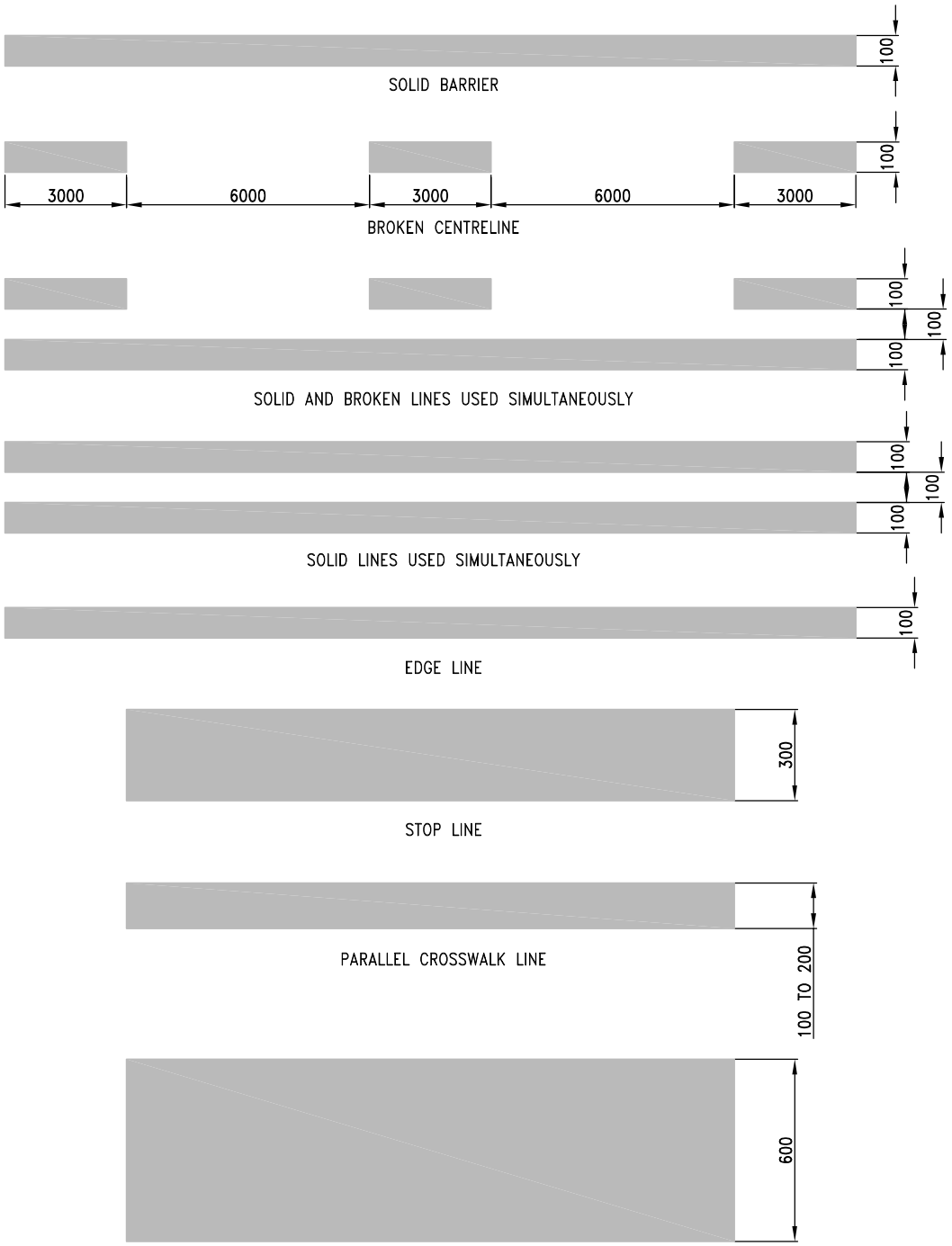



SECTION A–A – ROLL FACE

NOTES:
1. WIDTH OF "X" TO BE DETERMINED IN FIELD OR AS DIRECTED BY THE ENGINEER
2. 28 DAYS CONCRETE STRENGTH–30MPa

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

| COMMERCIAL/INDUSTRIAL CROSSING MONOLITHIC SIDEWALK | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T–33 |
| NOT TO SCALE | DRAWN: EWN | |




NOTES:

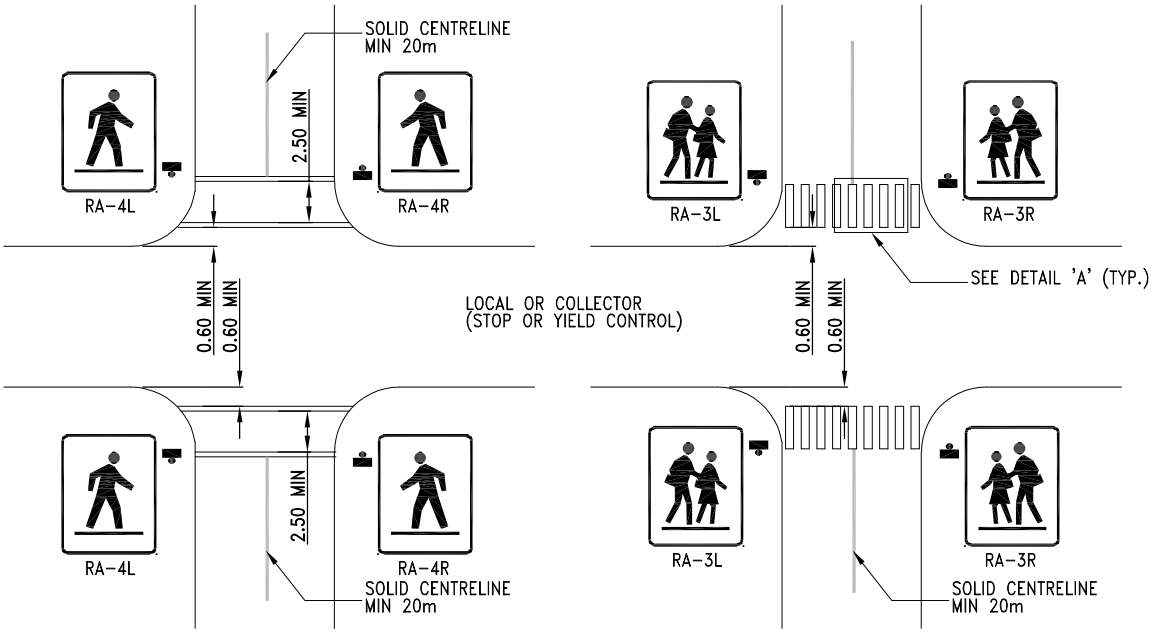
1. THESE TYPICAL DIMENSIONS ARE GENERAL IN NATURE. REFER TO DETAILED ENGINEERING PLANS OR DIRECTION FROM THE ENGINEER FOR PROJECT SPECIFIC APPLICATIONS.
2. REFER TO THE "MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR CANADA (MUTCD) TAC, 2021 FOR MORE INFORMATION AND GUIDANCE.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

# PAVEMENT MARKING TYPES AND WIDTH

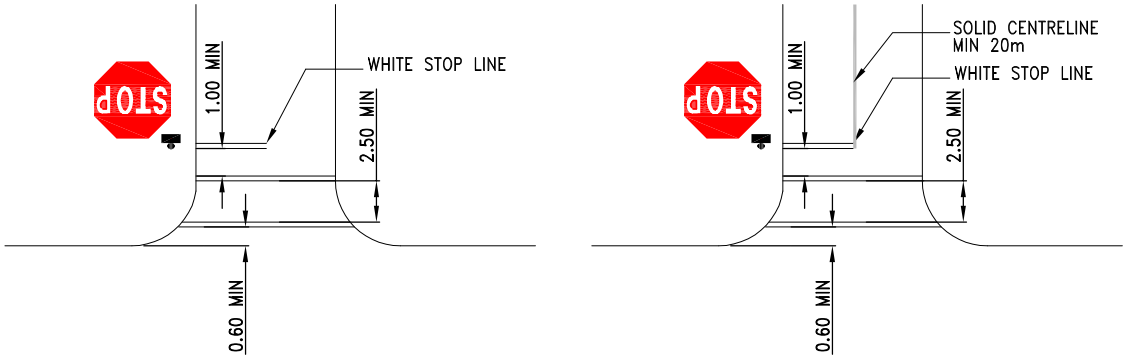
CITY OF FORT SASKATCHEWAN

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: B | DATE: APRIL 2022 | T-34 |
| NOT TO SCALE | DRAWN: EWN | |



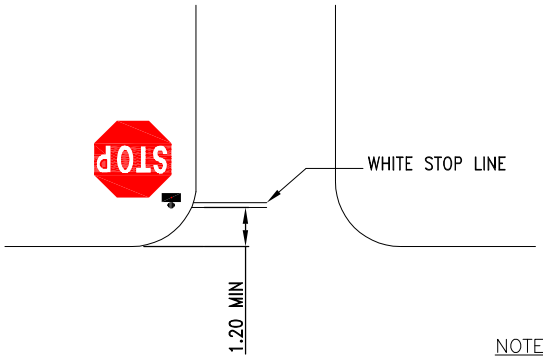

UNCONTROLLED COLLECTOR WITH TWO CROSSINGS

UNCONTROLLED COLLECTOR WITH TWO CROSSINGS
(SCHOOL ZONE)

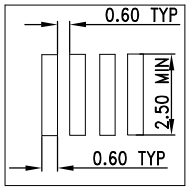



STOP CONTROL HIGH PEDESTRIAN LOCATION LOCAL ROAD

STOP CONTROL COLLECTOR ROAD




STOP CONTROL LOCAL ROAD

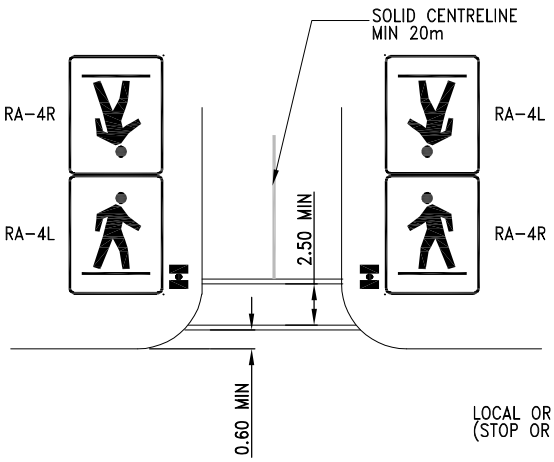



DETAIL 'A'

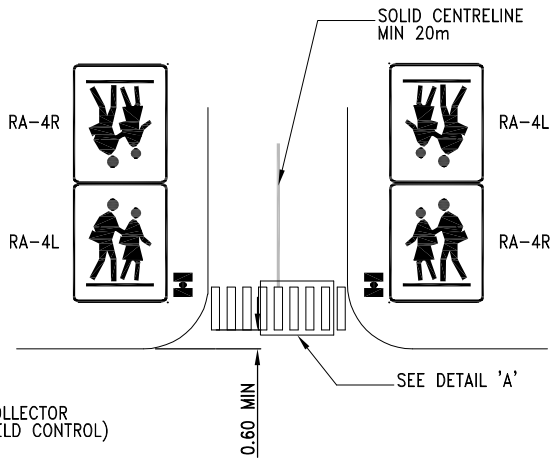
NOTES:
1. THESE TYPICAL DIMENSIONS ARE GENERAL IN NATURE. REFER TO DETAILED ENGINEERING PLANS OR DIRECTION FROM THE ENGINEER FOR PROJECT SPECIFIC APPLICATIONS.
2. REFER TO DWG T-36 AND THE "MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR CANADA (MUTCD) TAC, 2008 FOR MORE INFORMATION AND GUIDANCE.

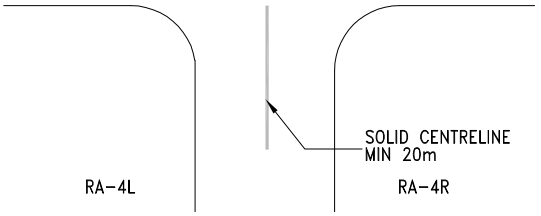
ALL DIMENSIONS IN METERS
UNLESS OTHERWISE NOTED

| INTERSECTION PAVEMENT MARKINGS | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: APRIL 2022 | T-35 |
| NOT TO SCALE | DRAWN: EWN | |

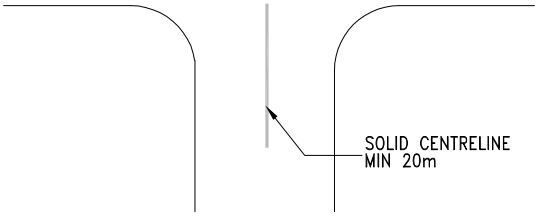



LOCAL OR COLLECTOR
(STOP OR YIELD CONTROL)

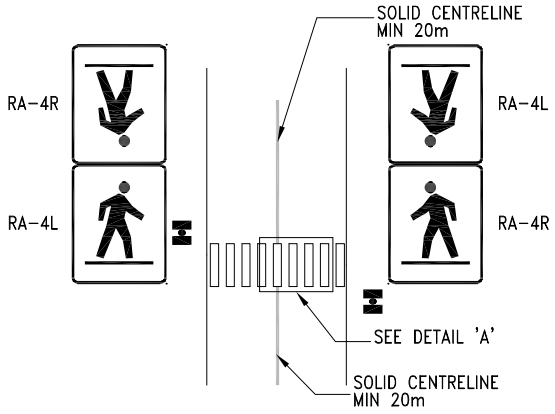


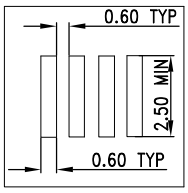

UNCONTROLLED COLLECTOR WITH ONE CROSSING




UNCONTROLLED COLLECTOR WITH ONE CROSSING
(SCHOOL ZONE)




MID-BLOCK PEDESTRIAN CROSSING

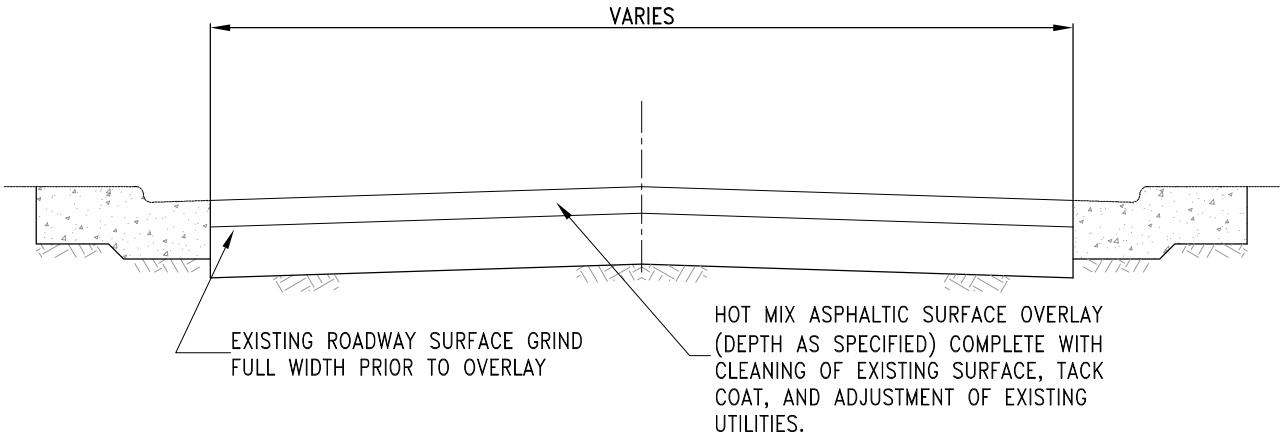



DETAIL 'A'

NOTES:
1. THESE TYPICAL DIMENSIONS ARE GENERAL IN NATURE. REFER TO DETAILED ENGINEERING PLANS OR DIRECTION FROM THE ENGINEER FOR PROJECT SPECIFIC APPLICATIONS.
2. REFER TO DWG T-36 AND THE "MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR CANADA (MUTCD) TAC, 2008 FOR MORE INFORMATION AND GUIDANCE.

ALL DIMENSIONS IN METERS
UNLESS OTHERWISE NOTED

| INTERSECTION PAVEMENT MARKINGS | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: A | DATE: APRIL 2022 | T-36 |
| NOT TO SCALE | DRAWN: EWN | |




NOTE:

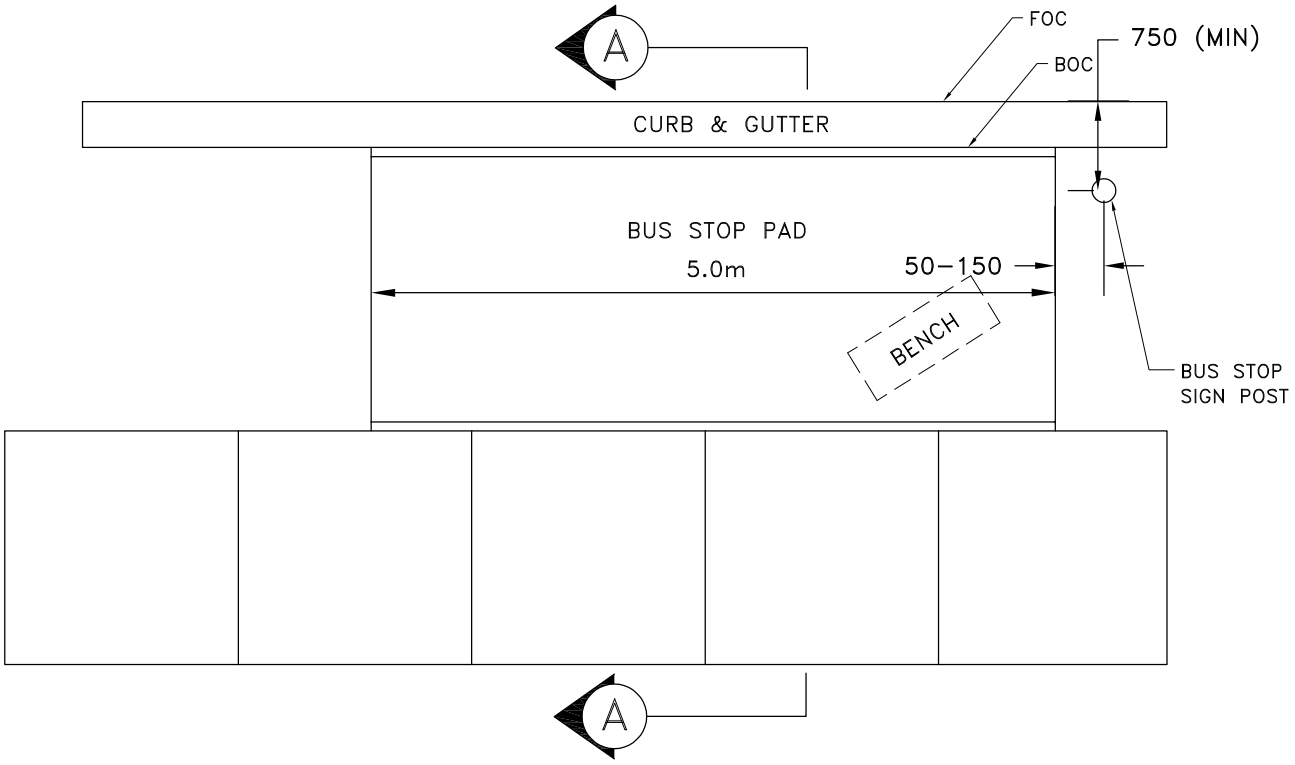
WHERE CONCRETE SWALES ARE USED, PROVIDE ISOLATION JOINT BETWEEN ASPHALT AND CONCRETE. FILL JOINT WITH ELASTIC COMPOUND.

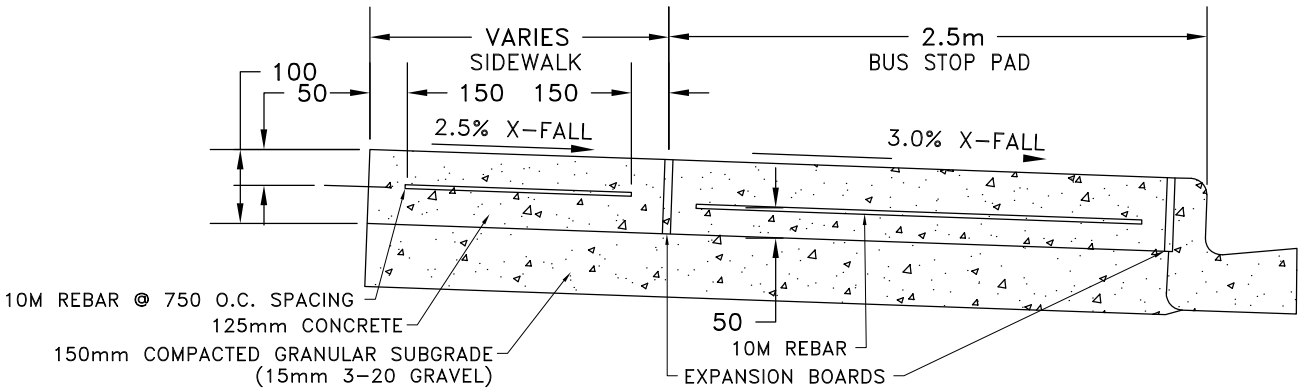
ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED

# TYPICAL OVERLAY

CITY OF FORT SASKATCHEWAN

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: B | DATE: APRIL 2022 | T-37 |
| NOT TO SCALE | DRAWN: EWN | |

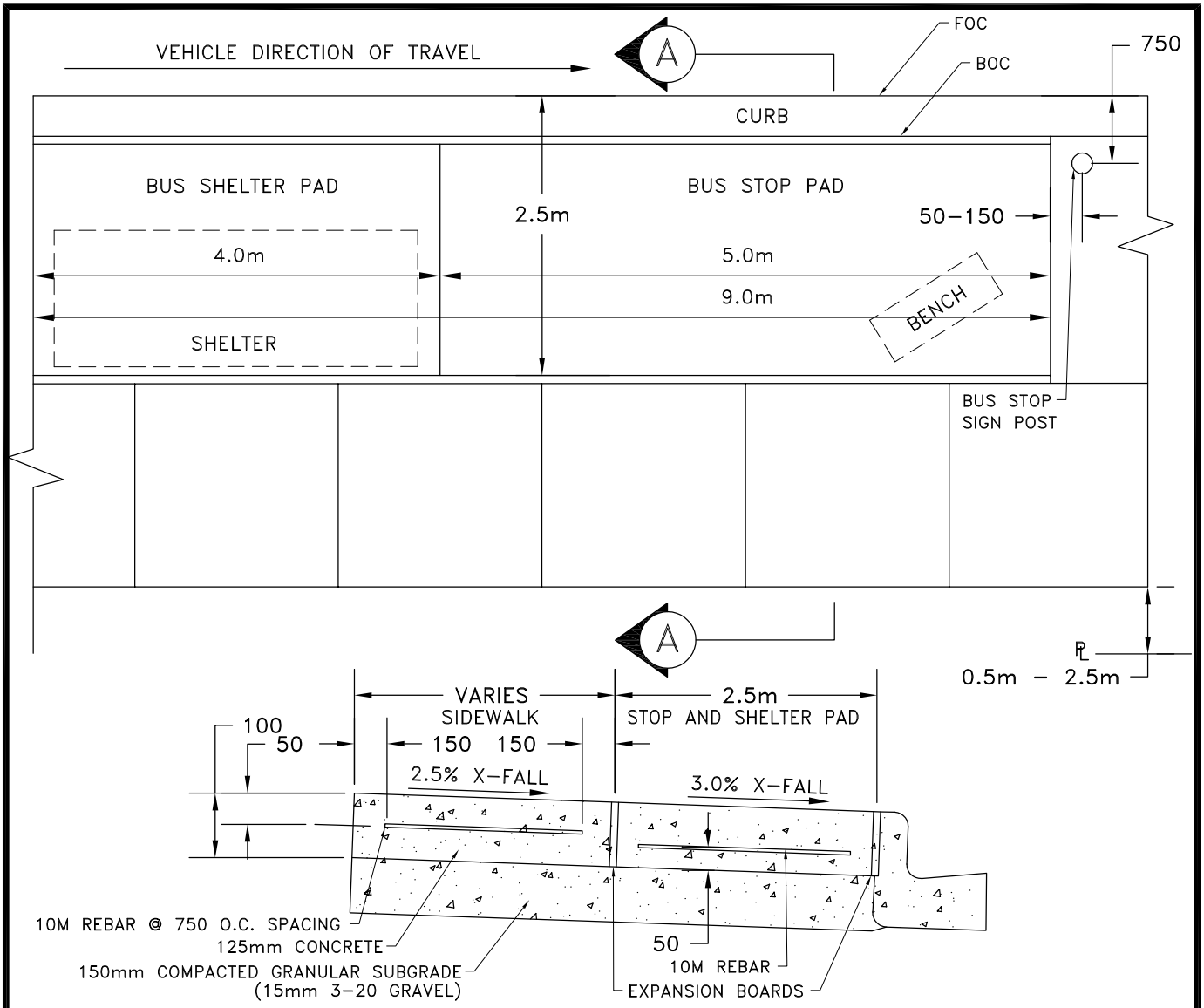



SECTION A–A
SCALE: NTS

NOTES:
1. CONCRETE TO MEET CITY OF FORT SASKATCHEWAN STANDARD
2. UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.

