

# SUBDIVISION MANUAL

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# SECTION I

## GENERAL SUBDIVISION DESIGN PRINCIPLES DESIGN STANDARDS

### INTRODUCTION

The City of Cornwall, through the subdivision review process, encourages well designed, attractive subdivisions. This document, together with various bylaws and the City's Official Plan, provide guidance and outlines requirements and design standards for new subdivision development.

The standards are based on considerable technical background, design approaches and experience in maintenance of urban infrastructure. Generally, no variance is allowable for specific minimum standards. Any variance to a specific standard would have to be approved by Council by a specific request or through approval of the Subdivision Agreement.

Certain alternative or "neo-traditional" design approaches are being used in test installations across Ontario, particularly as they relate to street widths and lot and house locations. The City of Cornwall may consider a limited number of small scale test installations of such approaches on a case-by-case basis. Those models should be based on documented alternative standards. In particular, various alternative standard approaches contained in Ontario Ministry of Municipal Affairs research. Early consultation is critical for such approaches.

#### **I.1 Watercourses, Tree Preservation and Environmental Issues**

Any design shall have regard for the existing topography, tree coverage and environmental conditions of the property. The Official Plan provides for the preservation of certain natural features including significant wetlands, tree stands, and natural watercourses.

Natural watercourses are to be preserved wherever feasible. If the watercourse is required to be engineered, the facility should be designed to have natural restoration including tree planting.

The existing tree coverage should be retained as much as possible. Road grades and other engineered features should be planned with a view to minimizing grade changes.

#### **I.2 Parks**

A minimum of 5% of park space is required in each subdivision. In small subdivisions where 5% would not form a useful parcel, cash in lieu of the park space may be acceptable. Cash in lieu is calculated on the day before draft plan approval.

Undevelopable land, retention/detention ponds, or hazard lands will generally not be accepted as part of the 5% park dedication unless it can be demonstrated that they are adequately sized, located and developable for park uses.

Parks should be centrally located with good access from the subdivision and surrounding neighborhood. A minimum of 25% park frontage on a street is necessary except where specific conditions prevent compliance. Walkways providing other access to the park may be necessary.

Improvements to the park will be necessary including fencing, grading, and tree preservation. Details of requirements for individual sites would be covered in an applicable subdivision agreement.

Park naming is at the discretion of the Municipality.

### **I.3 Phasing, Building Types, Zoning**

Plans should indicate expected phases of development. Phases should be appropriately sized to provide for reasonable completion of building. It is desirable to complete minor street systems in individual phases, thereby providing a minimum of dead end streets. In addition, proper planning of phases eliminates continuous construction of streets.

Subdivision can provide a range of dwelling types consistent with the zoning applying to the property. An appropriate clustering of uses in an orderly fashion is encouraged. The more dense the development, the closer it should be to the perimeter of a neighborhood. Medium or high density developments must be located on collector or arterial street.

Subdividers may consider or be required to site various facilities located in a Plan of Subdivision. These might include neighborhood commercial facilities or, at the request of a School Board, a school site. Such facilities should be appropriately located and properly zoned.

The siting of those facilities should consider the effect of traffic generation, proximity to parks and parking and loading issues. In general, such facilities should be located with access to an arterial or collector street. Neighborhood commercial uses shall generally be located on the course of arterial and collector streets with access only from collectors.

Where various areas of a subdivision have been pre-serviced for specific land use, there will be a requirement by the developer that the zoning reflect those land uses. The primary reason for the requirements is the prohibition of re-servicing lots which have been pre-serviced, thereby necessitating road cuts.

### **I.4 Service Extensions, Sidewalks**

All service extensions required for the subdivision will be the responsibility of the developer. Oversizing of certain facilities may be required and will also be the responsibility of the developer. Extensions of services to boundaries to accommodate future development is required.

It may be required that sidewalks be installed outside of the proposed subdivision to connect the new development to existing systems.

### **I.5 Draft Plan Approval**

Twenty (20) copies of a draft plan drawn to scale should be submitted to the Planning Department for circulation to City staff, local Ministries, and outside agencies, which include the following information, as required by the Planning Act:

- (a) the boundaries of the land to be subdivided, certified by an Ontario Land Surveyor;
- (b) the locations, widths and names of the proposed highways within the proposed subdivision and of existing highways on which the proposed subdivision abuts;
- (c) on a small key plan, on a scale of not less than one centimeter to 100 meters, all of the land adjacent to the proposed subdivision that is owned by the applicant or in which he has an interest, every subdivision adjacent to the proposed subdivision and the relationship to the boundaries of the land to be subdivided to the boundaries of the township lot or other original grant of which such land form the whole or part;
- (d) the purpose for which the lots are to be used;
- (e) the existing uses of all adjoining lands;

- (f) the approximate uses of all adjoining lands;
- (g) natural and artificial features such as buildings or other structures or installations, railways, highways, watercourses, drainage ditches, swamps and wooded areas within or adjacent to the land proposed to be subdivided;
- (h) the availability and nature of domestic water supplies;
- (i) the nature and porosity of the soil;
- (j) existing contours or elevations as may be required to determine the grade of highways and the drainage of the land;
- (k) the municipal services available or to be available to the land proposed to be subdivided; and
- (l) the nature and extent of any restrictive covenants or easements affecting the land proposed to be subdivided.