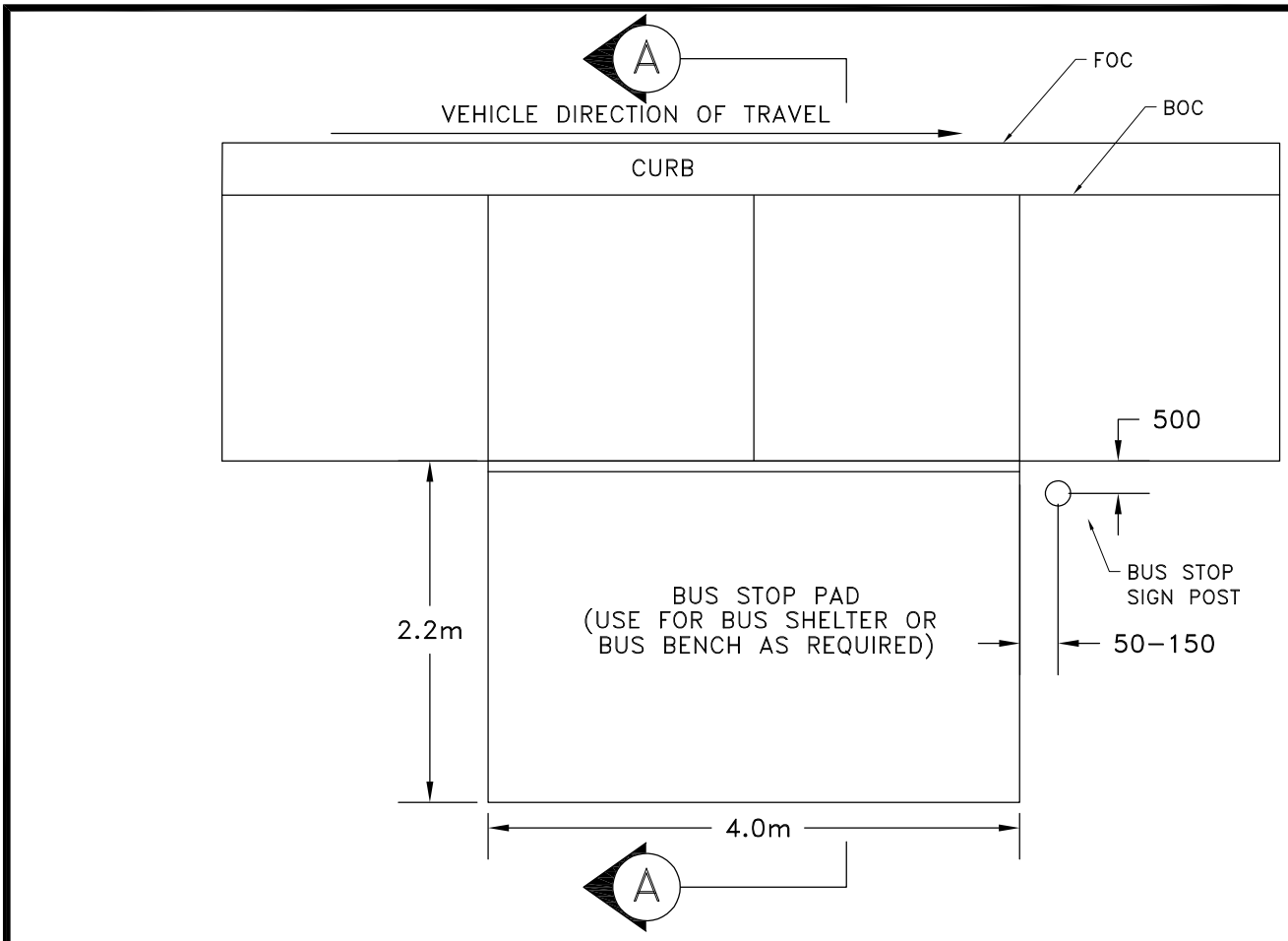
| 5m BUS STOP (NO SHELTER) | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: A | DATE: APRIL 2022 | T-38 |
| NOT TO SCALE | DRAWN: EWN | |

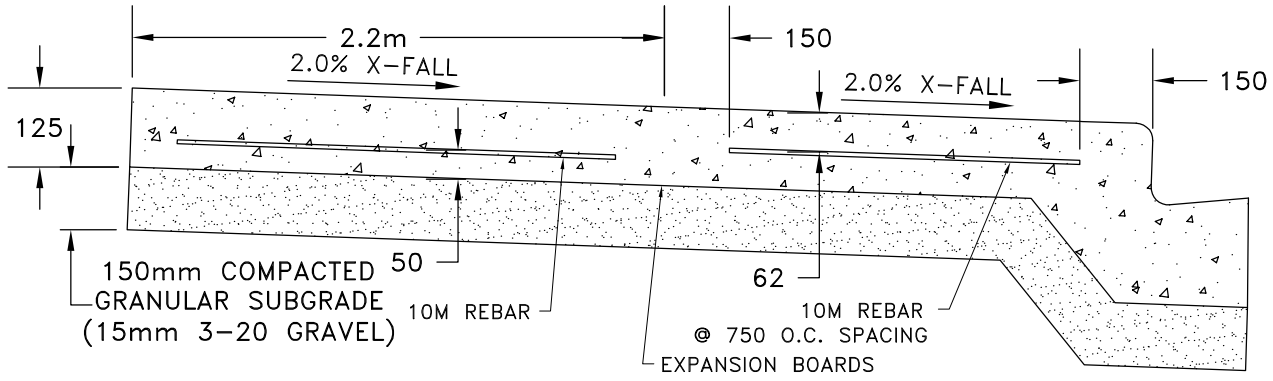



## SECTION A–A
SCALE: NTS

NOTES:
1. CONCRETE TO MEET CITY OF FORT SASKATCHEWAN STANDARD
2. CONTRACTION JOINTS ARE TO BE PROVIDED AT A MINIMUM 3.0m SPACING
3. UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.
4. THE DEVELOPER IS RESPONSIBLE TO INSTALL BUS SHELTERS UPON ARTERIAL ROADS
5. THE DEVELOPER IS RESPONSIBLE TO INSTALL BUS SHELTERS UPON COLLECTOR ROADS ADJACENT TO MULTI–FAMILY SITES.
6. BUS STOP BENCH MUST BE ANCHORED TO THE CONCRETE PAD.
7. THE FRONT EDGE OF THE BUS STOP BENCH MUST BE SET BACK A MINIMUM 1.5m FROM THE FACE OF CURB AND ANGLED TO FACE DIRECTION OF TRAVEL. THE REAR EDGE OF THE BUS STOP BENCH MUST NOT EXTEND ONTO THE SIDEWALK
8. THE FRONT EDGE OF THE BUS STOP SHELTER MUST BE SET BACK A MINIMUM OF 1.0m FROM THE FACE OF CURB. THE REAR EDGE OF THE BUS STOP SHELTER (INCLUDING ANCHOR PLATE) MUST NOT EXTEND ONTO THE SIDEWALK.
9. THE OPENING OF THE BUS STOP SHELTER MUST DIRECT USERS TO THE SIDEWALK.
10. ADVERTISEMENTS UPON BUS STOP BENCHES AND SHELTERS ARE NOT PERMITTED WITHOUT WRITTEN CONSENT FROM THE CITY OF FORT SASKATCHEWAN TRANSIT DEPARTMENT.

| 9m BUS STOP (WITH SHELTER) | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: A | DATE: APRIL 2022 | T-39 |
| NOT TO SCALE | DRAWN: EWN | |




## SECTION A–A

SCALE: NTS

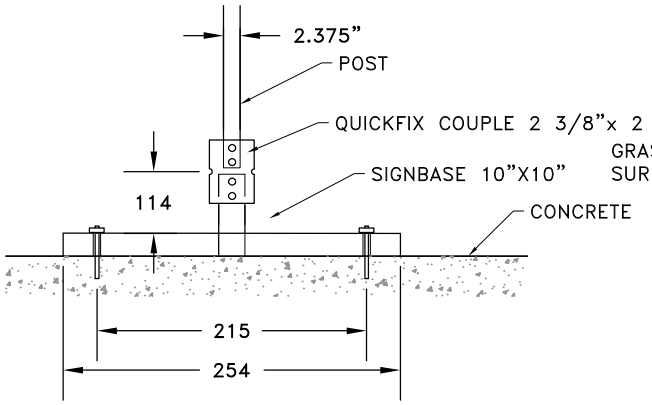
NOTES:

1. CONCRETE TO CLASS C STANDARD.
2. CONTRACTION JOINTS ARE TO BE PROVIDED AT A MINIMUM 3.0m SPACING
3. UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.
4. BUS STOP BENCH MUST BE ANCHORED TO THE CONCRETE PAD.
5. THE FRONT EDGE OF BUS STOP BENCH MUST BE SET BACK A MINIMUM 0.5m FROM THE SIDEWALK AND ANGLED TO FACE DIRECTION OF TRAVEL.
6. THE EDGE OF THE BUS STOP SHELTER (INCLUDING ANCHOR PLATE) MUST NOT EXTEND ONTO THE SIDEWALK
7. THE OPENING OF THE BUS STOP SHELTER MUST DIRECT USERS TO THE SIDEWALK.
8. ADVERTISEMENTS UPON BUS STOP BENCHES AND SHELTERS ARE NOT PERMITTED WITHOUT WRITTEN CONSENT FROM THE CITY OF FORT SASKATCHEWAN TRANSIT DEPARTMENT.

| MONO WALK BUS STOP (WITH SHELTER) | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: A | DATE: APRIL 2022 | T-40 |
| NOT TO SCALE | DRAWN: EWN | |

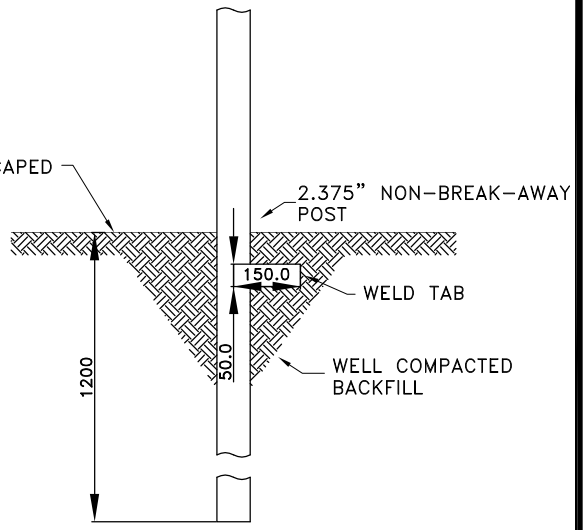
## CONCRETE

POST INSTALLATION DETAIL

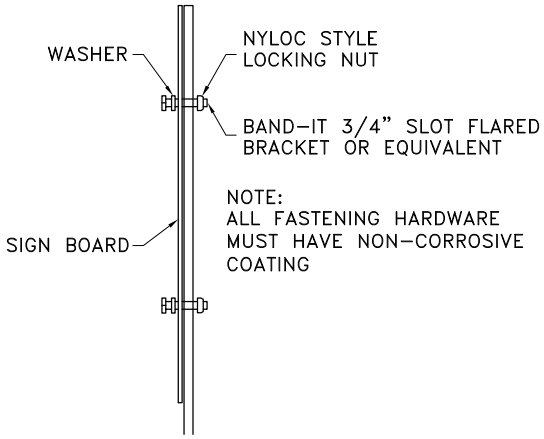



## GROUND

POST INSTALLATION DETAIL




## SIGN BOARD FASTENING DETAIL




| ACTUAL INCH & MILLIMETER SIZES | |
|---|---|
| 1.75" | 44.45mm |
| 1.88" | 47.50mm |
| 2.00" | 50.08mm |
| 2.25" | 57.15mm |
| 2.50" | 63.50mm |
| WALL | |
| 0.105" | 2.667mm |

APPROVED POSTS AND HARDWARE:

ALUMINUM BREAK-A-WAY SYSTEMS:
QUICKFIX SIGN SYSTEM.

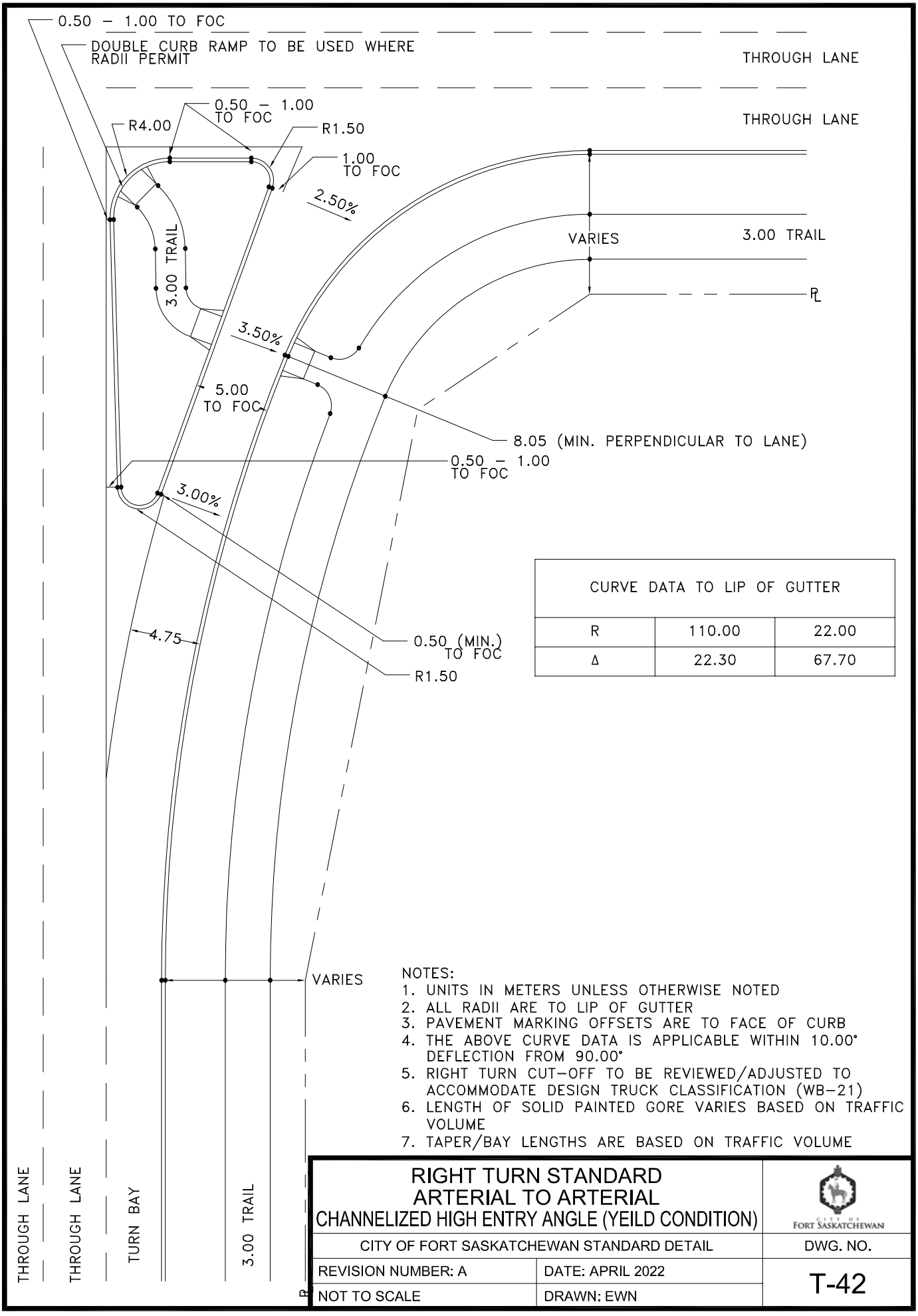
METAL UTILITY POLE MOUNTS:
FASTENERS ARE BAND-IT 3/4" SLOT FLARED BRACKET STAINLESS STEEL C/W BOLT, SS AND FIBER WASHER OR APPROVED EQUIVALENT

SELF-TAPPING SCREWS ARE NOT PERMITTED

CONCRETE CASE ANCHOR BOLTS TO BE STAINLESS STEEL

NOTES:
1. QUICKFIX BASES ARE REQUIRED ON ARTERIAL AND MAJOR COLLECTOR ROADS ONLY.
2. ALL DIMENSIONS ARE IN METERS (m), UNLESS OTHERWISE NOTED

| SIGN INSTALLATION DETAIL | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: A | DATE: APRIL 2022 | T-41 |
| NOT TO SCALE | DRAWN: EWN | |




| CURVE DATA TO LIP OF GUTTER | | |
|---|---|---|
| R | 110.00 | 22.00 |
| Δ | 22.30 | 67.70 |

NOTES:
1. UNITS IN METERS UNLESS OTHERWISE NOTED
2. ALL RADII ARE TO LIP OF GUTTER
3. PAVEMENT MARKING OFFSETS ARE TO FACE OF CURB
4. THE ABOVE CURVE DATA IS APPLICABLE WITHIN 10.00° DEFLECTION FROM 90.00°
5. RIGHT TURN CUT–OFF TO BE REVIEWED/ADJUSTED TO ACCOMMODATE DESIGN TRUCK CLASSIFICATION (WB–21)
6. LENGTH OF SOLID PAINTED GORE VARIES BASED ON TRAFFIC VOLUME
7. TAPER/BAY LENGTHS ARE BASED ON TRAFFIC VOLUME

# RIGHT TURN STANDARD
# ARTERIAL TO ARTERIAL
# CHANNELIZED HIGH ENTRY ANGLE (YEILD CONDITION)

CITY OF FORT SASKATCHEWAN

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: A | DATE: APRIL 2022 | T-42 |
| NOT TO SCALE | DRAWN: EWN | |

# 6.0 LANDSCAPING

This section outlines design standards and procedures for landscape improvements in the City of Fort Saskatchewan. These standards outline minimum standards for development of the public realm, and the procedures to be followed through the design, construction, maintenance and approval process.

Through these standards, the City of Fort Saskatchewan (the City) aims to provide high-quality public open space and experiences for residents and visitors to our community. Public open spaces, ranging from Formal Landscapes to Natural Areas serve our residents and wildlife with recreational, aesthetic, ecological, health and safety benefits. Through the development of public open space, the City encourages that people maximize their enjoyment of the outdoors while adequately protecting natural and naturalized ecosystems.

Terms that are capitalized within these standards (i.e., Formal Landscapes or Developer) are defined in Section 1.2 – Definitions.

## 6.1 General

The Development Guidelines and Standard Specifications provided in the following section are minimum standards, and are to be used in conjunction with the following documents:

- The City of Fort Saskatchewan Land Use Bylaw;
- Community Sustainability Plan; and
- Fort Saskatchewan Engineering Servicing Standards.

The City reserves the right to supplement these guidelines with regular updates to these standards. Developers, Consultants and Developer Representatives using these standards should consult with City Representatives to ensure any supplemental requirements are adhered to. For example, the City shall, on a regular basis, update permitted and non-permitted tree species within these standards or other using other documents.

It is the City's mandate to promote safe, comfortable, sustainable and easily maintained public open space. We encourage the retention of natural areas where possible, and a balance of formal and naturalized constructed landscapes. The City recognizes the importance of ecological protection and creating landscapes that accommodate human use while respecting ecological integrity.

A Developer is responsible to construct landscape developments in accordance with the minimum landscape development standards indicated to the satisfaction of the City Representative. The City at its discretion, may consider alternatives to or relaxations of the Guidelines and Specifications when the Developer or their agent provides a written submission identifying the reasons for special considerations.

These Guidelines will be reviewed and updated on a regular basis to always remain relevant to the City's development objectives. It is the responsibility of the Developer or the Developer Representative to ensure the latest guidelines are being used.

The Developer is responsible for assigning a qualified individual or consulting firm to act as Developer Representative. The assigned Developer Representative acting on behalf of the Developer must be fully competent and licensed in good standing with its applicable professional organization. During construction, the Developer Representative will be responsible for:

- ensuring Contractors comply with all local, Provincial and Federal requirements related to health and safety, environmental protection and corporate certification as described elsewhere in these standards;
- ensuring all work is completed in accordance with these standards, the development agreement, and the approved drawings;
- ensuring compliance with all required setbacks and monitoring site locations provided by Alberta First Call or other similar utility location agencies;
- arranging for a project startup meeting prior to any construction and any required site meetings that may be required during construction. City representatives shall be invited to attend these meetings;
- approving rough and finished grades for all work, and approving the location of all proposed site features such as trails, trees and shrubs;
- ensuring plant material conforms to all required standards, prior to installation, and receiving validation of the plant material source(s);
- ensuring fences are built in accordance with the survey completed;
- making regular records on the progress of construction, which shall be made available to the City upon request; and
- coordinating all applications and inspections as required.

These Guidelines are organized in the following sections:

6.2: Definitions and Acronyms;
6.3: Drawing Approval and Preparation;
6.4: Site Preparation;
6.5: Surface Improvements;
6.6: Plant Material;
6.7: Site Amenities;
6.8: Special Features;
6.9: Stormwater Management Facilities;
6.10: Construction Completion, Warranty and Maintenance Period Final Acceptance; and
6.11: Standard Drawing Details.

## 6.2 Definitions and Acronyms

CCC – Construction Completion Certificate;

City Representative – the designated individual appointed by the City of Fort Saskatchewan having the authority to review, approve and accept proposed drawings and applications;

Construction Completion – point at which at least 95% of all proposed improvements are in place, and constructed in accordance with the City Specifications, detailed drawings and the development agreement;

Consultant/Developer Representative – the designated party acting on behalf or in coordination with a Developer, providing expertise in a professional field such as engineering, landscape architecture, planning, geomatics, etc.;

Developer – usually the landowner of developing land who intends to, or has executed a development agreement with the City to improve public open space;

**Developer's Representative** – an individual or professional consulting firm appointed to act on behalf of a Developer and liaise with the City on an official basis. For certification purposes, the individual or firm must provide evidence of professional competency and maintain in good standing Provincial professional registration with her or his corresponding profession and acting within scope of practice.

FAC – Final Acceptance Certificate

Formal Landscapes – public open space that includes a combination of native and non-native plant species, and requires a higher level of routine maintenance such as regular mowing, irrigation and programming of active recreation;

MR – Municipal Reserve, as defined by the Municipal Government Act of Alberta

Natural Ecosystems/Natural Areas – public open space comprised of naturally occurring ecosystems or those constructed to replicate natural areas of the region, such as native grasslands, native plant areas or constructed wetlands. These areas usually accommodate passive recreation limited to viewing areas and trails, while providing adequate setbacks to protect ecological integrity;

Naturalized Ecosystems – public open space constructed in a manner that replicates natural areas, such as constructed wetlands, native grasslands, and forested areas comprised of species native to the region. Naturalized ecosystems require maintenance practices different than formal landscapes; and

The City – meaning the City of Fort Saskatchewan.

## 6.3 Drawing Approval and Preparation

### 6.3.1 Guideline

The Developer must provide complete drawing sets that represent the full extent of development for landscape improvements. Drawings for all open space improvements must be submitted concurrently with engineering drawings, should engineering improvements be part of the project scope. Drawing reviews by the City are for the sole purpose of determining compliance with the standards and other applicable plans. The City's review and acceptance of any submissions do not relieve the Developer or Developer's Representative of their responsibility for errors and omissions or their obligation of meeting all requirements of these standards and any other Municipal, Provincial or Federal rules and regulations.

### 6.3.2 Certification

Drawings for all submissions must be sealed and signed by a Professional Landscape Architect (AALA), Professional Engineer (APEGA), Professional Agrologist (AIA), or Professional Architect (AAA) that is registered and in good standing with their Provincial Association. The signing professional must be competent in all facets of design that are included in the drawing set. Should more than one professional seal be applied to any drawing for interdisciplinary work, the drawing must clearly identify which professional seal covers what aspects.

Any Erosion and Sediment Control (ESC) plans must be certified by any of a Professional Engineer (P.Eng.) or Certified Professional in Erosion and Sediment Control (CPESC), in good standing with their respective professional association.

A current member of the Canadian Playground Safety Institute (CPSI) or Professional Landscape Architect (AALA) must certify drawings and information packages for any playground equipment.

6.3.3 Drawing Submission Requirements

Drawing Compilation

All drawings shall be completed in accordance with the City of Fort Saskatchewan drawings standards.

## Drawings Required

Location and Index Plan

All of this information may be included on a single drawing or on separate drawings depending on the size of the project and on individual preference. The location plan should show:

- street names or nearby roads;
- phasing (if applicable) for past and current stages;
- limits of proposed development for the current drawing package, etc.; and
- list of drawings in the package, required only for packages that exceed six pages.

Existing Conditions Plan

Any existing site features including:

- existing topography and overall drainage patterns;
- natural features, such as vegetation, watercourses, pipelines, railways, easements, etc.; and
- the context of surrounding development, including road or trail connections, grades, etc.

Grading Plan

Plans that demonstrates proposed grading to include:

- spot elevations at all property corners within or nearby the site;
- proposed contours at suitable intervals and locations depending on the scale of drawing;
- arrows showing generic pattern of flows as well as percentage slopes; and
- any temporary site access, laydown areas, parking, stockpile locations, equipment storage (during construction) and site boundaries.

Surface Treatment Plan

- existing and proposed surface materials, including but not limited to hard surfaces, mowed lawn area, naturalized grass areas, gravel surfaces, etc; and
- a table must be included on drawings that indicate the total area of mowed grass, trees and shrubs required and the number provided to reconcile plant requirements, total area of mulched beds, total area of naturalized grass, and total area of any other surface treatment.

Fencing Plan

- types, height and location of various fences;
- location of property lines, and notes stating where fence alignments are proposed compared to property lines;

- locations and widths of gates, if applicable; and
- locations of bollards along PULs, walkways, MR entrances, multiways, etc.

Planting Plan

- all turf, perennial plants, ground covers, shrubs, and trees;
- total measurements (in sq.m.) of shrub beds, flower beds, islands, buffers, PULs, MRs, ERs, SWMFs, parks, etc.;
- total measurements (in sq.m.) of proposed seeded and sodded areas, existing vegetation;
- existing and proposed utilities, including proposed planting setbacks from each of these utilities that conform to minimum setbacks prescribed by each utility owner;
- all existing vegetation to remain, any existing vegetation to be relocated on site, areas of existing ground to remain, etc.;
- plants to be drawn to 2/3 of the mature spread or diameter, as published in the Canadian Standards for Nursery Stock in its latest edition, a publication of the Canadian Nursery Landscape Association (CNLA);
- a plant schedule, with a graphical key that correlates the plant list with all species on that page. Plants must be coded with maximum three letters and must include the total number of plants that are keyed on the overall page. The plant schedule will include the number of each species, the name of each plant in both common and botanical (latin) name, the size of plants (height for coniferous trees, DBH for deciduous trees, height for deciduous shrubs, spread or height for coniferous shrubs and container size for perennials) and any conditions of the proposed plant (such as number of canes, minimum and maximum branching heights, etc.). The Canadian Standards for Nursery Stock in its latest edition must also be referred to in classifying plant sizes, conditions and other attributes noted on the plant schedule;
- areas to be seeded or sodded, and including the proposed seed mix for each area. The legend shall demonstrate what each seeded area hatch type represents. Each seed mix must also include proposed seed rates and type of application;
- mulches for plant beds or other landscaped areas, including mulch type and proposed depth;
- location of any trails, driveways and other hard surfaces; and
- a chart showing the total amount of MR on site, and a calculation demonstrating the rationale for the number of trees and shrubs proposed for each area.

Furniture Plan

- location of proposed site furnishings, such as benches, waste receptacles, picnic tables, pedestrian scaled lighting, signage, etc.
- lighting may be required at the discretion of the City, for multi-use trails. Stubbing must be completed for lighting along trails for multi-use trails, if required.

Irrigation

Irrigation is not a minimum requirement in Fort Saskatchewan for any new development. Special circumstances may lead to a proposed irrigation system for any of the public open spaces proposed in plans. Irrigation plans shall demonstrate:

- types of irrigation application used, such as drip, broadcast, etc. irrigation;
- stubbing of sanitary water and power; this is for irrigation or park washrooms;
- location of each irrigation head and extent of coverage for each unit;
- location and diameter of all water supply lines;

- requirement for tracer wire alongside all water lines and irrigation lines;
- location of all blow-out valves, controller units, junction boxes, control valves, etc; and
- power supply and lines for the irrigation system.

Erosion and Sediment Control

Erosion and sediment control (ESC) plans must include, at minimum and must consult with engineering standards:

- protection measures for all existing natural features, such as watercourses, vegetated areas to remain, etc.;
- inlet protection measures, demonstrating how catch basins and other utilities that lead to SWMFs are protected in advance of turf and other groundcovers being established and protected from erosion and sedimentation;
- temporary erosion control measures used to protect the site from erosion during the course of construction;
- permanent erosion control measures, such as blankets, mulches, etc. that are used to minimize or prevent erosion from taking place on site;
- sediment control measures such as silt fences, sediment socks, straw bales, etc. used to collect sediment once under transport;
- wind protection measures to prevent transport of sediment via the air, particularly addressing stockpiles and areas of soil that will remain bare for extended periods of time; and
- listing of best management practices for ESC planning, such as tracking, equipment washing, contouring, etc.

ESC plans should include a list of estimated units for each proposed ESC measure along with notes describing best management planning strategies such as having ESC products on hand during construction.

Playgrounds

Where playgrounds are proposed, detailed drawings must include, at minimum, the following information:

- layout plan including dimensions shown to the interior of the edging. Include lengths of all straight lines, tangent points and diameters. Dimensions to be interior of edging system;
- grading plan indicating subgrade elevations. Show spot elevations at key locations, and arrows indicating slope direction and percentage. Subgrade to be no less than 1% slope, preferred in a single direction. Grading plan to also include elevations of top and bottom of perimeter edger at regular intervals;
- drainage tile system is required for all playgrounds. Grades along both perforated pipe and solid pipe segments to be shown, demonstrating bottom of pipe elevation. Include grades for daylight points, and up to 5.0m beyond the playground to demonstrate flow of water away from the playground;
- all equipment to be designed in accordance with CSA Standards, and all equipment to meet all local, Provincial and National standards. Notes to include all standards that have been met; and
- include plan view, 3D perspective view and elevations of all proposed equipment, including foundations required for installation. Elevations to show location of subgrade and top of sand fill compared to equipment foundations.

Details

When a detail is available from these standards, drawings must include the standard drawing provided in its entirety, without modification and including the City of Fort Saskatchewan title block for each detail. Should any modification be made to any standard detail it cannot use the City of Fort Saskatchewan title block. Drawings must include any other detail required to depict construction materials, methodology and final product.

Supplemental Information

Along with all submissions for approval, the Developer shall submit documentation to the City indicating that permission has been received from appropriate authorities for crossing of pipelines, railways, highways, or other facilities that require approval.

## 6.4 Site Preparation

### 6.4.1 Subgrade Preparation

This section includes the requirements for the preparation of subgrade for landscaped areas.

Guideline

Prepare and provide grading plans for review and approval prior to commencement of work. Design the sub-grade to provide a minimum of 2% a gradient across all landscape areas and away from all structures. Grades for special features may have a lesser grade, however requires prior approval by the City. In no circumstance will turf areas be permitted to have a slope less than 1%.

Provide the City a minimum of 7 days' notice prior to arrival on site and advise what work is to be undertaken. Begin operations on site only when grading plans have been approved. Obtain permits as needed and maintain on site for review by inspectors

Off-site drainage onto a reserve parcel and public utility lot/right-of-way is to be limited.

Confirm the sub-grade is not contaminated and is free of all deleterious materials. If contamination or deleterious materials is suspected or found immediately inform the City of Fort Saskatchewan and suspend work pending resolution.

Materials

All materials used are subject to inspection, testing and approval by the City. Use only clean fill materials that are free of all hazardous and deleterious waste, large boulders, roots and other organic materials that may impact proposed development.

Installation

Place fill materials in compacted lifts not exceeding 300mm in depth. Do not place materials in wet, muddy or frozen state. Lifts shall be uniform in thickness throughout the project area as subgrade profiles are constructed.

Compact finished sub-grade and all fill material to a minimum 85% Standard Proctor Density for areas under turf or planting, 98% Standard Procter Density for areas under walks and site amenities.

Scarify sub-grade in areas for topsoil placement to a depth of 75mm in all areas except where considered impractical by The City. Whenever compaction is greater than or equal to 95% standard proctor dry density scarification will be required to a depth of 200mm.

## 6.5 Surface Improvements

### 6.5.1 Topsoil Supply and Placement

Guideline

Topsoil shall be placed in all areas that are intended to support plant materials to the depths specified for the intended use.

Imported topsoil may only be used with pre-approval from the City of Fort Saskatchewan.

Native soils must be used on all areas of natural reclamation and in environmental reserves.

Topsoil Material

Topsoil shall be free of subsoil, clay lumps, stones, live plants and other roots, sticks or other extraneous matter. The volume of rock shall not exceed 2%. Screened topsoil is preferred.

Recommended soil composition:

- 35% Sand; 30% Clay; 35% Silt;
- Organic matter 5 - 10 %
- Free of toxic materials
- Electrical conductivity of max. 1.5 ohms per $cm^2$
- pH of 6.0 - 7.5.

The contractor shall submit a sample and an independent laboratory analysis of topsoil from each source to be used seven calendar days in advance of delivery to the site. The laboratory analysis shall include tests for N, P, K, minor element values, soluble salt content, electrical conductivity, pH and physical values (sand, clay and organic material). Test results must be provided to the City Representative prior to topsoil installation. Copies of soil test results from a certified laboratory must demonstrate conformance to these standards. The soil test results must be submitted to the City by email to landscape@fortsask.ca. If necessary, bonemeal, limestone, pesticides, phosphates, sulfates or other amendments shall be added as accepted by the City.

Final topsoil test results and documentation of any amendments made after the time of testing must be provided to the City as part of any application for Construction Completion. The City reserves the right to refuse applications for Construction Completion without adequate testing information made available. The Developer's Representative, at the time of CCC application, must certify that topsoil test results provided are representative of the actual topsoil used on site, and that the tests resulted from samples that were properly collected in accordance with best management practices of the industry. Refer to Part I: Applications, Checklists and Forms for information on the certification required.

If organic material is required to meet the organic material specifications for topsoil, peat moss shall be added in the field and thoroughly mixed with cultivation equipment. The peat moss shall meet the following specifications:

- free of toxic material, live plants, live roots, seeds or other deleterious material

- delivered in a pulverized condition
- approved prior to mixing with the topsoil
- of a pH not less than 4.5 and not greater than 6.0

If necessary, clean sharp sand free of all deleterious materials may be added to meet topsoil specification.

Lime is to be used where the pH of the soil is less than 6.0. The lime shall be ground limestone containing not less than 80% of total carbonates combined. It shall be ground to such fineness that at least 50% will pass a 100-mesh sieve and at least 90% will pass a 20-mesh sieve. Where limestone is specified, it shall be stored in such a manner as to stay dry and free flowing.

Recourse and Procedures for Inadequate or Missing Tests

Developers are responsible for ensuring topsoil material used on projects in the City of Fort Saskatchewan meets the criteria set forth in these standards. Compliance must be demonstrated through testing by a certified laboratory. The City, at its discretion, may accept topsoil that does not meet standards, and in this instance will provide confirmation in writing that material outside the specifications may be used, either as-is or with proposed amendments.

Should documentation not be made available at the time of CCC application, the Developer will be responsible for topsoil sample collection from the site, taken at representative volumes to the full minimum depth specified for each area. The City may, at its discretion, take its own samples at any time and conduct independent testing at the expense of the Developer. Reconciliation of any expenses incurred by the City for follow-up testing must be completed prior to issuing a CCC for the subject area.

Should follow-up testing not meet proper specification, the Developer will be responsible for amending topsoil materials in place through rototilling in appropriate amendments or complete removal and replacement of inadequate topsoil. Reseeding may be required depending on the approved amendments.

Topsoil Installation

Prior to placing topsoil, ensure subsoil is prepared appropriately. All weeds, roots, stones larger than 25mm in diameter and other foreign matter shall be removed from the surface of the subsoil. Immediately before placing topsoil the subsoil shall be loosened to a depth of not less than 50mm by means of a disc, spike tooth harrow or other means satisfactory to the City and leveled to a firm, even surface. The final grade shall be 50mm (or as specified) below the adjacent top of curb and/or subgrade and sloped so that no ponding or runoff onto adjacent private property occurs.

All existing utilities shall be adjusted to finished grade elevations and all existing features (curbs, sidewalks, trees, monuments, valves, etc.) shall be protected against any damage.

The topsoil shall be uniformly spread in dry weather on the prepared subsoil over approved sub-grade to the minimum compacted depth specified. Topsoil shall not be placed when either the topsoil or subsoil is frozen, excessively wet, extremely dry or otherwise in a condition detrimental to proper grading, compaction or cultivation. The upper 50mm shall be of a fine texture and free of stones or lumps 6 mm or larger. Allowances for settlement shall be provided where necessary. Manually spread topsoil around trees, plantings and structures to prevent damage. Place topsoil to the following depths:

| Application | Min. Depth Required on Sand Subgrade | Min. Depth Required on Clay Subgrade |
|---|---|---|
| Seeded Areas, Mowed Grass | 300mm | 200mm |
| Seeded Areas, Naturalized (non-mowed) Grass | 250mm | 150mm |
| Sodded Areas | 200mm | 150mm |
| Shrub Beds | 750mm | 600mm |

If required, lime shall be well worked into the soil before the application of topsoil to obtain a minimum pH value of 6.0.

Ensure that finish grades will be flush with adjacent surfaces, structures and property lines. After topsoil placement the area shall be thoroughly cultivated, harrowed and floated to a minimum depth of 100mm. All hard lumps shall be broken down and all stones larger than 25mm in diameter, roots, stumps and other foreign matter shall be removed and disposed of.

Fertilizer shall be applied at a rate of 10 kg/100 $m^2$ with an approved spreader and be well worked into the upper 75mm of soil. Alternate fertilizer application rates may be proposed based on soil test and fertilizer recommendations from these tests.

Topsoil shall be lightly compacted to 80 – 85% standard Proctor density to prevent disproportional settlement within the project area. Topsoil must be free of any rutting or heavily compacted areas as a result of any activities such as equipment travel over topsoil areas.

Float the surface until smooth and fine grade to eliminate rough or low areas. Final grade for seeded areas shall be flush with adjacent surfaces, for sod shall be 25mm below finished grade of adjacent work. Maintain all relative grades and drainage conditions as established and approved during sub-grade preparation. Obtain approval of finished topsoil grade and preparation from City before application of seed or sod.

Make good any damage caused by topsoil supply and placement activities to the satisfaction of the City of Fort Saskatchewan. Leave site in a neat and workmanlike condition able to receive landscape components to be installed. Any topsoil tracked onto roads, walks and trails to be cleaned after each workday, unless these areas are within fenced construction areas that are not accessible to the public or being used by City maintenance staff.

6.5.2 Supply and Installation of Grass Seed

Guideline

Areas proposed to be seeded and seed mixes shall be pre-approved for seed application by the City of Fort Saskatchewan. Seed shall not be planted before May 1 or after September 15$^{th}$, unless given consent in writing by the City Representative.

Seed which fails to germinate for whatever reasons shall be re-cultivated and re-seeded at the Developers expense until germination has taken place and satisfactory growth established.

Materials

Grass seed shall be Canada #1 certified seed meeting the requirements of the "Canadian Seeds Act". The mixture shall comply with federal and provincial seed laws and have a minimum germination of 75% and a minimum purity of 97%. Bags containing the seed mixture shall be clearly tagged, showing the name of the supplier, the contents, the date bagged and location, and the year of seed production. Seed varieties shall be mixed and application rate set to suit the planting conditions and location. Acceptable seed mixes and application rates are outlined in Table 1. Other mix designs may be used, subject to the written approval of the City.

Water shall be free of any impurities that would inhibit germination or otherwise adversely affect growth.

Fertilizer shall be packed in standard containers, clearly marked with the name of the manufacturer, mass and analysis. Use only standard commercial fertilizer with guaranteed chemical analysis. Fertilizer to be stored in a dry location prior to use.

Seed mixes that are recommended by the Developer's Representative will be assessed by the City to ensure adequate conditions and appropriate species. The City reserves the right to accept or reject any proposed seed mix. Seed mix recommendations must be endorsed by a qualified professional with adequate competencies in seed mix design and applications.

**TABLE 1**
**RECOMMENDED SEED MIXES**

| GENERAL PARKS AREA MIX | | | |
|---|---|---|---|
| **SUITABILTY** | **MIXTURE** | | **APPILICATION RATE** |
| For general use in park areas | Argyle Kentucky Bluegrass | 25% | Seed Drill = 100 kg/ha |
| | Bluechip Kentucky Bluegrass | 25% | |
| | Tomcat Tall Fescue | 25% | |
| | Creeping Red Fescue | 15% | Broadcaster = 125 kg/ha |
| | Perennial Rye Mix | 10% | |
| | Total | 100% | |

| SPORTS FIELD MIX – A | | | |
|---|---|---|---|
| **SUITABILTY** | **MIXTURE** | | **APPILICATION RATE** |
| For use on dry land,non-irrigated sports fields | Argyle Kentucky Bluegrass | 25% | Seed Drill = 150 kg/ha |
| | Able 1 Kentucky Bluegrass | 25% | |
| | Nu Density Kentucky Bluegrass | 15% | **OVER SEEDING RATE** |
| | AC Parkland Crested Wheatgrass | 20% | Vertical/spike Overseeder = 100 kg/ha |
| | Tomcat Tall Fescue | 25% | |
| | Citation Perennial Ryegrass | 15% | |
| | Total | 100% | |

| SPORTS FIELD MIX – B | | | |
|---|---|---|---|
| **SUITABILTY** | **MIXTURE** | | **APPILICATION RATE** |
| For use on irrigated sports fields | Award Kentucky Bluegrass | 20% | Seed Drill = 150 kg/ha |
| | Nu Density Kentucky Bluegrass | 20% | |
| | Tsunami Kentucky Bluegrass | 20% | **OVER SEEDING RATE** |
| | Tomcat Tall Fescue | 25% | Vertical/spike Overseeder = 100 kg/ha |
| | Citation Perennial Ryegrass | 15% | |
| | Total | 100% | |

| STORM WATER POND MIX – A | | | |
|---|---|---|---|
| **SUITABILTY** | **MIXTURE** | | **APPILICATION RATE** |
| Wet meadow to withstand 2-3 weeks of flooding | Fowl Bluegrass (Nutracoat) | 25% | Seed Drill = 30 kg/ha |
| | AEC Hillcrest Awned Wheatgrass | 20% | Broadcaster = 60 kg/ha |
| | Nortran Tufted Hairgrass (Nutracoat) | 15% | Hydro Seeder = 120 kg/ha |
| | ARC Sentinel Spiked Trisetum | 15% | |
| | Fults Distans Alkali Grass | 15% | |
| | Beckmann's Sloughgrass | 10% | |
| | Total | 100% | |

| STORM WATER POND MIX – B | | | |
|---|---|---|---|
| **SUITABILTY** | **MIXTURE** | | **APPILICATION RATE** |
| Dry meadow to withstand 2-3 days of flooding | ARC Mountainview Junegrass | 20% | Seed Drill = 30 kg/ha |
| | Adanac Slender Wheatgrass | 20% | Broadcaster = 60 kg/ha |
| | Elbee Northern Wheatgrass | 15% | Hydro Seeder = 120 kg/ha |
| | Green Needle Grass | 15% | |
| | Sodar Streambank Wheatgrass | 10% | |
| | Nakiska Sheep Fescue | 10% | |
| | Blue Gama (Nutracoat) | 10% | |
| | Total | 100% | |
| **HIGHWAY/ROADSIDE MIX** | | | |
| **SUITABILTY** | **MIXTURE** | | **APPILICATION RATE** |
| Highways and roadsides inlcuding ditch sides and bottoms | Slender/Awed Wheatgrass | 25% | Seed Drill = 30 kg/ha |
| | Green Needle Grass | 15% | Broadcaster = 60 kg/ha |
| | Fringed Brome (Nutracoat) | 15% | Hydro Seeder = 125 kg/ha |
| | Northern Wheatgrass | 10% | |
| | Indian Rice Grass | 10% | |
| | Canada Wild Rye | 10% | |
| | Alkali Grass | 10% | |
| | Western Wheatgrass | 5% | |
| | Total | 100% | |
| **TEMPORARY COVER MIX - DISTURBED SOILS TYPE A** | | | |
| **SUITABILTY** | **MIXTURE** | | **APPILICATION RATE** |
| For disturbed soils where development will occur within 1 - 2 years | Annual Ryegrass | 25% | Seed Drill = 100 kg/ha |
| | Perennial Ryegrass | 75% | Broadcaster = 125 kg/ha |
| | | | Hydro Seeder = 200 kg/ha |
| | Total | 100% | |
| **TEMPORARY COVER MIX - DISTURBED SOILS TYPE B** | | | |
| **SUITABILTY** | **MIXTURE** | | **APPILICATION RATE** |
| For disturbed soils where development will occur within 4 - 5 years | Annual Ryegrass | 25% | Seed Drill = 100 kg/ha |
| | Perennial Ryegrass | 25% | Broadcaster = 125 kg/ha |
| | Argyle Kentucky Bluegrass | 25% | Hydro Seeder = 200 kg/ha |
| | Turf Type Tall Fescue | 25% | |
| | Total | 100% | |

Installation

The Developer shall obtain approval of the seedbed from the City Representative before proceeding with any seeding. Once subgrade preparation is complete, the Developer must inform the City Representative that sites are ready for topsoil with three days' notice prior to seeding. The City at its own discretion may conduct an interim inspection of subgrade areas. The seedbed shall be free of frost, snow or standing water. Seeding shall not occur if the soil temperature is below 7°C. Seeding shall not be carried out when wind velocities are above 15 km/h. All seed tags from bags used during construction shall be collected and provided to the City at the time of Construction Completion Inspection. Seed tags must demonstrate that seed mixes are consistent with design drawings, and the number of seed tags collected will demonstrate the quantity of seed used for the site.

For slopes less than 3:1, grass seed shall be sown at a rate (kg/100 $m^2$) as per supplier recommended in two passes of a mechanical spreader at 90° to each other. Seed shall be applied by means of an approved mechanical dry seeder "Brillion" or approved equal which can roll and cover the seed with 3mm to 6mm of soil. Where the above type of equipment cannot be used, seeding may be done by a cyclone seeder or equivalent dragged with flexible wire mat and rolled with a light turf roller weighing between 90 and 114 kg into the prepared seedbed in two directions in equal amounts.

For slopes greater than 3:1, a hydro-seeder of approved design capable of thoroughly mixing water, grass seed, fertilizer and pulverized wood fiber shall be used at the following rates:

- Grass Seed 24 kg/1000$m^2$
- Water 468 L/1000$m^2$
- Mulch 170 kg/1000$m^2$
- Fertilizer 50 kg/1000$m^2$

In lieu of using a hydro-seeder, seeding may be done by a mechanical dry seeder as described above, but the seeded slope shall be protected with an approved erosion control blanket installed to manufacturer's specifications to prevent erosion.

Make good any damage caused by seeding activities to the satisfaction of the City. Leave site in a neat and workmanlike condition. Any debris tracked onto roads, walks and trails to be cleaned after each workday, unless these areas are within fenced construction areas that are not accessible to the public or being used by City maintenance staff. Any damage to seeded areas to be addressed promptly.

Seeded areas are to be watered frequently and with a fine spray which will not create any erosion problems.

Approximately six weeks after germination the area shall receive a supplementary application of an organic fertilizer at rates determined by soils tests. If seed fails to germinate within four growing months re-cultivate and reseed until germination takes place.

Application for CCC for developments that include seeded areas cannot be made until which time evidence of germination is in place. Germination at CCC includes minimum 80% coverage of all seeded areas.

Continuously maintain and warranty landscape work as specified for a period of at least two (2) years from the issuance of a Complete Completion Certificate (CCC) and until the issuance of a Final Acceptance Certificate (FAC). At the time of FAC, seeded areas must be fully covered with vigorous growing grass, with no evidence of seed rows. Maintain all seeded areas in accordance with Part H: Construction Completion, Warranty Period and Final Acceptance.

For any development that includes seeded areas, the Developer is responsible for scheduling an interim inspection with the City, approximately one year after CCC. The purpose of this inspection is to ensure full coverage of seed and to ensure weed control has been completed during the first twelve months of growth. The City, at its own discretion, may inspect sites on a routine basis during the warranty period and require the Developer to mitigate for any concerns with germination, turf coverage and weed control. Refer to Part H: Construction Completion, Warranty Period and Final Acceptance for additional information.

Final inspection of seeded areas will be made prior to the end of the warranty period. At the time of inspection the turf should be mowed and shall be alive and in a healthy satisfactory growing condition, free of weeds. Areas that show root growth failure, deterioration, bare or thin spots or which have been damaged by any means will not be accepted by the City.

Recourse and Procedures for Inadequate Germination or Weed Control

It is understood that sites may not be fully germinated and entirely weed free at the time of CCC. An interim inspection after one full year of growth will identify germination, coverage of turf and weed control. The City maintains discretion to extend the warranty period of any site at the time of any interim inspection or at the time of FAC should inadequate germination, coverage or weed control be observed.

6.5.3 Supply and Installation of Sod

Guideline

Areas proposed for sod and sod type shall be pre-approved for application by the City of Fort Saskatchewan. Sod shall not be planted before May 1 or after September 15th, unless given consent in writing by the Client Representative. Sod which fails to establish for whatever reasons shall be re-planted at the Developers expense until establishment and satisfactory growth has been demonstrated.

Materials

Sod shall be certified No. 1 cultivated turf grass sod of the type as specified on the Plant List, grown and sold in accordance with the classification of the Nursery Sod Growers Association of Alberta and Western Turfgrass Association Standards. At time of sale it shall have a strong, fibrous root system and shall be free from stones and burned or bare spots. Sod shall consist of a uniform mixture of the industry standard mix as per Sod Growers Association of Alberta latest manual, or approved equal. Sod shall be cut by approved methods in accordance with the recommendations of the Sod Growers Association of Alberta and/or the Canadian Nursery Trade Association shall be:

- a minimum of eighteen months old;
- of a quality that satisfies weed tolerance rates as outlined by the Growers Association;
- 20 - 25mm in uniform thickness;
- cut in strips of uniform width;
- sufficiently moist so that no burning of the edges has occurred; and
- harvested at min. 12mm soil depth, cut uniform free of any holes and tears.

Water shall be free of any impurities that would inhibit germination or otherwise adversely affect growth.

Topsoil used as joint dressing shall be of best quality and screened.

Fertilizer shall be packed in standard containers, clearly marked with the name of the manufacturer, mass and analysis. Use only standard commercial fertilizer with guaranteed chemical analysis. Fertilizer to be stored in a dry location prior to use.

Installation

The Contractor shall obtain approval from the City Representative before proceeding with any sod installation to ensure proper topsoil placement. Sod shall not be laid before May 1 or after September 30, unless authorized in writing by the City Representative. Sod laying on slopes 3:1 or steeper shall not be done when temperature is above 23°C. Sod shall be laid evenly with staggered joints closely butted together and matched to the existing grades or surrounding areas. All areas shall be rolled with a medium roller (90 to 114 kg) to provide close contact between sod and topsoil and to produce a smooth and even surface. Sod shall be laid at right angles to the slope along the contours of the slope. On slopes of three horizontal to one vertical or steeper, pegs/staples shall be driven full depth on intervals of 1 m. horizontally and vertically.

The sod shall be watered sufficiently to saturate the upper 150mm of soil immediately after installation. After sod and soil has dried sufficiently to prevent damage, the area shall be again rolled with a medium roller to ensure a good bond between sod and soil and to remove minor depressions and irregularities. Adequate watering shall again be applied immediately following rolling to saturate the upper 150mm of soil. Watering shall be carried out when required to prevent grass and underlying soil from drying out for a minimum period of 15 days after placement or until the sod is well rooted and established.

The finished turf shall be smooth and even, and there shall be no sudden irregularities in the final grade.

Approximately four weeks after sod is laid, and after the initial cutting, the sod area shall receive an application of organic fertilizer, rates determined by soils tests.

Continuously maintain and warranty landscape work as specified for a period of at least two (2) years from the issuance of a Complete Completion Certificate (CCC) and until the issuance of a Final Acceptance Certificate (FAC). Maintain all sod areas in accordance with Part H: Construction Completion, Warranty Period and Final Acceptance.

Final inspection of sod areas will be made at the end of the warranty period. At the time of inspection the turf should be mowed and shall be alive and in a healthy satisfactory growing condition, free of weeds. Areas that show root growth failure, deterioration, bare or thin spots or which have been damaged by any means will not be accepted by the City. The City will accept topdressing and overseeding of sod for any area less than 1 sq.m. Areas larger than 1 sq.m. must have the dead sod cut and replaced with new sod. Any new sod must be fully established and well knit prior to FAC.

Make good any damage caused by sod activities to the satisfaction of the City. Leave site in a neat and workmanlike condition. Any debris tracked onto roads, walks and trails to be cleaned after each work day. Any damage to sod areas to be addressed promptly.

## 6.6 Plant Material

### 6.6.1 Guideline

Plant Source and Hardiness

All plant material shall conform to the horticultural standards of the "Canadian Nursery Trades Association" standards for the Fort Saskatchewan area. Nomenclature (plant names) shall conform to the rules of the international code of nomenclature for cultivated plants. All plants shall be nursery grown in Alberta, unless approved otherwise, of sound stock, typical of their species or variety.

Plant materials shall be healthy (free from damage, disease and pests, eggs or larvae), well-branched, densely foliated when in leaf with well-developed root systems and of the specified caliper and height. All undersized or girdling root systems will be rejected. Stock shall be free of mechanical damage. Tags shall remain until inspection is complete. Substitutes are not permitted unless pre-approved in writing by the City Representative.

Species of trees, shrubs, and ground covers shall be selected to suit the planting conditions and site locations. Fort Saskatchewan is situated between the Boreal Forest – Dry Mixed wood Natural Region and the Central Parkland Natural Region of the province. For parks, open spaces, and naturalization areas, diversity of species, aesthetics, hardiness, disease resistance, natural occurrence, rate of growth and growth habit, and ratio of trees, shrubs, and perennials shall be considered when selecting varieties. Special consideration shall be given to the suitability of a species (including size, growth habit, hardiness, and maintainability) for boulevard and median plantings.

Prior to installation trees and shrubs may be pre-selected at the nursery. This however does not ensure that trees will be accepted by the City when they arrive on site as damages that occur while in transit may over-ride acceptance at the nursery. The Developer is responsible to ensure all plant materials arrive safely, without damage and in a healthy growing condition.

Plant Material Selection

The City encourages a diversity of trees and shrubs throughout its public realm. Designers are encouraged to specify a range of species, while ensuring species are well suited to the region, actual site soils and other growing conditions presented by each site.

For some species and varieties that are unknown to the City or have yet to be used in Fort Saskatchewan, the City may require clarification or more research by the Applicant to justify the selection and to demonstrate local hardiness and suitability. All proposed plant material must be hardy to minimum Zone 3b, referring to the Plant Hardiness Zone by Municipality charts published by Natural Resources Canada, Government of Canada. All plant material must be certified plants, sourced from an Alberta-based nursery or growing operation. Proof of source may be requested by the City prior to delivery and installation. Any proposed substitutions after drawing approval will require approval by the City.

Tree selection criteria include:

- trees that provide adequate, year-round sightlines maintained for pedestrian and vehicular safety;
- minimum 1.8m branching height for all trees adjacent to roadways and walkways;
- trees with a single and sturdy vertical trunk with a well-balanced crown and fully developed leader, unless uncharacteristic for that species;
- trees with a single and prominent central leader and balanced branching habit. They must be tree from disease and insect pests, eggs or larvae, rodent damage, sunscald, frost cracks and other abrasions or scars to the bark;
- plant material that is structurally sound, healthy and vigorous, well branched and densely foliated when in leaf;
- alternating patterns of trees along streetscapes to avoid a monoculture of trees in a particular area; and
- no fruit bearing trees or oak trees to be placed near any sidewalk or trail near streets or boulevards but will be considered in along trails in open spaces.

Non-Permitted and Discretionary Plant Material

The following are non-permitted tree and shrub species that the City will not accept for planting. This list also includes discretionary plants, which may only be used with special consent by the City Representative. The City may, from time to time, amend this list on an annual basis as a result of new research, pests in the area, and other factors. Developers and their Developer Representatives should refer to the City website for any annual updates to this list of non-permitted species.

| Non-Permitted Trees/Shrubs | |
|---|---|
| Any known invasive species, as listed by the Alberta Invasive Plants Council | |
| Caragana arborescens | Caragana |
| Elaeagnus angustifolia | Russian Olive |
| Populus tremuloides erecta | Swedish Aspen |
| Prunus padus commutate | Mayday |
| Prunus virginiana 'Shubert' | Shubert Chokecherry |
| Tamarix spp. | Salt Cedar |
| | |
| Discretionary Trees/Shrubs | |
| Acer negundo | Manitoba Maple |
| Acer platinoides | Norway Maple |
| Berberis vulgaris | Japanese Barberry |
| Berberis incana | Common Barberry |
| Cotoneaster acutifolia | Peking Cotoneaster |
| Cotoneaster integerrimus | Red-Fruited Cotoneaster |
| Cotoneaster nigra | Dark-Seeded Cotoneaster |
| Elaegnus umbellate | Autumn Olive |
| Fraxinus pennsylvanica | Green Ash |
| Hippophae rhamnoides | Sea Buckthorn |
| Lonicera tararica | Tatarian Honeysuckle |
| Picea abies | Norway Spruce |
| Pinus sylvestris | Scotch Pine |
| Populus alba | White Poplar |
| Rhamnus cathartica | Common Buckthorn |
| Rhamnus frangula (Frangula alnus) | Glossy Buckthorn |
| Sambucus racemose var. pubens | Elderberry |
| Sorbus aucuparia | European Mountain Ash |
| Syringa reticulate | Japanese Lilac |
| Syringa vulgaris | Common Lilac |
| Ulmus pumila | Siberian Elm |
| Viburnum opulus | European Highbush Cranberry |

6.6.2 Materials

The planting of trees less than 40mm caliper shall only be undertaken on pre-approval in writing from the City of Fort Saskatchewan.