## **I.6 Subdivision Plan Approval**

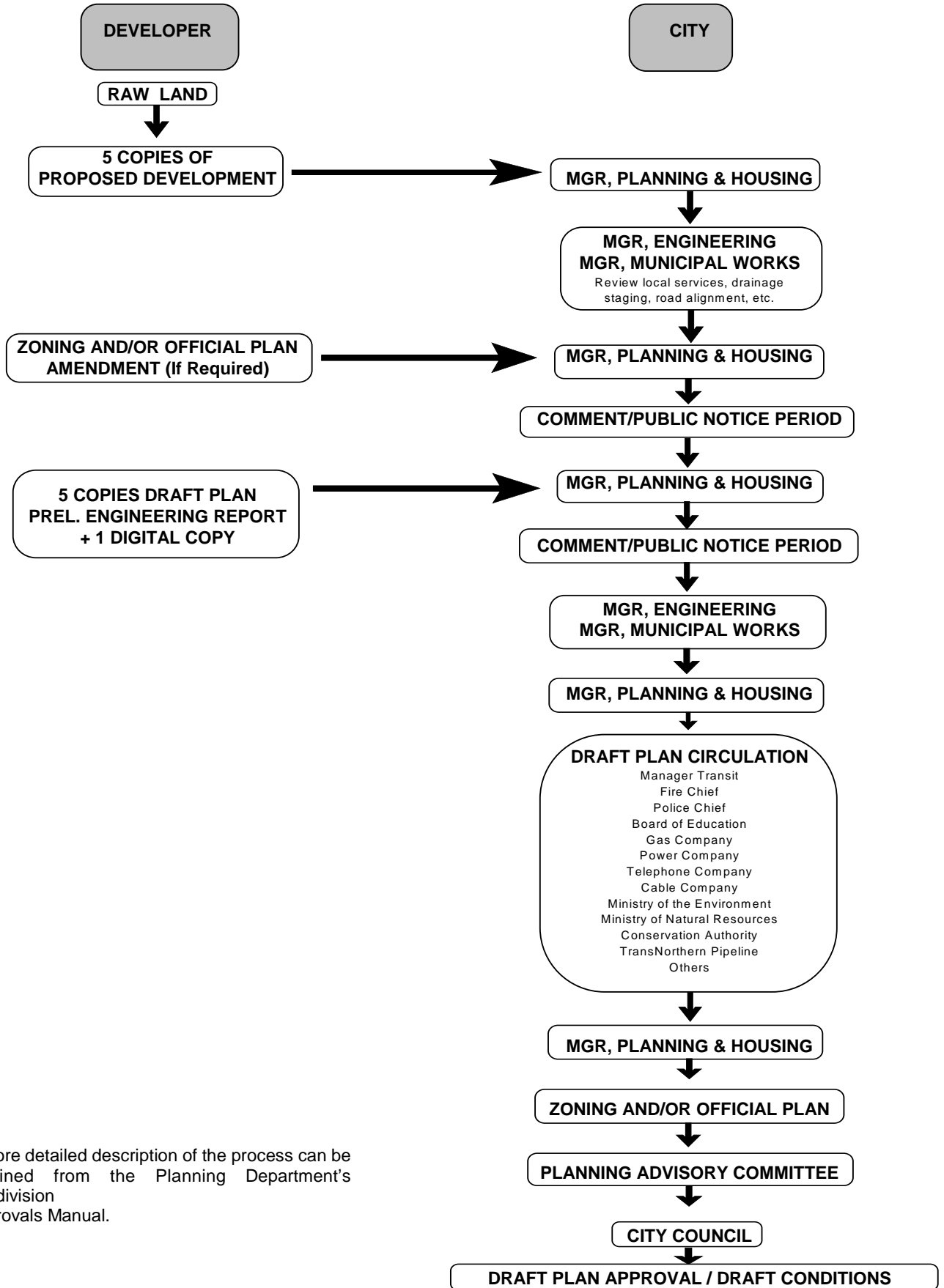
With the completion of the “Draft Plan Approval” process, the Developer must then begin the “Subdivision Plan Approval” process. This process bring the development to the Subdivision Agreement stage which regulates the completion and execution of the following:

- ▶ Construction Drawings;
- ▶ Certification of Title;
- ▶ Ministry of the Environment Approval for Sewer & Watermain;
- ▶ Approval of all other agencies;
- ▶ Letter of Credit.

## **I.7 Final Approval**

With the completion of the “Subdivision Plan Approval” process, the Developer must continue to the “Final Approval” process. This process will take the development to the registration of the Plan and ultimate acceptance of municipal services by the City of Cornwall.