Trees larger than 40mm shall be referenced by caliper. Caliper shall be measured by:

- Deciduous trees with a caliper up to 100mm shall be measured no less than 15cm above the ground.

- Deciduous trees with a caliper 100mm and larger shall be measured no less than 30cm above the ground.

Deciduous trees 100mm caliper and larger shall be machine dug as noted in table 2 and 3. Balled and burlapped trees shall be dug with firm natural balls of earth to sufficiently include most of the fibrous roots. Ball sizes shall meet the specifications noted in table 2 and 3.

Container grown trees shall be locally grown in a container for a minimum of two years and shall have a fully developed root system to sufficiently hold its soil together - no plants shall be loose in the container. Soil shall have sufficient moisture.

Table 2 - Deciduous Trees

| Caliper (mm) | Root Ball Diameter (mm) | Machine Ball Diameter (mm) |
|---|---|---|
| 25 | 600 | N/A |
| 50 | 750 | 860 |
| 75 | 900 | 1220 |
| 100 - 125 | N/A | 1520 |
| 150 - 250 | N/A | 2280 |

Table 3 - Coniferous Trees

| Height (m) | Root Ball Diameter (mm) | Machine Ball Diameter (mm) |
|---|---|---|
| 1.5 - 2.4 | 900 | 1220 |
| 2.4 - 3.0 | 1220 | 1520 |
| 3.0 - 3.5 | 1220 | 2280 |

Bare Root Shrubs shall be planted with adequate fibrous roots retained. The minimum size of root balls for shrubs shall be as specified by the Canadian Nursery Trades Association. Container grown shrubs shall be locally grown in containers for a minimum of two years. Container sizes shall be as specified by the Canadian Nursery Trades Association.

Fertilizers shall be 8-24-24 or approved equal delivered as specified in standard size, unopened containers, showing the weight, analysis and manufacturer's name, and will specify as either coniferous or deciduous.

Tree stakes shall be 2.0 - 2.5m in length and of the steel "T" bar type. Tree ties shall be a number ten (#10) gauge galvanized wire inserted into a 200 mm length of 10mm diameter polyethylene plastic tubing. Tree ties shall be marked with orange flagging.

Water shall be free of any impurities that would inhibit germination or otherwise adversely affect growth.

Any wood type mulch is acceptable except that which is chemically treated or is salvaged from construction lumber, building demolition, or shipping waste. Coarsely ground mulch is preferred; otherwise use an even mixture in a range of sizes from 10mm x 10mm x 5mm to 40mm x 60mm x 35mm. Material should have no more than 5% by volume of soil, sawdust, peat moss, or needles. The best material is pulled out of piles that have composted for a year. No mulch from diseased or infested plant material is allowed unless it can be shown the material presents no risk to tree health.

6.6.3 Installation

The following table includes required spacing between various trees. Spacing is measured at the center of the tree trunk.

Table 4 – Blvd Tree Planting Spacing

| Species | Min Blvd Width (m) | Min Spacing (m) | Max Spacing (m) |
|---|---|---|---|
| American Elm | 2.0 | 15.0 | 20.0 |
| Brandon Elm | 2.0 | 10.0 | 15.0 |
| Green Ash | 2.0 | 9.0 | 14.0 |
| Prairie Spire Green Ash | 2.0 | 8.0 | 14.0 |
| Foothill Green Ash | 2.0 | 8.0 | 14.0 |
| Patmore Green Ash | 2.0 | 7.0 | 12.0 |
| Crimson Sentry Maple | 2.0 | 4.0 | 10.0 |
| Redmond Linden | 2.0 | 6.5 | 12.0 |
| Bur Oak | 2.0 | 9.5 | 14.0 |
| Ohio Buckeye | 2.0 | 4.5 | 10.0 |
| Silver Cloud Maple | 2.0 | 7.0 | 12.0 |
| Columnar Norway Maple | 2.0 | 2.0 | 6.0 |
| Japanese Tree Lilac | 2.0 | 4.0 | 10.0 |
| Red Rocket Maple | 2.0 | 2.0 | 5.0 |
| Purple Spire Crabapple | 2.0 | 1.4 | 5.0 |
| Pinacle Birch | 2.0 | 1.6 | 5.0 |
| Amur Maple | 2.0 | 3.0 | 8.0 |
| Parkland Pillar Birch | 2.0 | 1.4 | 5.0 |
| Swedish Columnar Aspen | 2.0 | 3.0 | 5.0 |

The following distances are minimum setbacks of trees from various site features. Spacing is measured from the closest edge of any site feature to the center of the tree trunk.

Table 5 – Minimum Setback Distance

| Site Feature | Min Setback (m) |
|---|---|
| Street Corner | 7.5 |
| Light Poles | 3.5 |
| Stop and Yield Signs | 4 |
| Bus Stops | 4 |
| Other Signs | 2 |
| Driveways and Walkways | 2 |
| Fire Hydrants | 2 |
| Underground and Overhead Utilities, Pedestals, Transformers, and other Street Furniture | 2 |

The following table outlines the minimum size of trees permitted to be planted. Smaller planting sizes are only permitted with consent in writing by the City Representative. Any trees that do not meet the minimum size specifications as note below may not be included in the total plant count of a site, at the discretion of the City.

Table 6 – Minimum Size Specification

| | Size |
|---|---|
| Deciduous Trees | 50mm Caliper at 15cm Above Ground |
| Coniferous Trees | 2.0m in Height |

Shrub beds shall be located as indicated on the approved drawings and staked on site so the limits of the bed can be assessed prior to excavation and planting.

Trees are to be planted as follows:

- Tree pits shall be excavated 450mm (18 inches) greater in diameter than the ball of earth or spread of roots of the tree and deep enough to allow for a 150mm well compacted layer of the planting mixture beneath the ball or roots.
- Trees shall be set straight in the Centre of the pits, the root flare of the plant will be at the surrounding finished grade. Trees shall be faced to give the best appearance or relationship to adjacent structures, walkways or park features.
- Topsoil shall be backfilled in lifts not exceeding 300mm in depth. Each lift of soil shall be compacted to approximately 85% Standard Procter Density. Apply fertilizer as recommended by soil test or as noted on approved drawings.
- The top third of the wire basket must be cut off or folded down. All treated burlap is to be removed. Non-treated burlap can be pulled back and left.

- All plants shall be pruned after planting to the minimum necessary to remove dead or injured branches and to compensate for the loss of roots. Pruning practice shall be completed according to the I.S.A.
- A 75mm high x 1000mm diameter ring of topsoil shall be constructed around each tree with the tree trunk centered in the ring to facilitate watering. This ring will be covered entirely by mulch.
- Each tree shall be well watered at the time of planting. A regular schedule of watering shall continue until maintenance period expires.

Trees are to be staked as follows:

- Deciduous Trees (bare root) shall be supported by a tree stake driven securely into the ground, plumb, on the windward side of the prevailing wind. The tree shall be fastened to the stake with a tree tie. (See Std. Dwg. H2.1)
- Evergreens and Deciduous Trees (Balled and Burlapped and machine planted) shall be supported by two (2) steel bars driven securely into the ground and fastened with a tree tie. Stakes shall be driven outside of the root ball. (See Std. Dwg.)

All newly planted trees are to be protected at the base with a horticulturally approved arbor guard.

Shrub beds to be prepared to a depth of 450mm below finished grade. Installation to include 600mm depth topsoil (clay subgrade) or 750mm depth topsoil (sand subgrade), and 100mm depth wood chip mulch or other specified decorative mulch. Install aluminum edger at min. 400mm depth all around beds as per manufacturer's specifications and flush with finished grade. Edger is not required where beds interface with paved surfaces.

Fertilizer shall be applied evenly over the pit at the following rates when approximately two thirds of the plant pit has been backfilled with soil:

| Application | Application Rate |
|---|---|
| Vines, Groundcover | 0.03 Kg/plant |
| Herbacious Plants | 0.03 Kg/plant |
| Small Shrubs | 0.06 Kg/plant |
| Small Trees | 0.25 Kg/25 mm of caliper |
| Shade Trees | 0.50 Kg/25 mm of caliper |
| Evergreens | 0.03 Kg/300 mm of height |

All tree pits and shrub beds shall be mulched to a depth of 100mm. Mulch shall be kept back a minimum of 50mm from the base/trunks of each shrub/tree.

Continuously maintain and warranty all trees and shrubs for a period of at least two (2) years from the issuance of a Complete Completion Certificate (CCC) and until the issuance of a Final Acceptance Certificate (FAC). Maintenance shall include all measures necessary for and incidental to the establishment of all plants in an acceptable, vigorous and healthy growing condition. Maintenance includes the cultivation, edging and weeding of shrub beds and tree pits.

Replacements of dead/unacceptable plants shall be made within 72 hours of notification unless arrangements are otherwise made and agreed to in writing. Refer to Part H: Construction Completion, Warranty Period and Final Acceptance.

Final inspection of trees and shrubs will be made prior to the end of the warranty period. At the time of inspection trees and shrubs shall be alive and in a healthy satisfactory growing condition. Trees that have been recently replaced or are dead, damaged, diseased will not be accepted by the City. All plant material must be in place for no less than 12 months prior to FAC in order to be considered for acceptance.

Subject to approval from the City of Fort Saskatchewan Parks Department, the City will consider a cash in lieu payment for extended warranty or tree replacements when less than 5% of the tree material does not pass final inspection. The fee for the City to take over the warranty of the tree will be $250 per tree.

Make good any damage caused by planting activities to the satisfaction of the City. Leave site in a neat and workmanlike condition. Any debris tracked onto roads, walks and trails to be cleaned after each work day, unless these areas are within fenced construction areas that are not accessible to the public or being used by City maintenance staff. Any damage done by planting activities to be addressed promptly.

### 6.6.4 Planting Requirements

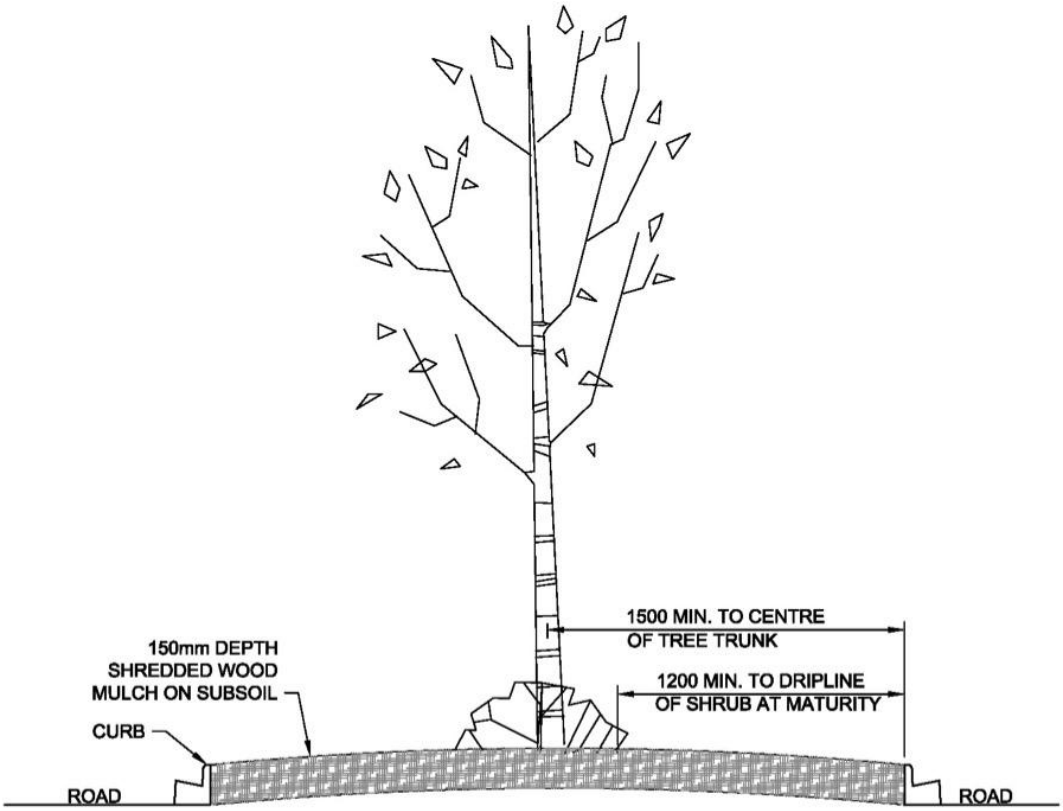
#### Entrance Feature Areas

Plantings surrounding entrance features may be implemented at the discretion of the City. All designs for special entrance features shall be subject to review by the City as a special consideration. Plant materials will not be part of planting count requirements for any open space. Entrance feature planting shall be low maintenance, and can only consist of trees and shrubs. Shrubs must be massed within planting beds, with deciduous shrubs minimum 500mm ht. and coniferous shrubs minimum 400mm spd. Shrub beds are only permitted at entrance features and roadway island areas, and not within boulevards, PULs or MR's.

#### Roadway Islands

Roadway islands may be entirely mulched and filled with low lying shrubs that have a maximum mature height of 750mm, however the City's preference is to have islands limited to hard surfacing such as continuous concrete. Islands may not have any plantings within 1.2m of the outside curb of the island, measured to the drip line of the plant material at its maturity. All islands must be filled with adequate topsoil, positively drained from the middle of the island outward to the curb in all directions and covered in min. 100mm depth shredded wood chip mulch. Only deciduous trees that have a minimum branching height of 1.75m may be planted in roadway islands. Trees may not be planted within 1.5m from any curb and can only be planted in islands min. 3.0m dia.

The following diagram demonstrates the minimum setbacks for medians and islands.




MEDIAN AND ISLAND SETBACKS

Medians

Medians that are less than 3.0m wide must be entirely mulched or covered in concrete surfacing, and may not contain any plant material. Medians equal to or greater than 3.0m wide must be and filled with low lying shrubs that have a maximum mature height of 750mm. Medians may not have any plantings within 1.2m of the outside curb of the island, measured to the drip line of the plant material at its maturity. Islands that are 3.0m or greater in width may include portions in sod where plantings are not included. Seeding is not permitted, and all grass areas must be sod. Only deciduous trees that have a minimum branching height of 1.75m may be planted in roadway islands. Trees may not be planted within 1.5m from any curb and can only be planted in medians equal to or greater than 3.0m in width.

The above diagram demonstrates the minimum setbacks for medians and islands.

Municipal Reserve

All MR areas require 75 trees per hectare, measuring the entire land parcel and excluding the area of any proposed buildings or parking lots (ie. in the instance of school sites). Trees may be substituted with shrubs at a rate of five shrubs to one tree. Shrub beds are not permitted in MRs, with exception to beds placed at the entrance of communities or in roadway islands.

## 6.7 Site Amenities

### 6.7.1 Trails

Public Open Space may contain either gravel, paved asphalt or concrete trails. The following includes minimum trail widths:

- gravel trails min. 1.5m;
- paved asphalt trails min. 3.0m; and
- concrete trails min. 1.5m.

Trails anticipated to have intensive use or in MR areas that have wintertime activities possible, asphalt trails will be required. Gravel trails are only permitted in areas of public open space with only summertime activities. Trail lights may be required at regular intervals along all paved multi-use trails, at the discretion of the City.

### 6.7.2 Pedestrian Furniture and Signage

Pedestrian furniture must be installed in MR areas, including benches and waste/recycling receptacles. Furniture should be installed in highly visible areas, along trails and on furniture pads. The following lists the standard furniture for all open space development in the City:

- benches – See detail L-10;
- picnic tables – See detail L-11;
- bicycle racks – Model 101 (in-ground mounted) or Model 102 (surface mounted), by Maglin Site Furniture (or approved equal). All components to be powder coated black; and
- waste/recycling receptacles – Model SP-HBIS-N (waste) and Model SP-HBIS-Y (recycling) by Haul-All Equipment Systems.

Furniture shall not be installed until which time all trails have been installed, and surrounding turf has been established to avoid causing premature intensive use of certain areas.

#### General

Select and locate furniture elements to provide service and comfort to the park user. Locate signs and furnishings on the basis of:

- safety to park user and maintenance crews, consider pedestrians, cyclists, skiers, individuals with roller blades, etc., and maintenance vehicles;
- facilitate routine operational and maintenance programs; and
- minimize clutter in the landscape, select and locate signs of necessity considering safety of park user and key information.

Supply all labor, equipment, materials, products and incidentals necessary to complete signs and furnishings ready for public use. Assemble and finish items ready for installation. Check to ensure all surfaces are smooth to touch, all splinters and burrs removed and marred finishes repaired or refinished. Damaged components shall be repaired or replaced at the direction of the City. When requested, supply extra materials to City's storage facility.

Make no deliveries until site conditions are adequate to receive this work. Protect materials from weather while in transit to site. Adequately protect finished surfaces during handling and shipping.

Do not install furnishings and signs which encourage public use until the site is ready to sustain such use safely and without damage to surrounding areas. Mark proposed location of signs and furniture items in the field. Prior to continuing with construction, the Owner shall review proposed locations and the Contractor shall have underground utilities marked. Supply and install bollard posts, T-bollards and other barriers as soon as possible. Supply and install safety signs as soon as possible. The Contractor must notify the City as soon as bollards are installed so that City supplied locks can be installed immediately after installation.

All materials and workmanship shall be guaranteed for two years from date of sign and/or furnishing installation.

Materials and Finishes

20 mm Crushed Gravel: locally available sound, hard durable particles free from elongated particles, soft shale, organic or other materials.

For concrete piles, supply "Controlled Concrete" with 28-day strengths as defined by CAN3-A23.1-M90 in accordance with following table:

| | |
|---|---|
| Concrete Strength (Minimum) | 25 MPa |
| Cement Type | 50 |
| Exposure Class | S-3 |
| Air Content | 5-7% |
| Aggregate Size (Maximum) | 20 mm |
| Slump | 80 ± 20 mm |

For concrete slabs, concrete to meet following requirements:

| | |
|---|---|
| Concrete Strength (Minimum) | 30 MPa |
| Cement Type | 10 |
| Exposure Class | C-2 |
| Air Content | 5-7% |
| Aggregate Size (Maximum) | 20 mm |
| Slump | 60 ± 20 mm |

| | |
|---|---|
| Strength | 28 day compressive strength per CSA.A23.2 |
| Type | Cement type as defined in CSA.A23.1 clause 3 |
| Exposure | Class of exposure per CSA.A23.1 clause 15 for determination of water cement ratio |
| Air | Air content % by volume; N = natural air - no air entraining agent |
| Slump | As determined in accordance with CSA.A23.2-5C |

- Add air entraining agent to CAN-A23.1-M90, Section 6;
- Curing Compound: Liquid membrane conforming to CAN3-A23.1-M90;
- Preformed Joint Filler: Asphalt impregnated type to ASTM D1751-73;
- Poured Joint Filler: Asphalt elastic compound to ASTM D1190-74 (1980);
- Welded Wire Fabric: 150 x 150 - MW 11.1 x M2 11.1 welded wire mesh to CSA G30.5M, flat sheets;
- Reinforcing Steel: 10 M bars to CSA G30.12-M77;

- Forms: pre-manufactured and profiled steel forms, wooden or steel forms for curved sections; and
- Form oil: non-staining mineral type.

Wood timbers to meet the following requirements:

- Wood bollard posts and posts for title sign, 250 x 250 square, spruce, pressure preserved CCA-PEG or ACZA, green. CAN/CSA O 80.0-M89, M1-89, M3-89 and CAN/CSA - O 80.1-M89, Preservative Treatment of All Timber Products by Pressure Processes, and CAN/CSA - O 80.5-M89, Preservative Treatment of Posts by Pressure Processes;
- Wood shall be incised;
- Wood members round or sawn greater than 114 mm shall be treated by full cell process;
- All lumber shall be stamped ACA or CCA;
- All lumber shall be dried to a moisture content not exceeding 25%; and
- Cut ends of timbers shall be carefully painted with two (2) coats green CCA or ACA preservative to match preservative used on timbers. Apply to manufacturer's specification.

Lumber for trail signs shall be green CCA or ACA pressure preserved spruce, incised wood to same specification as wood timbers.

Lumber for benches and picnic tables shall be green CCA or ACA pressure preserved, S4S, non-incised pine, same as specification for wood timbers. Knots shall be firm, without gaps and not exceed 1/4 of the lumber face. All lumber surfaces shall be sanded smooth to touch.

Brush on preservative for cut ends to match lumber preservative and to manufacturer's specifications.

All fasteners shall be weatherproof cadmium coated, stainless steel, galvanized, ardox, etc. Fasteners shall be supplied as specified. If changes are required due to supply conditions, discuss and receive approval of Owner prior to substitutions.

Waste containers to be as follows:

- Waste containers shall be Haul-All Equipment Systems - HID-A-BAG I, HID-A-BAG II and HID-A-BAG MINI as required by the site and program or approved equal;
- Waste containers shall be supplied in custom colour in polyester powder coat finish to match item H - 8.2 below; and
- Waste container(s) shall be mounted on a concrete slab, sized so to extend a minimum of 300mm beyond all edges of the container and to finish level and flush with adjacent walk, trail or other pedestrian surface. Front face of container shall be located a minimum of 900mm clear to edge of adjacent trail. Clearance to any obstruction at the back of the unit minimum 1200mm.

All fabricated metal frames and fasteners shall be hot dipped galvanized to 550 $g/m^2$ coating.

Hot dip galvanizing shall occur after complete assembly and manufacture of each full component. In the fabrication of each metal component for galvanizing, drain holes shall be provided in hollow tube frames as needed to properly drain galvanic bath. Fasteners which are otherwise weatherproof, i.e., cadmium coated, stainless steel, aluminum etc., shall not be galvanized.

Trail signs to meet the following requirements:

- Sign panels shall be 200 x 200mm, 0.2cm aluminium panel, with message in reflective plastic sheeting to CGSB 62--GP-3a high intensity "Scotchlite" by 3M. Message element shall be white with dark blue background;
- Sign panels shall be fastened with a minimum of two (2) stainless steel security screws 20mm length; and
- A maximum of three sign panels shall be installed on any single face of the trail signage.

Title signs to meet the following requirements:

- Title signs shall be considered only for major parks that provide sports and/or recreation facilities of interest to the entire community and visiting teams;
- Signs shall be located so to be clearly visible from arterial and collector streets, but not to interfere with safe transportation sight lines;
- Proposed location of sign shall be staked on site. The City shall review the proposed location. Thereafter, underground utilities shall be marked and location adjusted if necessary;
- City logo shall be provided as a self-adhesive decal. Sign panels for key park facilities shall be to the same specification as trail sign panels. Park facility panels shall be 300mm x 300mm and fastened with four (4) stainless steel security screws; and
- The sign manufacturer shall select and warranty materials, finishes and fabrication methods against deterioration, other than normal surface weathering, for a period of five (5) years.

Interpretive signs to meet the following requirements:

- Permanent interpretive signs shall be considered only in areas where continuously new audiences occur Interpretive signs shall be custom designed to suit the setting and program to which they provide information. Mounting height and angle (if any) shall be determined on the basis of the audience to be served. When preparing sign panels minimize text and maximize graphic information;
- Original artwork shall be prepared for the City and supplied to the sign manufacturer. Sign size, story line, panel(s) layout, proposed graphics, text and type styles shall be progressively reviewed by the City and any special interest group(s) or individuals as sign design progresses;
- All graphic materials shall be accurately annotated and credited
- All spelling and grammar shall be proofed by an independent editor.;
- Original artwork shall remain the property of the City; and
- The message panels can be of the following systems:
  Photo Aluminium Sign Panels
  Porcelain Enamel Panels.

Dog waste bag dispensers are required at the entrance of all parks, located at trail heads or primary access points to a neighbourhood, community or regional park:

- Dispensers to be style SINGLPul, dark green in colour, supplied by Sudden Fun Equipment, Tel. 403.254.0500 or 1.800.490.0501 or approved equal.

Execution

All signs, furniture items and buildings shall be staked in the field to illustrate proposed location and finished elevation of slabs. Prior to continuing construction, staking shall be reviewed and approved by the City and Developer's Representative, and underground utilities shall be located and marked.

Dog waste bag dispensers to be mounted to wood signage posts at the entrance of parks no less than 1.0m from the ground.

Prior to commencing construction coordinate access point(s) and route(s) materials storage on-site and site preparation (clearing, grubbing, pruning, topsoil stripping, pavement demolition, cutting and patching) necessary to complete supply and installation.

If not included in a comprehensive construction package, specify site restoration and construction clean-up requirements of supply and installation contract. As a minimum, site will be restored to the condition in which it was received. The Developer shall be responsible for repairing and/or replacing at no cost to the City, all work of others and site development damaged by his activities.

New materials, best of their kind only, shall be utilized in the work. The Developer shall inspect and pre-select materials, removing any substandard and unacceptable materials and/or component assemblies.

The Developer shall hire contractors, subcontractors, workers and suppliers who are experienced and knowledgeable in the work for which they are engaged. The Developer shall be responsible for the actions and safety of its contractors, subcontractors, employees and suppliers.

The work site(s) shall be signed, barricaded and controlled to ensure public safety. The City shall not be responsible for theft, fire or damage to the work until following FAC of the work.

All picnic tables, benches and waste containers shall be installed on concrete, or other hard surfaces. Hard surfaces shall extend for a minimum of 600mm beyond the extremities of picnic tables and benches and to Section H - 10.7.a. for waste containers. Hard surfaces shall finish flush with surrounding grade.

All signs shall be installed plumb and vertical.

All furnishings shall be installed to fall with surrounding grade. Where slope exceeds 4% (1in 25) the furniture pad and/or activity area shall be leveled to produce a slope, not less than 1.5% (1 in 66), or greater than 4% (1 in 25).

6.7.3 Wood Screen Fencing & Gates

Description

All uniform wood and metal fencing and gates shall be constructed and installed in accordance with standard detailed drawings H1.1 to H1.10. Uniform wood fencing shall be constructed adjacent to the following:

- expressways and arterial roadways;
- parks and playfields;
- public walkways and utility lots;
- city-owned lands;

- school sites;
- multiple family sites;
- neighborhood commercial sites;
- institutional sites; and
- other areas as required by the City.

All wooden fence material shall be pressure treated cedar or approved alternative and stained or painted (2 coats). The Developer shall be responsible for, and at its own expense, correcting any defect, deficiency or fault in the completed work prior to the end of the specified maintenance period. The work is to comply with the applicable requirements of the Alberta Building Code, latest revision thereof.

Materials

All materials used are subject to inspection and approval by the City. Materials must be protected from weather at all times.

All lumber is to be graded by an agency certified by the Canadian Lumber Standards Administrative Board and marked with a recognized, visible grade stamp.

Dimension Board Lumber Graded in accordance with National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber and to CSA 0141-1970 and meeting the following criteria:

- maximum 19% moisture content at time of installation; and
- lumber to be rough sawn to sizes noted on the drawings.

Nails and Spikes in accordance with Alberta Building Code 1981 and as follows:
- use common spiral nails except where indicated otherwise; and
- use hot tip galvanized finished steel for exposed exterior work.

Bolt, nut, washer, screw and pin type fasteners: hot dip galvanized sheet steel finish to CSA G164-1955 (R1972)

Rail Bracket:
- minimum 1.6mm sheet, galvanized;
- configuration to suit detail; and
- to be approved by the Owner prior to installation.

Fence Post U-Bracket to be 800 x 152 x 100mm wide x 6.25mm thick galvanized sheet steel.

Man Gate Hinges to be No. 311 x 165mm, quantity - 1 pair, manufactured by Richards- Wilcox Manufacturing company or approved equal.

Bow Handles to be no. 81-#2, (200mm long) quantity - 2, No. 81-#1 quantity - 1, manufactured by Richards - Wilcox Manufacturing Company Limited or approved equal.