# DRAFT PLAN APPROVAL

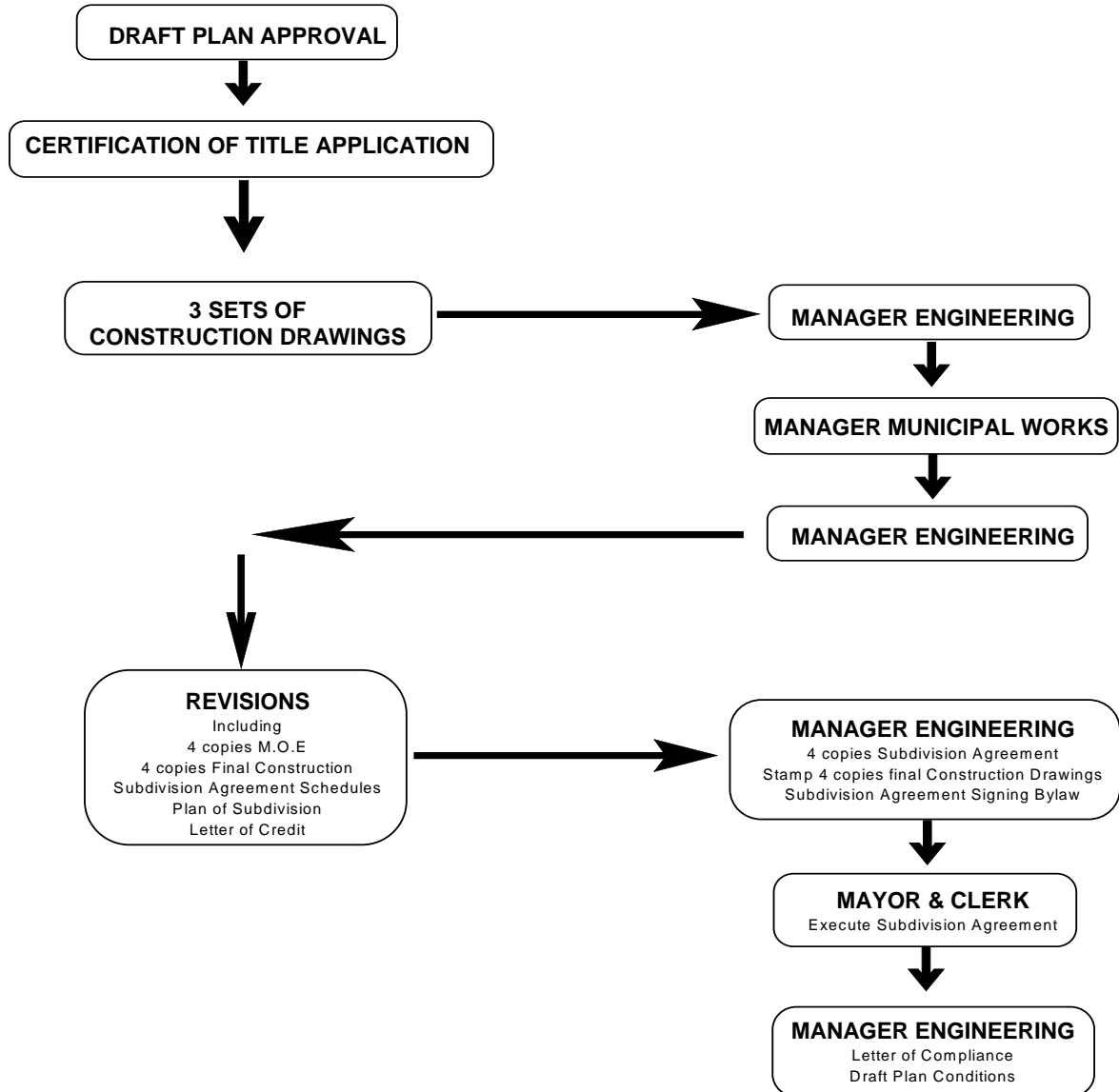


A more detailed description of the process can be obtained from the Planning Department's Subdivision Approvals Manual.

# SUBDIVISION PLAN APPROVAL

DEVELOPER

CITY

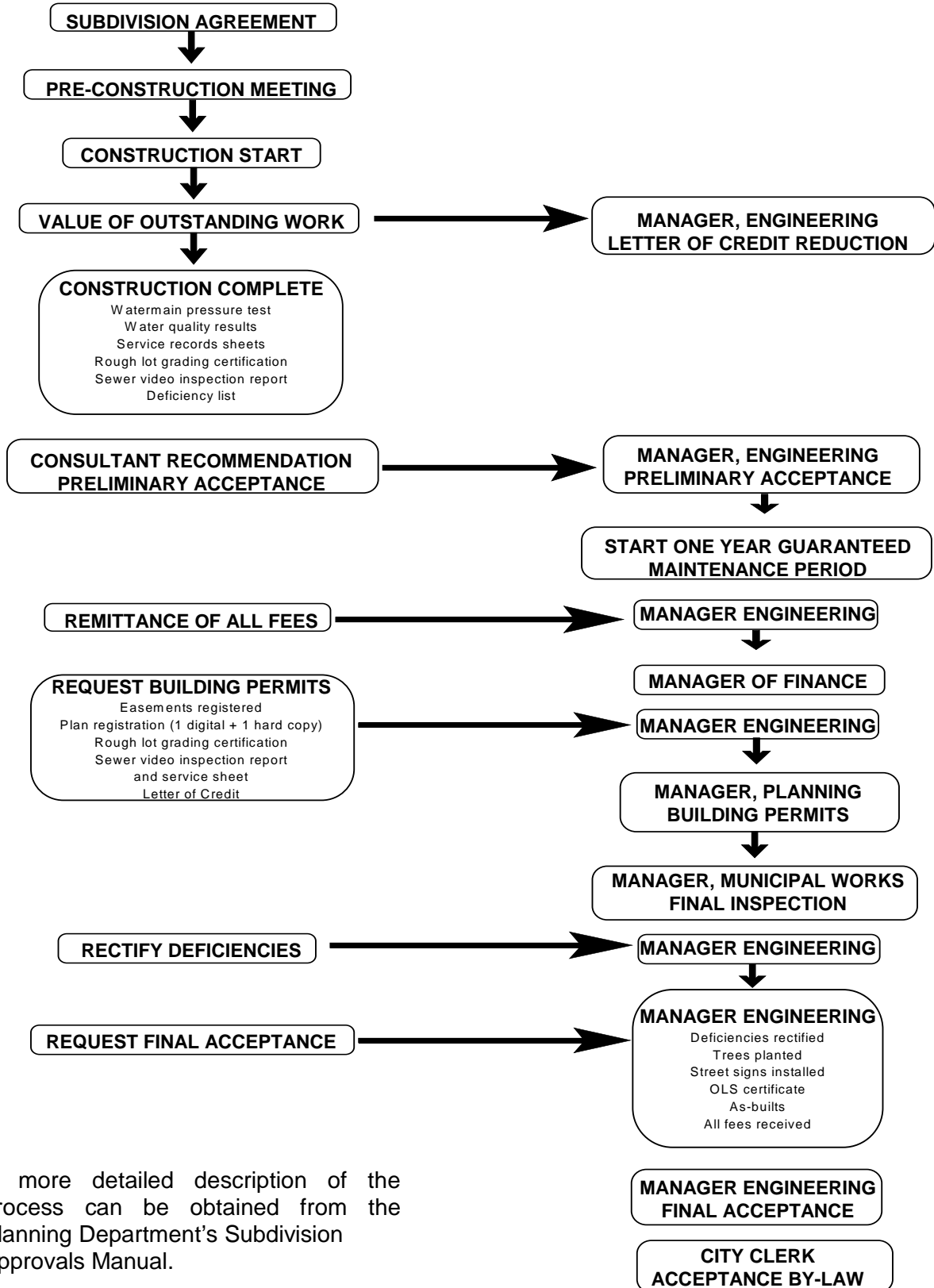


A more detailed description of the process can be obtained from the Planning Department's Subdivision Approvals Manual.

# FINAL ACCEPTANCE

**DEVELOPER**

**CITY**



A more detailed description of the process can be obtained from the Planning Department's Subdivision Approvals Manual.

## SECTION II

### WATER DISTRIBUTION SYSTEM DESIGN STANDARDS

#### II.1 Location of Pipe in Right-of-Way

Watermain shall be located 4.5 m from the north or east property line as per “Typical Service Layout” Sketch (CC-101, CC-102).

Where it is not possible to install the pipe in its corridor, an alternate location may be considered.

#### II.2 Hydraulic Design

- .1 The hydraulic design of the water distribution system will be based on a report prepared by Gore & Storrie Limited, Consulting Engineers, (February 22, 1978) latest revision.
- .2 The maximum working pressure will not exceed 690 kPa (100 psi). Pressure reducing valves are required where localized areas exceed 690 kPa (100 psi).
- .3 The minimum working pressure will not fall below 275 kPa (40 psi) under normal operating conditions, nor fall below 140 kPa (20 psi) under fire flow conditions.
- .4 If problems of flow and pressure are anticipated, a water distribution analysis may be required on the system. The results of that analysis, drawing and calculations will be submitted for review.
- .5 When sizing a distribution system, the following friction factors (C) will be used:

Pipe Diameter (mm)	C-Factor
150	100
200 and 250	110
300 and 600	120
> 600	130

Field tests shall be made when calibrating the model of an existing system.

- .6 Average Consumption

If no reliable flow data is available, the average consumption shall be as follows:

<b>Domestic (Residential, Commercial, Institutional)</b>	Average Day	340 lpcd
	Maximum Day	570 lpcd
	Peak rate	1,300 lpcd
<b>Industrial</b>	Average Day	16,300 l/ha/d
	Maximum Day	25,200 l/ha/d
	Peak rate	40,450 l/ha/d
<b>Fire Demand</b>	Fire flows should be considered in accordance with the requirements of the Insurer's Advisory Organization (formerly Canadian Underwriters Association).	

## **II.3 Parallel Installations**

- .1 Under normal conditions, watermains must be installed at 2.5 m horizontally from any sewer.
- .2 Under unusual conditions or in congested areas where other utilities prevent a horizontal separation of 2.5 m, this distance may be modified, provided:
  - (i) that the obvert of the conflicting service is at least 500 mm below the invert of the watermain. Such a separation should be of undisturbed native material or compacted backfill;
  - (ii) where the above separation cannot be obtained, the sewer should be constructed of materials and with joints that are equivalent to watermain standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.

## **II.4 Crossings with Sewers**

- .1 Under normal conditions, watermains shall be constructed above the sewer or sewer lateral, with a vertical separation sufficient to provide adequate bedding and structural support for the watermain, sewer main and/or sewer lateral.
- .2 Under unusual conditions, where it is not feasible for the watermain to cross above a sewer or sewer lateral, the watermain may be constructed beneath the sewer or sewer lateral provided the following construction techniques are employed:
  - (i) that a vertical separation of at least 500 mm is provided between the invert of the conflicting service and the crown of the watermain;
  - (ii) that adequate bedding and structural support for the sewers be provided to prevent excessive deflection of the sewer, as sewer settlement and associated loadings could cause deflections and breaking of the watermain;
  - (iii) that the length of water pipe passing under a sewer main be centered at the point of crossing so the joints will be equidistant and as far as possible from the sewer main.

## **II.5 Dead End Mains**

Due to the long term concerns of maintaining the chlorine residual in watermain and to ensure proper flows, dead end mains should be avoided by looping all watermains. In some areas, this may require that the city acquire a block of land between proposed lots. Easement are not acceptable.

## **II.6 Depth of Cover and Frost Protection**

Generally, the depth of cover should not be less than 2.0 m with the depth of cover being measured to the obvert of the main or house connection gooseneck.

- .1 Insulation:
  - (i) Insulation shall be installed in areas where frost protection is deemed necessary due to reduction of cover.

- (ii) Where polystyrene (Styrofoam SM) is proposed as an insulating material, it is required that a minimum 50 mm thickness be provided for every 300 mm of reduction in the frost-free depth.

The width of polystyrene board required should be determined by use of the following formulae:

$$W = (F - X) - Y$$

Where: W = required width of Styrofoam SM in mm  
F = frost-free depth in mm 1800 mm + 300 mm (safety factor)  
X = depth from finish grade to top of the Styrofoam SM, mm  
Y = clearance between underside of the Styrofoam and the top of the pipe (minimum 150 mm).