Cane Bottom bolt to be No. 524-#2 (19 x 600mm long) quantity 7 - 2, with keepers, manufactured by Richards - Wilcox Manufacturing Company or approved equal.

Man Gate Latch to be No. 128-#2 (12 x 200mm long), quantity - 1, manufactured by Richards - Wilcox Manufacturing Company, or approved equal. Furnish with padlock eye.

Chain to be 38.1 x 22.2 x 6.35mm diameter galvanized steel, electro-weld type chain, 600mm long to be looped through vehicle gate bow handles and secured with padlock. Padlock to be supplied by the private property owner.

Surface Applied Wood Preservative

Surface apply Cuprinol clear stain or approved equal wood preservative to all wood components. Treat surface of components with wood preservative before installation. Wherever possible apply preservative after components have been cut and fitted to size. Apply preservative by dipping, or by brush or spray to completely saturate and maintain wet film on surface for minimum 3-minute soak on lumber.

Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of surface applied wood preservative before installation.

Wood Fence and Gate Components

All work to be fabricated and finished as shown on drawings. Members shall fit close and accurately together. Verify all dimensions on site prior to proceeding with fabrication. Whenever possible, members shall be precut prior to treatment. Site cuts are to be treated with two coats preservative brushed in. Allow preservative to cure prior to erecting members. Ensure all ardox nails are installed flush to fence slats.

Fence post brackets to be cast in concrete footings as detailed so that final post alignment is plumb. Supply all components required for anchoring fence posts to concrete footings.

The wood fence shall provide a firm continuous structure. Finished unit should not utilize any cracked or damaged timber panels or posts. Height of fence panels to remain constant above grade. Difference in height of fence panel in relation to next panel due to grade change to be taken up at fence post between panels.

Use Type 50 Sulfate Resistant with compressive strength of 25 MPa at 28 days.

6.7.4 Chain Link Fencing

Material

Pipe material used for fencing shall be hot-dipped, zinc-coated, butt-welded, Schedule 40 seamless steel pipe fabricated in conformance with ASTM A120. Zinc coating shall be not less than 0.61 kg per square meter of total surface area. The use of tubing, conduit, or open seam material will not be permitted. Pipe material shall have the following minimum dimensions:

1.8m Fencing

| Type of Post | Outside Dia. (mm) | Min. Weight Per Meter | Min. Wall Thickness |
|---|---|---|---|
| Line Post | 60 | 5.43 | 3.91 |
| Terminal Post | 90 | 11.30 | 5.49 |
| Top Rail | 42 | 3.40 | 3.56 |
| Brace | 42 | 3.40 | 3.56 |
| Gate Post | 100 | 13.60 | 5.74 |

1.2m Fencing

| Type of Post | Outside Dia. (mm) | Min. Weight Per Meter | Min. Wall Thickness |
|---|---|---|---|
| Line Post | 47 | 5.43 | 3.91 |
| Terminal Post | 73 | 11.30 | 5.49 |
| Top Rail | 42 | 3.40 | 3.56 |
| Brace | 42 | 3.40 | 3.56 |
| Gate Post | 100 | 13.60 | 5.74 |

Line posts support fencing at points where fabric is continuous. In wet areas they are to be a minimum 3600mm length. (See Std. Dwg.). All posts are to be capped.

Terminal posts are end posts, corner posts, straining posts, and gate posts, positioned where fencing or fabric is discontinuous and attached to posts by means of tension bars. Posts for barb wire overhang are to be 1050mm longer than fabric height.

Top rails are horizontal pipes supporting the top selvage of fabric. Top rails shall be continuous at line posts and pass through holes in line post tops.

Braces are horizontal galvanized 45mm CD pipes positioned at mid-height of fabric and shall extend from terminal posts to the nearest line post along each fabric attached to the terminal post. All fittings shall be galvanized steel or aluminum.

Tension bars shall be 5 x 19mm and shall have a length equal to the height of the fabric.

Tension bands shall be not less than 9mm in width and shall be not less than 3.5mm in thickness.

Couplings shall be an outside type, not less than 175mm in length, and shall have a material thickness of not less than 3.5mm.

Extension arms shall be malleable iron or cast iron and shall have provision to accommodate 3 strands of barbed wire at $45^{o}$ angle overhand. The top strand of barbed wire shall be approximately 300mm above the fabric. Extension arms shall have holes for top rails.

Post tops shall be of galvanized steel or aluminum. Line post tops shall have holes for top rails.

Zinc coating shall be applied to tension bars, tension bands, fittings, and post tops which are not fabricated from corrosion-resistant material. Zinc coating shall be not less than 0.61 $kg/m^2$ of surface area and shall be applied by hot-dip in conformance with ASTM A123.

Tension wire shall be not less than 4.8mm diameter, single strand, electro-galvanized wire that will withstand at least 6 dips in conformance with ASTM A239. Fabric shall be double galvanized 150 x 150mm, 3.7 - 180mm high (See Std. Dwg.). Tension wire shall have an ultimate tensile strength at least equal to that specified for wire for chain link fabric and shall have a corrosion protection system equal to that specified for fabric.

Barbed wire to be galvanized 2mm thickness with 4 point barbs at 150mm centers wire to ASTM A121-77. Fastening clips galvanized to wire.

Gates requirements are as follows:

- gates to be framed with steel pipe ASTM A120-77 standard galvanized. Use 45mm O.D. pipe for outside frame and 40mm O.D. pipe for bracing. Galvanize after welding
- Gate posts to conform to the following:

| Opening | Gate Post O.D. |
|---|---|
| Single to 3.0m and double to 6.0m | 90mm 2 hinges per leaf |
| Single from 3.0m to 4.3m and double to 6.0m | 114mm 3 hinges per leaf provide brace |
| Single from 4.3m to 7.6m and double from 8.5m to 12.2m | 170mm 3 hinges per leaf provide brace |

- gate fabric to be 3.7mm galvanized Chain link with 50 x 50 mm mesh;
- gates shall be fabricated with electrically-welded joints, complete with galvanized, malleable iron hinges, lockable latch & latch catch;
- gate latches shall be suitable for padlock which can be attached and operated from either side of the gate;
- gate hinges shall permit a 90º swing both in and out; and
- double gates to have centre rest with drop bolt for closed position and chain hold open for open position.

Concrete requirements are as follows:

- compressive strength 25 MPa at 28 days;
- use type 50 Sulfate Resistant Cement;
- shop drawings of gates and related appurtenances shall be approved by the Developer and submitted to the City by email to landscape@fortsask.ca for review prior to fabrication of assembly.

Workmanship

Remove debris and grade between posts to provide ground clearance between 40mm and 70mm.

All posts shall be set in concrete and the concrete extended above ground (approximately 25mm) for drainage.

Concrete foundations shall be of such size and shape as required to withstand any strain or shocks ordinarily brought to bear on the fence, but not less than indicated below:

| Post Type | Diameter of Concrete (mm) | Depth of Concrete (mm) |
|---|---|---|
| Line Post | 300 | 1100 |
| Terminal Post | 300 | 1100 |
| Gate Post 100mm OD | 300 | 1100 |

- concrete for footings shall be compacted by interval vibrator or by rodding and shall be allowed to set sufficiently before cutting fence - minimum 5 days; and
- if forms are used, compact backfill to density of adjacent in-situ soil.

Posts shall be set in concrete footings plumb and true to line. Spaces between line posts shall be uniform and shall not exceed 3.0m. Install straining posts where required.

Top rails shall be secured to terminal posts using receptacle fittings, shall be run through holes in line post tops and joined with couplings.

Chain link fabric shall be suitably tensioned. Fabric shall be attached to terminal posts using tension bars and bands. Tension bars shall be threaded through fabric mesh and shall be connected to terminal posts by means of tension bands spaced not more than 375mm apart. Fabric shall be fastened with tie wire to line posts at approximately 300mm o/c, and to top rails, braces, and tension wire at approximately 450mm o/c. The bottom selvage of fabric shall be approximately 50mm, but no more than 125mm, above finished grade.

Bottom tension wire shall be strung along the bottom selvage of the fabric, pulled taut, and firmly attached to terminal posts with suitable fittings.

Gates shall be installed at locations shown on the drawings or as directed by the City Representative. Gates shall be hung to be level and 50mm above finished grade. Gates shall swing into the site 90 degrees. A gate "Spot Post" or other means shall be provided to hold the gate open. Gates shall be so constructed that they can be opened and closed smoothly with minimum effort.

Touch up damaged galvanizing by cleaning with a wire brush and applying two (2) coats of galvanizing application.

## 6.8 Special Features

### 6.8.1 Playgrounds

Playground Placement

Playgrounds may be proposed inside any MR parcel. Playgrounds shall be situated with the following guidelines:

- good visibility from nearby roadways;
- a distance no less than 15m from any private property;
- with surrounding ground slope no more than 2.5%; and
- along a paved asphalt trail with good access from surrounding areas.

Playground Edging and Base Fill Material

Playground edger must include a cast in place concrete curb with the option of either sand or engineered wood fiber as fill material. Alternatives to fill material will only be considered for accessibility reasons.

Drainage System

Playground subgrade must have positive drainage in one direction no less than 1.0% in grade. A drainage tile system of 100mm dia. socked perforated pipe must be installed at the low end of playground areas, within the perimeter edger and daylighting as required. Where pipes daylight through the perimeter use solid pipe to extend water through the perimeter edger and beyond the playground, or leading directly by pipe to a storm service line. Ensure water flows away from the playground with slopes leading away from the playground.

Playground Site Furniture

Each playground structure shall include at minimum two benches, two waste receptacles and two picnic tables.

Drawings and Submittals

Prior to CCC, the Contractor must provide the City with the following documentation:

- as-built drawings of the playground and all components;
- warranty documents; and
- third party Playground Inspection and Surface Impact Testing reports, to the satisfaction of the City.

All drawing and submittals to be sent by email to landscape@fortsask.ca.

Safety Fencing

The Contractor is responsible for erecting and maintaining a sturdy safety fence around the perimeter of the playground construction area. Construction area must include the playground footprint and any materials storage or stockpile area. The fence material must be min. 1.5m ht, made of moveable metal panel. Safety fencing must be maintained until the playground structure has been granted CCC and all safety reports have been completed to the satisfaction of the City.

## 6.9 Community Entrance Features

Location

Community entrance features may be proposed by the Developer for review and acceptance by the City. Any entrance feature must be built entirely on private property and no portion of the structure, base, or overhang may be placed on public property. Applicants must register legal easements for any entrance feature on title of the private property upon which it is located. The Developer must demonstrate to the City that this legal easement has been put in place prior to the construction of any permanent entrance feature.

Maintenance

The design for special entrance features shall be subject to the review and acceptance by the City. Entrance features must be low maintenance and be composed of materials that will remain available for years to come should any maintenance be required. The City will also require evidence of an agreement for the long-term care, damage recovery or replacement of any entrance feature for a term no less than 30 years. The Developer shall be fully responsible for establishing this maintenance reserve to the satisfaction of the City.

Should a sign become in disrepair and the Developer is not committed to repair or replace entrance features, the City reserves the right to remove the sign in its entirety.

## 6.10 Stormwater Management Facilities (SWMFs)

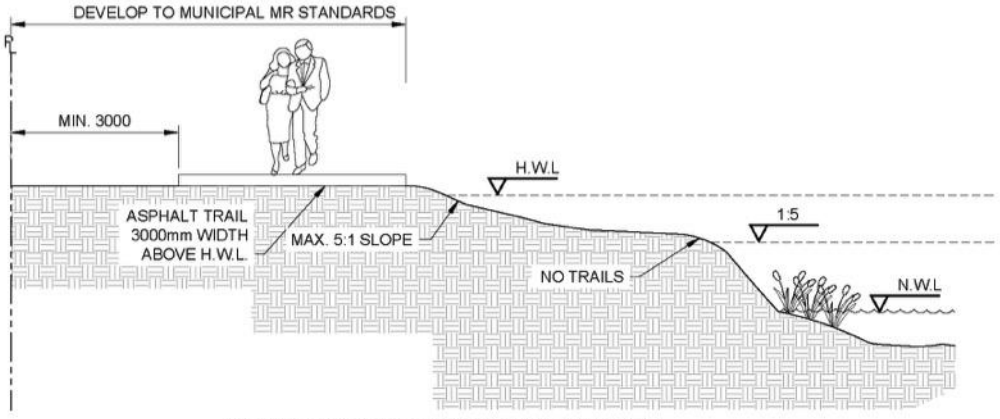
### 6.10.1 Stormwater Management Facility Configurations

SWMFs must be designed to be naturalized. The City's preference is that SWMFs be developed in the configuration of a constructed wetland. Other SWMF configurations such as dry ponds, wet ponds or confined channel systems must be approved by the City in advance of commencing designs.

6.10.2 Elements of a Constructed Wetland

Elements of constructed wetlands can include, but are not limited to:

- open water areas at depths of 1500 to 2500mm depth below normal water level (NWL), representing 40-60% of the total area within the normal water level;
- emergent vegetation areas at depths of 200 to 300mm depth below normal water level, representing the balance of the total area within the normal water level that is not open water. Emergent vegetation zones are to be planted using either live soils from donor wetland, or planted plugs of live bare root plants. Planted plugs must be included in soft landscape detailed drawings. Benches of shallow areas to have emergent vegetation shall undulate in width, and shall not be less than 5m (with exception to areas near inlet/outlet structures);
- grades below NWL should be designed in such a way that maximizes retention time of stormwater passing through the system. Avoid the ability for water to shortcut between inlet and outlet structures;
- including recreational amenities within SWMFs, such as trails and pedestrian furniture is highly encouraged. Asphalt trails may only be developed above the 1:5 flood elevation and must be asphalt paved and min. 3000mm in width. Gravel trails 2000mm in width may be developed below the HWL but must be above the 1:5 flood elevation. No trails can be implemented whatsoever below the 1:5 flood elevation;
- areas of SMWFs above the Freeboard elevation are to be built to Municipal Reserve standards which requires minimum 75 trees per hectare. The Developer may negotiate MR credit for portions of areas above freeboard elevations that have sufficient size for open play, that receive the required landscape improvements as credit for Municipal Reserve, and have slopes not exceeding 2.0%. These negotiations must be in place at the time of development agreement;
- asphalt trails developed above HWL must be at least 3000mm away from any adjacent property line;
- any other features such as lighting, pedestrian furniture, etc. must be placed above the HWL;
- the diagram below indicates permitted slopes, setbacks, widths, etc.; and
- safety signage that indicates potential "thin ice" conditions in winter months (approximately November through April) and "no swimming" in summer months (approximately May through October).



STORM WATER MANAGEMENT FACILITY

6.10.3 Other Jurisdictions

In addition to the minimum requirements set forth by these standards, the requirements of the Stormwater Management Guidelines for the Province of Alberta, as published by Alberta Environment in its latest edition, must be incorporated into the SWMF design. Where feasible and applicable, Alberta Environment's stormwater BMPs shall also be applied within the design.

6.10.4 Signage

The Developer shall be responsible for the installation of the following signage near the public entrance to all SWMF parcels:

- Danger Thin Ice. Signs must be in place during months of frozen conditions, being approximately November 1st to April 30th;
- No Swimming. Signs must be in place during months of frozen conditions, being approximately May 1st to October 31st; and
- safety signage to be customized to on site conditions to make the public aware of safety risks associated with amenities such as lift stations, outfall structures, electrical components, etc. Any customized signage must be approved by the City during the course of drawing approval.

## 6.11 Construction Completion, Warranty and Maintenance Period, Final Acceptance

### 6.11.1 Construction Completion

CCC Application

Prior to applying for CCC, the Developer Representative must fully inspect all work completed and ensure that all construction techniques and materials conform to the approved drawings, specifications and all Municipal, Provincial and Federal standards, bylaws, guidelines, Acts and Legislation. A CCC request application must be submitted to the City Representative by email to landscape@fortsask.ca requesting an inspection for the entire phase of development – a copy of this application can be found on the City's website – www.fortsask.ca. Three 11x17 hard copies of all pertinent drawings must accompany each CCC request application. Refer to the checklist in Part I for a complete list of deliverables that are required at CCC Application.

CCC Inspection

Within 15 calendar days of receiving a request for CCC inspection, the City will arrange for an inspection to review all aspects included in the CCC request application. CCC inspections may happen at any time from May 1 to October 31, however will be to the discretion of the City if site conditions due to heavy rain, snow cover, temperature and other considerations are cause to delay or suspend an inspection. If an inspection occurs after October 31st of any calendar year, warranty for all plant material will not begin until May 1st of the following year. Seeded areas will not be inspected until which time initial germination has occurred.

The Developer or Developer Representative must provide a representative to attend all inspections.

Standard CCC Records

The Developer Representative shall be responsible for taking notes and providing copies of all documentation to attendees of each inspection. A copy of a standard inspection form can be found on the City's website – www.fortsask.ca. Copies of all forms must be distributed digitally and in hard copy to the City within three working days of ay inspection. At the completion of a CCC inspection, the Developer Representative must complete and submit a construction completion certificate, along with all required attachments. A copy of this certificate can be found on the City's website – www.fortsask.ca.

CCC Re-Inspections

The City will attend a first CCC inspection for each stage of development. The City will not segregate sites into smaller stages or portions of sites, unless stipulated in the development agreement and clearly identified as separate components. The City will, however, inspect fencing separate from all other aspects of development. The first inspection will be conducted at no cost to the Developer. The following schedule identifies costs that will be borne onto the Developer by the City for any re-inspections required:

| Inspection | Fee to the Developer |
|---|---|
| First CCC Inspection | n/c |
| First Re-Inspection | $1,500 |
| Second Re-Inspection | $2,500 |
| All Subsequent Inspections | $2,500 |

The City may contract landscape inspection services out to a third party and therefore may incur costs for interim construction reviews, pre-inspections, CCC inspections, maintenance monitoring and FAC inspections.

6.11.2 Warranty and Maintenance Period

General

Continuously maintain and warranty landscape work as specified for a period of at least two (2) years from the issuance of a Complete Completion Certificate (CCC) and until the issuance of a Final Acceptance Certificate (FAC). As part of the FAC application, the Developer or its Representative must provide minimum monthly inspection reports from each stage of development for all months of growing conditions (approximately April through November).

Perform maintenance work during regular working hours of 07:00 to 18:00, Monday to Friday. Obtain City approval to do maintenance outside of regular working hours. Provide the City with at least three days advance notification of intent to spray for weed and insect control.

Keep a daily maintenance log throughout contract and submit the log to the City by email to landscape@fortsask.ca at the end of the first year of maintenance, and as part of FAC applications. This log shall include:

- a detail of activities and dates in which activities were carried out; and
- Detail off chemical applications, including target weed or insect, mode, type and rate of application of chemical, date, time, weather conditions and results of application.

During the maintenance period, the Developer shall provide, erect and maintain barricades, signs and protection that may be necessary for the preservation of public health and safety during maintenance activities. The site must otherwise be safe for public use during the warranty period, unless otherwise approved by the City for public closure due to special circumstances.

Provide City with copies of permits and licenses required by regulatory authorities, including current pesticide applicator's license number.

The Developer shall be responsible for all costs incurred related to the liability and damages caused by contractor's personnel and equipment during the term of the contract. Report damages immediately to City and obtain approval of City for repairs and replacements. Return grass areas, plants, equipment and buildings to their original condition before damage. Scalping of turf and mechanical damage to trees including tearing bark shall be considered as damage and shall be repaired to the City's satisfaction.

Schedule timing of operations to growth, weather conditions and use of site. Provide copy of schedule for approval by city. Do each operation continuously and complete within a reasonable time period. Provide equipment and material necessary for maintenance to acceptable horticultural standards. Coordinate maintenance practices with City. Maintenance schedules may have to be altered to accommodate City's site activities. Collect and dispose of excess material and debris to municipal disposal site following each day's work. Cleanup shall be a continuous operation and at no time shall topsoil or debris of any kind be allowed to remain on roadways overnight.

Turf Maintenance

Maintenance shall include all measures necessary to establish and maintain seeded and sodded areas in an acceptable, vigorous and healthy growing condition during the maintenance and warranty period. Proper grades established, should not have divots, low/high spots.

Maintain turf with sharp mowers at 80-90mm during growing season. Cut as required to maintain specified height. Remove papers, rocks, and other foreign material before cutting. Change direction of cut with each mowing where practical. Do not remove grass clippings from turf areas unless volume is such as to be harmful to turf areas or unsightly. Remove clippings from sidewalks, roads, parking lots, windows or building during the same mowing and remove from site. If growth of turf has exceeded 90mm, raise mower blades so that not more than 30% of grass blade will be cut at one time. Do not allow turf height to exceed 100mm.

Adjust fertilizer requirements according to soil test analysis. Use only mechanical equipment. Check calibration of spreader to ensure that specified rat is used. Spread 50% of fertilizer in one direction, then 50% at right angles. Water, immediately after fertilizing, according to manufacturer recommendations; obtain moisture penetration of 50rmm minimum. Apply fertilizer at manufacture's specified rates. Fertilize three times per growing season:

- spring – apply 12-51-0 fertilizer (or approved equal) before May 31st;
- summer- apply 27-14-0 fertilizer (or approved equal) during the first two weeks of July; and
- fall – apply 16-20-0 fertilizer (or approved equal) during the last two weeks of August.

For sodded areas, supply labour, water truck, pumps, potable sprinkler systems and water necessary to provide adequate watering to maintain plant growth during warranty period. Fire hydrants shall not be used as a source of water supply unless written approval is provided by the City.

Mow grass to height of 60mm. After mowing, rake thoroughly, removing loose and dead grass, stones and debris. Spread topsoil to maximum thickness of 15mm, filling in low areas and bare spots. Overseed areas with seed mixture equivalent to existing grasses at manufacturer specified rates. Rake seed into topsoil. Roll lightly. Water to ensure penetration of 80mm and at frequent intervals to maintain vigorous growth.

Cut out areas of dead or unhealthy sod and replace with new sod. All repair areas to be square or rectangular. Rake topsoil before installing new sod. Butt new sod tightly to adjacent existing sod and grades. Roll lightly to reduce contact will soil. Water to ensure penetration of 80 mm and at frequent intervals to maintain healthy growth.

Tree and Shrub Maintenance

Tree and shrub maintenance shall include all measures necessary to establish and maintain all plants in an acceptable, vigorous and healthy growing condition during the maintenance and warranty period.

Deep water trees and shrubs to maintain adequate moisture level within root systems to meet the plant's requirements. The Developer is responsible for supplying loading, hauling and distributing water.

Cultivate upper 40mm of soil monthly. Edge plant beds evenly to depth of 100 mm in lines of original layout. Remove weeds bi-weekly including their roots. Do not damage roots of plants. Collect and dispose of paper, refuse and dead plants.

Keep stakes and guy wires taut and plants plumb for duration of maintenance period. Remove flagging/rope from plants at time of planting.

The amount of pruning shall be limited to the minimum necessary to remove dead or injured branches. Only clean, sharp pruning tools shall be used. All cuts shall be clean and cut to the branch collar, leaving no stubs. Pruning of trees and shrubs shall be performed by an experienced pruner knowledgeably on horticulture industry standards.

All plant materials found dead or not in a healthy, satisfactory growing condition or which, in any other way, does not meet the requirements, shall be replaced immediately by the contractor at the contractor's own expense.

Apply a high phosphorous fertilizer, 10-52-10 (or approved equal) at manufacturer specified rates at the time of planting and each spring prior to June 1st. No fertilizer should be applied in July or August. Apply water after fertilizing to ensure penetration of fertilizer level.

Weed, Insect and Disease Control

Ensure proper, positive identification of infestations and consult with the City before taking corrective action. Before chemical applications, obtain written approval from the City and treatment area to be posted. Use equipment and containers free of harmful residues not related to specific control measures applicable to situation. Perform disease, weed and insect control, in accordance with Provincial chemical application regulation. Notify the City of intent at least three days before any chemical application. Prepare and apply chemical according to manufacturer specification by licensed applicator. Minimize drift at all times. Carry out treatment with regard to climatic effect on surroundings and occupants of buildings. Public notification of any spraying activities is required.

Apply chemical to eradicate weeds or perennial grass in turf areas, driveways, interlocking concrete paving stone areas, along fences, storage areas, parking lots, gravel and rip-rap stone areas with boundary of site. Repair and pay for damage caused by application of herbicides. Effectiveness of treatment program to be determined by inspection by City. Repeat as required.

Make weekly inspection of lawns and plants for insect and disease infestations. Laboratory testing may be required for diagnosis of disease. Apply chemicals based on development stage of insects' life cycles. Repair and pay for damages caused by application of chemicals. Effectiveness of treatment program to be determined by inspection by the City. Repeat as required.

Spring and Fall Tasks

Complete spring clean-up as soon as working conditions are favourable and by May 15. Remove and dispose of sand, gravel, salt and debris, accumulated during winter months, to municipal disposal site. Remove any snow fences, stakes and sand containers from the site. Clean plant beds and planters of debris and dead plant material. Loosen and lightly cultivate soil without disturbing roots of permanent plantings.

In the fall, remove and dispose of annuals form plant beds and planters within one week after first killing frost. Deep cultivate plant beds and planters. Cut back foliage of perennials within one week after killing frost. Stake locations of perennials if required. Deep water trees and shrubs between October 1 to 15.

6.11.3 Interim Inspections

Routine Site Reviews

The City will conduct routine reviews of construction progress to ensure proper construction techniques, materials and methodologies are used. The City may provide feedback in writing to the Developer to highlight any discrepancies or concerns that require correction. Should corrections not be made in a timely manner, requests for future inspections will be rejected until which time concerns are rectified.

Pre-Inspections

The City reserves the right to conduct pre-inspections in advance of scheduled CCC and FAC inspections to bring specialist staff on site to observe completed work. Feedback from these pre-inspections may be brought forward to scheduled inspections and added to deficiency lists.

Mid-Term Seed Area Maintenance Inspection

As noted in Section C.2.3 of this standard, the Developer is responsible for scheduling an interim inspection with the City, approximately one year after CCC, for any development that includes seeded areas. The purpose of this inspection is to ensure full coverage of seed and to ensure weed control has been completed during the first twelve months of growth. The City, at its own discretion, may inspect sites on a routine basis during the warranty period and require the Developer to mitigate for any concerns with germination, turf coverage and weed control.

6.11.4 Final Acceptance Certificate Inspection

General

Final inspection of seeded and sodded areas will be made prior to the end of the warranty period. At the time of inspection the turf should be mowed and shall be alive and in a healthy satisfactory growing condition, free of weeds. Replacing areas that show root growth failure, deterioration, bare or thin spots or which have been damaged by any means to the satisfactory of the City.

Final inspection of trees and shrubs will be made prior to the end of the warranty period. At the time of inspection all non-mulched beds and tree pits shall be freshly cultivated. Mulched beds and tree pits shall be refilled to original specified depths. All planting areas and tree pits shall be free of weeds and debris. Any plant that is dead, not true to name or specified, or not in satisfactory growth, shall be removed and replaced.

Record Drawings

No more than three months prior to any anticipated FAC inspection, the Developer Representative must provide record drawings for any stage of development. As-builts shall include an accurate record of all improvements as constructed or changed during the course of the maintenance period. Any approved design information that was altered since drawing approval will be struck through and replaced with field verified data. All changes will be shown in red text. The Applicant must provide two hard copies of record drawings, along with a digital submission of drawings in AutoCAD compatible format.

In addition to the information required for detailed drawings, record drawings shall include, at minimum, the following additional information:

- date of construction completion;
- date which as-built drawings were completed;
- name of contractor(s);
- construction start and completion dates; and
- all street names and addresses for properties within the scope of work.

Upon review and acceptance of record drawings by the City, the Developer Representative shall convert red line markups to black and prepare project record drawings. After verification by the professional member, the Developer Representative shall provide one copy of the record drawings in AutoCAD compatible format and one set of signed .pdf files of all drawings. FAC inspection request forms will not be accepted until which time any final record drawings have been accepted by the City.