- (iii) Where pre-insulated pipes are required by the Engineer, the manufacturer's design and construction recommendations shall be adhered to.

## II.7 Hydrants

- .1 Hydrants shall have minimum 150 diameter leads.
- .2 Hydrants should have drain holes plugged by the manufacturer.
- .3 Hydrants with two 65 mm nozzles and one 115 mm pumper nozzle should be used in commercial, industrial and high density areas (apartment buildings and multi-family dwellings).
- .4 Hydrants should be located at high points, low points, or dead ends to eliminate the need for vacuum-air relief valves and/or 50mm size blow offs.
- .5 In residential areas, the maximum hydrant spacing shall be 150 m and located at all intersections.
- .6 Hydrants spacing must be reduced in high risk commercial areas where the fire demand increases.
- .7 The standard valve and hydrant shall be located 3.1 m north or east of the northeast corner bar at intersections, opposite lot lines in single family detached areas or 8.0 m north or east of the lot line where semi-detached and multiple family units are planned.
- .8 Hydrants shall be located 3.1 m from the property line.
- .9 Hydrant manufacturers acceptable to the Municipality are as follows:
  - i) Canada Valve
  - ii) Century
  - iii) McAvity M-67
  - iv) Mueller
  - v) Bibby
  - vi) Sentinal
- .10 Hydrants shall be protected with zinc anodes, as per CC-121.
- .11 Hydrants shall include a Storz fitting on large pumper nozzle.

## **II.8 Thrust Block**

Thrust restraints for hydrants, tees, crosses, bends and plugs shall be formed concrete braced against a sufficient area of un-excavated earth or they shall be tied to the pipe with suitable metal tie rods, clamps, or retaining glands as directed by the Engineer. Tie rods, clamps, or other components of dissimilar metal shall be protected against corrosion by hand application of a bituminous coating or by encasement of the entire assembly with 8 mil (0.2 mm) loose polyethylene film in accordance with A.W.W.A. C-105, or the installation of magnesium or zinc sacrificial anodes.

## **II.9 Gate Valve, Butterfly Valve, Air Relief Meter, Blow-off Drain Chambers**

- .1 Chambers containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any sewer.
- .2 Blow-offs shall discharge to one of the following:
  - i) to the surface at locations which are not subject to flooding by surface waters;
  - ii) to absorption pits underground;
  - iii) to a sump within the chamber if the ground water level is below the chamber floor.
- .3 Valves should be located opposite the property line which is perpendicular to the main at intersections. Valves may not be placed more than 300 meters apart or include more than 40 residential units on any section.
- .4 Valves: 150 - 450 mm diameter shall be A.W.W.A. gate valves direct bury;  
500 - 600 mm diameter shall be A.W.W.A. C-900 butterfly valve direct bury.
- .5 Two (2) valves shall be installed at T intersections, and three (3) valves shall be installed at X intersections.
- .6 Valves shall be protected with zinc anode, as per CC-121. Factory installed coatings shall not be acceptable for corrosion protection.
- .7 Valve manufacturers acceptable to the Municipality are as follows:
  - i) Mueller
  - ii) Canada Valve
  - iii) McAvity
  - iv) Bibby
  - v) Clow

## **II.10 Minimum Pipe Size**

The minimum size for watermains is 150 mm in diameter.

## **II.11 Pipe Material**

Acceptable pipe materials are as follows:

- a) PVC, A.W.W.A. C-900, Class 150, watermain pipe for pipe sizes of 100mm to 300mm;
- b) Ductile iron ANSI/AWWA C-151/A21/51. PC350 watermain pipe complete with Polyethelene Encasement;
- c) PVC, A.W.W.A., C-905, DR18, C.I.O.D. for sizes of 350mm to 500mm.

Pipe selected shall have been manufactured in conformity with the latest standards issued by the Canadian Standards Association, the Canadian Government Standards board, the American Water Works Association, the American Society for Testing Materials. Reference should be made to the Ontario Provincial Standard Specification and the City of Cornwall Construction Specifications for Watermains and Sewers for the recommended standards for pipe, joints and fittings manufacture, bedding and cover materials. Etc.

Tie rods, bolts, clamps or other components of dissimilar metals shall be protected against corrosion by hand application of a bituminous coating or by encasement of the entire assembly with 8 mil. (0.2 mm) loose polyethylene film in accordance with A.W.W.A. C-105 or the installation of magnesium or zinc sacrificial anodes.

A tracer wire shall be installed with PVC pipe. Tracer wire must be continuous (unspliced), 14 gauge, solid copper plastic coated wire, T.W.U. 75, 600 V, secured to pipe every 3.0 meters using fiberglass tape or plastic tie wrap, and fastened to a bolt on valves in valve boxes. Tracer wire continuity of current must be tested and verified by Engineer.

**II.12 Service Connections**

A 20 mm diameter Type K copper service connection is required for each residential unit and shall extend from the main to the property line, and terminate with a curb stop and box. All service connections shall be protected with zinc anode, as per CC-121.

Service connections for multiple family (without fire flow) shall be as per the following:

<b>25 mm</b>	<b>2 - 8 units</b>
<b>37 mm</b>	<b>9 - 30 units</b>
<b>50 mm</b>	<b>31 - 90 units</b>
<b>100 mm</b>	<b>91 - 300 units</b>

Commercial, institutional and industrial blocks shall be designed to handle the hydraulic and fire demands anticipated. These connections should terminate at the property line with an approved valve and box. Taps are usually at 10 and 2 o'clock, tapped at least 300 mm apart and staggered, e.g. 10, 11 or 12 o'clock, 2, 1, or 12 o'clock. Copper gooseneck shall be vertical.

Backflow prevention device shall be installed to isolate the premises as required by the Canadian Standard 864.10 - M1981, or latest accepted revision.

**II.13 Construction**

Construction of a distribution system shall comply with the latest revision of the City of Cornwall Construction Specifications for Watermains and Sewers, Ontario Provincial Standard drawings and approved detail drawings.

The contract documents shall be approved prior to tendering and the Contractor approved prior to awarding of contract for these works.

The City will make all connections to existing mains at the Developer's expense.

The Contractor shall not operate any valve, hydrants or open the new mains to the existing City system. The watermains must be left empty until construction is completed. The City will open valve to load newly constructed mains.

## **II.14 Approvals**

It is the developer's responsibility to obtain and pay for all approvals required from the City of Cornwall, Ministry of the Environment, and other regulatory agencies (submission of drawings and calculations included). Approval from the City must first be obtained before all others.

## **II.15 Testing and Inspections**

The City requires full time inspection by a qualified Consulting Engineer.

Compaction Reports by a qualified Geotechnical Engineer shall be submitted for pipe bedding and trench backfill at frequencies acceptable to the City.

The testing of the works before acceptance by the City shall conform to the City of Cornwall Construction Specifications for Watermains and Sewer - Division 4 (appended), and in accordance with ANSI/AWWA C651-99 or latest accepted revision.

## SECTION III

# STORM AND SANITARY SEWER DESIGN STANDARDS

### III.1 Storm and Sanitary Sewer Design Criteria

#### .1 Location of Pipe in Right-of-way (20.0 m, 25.0 m)

Storm Sewer: 7.90m (20.0 m R.O.W.), 9.0m (25.0 m R.O.W.)  
from north or east property line.

Sanitary Sewer: 4.50 m from south or west property line.

As per "Typical Service Layout" standard drawing (CC-101, CC-102).

Where it is not possible to install the pipe in its corridor, an alternate location may be considered.

#### .2 Cover (Minimum)

Storm Sewer: 1.50 m

Sanitary Sewer: 2.40 m

Sanitary sewers must be deep enough to provide a gravity drain for all residential basements.

Storm sewers must be deep enough to provide a gravity drain for all foundation drains (if possible).

#### .3 Manholes

Manholes are required where pipes intersect, change in size, grade, or direction.

Maximum Spacing: 110 m for pipes 900 mm and smaller,  
150 m for larger pipes.

Benching is required to spring line of pipe for sanitary sewers.

#### .4 Head Loss

To compensate for head loss through manholes, the minimum drop between inverts shall be:

30 mm	direction change 10° to 45°
60 mm	direction change 45° to 90°
150 mm	direction change over 90°

Drops required for high velocity sewers must be calculated and approved by the Engineer.

Pipes to be obvert to obvert at size changes.

.5 Catchbasins

Catchbasins shall be 600 mm square, as per O.P.S.D. 705.01 M with square frame and grate as per O.P.S.D. 400.020 M. Location as follows:

- at intersections; the upstream end at curb radii
- all low points;
- maximum spacing: 105 m for road grades 0.5% to 3.0%  
90 m for road grades 3.0% to 4.5%  
70 m for road grades 4.5% and up.

Sumps required in all catchbasins. Catchbasin manholes are acceptable under certain circumstances.

Rear lot catchbasins shall be represented by plan and profile.

.6 Lot Grading

Before Building Permits can be issued, the “Rough Lot Grading” requirement must be met. The criteria used to establish this requirement is as follows:

Type of Housing	Ground Elevation must be 0 mm to ___ mm <b>BELOW</b> final lot grade
Single Family	300
Single Family (heavily treed)	450
Multiple Unit	450
Mix	375

- a) All lots and blocks for private use on the lands are to be developed in accordance with the lot grading details and these requirements.
- b) Existing ground contours and/or elevations must be on grading plan. The contours and elevations must represent the existing ground elevation at the time of entering into the Subdivision Agreement.
- c) Exact location of service connections, street appurtenances, and lot catchbasins and leads are provided in Engineering plans.
- d) All ground surfaces shall be graded to provide positive drainage to approved swales or catchbasin outlets.
- e) All block swales and all lot swales which carry flow from more than one lot shall be at least 100 mm deep with 1.0% minimum grade, and 4:1 maximum side slopes. Swales are not to exceed 750 mm from invert to top of bank. Embankments may be required to maintain these criteria.
- f) Minimum surface grades (excluding swales):
  - i) grass yard areas - 2.0%;
  - ii) paved driveway and parking areas - 1.0%.
- g) Where required, lots or blocks which abut a subdivision or internal limit shall be graded to provide a 600 mm wide strip which is at the same grade as the adjoining lands. Any embankment required for internal grading is to be commenced along the inside edge of this strip.

- h) The grading of all lots and blocks is to provide finished perimeter surfaces which are level with given street line, rear and side line elevations.
- i) Final perimeter grades for a lot or block which have not been specified shall be coincident with the adjoining perimeter grades which have been previously established by, or constructed in accordance with an approved Municipal site plan or approved Developer grading plan.
- j) Rear yard grades shall not exceed 4.0%. Differentials that cannot be accommodated within this limit must be made up of either 2:1 maximum embankments and/or retaining walls. Retaining wall locations will be clearly noted and registered on title of affected lots.
- k) Perimeter swales conforming with City of Cornwall grade control criteria must be installed along side and rear lot lines when rear yard grades exceed 4.0%.
- l) Any embankment shall not commence less than 600 mm from side wall, or 3000 mm from rear wall of any housing unit.
- m) No embankment shall exceed a 2:1 slope and will be sodded and pegged. Elevation differentials resulting in slopes steeper than 2:1 will be retained with a structure approved by the City of Cornwall's Engineering Department.
- n) Maximum parking area pavement grades are not to exceed 7.0%.
- o) The rear and internal lot elevations shown are the elevations for the designed drainage pattern. Any alternate grading proposals must be approved by the City of Cornwall's Engineering Department before proceeding.
- p) Given house grades shall be adjusted as necessary to compensate for differences between assumed and actual building dimensions in accordance with the established criteria for the lot drainage pattern.
- q) Driveways shall not be used as front lot drainage outlets. If an outlet is required on the driveway side of the lot, then a sodded swale is to be provided along the driveway.
- r) Specified housing unit types may be constructed on lots with symbols as follows:

<b>B/S</b>	indicates special backsplit type, under 1200 mm slope, front to rear
<b>FWO</b>	indicates special front walkout or basement garage type, over 1200 mm slope, front to rear
<b>W/O</b>	indicates special walkout type (may be backsplit 2 storey walkout) over 1200 mm slope, front to rear
	All remaining lots are un-designated and conventional types and backsplits (up to 1200 mm slope, rear/front or front/rear) may be used

- s) The Developer will conform with the curb location policies of the Municipality, and shall be responsible for the rectification of any discrepancies.
- t) The toe of slope for embankment construction is to be at least 1500 mm from rear lot line.

.7 Service Lateral

Foundation drains are to be connected by gravity to the storm sewer.

Should this not be possible, sump pumps will be required discharging via a storm lateral to the storm sewer.

Should storm sewers not exist, storm laterals shall discharge to the rear yard swale. The rear yard swale will include the installation of a perforated pipe subdrain system.

The minimum size for a residential sanitary service lateral is:

100 mm, Colour: White, PVC SDR 35

The minimum size for a residential storm service lateral is:

100 mm, Colour: Green, PVC SDR 35

For multiple units, the sanitary sizes are as follows:

100 mm to 6 units  
 150 mm to 20 units  
 200 mm to 45 units  
 250 mm to 85 units

The minimum grade shall be 2.0%.

.8 Sewer Pipe Material

Acceptable pipe materials are as follows:

Pipe Materials	Sanitary	Storm
PVC SDR35 - CSA B182.2	X	X
PVC Rib Pipe, Concentric Ribs - CSA B182.4 Min. Pipe Stiffness - 320 kPa	> 450	X
R.C. Reinforced Concrete - CSA A257.2	> 750	X
Polyethylene (PE) CGS P41 - CP - 23M	Special Conditions	Special Conditions

Pipe selected shall have been manufactured in conformity with the latest standards issued by the Canadian Standards Association, the Canadian Government Standards Board, the American Water Works Association, the American Society for Testing Materials, the Ontario Provincial Standard Specification, City of Cornwall Construction Specifications for Watermains and Sewers.

.9 Approvals

It is the Consultant's responsibility to obtain all approvals required from the City of Cornwall, Ministry of the Environment, and other regulatory agencies (submission of drawings and calculations included, if required). Approval from the City must first be obtained before all others.

.10 Testing and Inspection

The City requires full time inspection by a qualified Consulting Engineer and will periodically inspect all storm and sanitary sewers during construction, as well as via closed circuit camera after construction.

Compaction Reports prepared by a qualified Geotechnical Engineer shall be submitted for pipe bedding and trench backfill.

The testing of the storm and sanitary system shall conform to the City of Cornwall "Construction Specifications for Watermains and Sewers" Division 4.

### III.2 SANITARY FLOW DETERMINATION

Sanitary sewage flows will be estimated using the following formula:

$$Q = \frac{PqM}{86.4 + IA}$$

Where:

- Q = peak sewage flow, including infiltration, l/s
- P = design population, in thousands (see Table 1)
- Q = 340 Lpcd = average daily domestic flow
- M = peaking factor =  $1 + \frac{14}{4 + \sqrt{P}}$  maximum = 4 minimum = 2
- I = 0.19 l/s/ha = infiltration for new subdivision  
0.28 l/s/ha = infiltration for older tributary areas  
or as determined by field monitoring
- A = tributary area (ha).

<b>Zoning</b>	<b>Population</b>
RES 10	60 Ppha
RES 15	75 Ppha
RES 20	85 Ppha
RES 30	125 Ppha
RES 40	250 Ppha
RES 50	125 Ppha
CC, CN	65 Ppha
COM 41, 42, CH	85 Ppha
COM 10, 11, 12	100 Ppha
COM 51, 70, CBD	150 Ppha
MFR 10, 20, 30, 40, MS	100-150 Ppha*
* May vary depending on industrial use	

Flow estimates shall be based on ultimate flows generated for all tributary areas. When an existing sewer area is tributary to a proposed sewer, an evaluation must be made to determine actual peak flows from the area.

Calculations shall be made on City of Cornwall Sanitary Sewer Design Charts or a comparable form, an example of which is hereto attached, and shall be accompanied by a plan of the area to be serviced showing all tributary areas.