FAC Application

Prior to applying for FAC, the Developer Representative must fully inspect all work completed and ensure that all construction techniques and materials conform to the approved drawings, specifications and all Municipal, Provincial and Federal standards, bylaws, guidelines, Acts and Legislation. An FAC request application must be submitted to the City by email to landscape@fortsask.ca requesting an inspection for the entire phase of development – a copy of this application can be found in Part I: Applications, Checklists and Forms. The City requires that all aspects of development included in detailed drawings per phase and in accordance with the development agreement be inspected at the same time.

FAC Inspection

Within 15 calendar days of receiving a request for FAC inspection, the City will arrange for an inspection to review all aspects included in the FAC request application and shown on the record drawings. FAC inspections will only occur when all plant material is in full leaf, and allowable full timing will be to the discretion of the City. No FAC inspection will occur past September 30. FAC inspections can be requested 60 days prior to the CCC warranty date.

The Developer or Developer Representative must provide a representative to attend all inspections.

At the completion of an FAC inspection, the Developer Representative must complete and submit a final acceptance certificate, along with all required attachments. A copy of this certificate can be found on the City's website – www.fortsask.ca.

FAC Re-Inspections

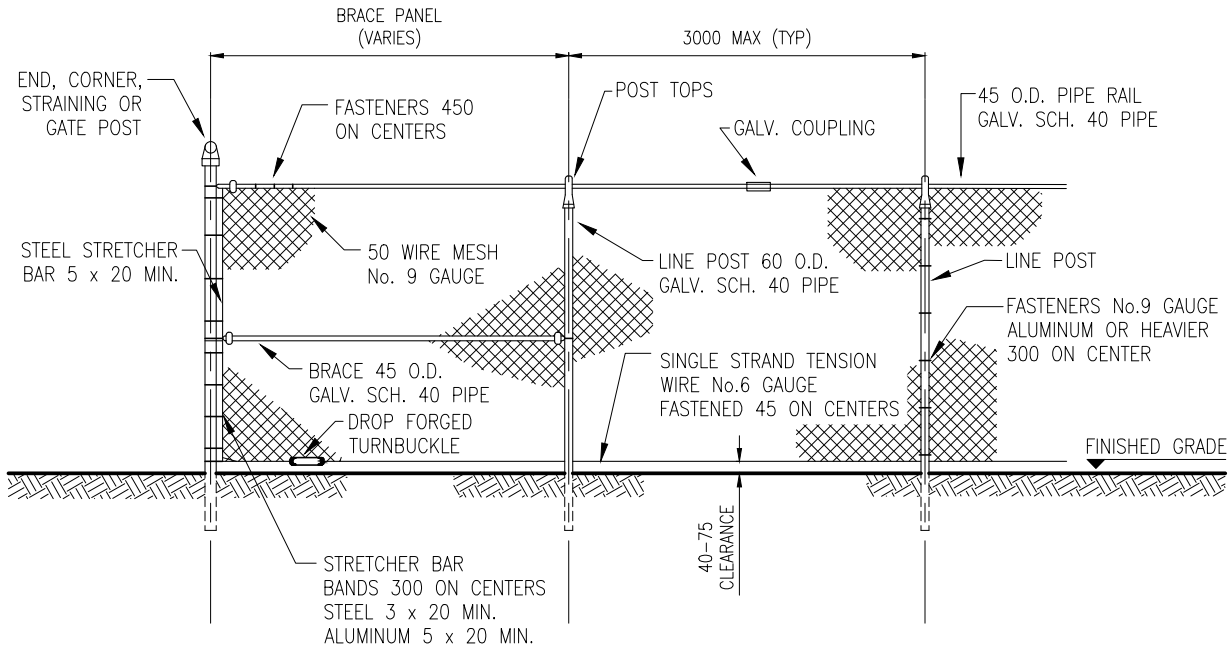
The City will attend a first FAC inspection for each stage of development. The City will not segregate sites into smaller stages or portions of sites, unless stipulated in the development agreement and clearly identified as separate components. The first inspection will be conducted at no cost to the Developer. The following schedule identifies costs that will be borne onto the Developer by the City for any re-inspections required:

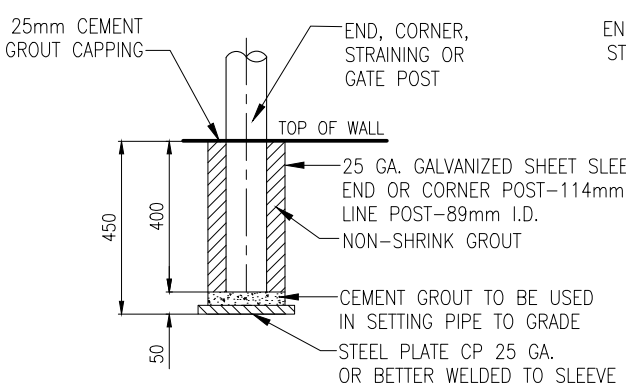
| Inspection | Fee to the Developer |
|---|---|
| First FAC Inspection | n/c |
| First Re-Inspection | $1,500 |
| Second Re-Inspection | $2,500 |
| All Subsequent Inspections | $2,500 |

The City may contract landscape inspection services out to a third party and therefore may incur costs for interim construction reviews, pre-inspections, CCC inspections, maintenance monitoring and FAC inspections.

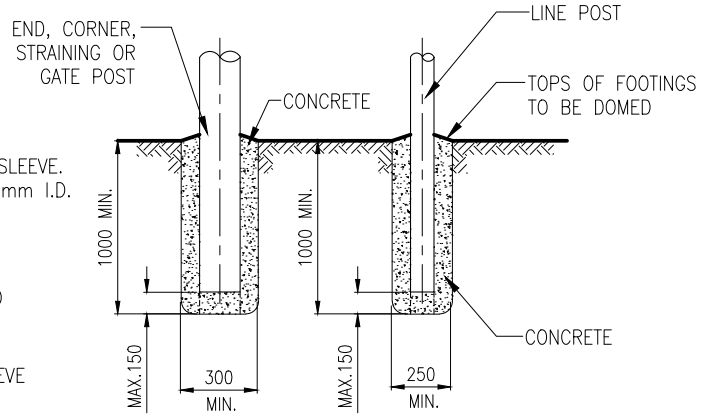
## 6.12 Standard Drawing Details

L-1 Chain Link Fence
L-2 Chain Link Single Gate
L-3 Chain Link Double Gate
L-4 Wooden Fence
L-5 Step Down Fence
L-6 Wood Post & Rail Fence
L-7 Typical Tree Planting
L-8 Typical Tree Trench Planting
L-9 Typical Shrub Planting
L-10 Bench
L-11 Picnic Table
L-12 Waste Receptacle
L-13 Typical Concrete Pad
L-14 Bike Rack
L-15 Trail Sign
L-16 Wood Bollard
L-17 Swing Gate Bollard
L-18 Concrete Playground Edger
L-19 Gravel Trail




ON RETAINING WALL




IN EARTH

NOTE:

- DEEPER PILES MAY BE REQUIRED IN AREAS OF POOR SUBGRADE MATERIAL OR IN AREAS OF UNCONTROLLED FILL.
- ALL COMPONENTS TO BE POWERCOATED BLACK.

## POST DETAILS

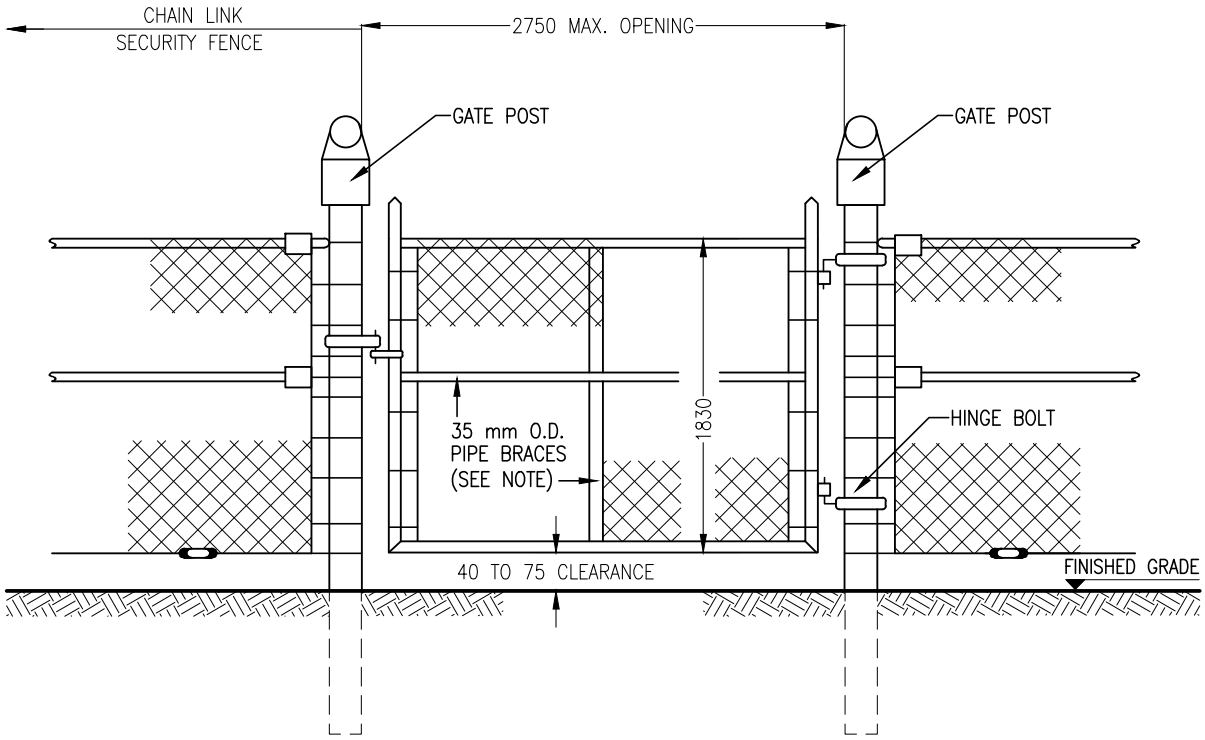
| DESCRIPTION | O.D. | LENGTH | | | | | |
|---|---|---|---|---|---|---|---|
| | | FABRIC WIDTH 1830 | | FABRIC WIDTH 1525 | | FABRIC WIDTH 1220 | |
| | | STANDARD | RETAINING WALLS | STANDARD | RETAINING WALLS | STANDARD | RETAINING WALLS |
| LINE POST | 60 | 2670 | 2170 | 2360 | 1870 | 2050 | 1560 |
| END, CORNER, STRAINING AND GATE POST WITH OPENINGS 450 MAXIMUM | 90 | 2890 | 2320 | 2590 | 2020 | 2290 | 1710 |
| GATE POST OPENINGS 800 MAX. | 114 | 2890 | – | 2590 | – | 2290 | – |

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

# CHAIN LINK FENCE

CITY OF FORT SASKATCHEWAN

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: 2 | DATE: MAY 2019 | L-1 |
| NOT TO SCALE | DRAWN: EDS Group | |

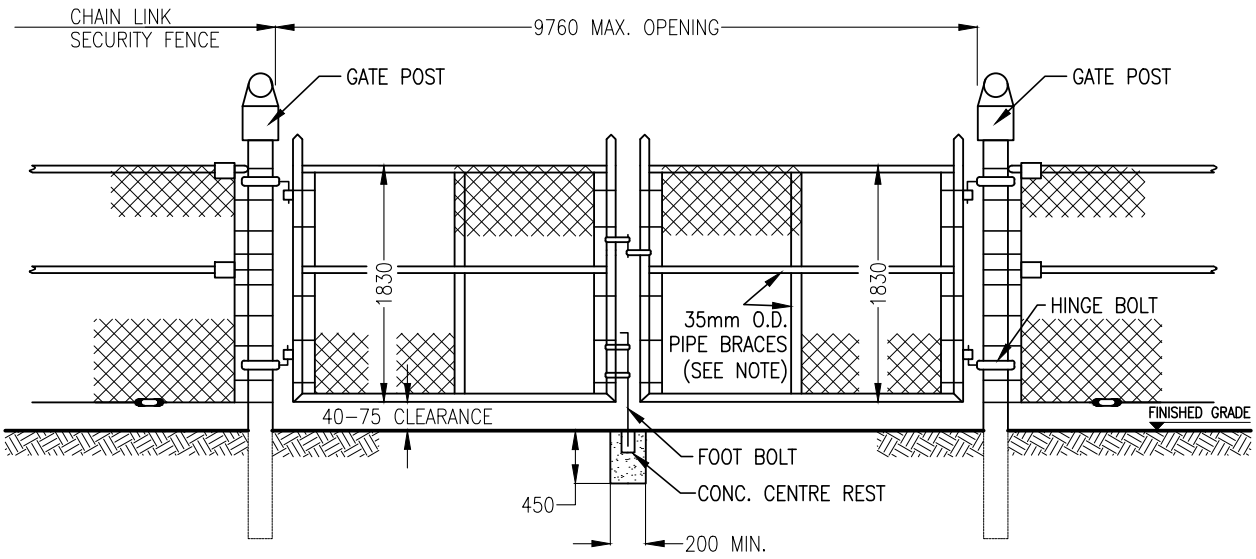



NOTE:
PIPE BRACES

- GATE LEAVES UP TO 1830 WIDE HORIZONTAL BRACE ONLY.
- GATE LEAVES OVER 1830 WIDE BOTH HORIZONTAL & VERTICAL BRACES.
- ALL COMPONENTS TO BE POWERCOATED BLACK.
- REFER TO DETAIL L–1 FOR POST DETAILS.

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| CHAIN LINK SINGLE GATE | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: MAY 2019 | L-2 |
| NOT TO SCALE | DRAWN: EDS Group | |



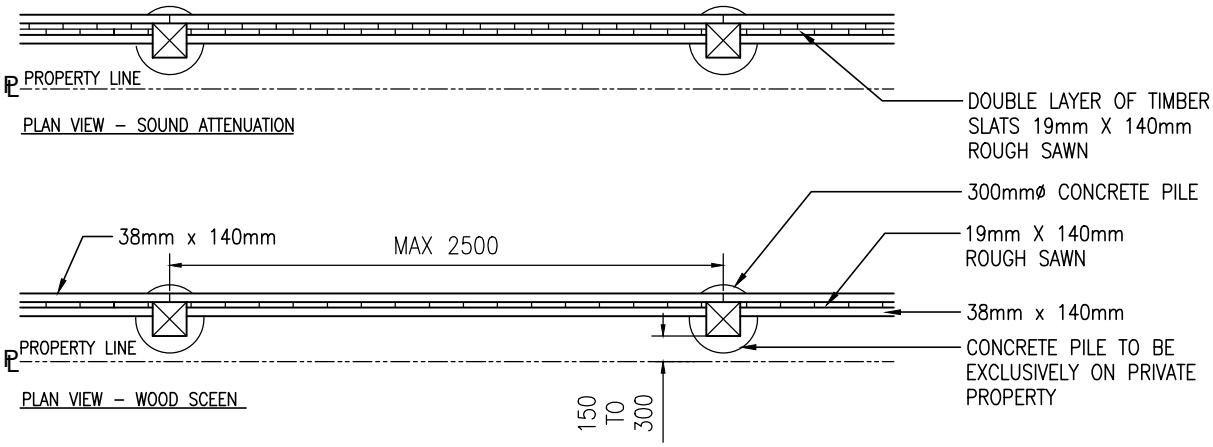

NOTE:

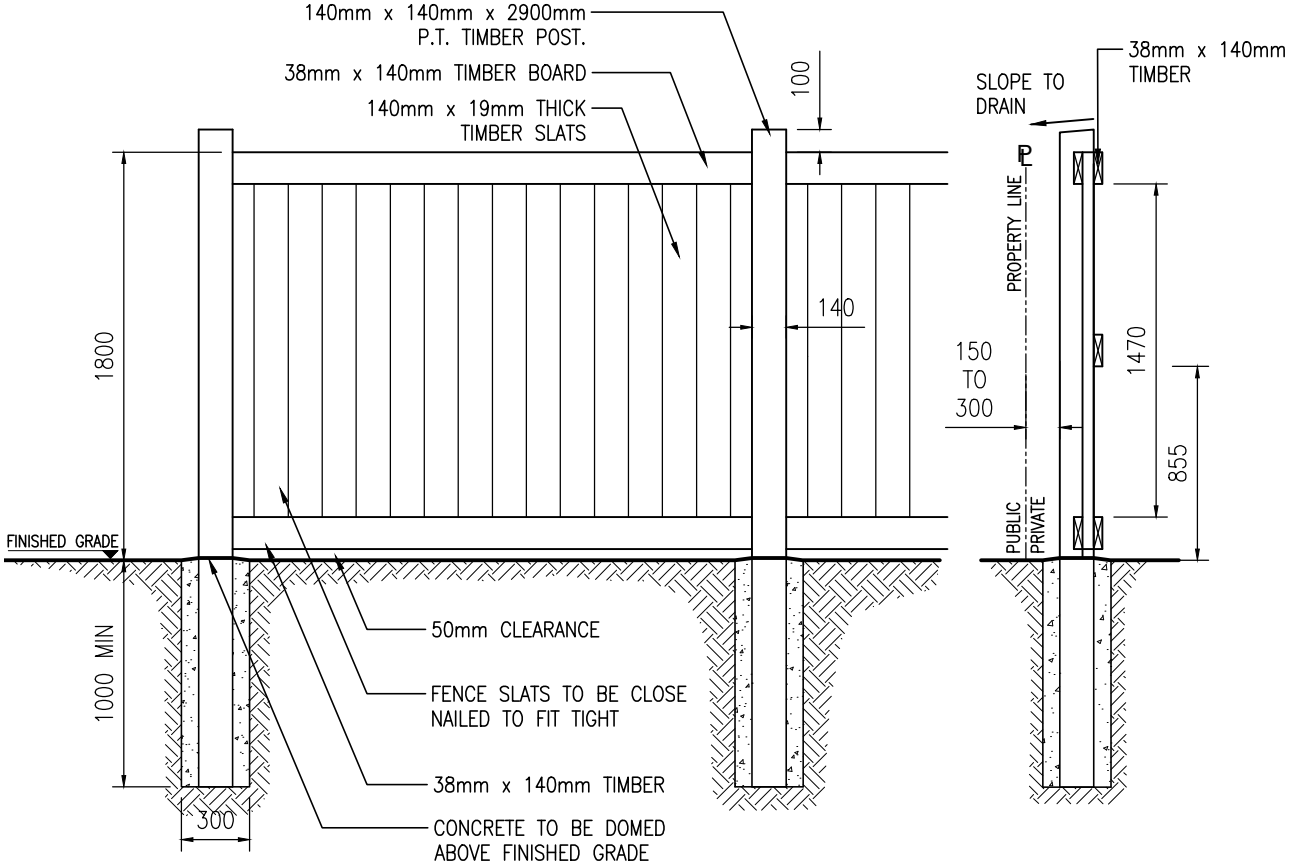
PIPE BRACES

- GATE LEAVES UP TO 1830 WIDE HORIZONTAL BRACE ONLY.
- GATE LEAVES OVER 1830 WIDE BOTH HORIZONTAL AND VERTICAL BRACES.
- ALL COMPONENTS TO BE POWERCOATED BLACK.
- REFER TO DETAIL L–1 FOR POST DETAILS.

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| CHAIN LINK DOUBLE GATE | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: B | DATE: MAY 2019 | L-3 |
| NOT TO SCALE | DRAWN: EDS Group | |




ELEVATION

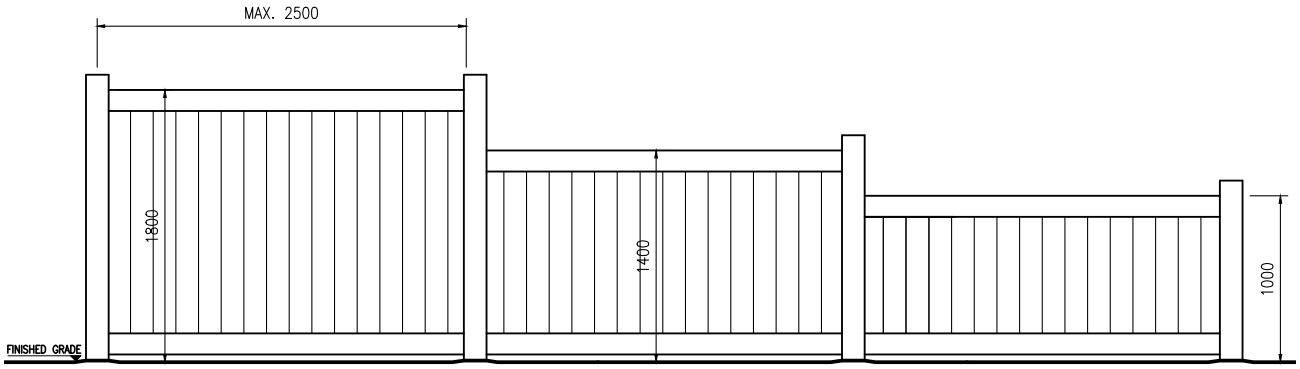
SECTION

NOTE:

- POSTS SHALL BE LOCATED AT LOT CORNERS w/ INTERMEDIATE POSTS, EVENLY SPACED 2500 O.C. MAX.
- POSTS TO BE A MINIMUM LENGTH OF 2900 & MUST BE INSTALLED IN A PLUMB POSITION.
- ALL WOOD COMPONENTS TO BE CEDAR, SPF OR S4S TIMBER.
- PRESSURE TREATED POSTS TO BE TREATED WITH A SOLUTION OF PENTACHLOROPHENOL AND PETROLEUM TO CSA–080.
- TIMBER SLATS SHOULD FIT TIGHT TO ACCOMMODATE SHRINKAGE.
- ALL NAILS TO BE GALVANIZED SCREW NAILS AND TO CONFORM TO C.S.A. G164.
- NAILS TO BE 89mm COATED FOR STRINGERS TO POSTS AND 50mm ARDOX FOR BOARDS.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

| WOODEN FENCE | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: MAY 2019 | L-4 |
| NOT TO SCALE | DRAWN: EDS Group | |



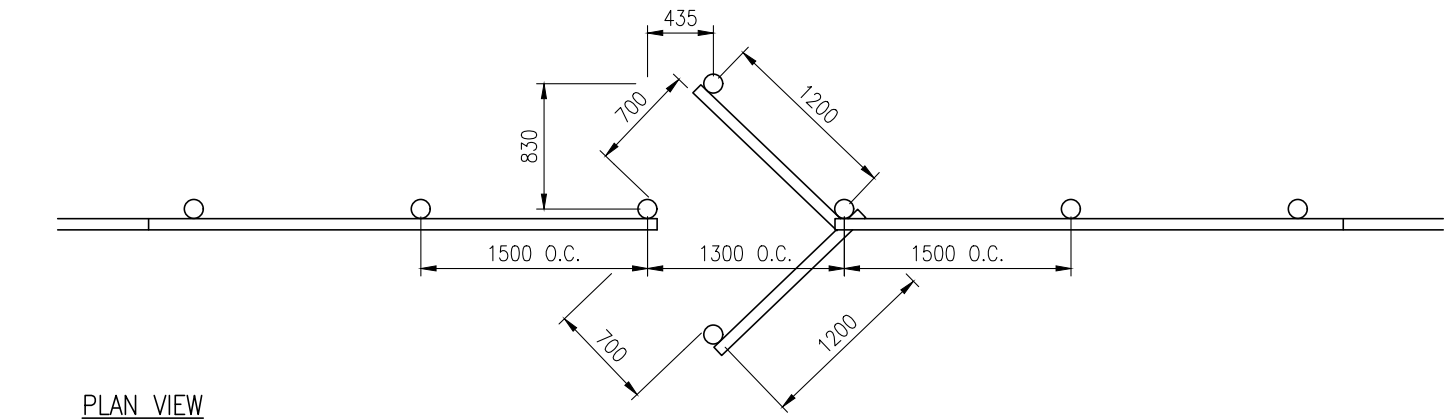

ELEVATION

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

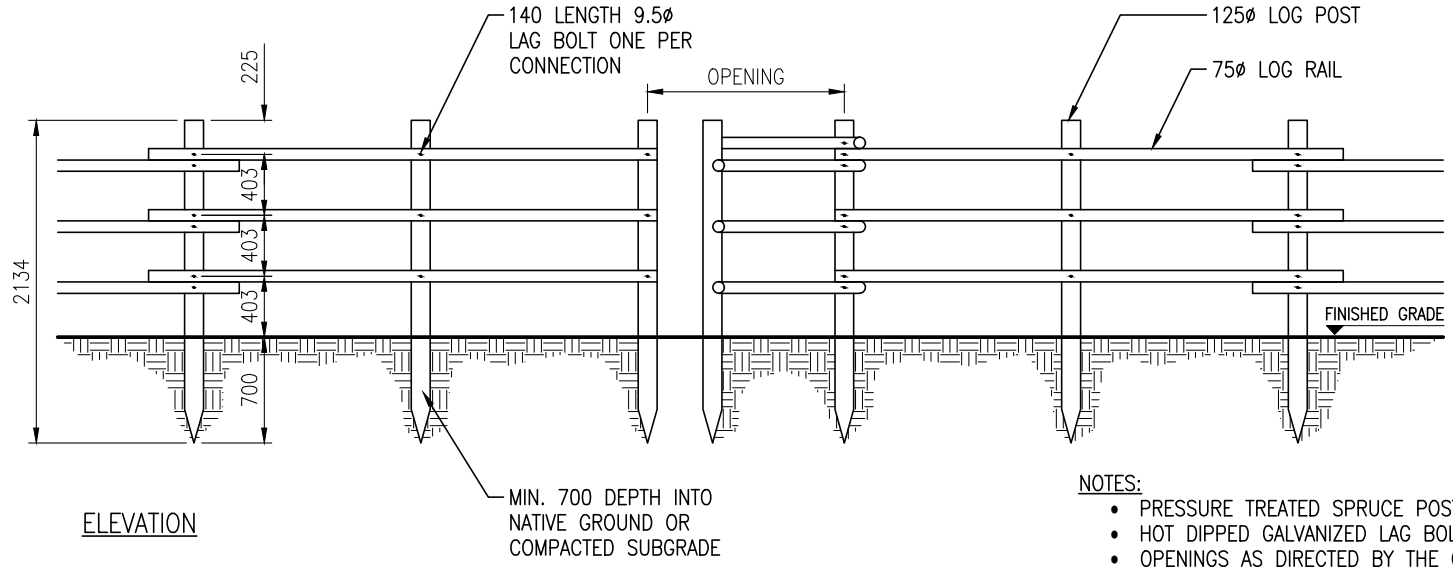
# STEP DOWN WOODEN FENCE

CITY OF FORT SASKATCHEWAN

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: 1 | DATE: MAY 2019 | L-5 |
| NOT TO SCALE | DRAWN: EDS Group | |




PLAN VIEW



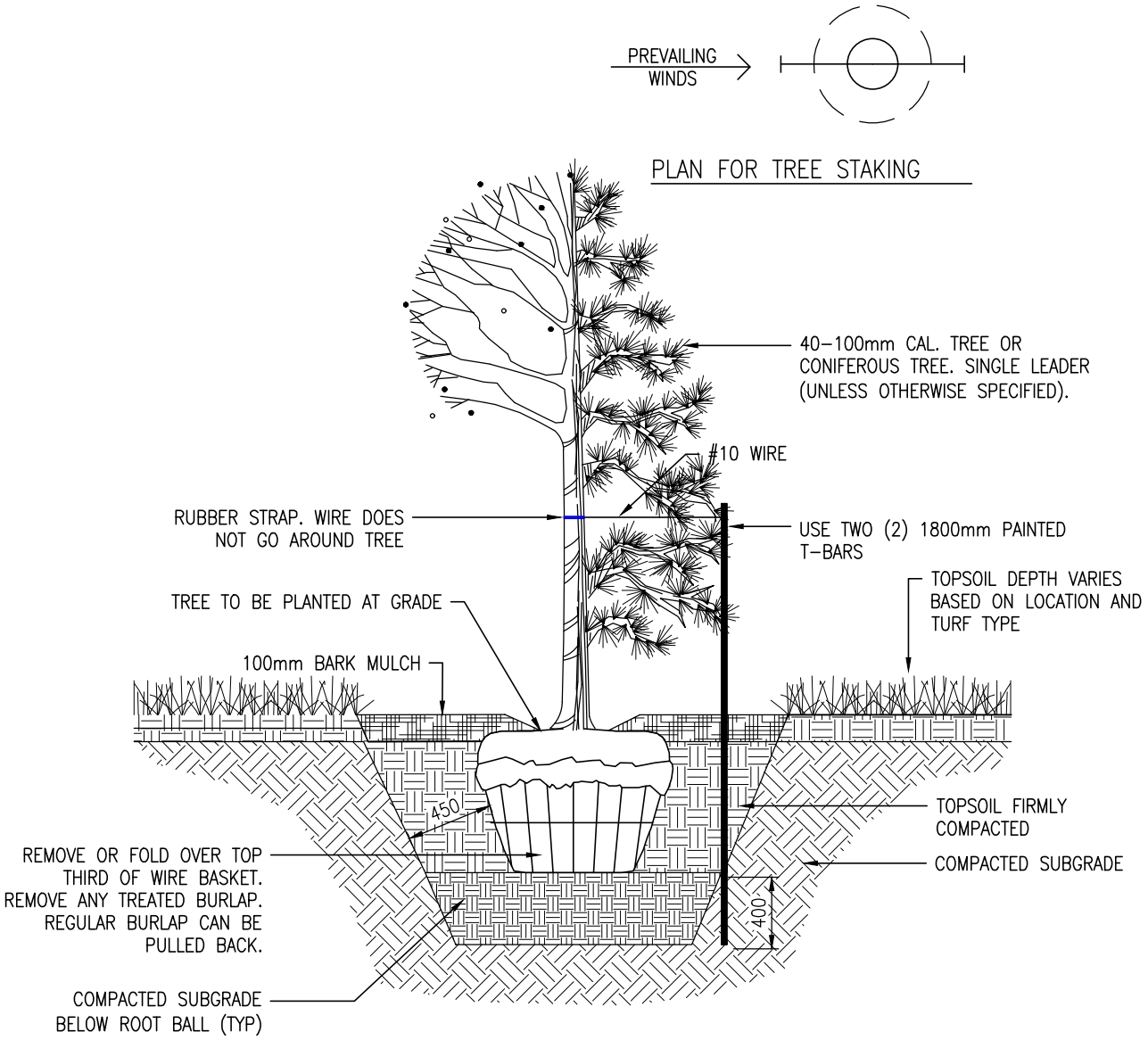

ELEVATION

NOTES:

- PRESSURE TREATED SPRUCE POSTS AND RAILS.
- HOT DIPPED GALVANIZED LAG BOLTS.
- OPENINGS AS DIRECTED BY THE CITY.
- THE USE OF THIS FENCING STYLE TO BE USED IN PUBLIC PARK SPACE AT THE DISCRETION OF THE CITY.

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| WOOD POST & RAIL FENCE | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: MAY 2019 | L-6 |
| NOT TO SCALE | DRAWN: EDS Group | |

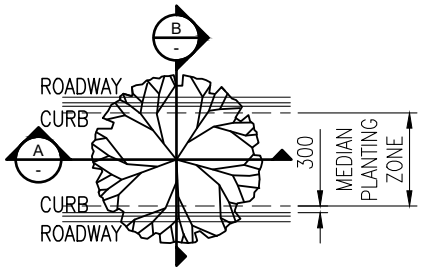



NOTE:

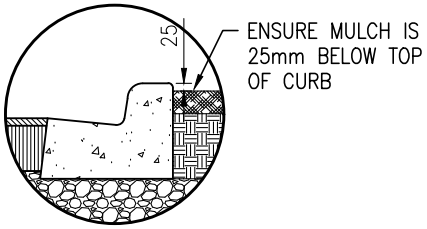
- EDGE OF BED TO BE STAKED & APPROVED BY DEVELOPER'S REPRESENTATIVE.
- IF TREE IS IN WIRE BASKET, CUT & REMOVE TOP THIRD OF BASKET OR FOLD DOWN TOP THIRD BEFORE PLANTING. PULL BACK BURLAP (NON–TREATED BURLAP ONLY).
- TREES TO BE PLANTED AT GRADE.
- PLACE ROOT BALL ON COMPACTED OR UNDISTURBED SUBGRADE.
- SCARIFYING OF THE TREE WELL IS REQUIRED.
- MULCH TO BE 50mm AWAY FROM ROOT FLARE/TRUNK. EXTEND TO THE EDGE OF THE DRIP LINE OR 1000mm.
- ON SITES OF EXTREME COMPACTION SCARIFYING IS RECOMMENDED.
- PRUNE DEAD BRANCHES TO MAINTAIN NATURAL FORM OF TREE – DO NOT PRUNE HEAVILY AT PLANTING.
- STAKE BEYOND EDGE OF ROOT BALL. BARS SHOULD BE HAMMERED DOWN INTO SOLID FOOTING (AT LEAST 400mm INTO SUB–SOIL BASE).
- USE RUBBER STRAPS AT END OF ALL GUY WIRES TO PROTECT THE TREE AT POINT OF CONTACT.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

| TYPICAL TREE PLANTING | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: MAY 2019 | L-7 |
| NOT TO SCALE | DRAWN: EDS Group | |



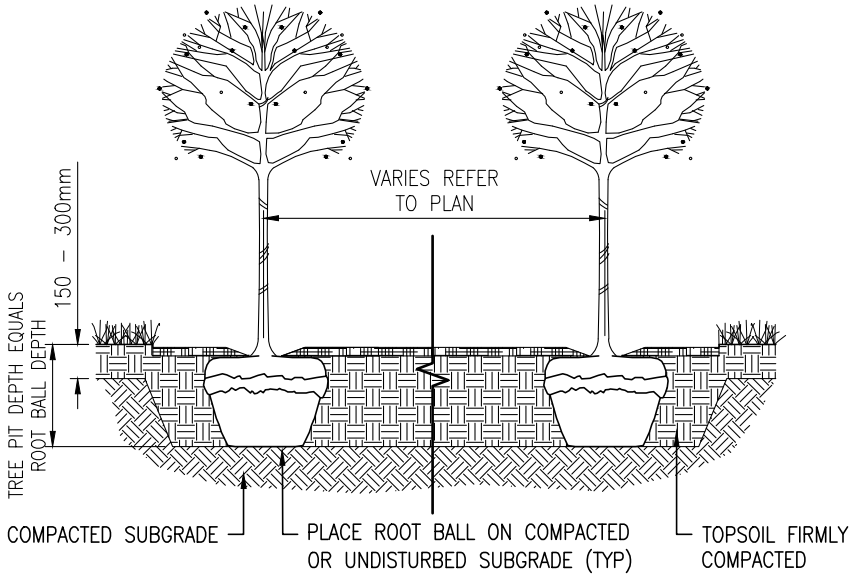

PLAN VIEW



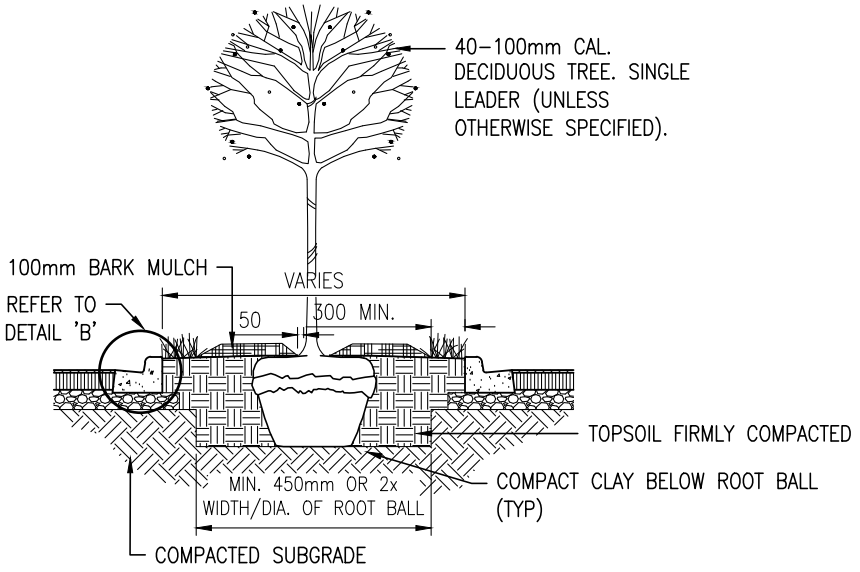

DETAIL 'B'

NOTE:

- DO NOT ALLOW AIR POCKETS TO FORM WHEN BACK FILLING.
- TREES TO BE PLANTED AT GRADE w/ TRUNK FLARE VISIBLE (NO MORE THAN 25mm ABOVE GRADE).
- IF TREE IS IN WIRE BASKET, CUT & REMOVE. IF TREE IS IN TREATED BURLAP, CUT & REMOVE. IF TREE IS IN REGULAR BURLAP, PEEL BACK.
- MULCH TO BE 50mm AWAY FROM ROOT FLARE/TRUNK.
- ON SITES OF EXTREME COMPACTION SCARIFYING OF THE TREE WELL IS REQUIRED.
- PRUNE DEAD BRANCHES TO MAINTAIN NATURAL FORM OF TREE – DO NOT PRUNE HEAVILY AT PLANTING.
- CROWN MEDIAN TO ENSURE POSITIVE DRAINAGE.
- DEPTH OF LOAM MIN. 150mm TO OPTIMUM OF 300mm. TREE SPADE OPTION IF DEPTH IS 300mm.
- REMOVE STAKING ONE YEAR AFTER INSTALLATION OR AS DIRECTED BY THE CITY REPRESENTATIVE.
- WHERE ADJACENT TO A CURB, MULCH SHALL BE 25mm BELOW TOP OF CURB.



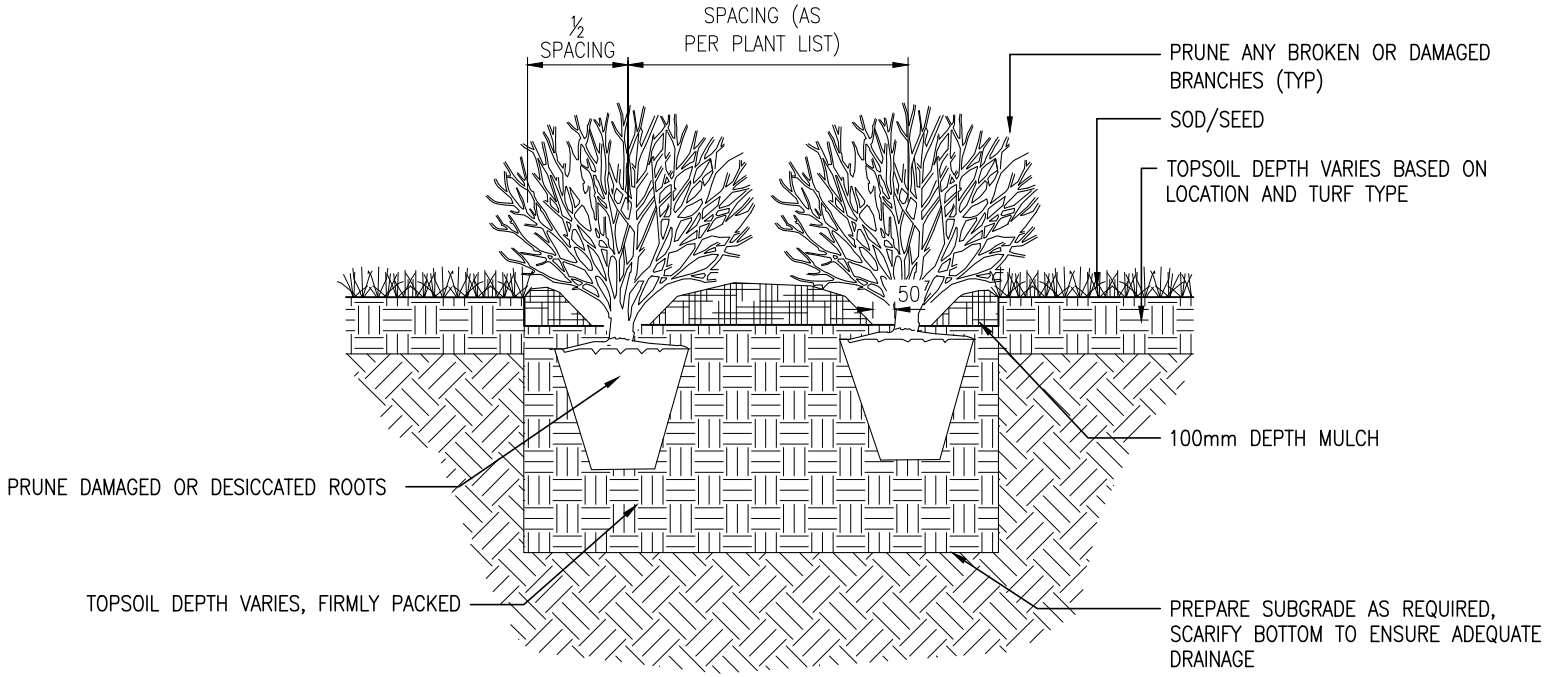

SECTION A




SECTION B

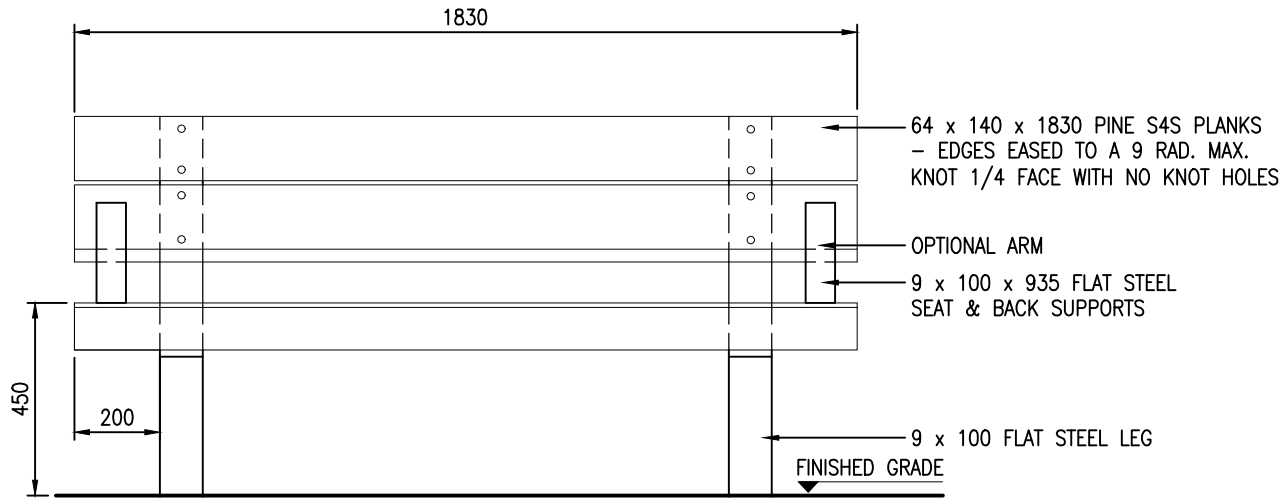
ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| TYPICAL TREE TRENCH PLANTING | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: MAY 2019 | L-8 |
| NOT TO SCALE | DRAWN: EDS Group | |

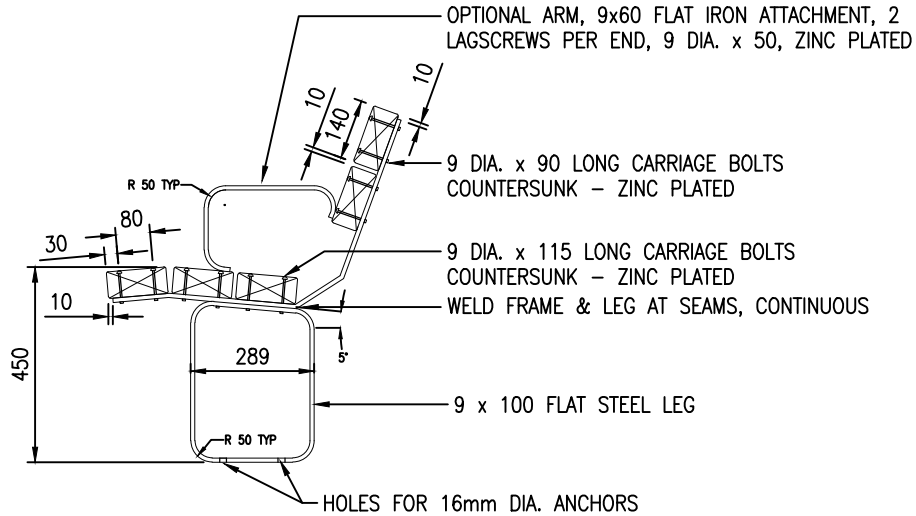



ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

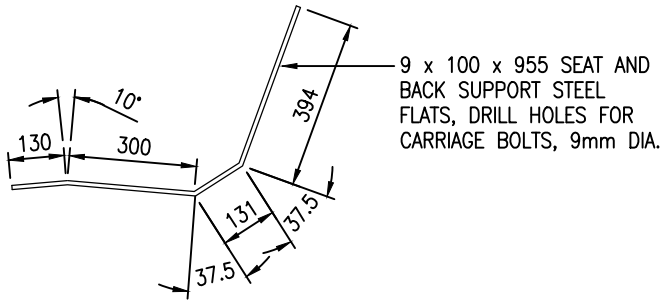
| TYPICAL SHRUB PLANTING | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: MAY 2019 | L-9 |
| NOT TO SCALE | DRAWN: EDS Group | |




FRONT ELEVATION




SIDE ELEVATION



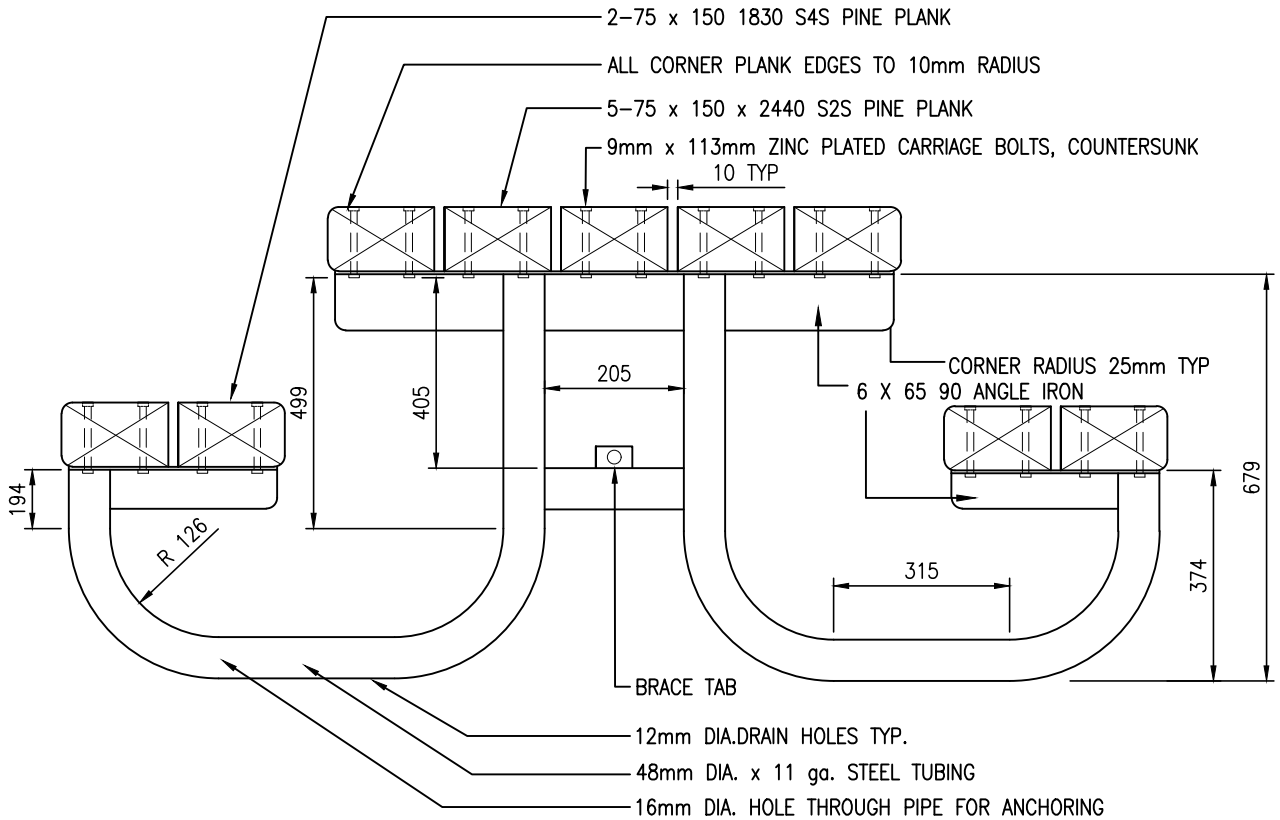

SUPPORT DETAIL

NOTES:

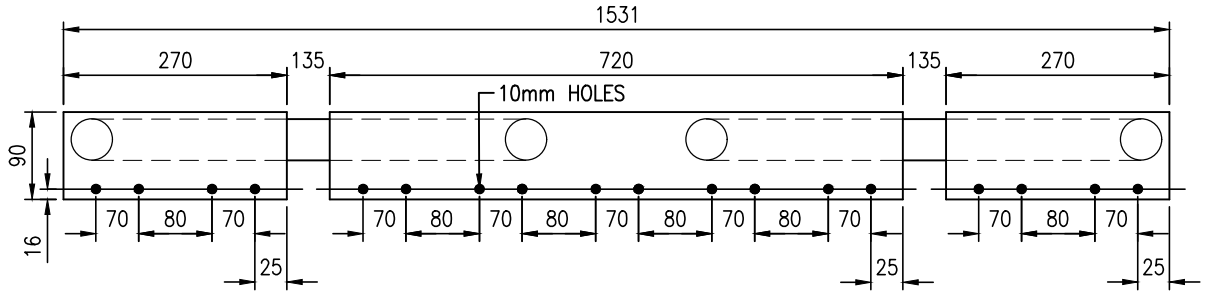
- FRAME COMPONENTS SHALL BE ELECTRONICALLY WELDED.
- WOOD COMPONENTS TO BE TREATED WITH CHROMATED COPPER ARSENIC (C.C.A.) GREEN.
- CONCRETE PAD IS 1.40m x 2.00m
- BENCH AVAILABLE FROM CUSTOM PARK & LEISURE OR APPROVED EQUAL

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| BENCH | |
|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | DWG. NO. |
| REVISION NUMBER: 2 / DATE: FEB 2024 | L-10 |
| NOT TO SCALE / DRAWN: EDS Group | |




SECTION



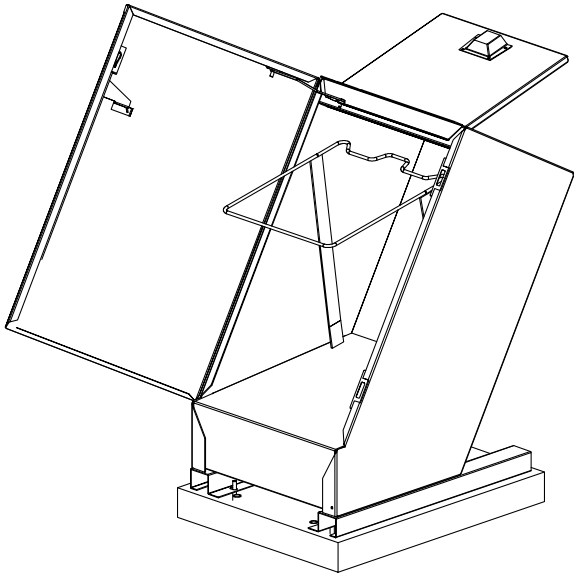

PLAN (END FRAME ONLY)

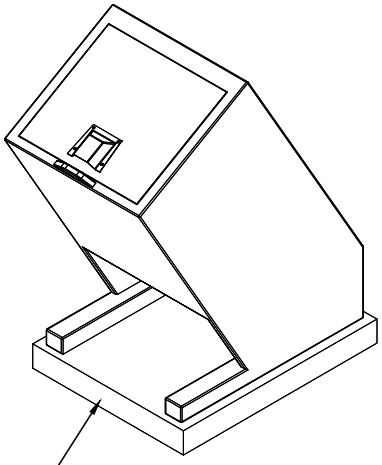
NOTES:

- FRAME COMPONENTS SHALL BE ELECTRONICALLY WELDED.
- WOOD COMPONENTS TO BE TREATED WITH CHROMATED COPPER ARSENIC (C.C.A.) GREEN.
- PICNIC TABLES AVAILABLE FROM CUSTOM PARK & LEISURE OR APPROVED EQUAL

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| PICNIC TABLE | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: FEB 2024 | L-11 |
| NOT TO SCALE | DRAWN: EDS Group | |

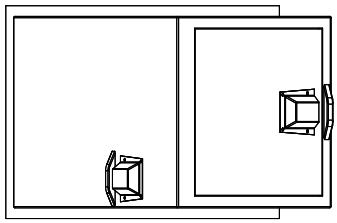




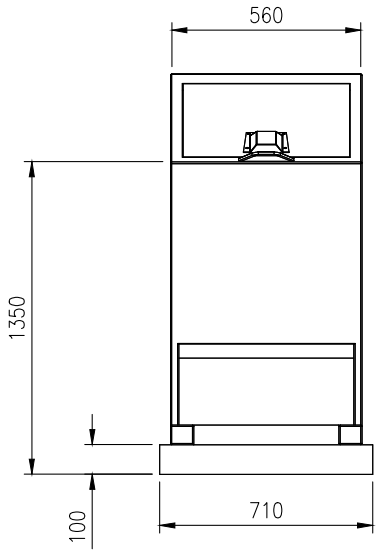
MOUNTING PAD SEE L16 FOR
CONCRETE SPECIFICATIONS

NOTE:

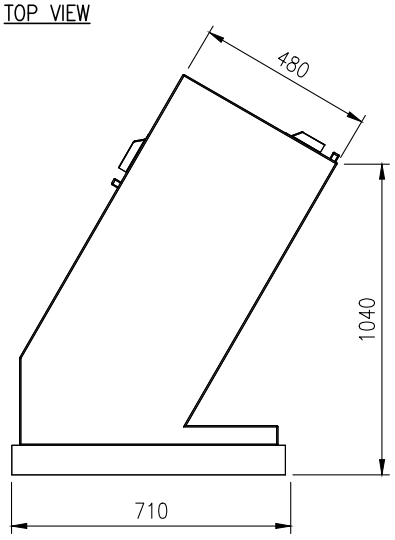
- HBIS CONTAINER (STANDARD) SP-HBIS-N
- GALVANIZED STEEL WITH POWDER COAT PAINT ARISTO BLUE
- STAINLESS STEEL HINGES AND LATCHES
- USES POLY BAG 2.5mil 1070mm X 1270mm
- MANUFACTURER:
  HAUL-ALL EQUIPMENT SYSTEMS
  WWW.HAULALL.COM
  1-888-428-5255



TOP VIEW



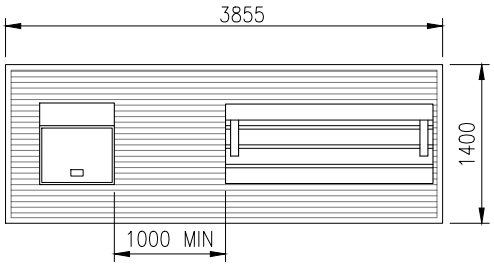

FRONT VIEW



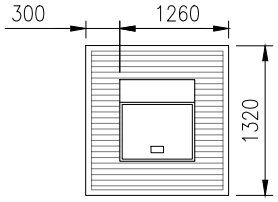

SIDE VIEW

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

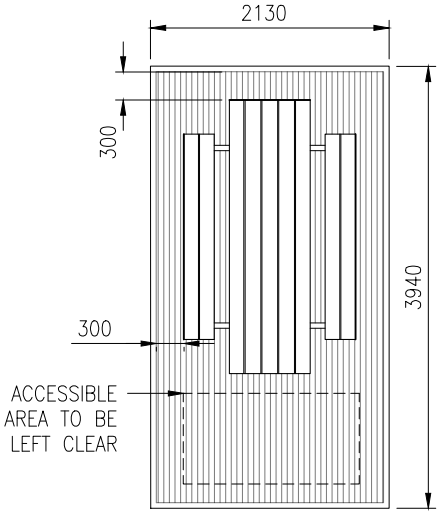
| WASTE RECEPTACLE | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 1 | DATE: MAY 2019 | L-12 |
| NOT TO SCALE | DRAWN: EDS Group | |



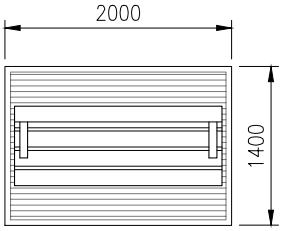

PLAN VIEW BENCH AND WASTE RECEPTACLE




PLAN VIEW WASTE RECEPTACLE



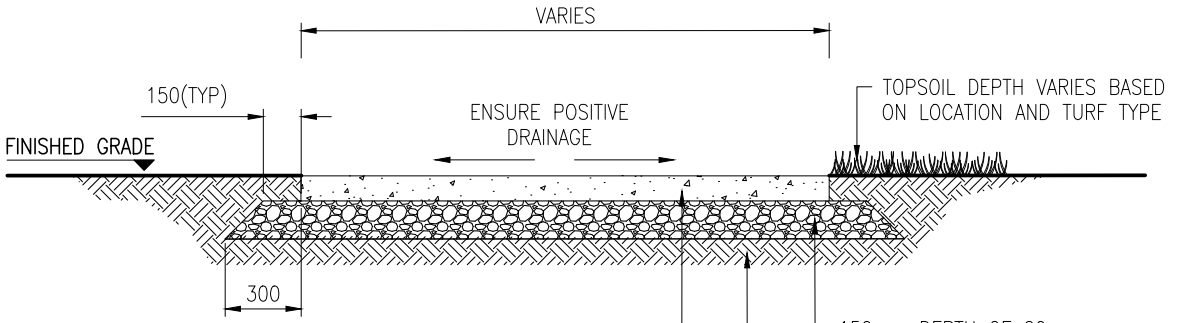

PLAN VIEW PICNIC TABLE




PLAN VIEW BENCH

NOTE:

- SEE L10 FOR BENCH MODEL AND MOUNTING DETAIL.
- SEE L11 FOR PICNIC TABLE MODEL AND MOUNTING DETAIL.
- SEE L12 FOR WASTE RECEPTACLE MODEL AND MOUNTING DETAIL.
- CONCRETE PAD TO BE BROOM FINISHED LINES PARALLEL TO LONGEST DIMENSION.
- SAW CUT ANY CONCRETE THAT EXCEEDS 2250mm IN LENGTH.
- REBAR TO BE SPACED AT 500mm GRID.



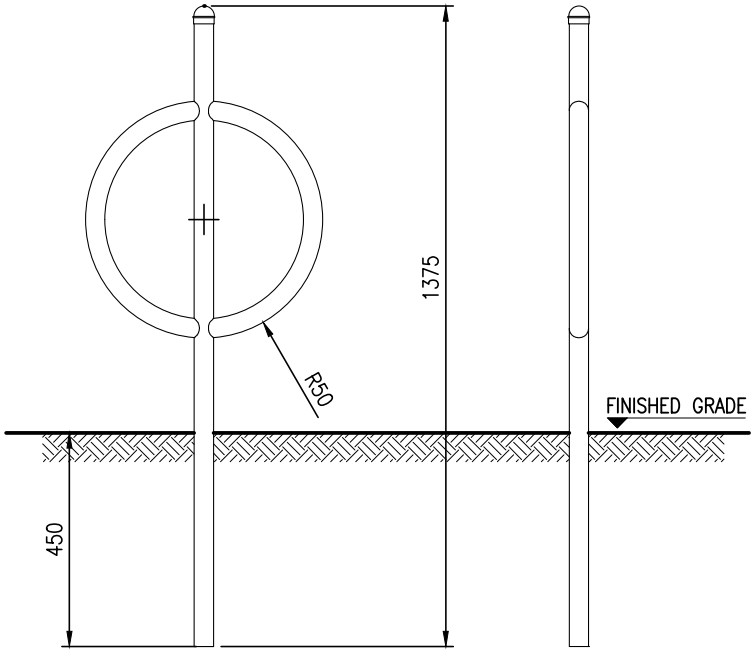

SECTION CONCRETE PAD

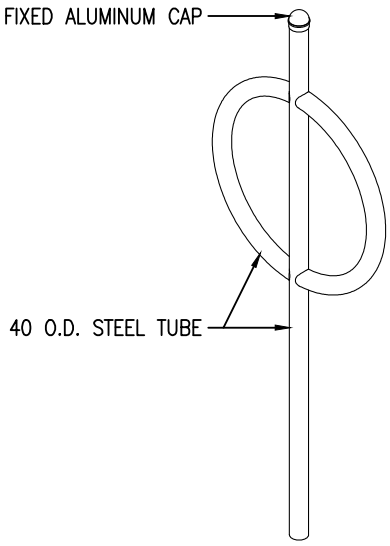
ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

# TYPICAL CONCRETE PAD

CITY OF FORT SASKATCHEWAN

| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
|---|---|---|
| REVISION NUMBER: 1 | DATE: MAY 2019 | L-13 |
| NOT TO SCALE | DRAWN: EDS Group | |

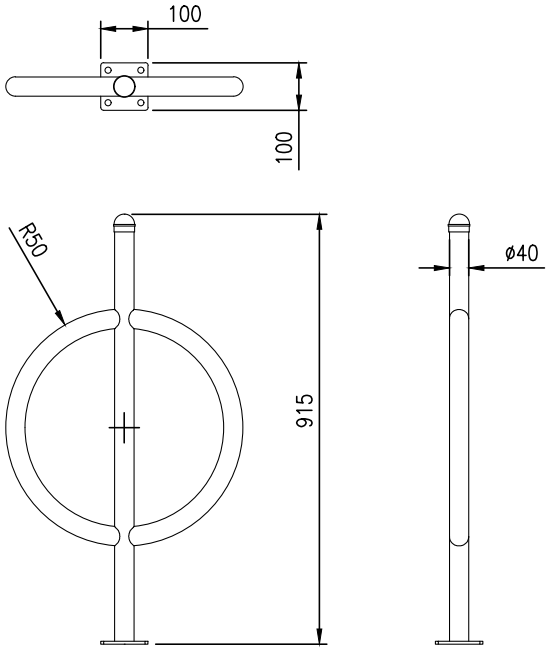


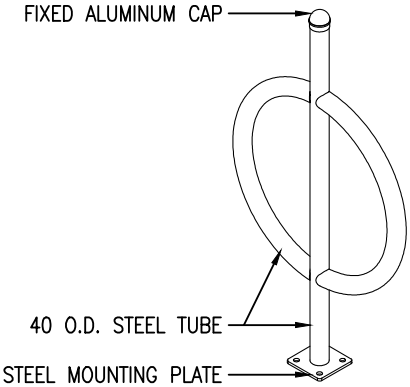




MODEL 101 (IN –GROUND MOUNTED)

NOTES:

- ALL METAL COMPONENTS TO BE POWDERCOATED BLACK.
- INSTALL AS PER MANUFACTURER'S SPECIFICATIONS.

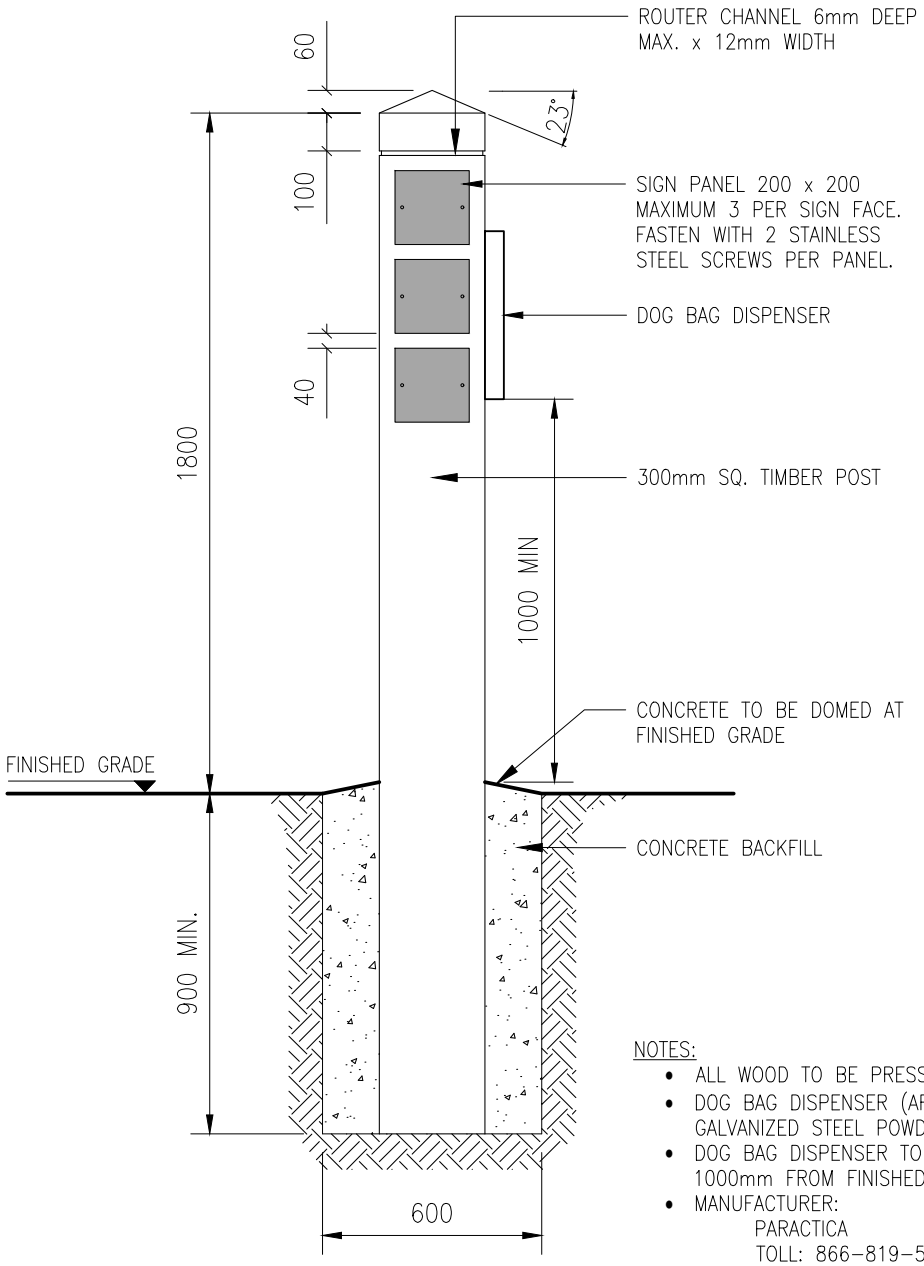



MODEL 102 (SURFACE MOUNTED)

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| BIKE RACK | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: MAY 2019 | L-14 |
| NOT TO SCALE | DRAWN: EDS Group | |



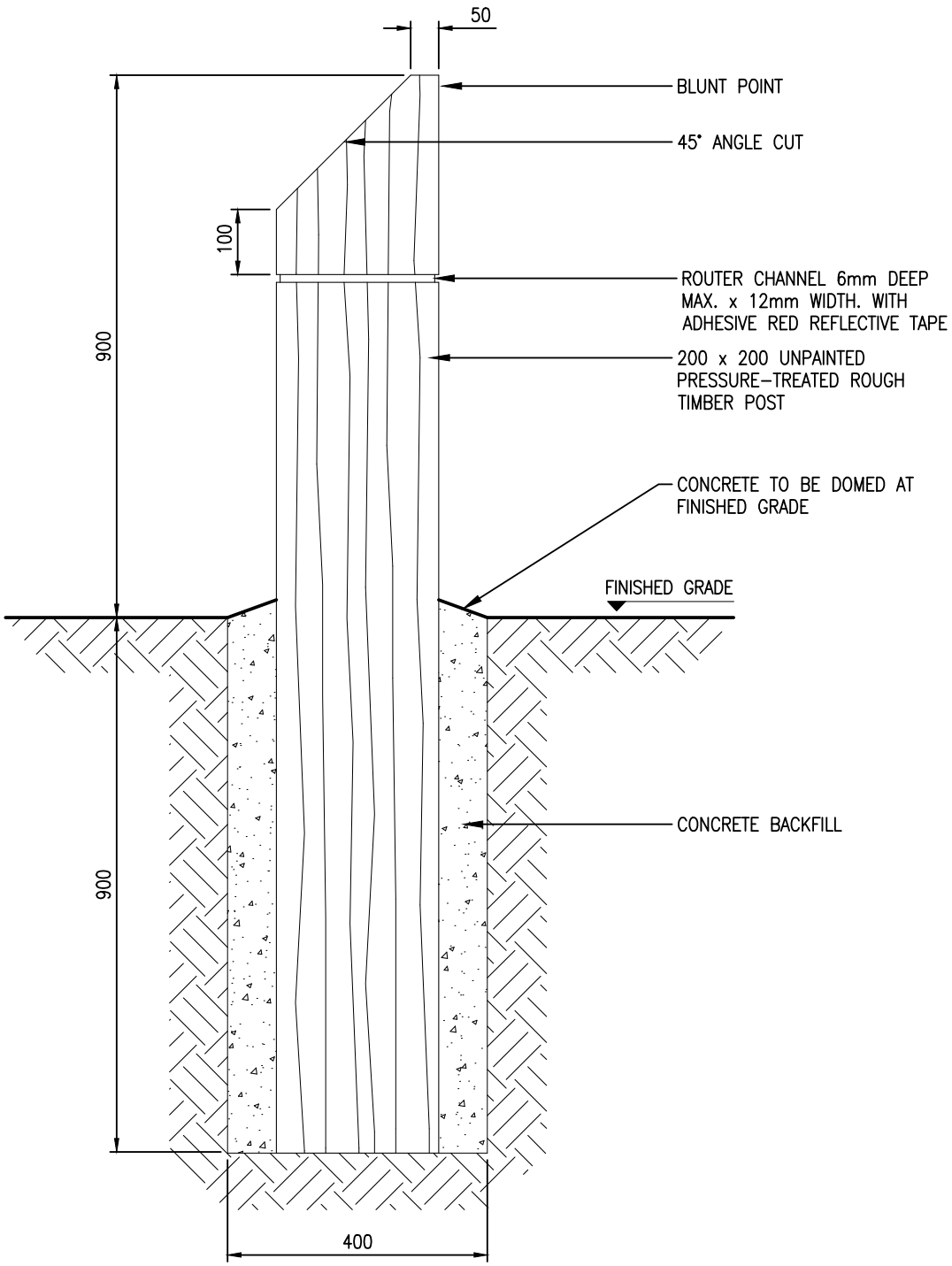

ELEVATION

NOTES:

- ALL WOOD TO BE PRESSURE TREATED, INCISED.
- DOG BAG DISPENSER (ARTICLE #201) BLUE 14 GAUGE GALVANIZED STEEL POWDER-COATED RUST RESISTANT.
- DOG BAG DISPENSER TO BE MOUNTED TO POST MIN. 1000mm FROM FINISHED GRADE.
- MANUFACTURER:
  PARACTICA
  TOLL: 866-819-5559
  PHONE: 519-624-9001

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| TRAIL SIGN | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: MAY 2019 | L-15 |
| NOT TO SCALE | DRAWN: EDS Group | |

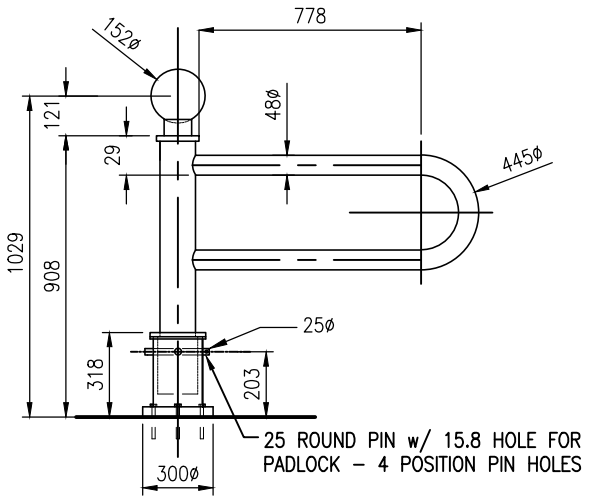


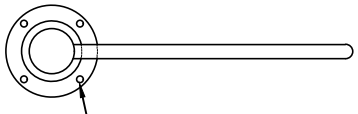

NOTES:

- REMOVE ALL LOOSE CHIPS AND SPLINTERS, SAND CUT EDGE LIGHTLY
- TREAT CUT FACE WITH PRESERVATIVE MATCHING UNCUT WOOD, TO MANUFACTURER'S INSTRUCTIONS
- INSTALL POSTS PLUMB, ALIGNED & VERTICAL WITH CUT SLOPES ALL FACING IN ONE DIRECTION
- WHERE MULTIPLE POSTS ARE REQUIRED, SPACE EQUALLY, NOT EXCEEDING 1500 O.C.
- INSTALL ALL WOOD BOLLARDS AT A UNIFORM HEIGHT USING A STRING LINE TO A TOLERANCE OF MAX. 15mm

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| WOOD BOLLARD | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: MAY 2019 | L-16 |
| NOT TO SCALE | DRAWN: EDS Group | |



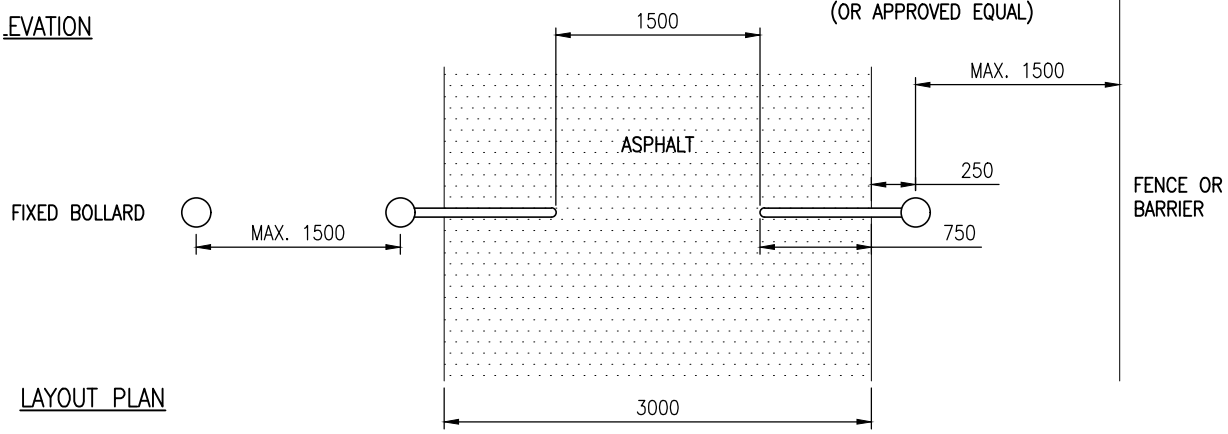
300 ROUND BASE PLATE w/ 4 – 25mm HOLES ON 260 BOLT CIRCLE. 4 – 150 LONG 19ø GALVANIZED BOLTS (COARSE THREAD) c/w FLAT WASHERS & NYLOCK NUTS. BURR THREADS TO PREVENT REMOVAL.

PLAN

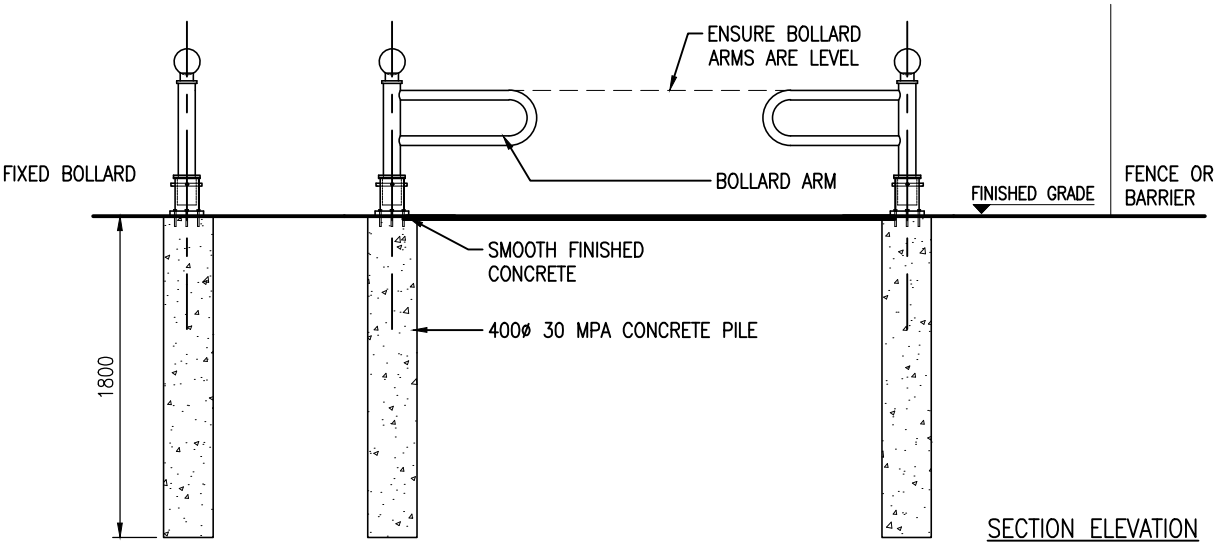
NOTES:

- ALL METAL COMPONENTS TO BE POWDER COATED; COLOUR TO BE 'BLACK' GLOSS FINISH.
- BOLLARDS AVAILABLE FROM:
  CWF WELDING & FABRICATION – EDMONTON
  PHONE: (780) 471–4290
  (OR APPROVED EQUAL)

ELEVATION



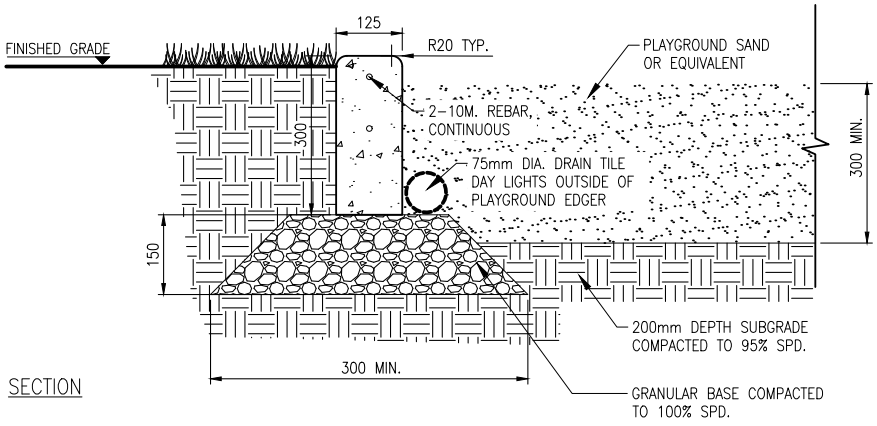

LAYOUT PLAN




SECTION ELEVATION

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

| SWING GATE BOLLARD | | |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 2 | DATE: FEB 2024 | L-17 |
| NOT TO SCALE | DRAWN: EDS Group | |



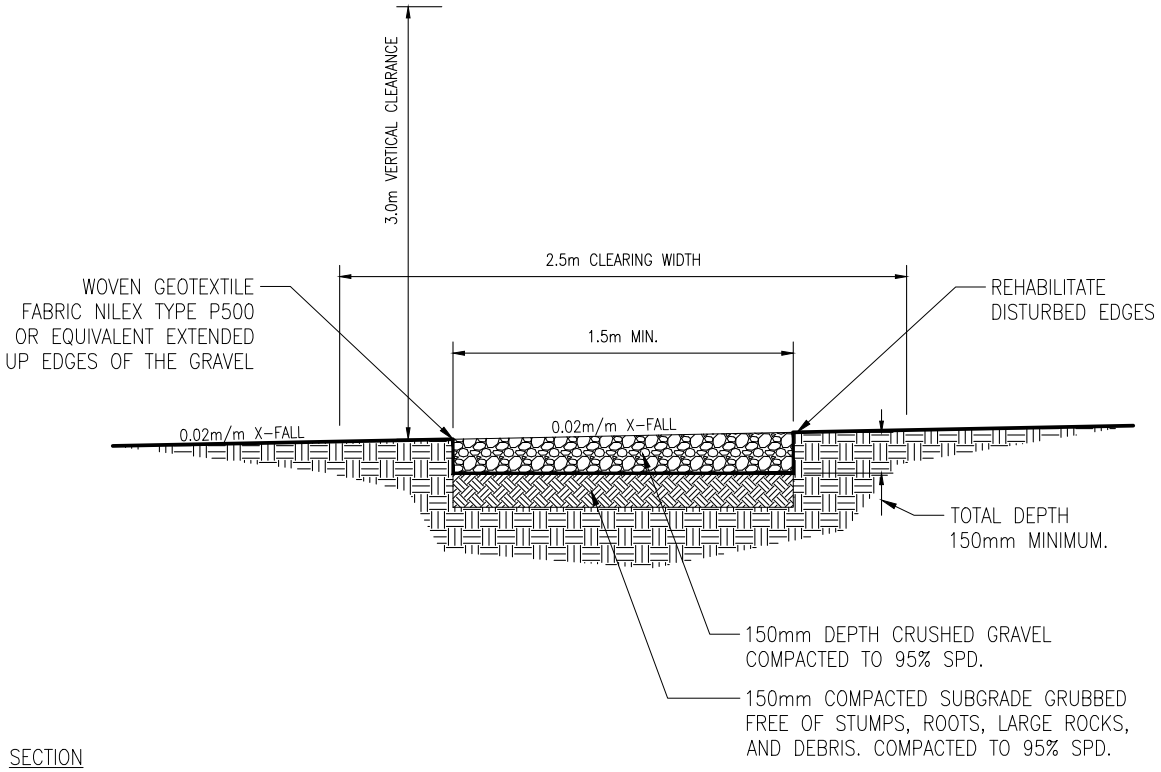

SECTION

NOTE:

- PLAYGROUND SUBGRADE MUST HAVE POSITIVE DRAINAGE IN ONE DIRECTION NO LESS THAN 1.0% GRADE.
- SAND MATERIAL TO MEET SURFACE IMPACT TESTING REQUIREMENTS.

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE NOTED

| CONCRETE PLAYGROUND EDGER | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 1 | DATE: MAY 2019 | L-18 |
| NOT TO SCALE | DRAWN: EDS Group | |




SECTION

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

| GRAVEL TRAIL | | CITY OF FORT SASKATCHEWAN |
|---|---|---|
| CITY OF FORT SASKATCHEWAN STANDARD DETAIL | | DWG. NO. |
| REVISION NUMBER: 1 | DATE: MAY 2019 | L-19 |
| NOT TO SCALE | DRAWN: EDS Group | |