### III.3 **STORM FLOW DETERMINATION**

#### .1 **Peak Runoff – Rational Method**

Storm water runoff may be determined using the Rational Method:

Where

- $Q = 2.8 CiA$
- Q = peak runoff from drainage area, l/s
- C = runoff coefficient (see Table 2)
- A = Area, ha
- i = average rainfall intensity, mm/hr (from A.E.S. intensity-duration curves). Return frequency, indicated in Table 3
- Tc = time of concentration = inlet time (from Table 4) plus time of travel in sewer

<b>Table 2 – Runoff Coefficients</b>	
<b>Land Use</b>	<b>Coefficient</b>
Flat Woodland	0.10
Rolling Woodland	0.20
Parkland (>5 ha)	0.20
(<5 ha)	0.25
Flat Cultivated	0.30
Single Family	0.45
Semi-Detached	0.50
Town & Row Housing	0.65
Apartments	0.70
Industrial, Institutional	0.75
Suburban & Tourist Commercial	0.80
Downtown Commercial	0.95

<b>Table 3 -- Return Frequency</b>	
<b>System</b>	<b>Return Frequency</b>
Minor System	5 year
Major System	100 year

<b>Table 4 – Inlet Times</b>	
<b>Land Use</b>	<b>Inlet Time</b>
Residential - Single Family, Semi-Detached	20 min.
Residential - Town and Row Housing	15/20 min.
Suburban Commercial, Industrial	15 min.
Downtown Commercial, Apartments, Expressways	10 min.

When estimating runoff, post development conditions must be considered for the entire drainage basin, ensuring that all tributary lands can be drained. Consideration must also be given to the receiving pipe or waterway's capability to accept the design flow. This applies particularly to the storm return frequency the receiving pipe was designed to accommodate. If the design flow is higher than the receiving system capacity, minor system storage shall be required.

When the rational method is used to determine storm runoff, calculations shall be made on City of Cornwall Storm Sewer Design Charts or comparable form, and shall include a plan showing the drainage area. If any other method is used to estimate runoff, the criteria used and all calculations must be recorded for inclusion in the design file or supplied on disk compatible with City software.

### III.4 **STORM AND SANITARY SEWER PIPE SIZING**

Storm and sanitary sewer pipe selection will utilize the Manning Formula for open channel flow, which states:

$$Q = \frac{1000 A R^{2/3} S^{1/2}}{n}$$

Where

- Q = flow, l/s
- A = cross-sectional area of flow, m<sup>2</sup>
- R = hydraulic radius, m
- S = pipe slope, m/m
- n = coefficient of roughness: - 0.013 PVC & concrete sewer pipes  
- 0.024 corrugated metal pipe

No pipe smaller than 200 mm diameter may be used for storm or sanitary sewer mains.

The slope must be adequate to maintain minimum velocity at full flow. The minimum slope for upstream section shall be 0.8%.

Minimum Sanitary	V = 0.6 m/s
Minimum Storm	V = 0.75 m/s
Maximum Storm & Sanitary	V = 3.35 m/s

### III.5 **OPEN CHANNEL DIMENSIONING**

Design of open channels shall be based on the Manning Formula for open channel flow stated in Section I.4, Storm and Sanitary Sewer Pipe Sizing, assuming a roughness coefficient, n, as indicated in Table 5.

<b>Table 5 – Coefficient of Roughness</b>	
<b>Channel Lining Material</b>	<b>Coefficient</b>
Asphalt, Concrete, or Brick	0.018
Corrugated Metal	0.024
Rubble or Rip-Rap	0.030
Grass	0.035

- Maximum velocity = 1.8 m/s for grass-lined channel.

- Freeboard - 20% of the design depth is to be provided for freeboard, minimum 300 mm.  
- Access - To facilitate cleaning and other maintenance activities, an access road or a flat grassed surface not less than 4.0 m wide should be provided adjacent to the channel, especially when grass channel used.

### **III.6 STORM WATER GUIDELINES**

Appendix G of the “Project Plan for the Retrofit of Fly Creek Stormwater Pond - Phase I” prepared by Aquafor Beech Limited, January 21, 1997 has been adopted as the City of Cornwall Stormwater Management Guideline, as attached.

The “Stormwater Management Planning and Design Manual” prepared by the Ministry of the Environment, March 2003 may be used as a tool providing technical and procedural guidance for the planning, design, and review of stormwater management practices.

### **III.7 OTHER GUIDELINES**

Developers involved in any development requests within the South Branch Raisin River watershed are suggested to review the “South Branch Raisin River Storm Water Management Study” prepared by the Thompson Rosemount Group, December 17, 2002 (available for review at the City Engineering office).

## **APPENDIX G: STORMWATER MANAGEMENT GUIDELINES**

### **G.1 RATIONALE FOR GUIDELINES**

Traditional drainage practices and designs are intended to efficiently direct stormwater away from transportation corridors and peopled areas to receiving water courses. The objective of this process is to afford the desirable level of protection against the loss of life and property. However, stormwater runoff from urban surfaces has also been recognized as a significant source of contaminants to receiving water bodies resulting in the degradation of water quality and the loss or reduction of aquatic habitat, recreation and aesthetic value. Field measurements of selected water quality constituents reported in Section 3 of this report for two wet weather events, indicates that stormwater runoff from Upper Fly Creek violates Provincial Water Quality Guidelines for the protection of wildlife. Consequently, these waters without treatment, pose of significant stress on wildlife, their habitat and the recreational use of the Fly Creek pond and the downstream watercourses.

There are many possible sources of contamination of surface drainage waters. Some of these sources are: the entrainment of accumulated debris and litter; animal droppings; eroded soil; tire and vehicular exhaust residue; atmospheric fallout; deicing compounds; pesticides and polychlorinated biphenyls; fertilizers and other chemical additives; decayed vegetation; corrosion of metal surfaces on buildings and structures; intermittent spills of chemicals; illicit discharges of paints, oils and other industrial and domestic wastes. The result is that a wide range of pollutants may be conveyed through surface drainage waters to the receiving water bodies. Prevention is the preferred treatment method, however, this method alone is not sufficient. Treatment of drainage waters must also be considered. This requirement stems from a philosophy that stormwater runoff is a resource to be managed for the benefit of society as opposed to a waste to be disposed of as quickly as possible.

The Ontario Ministry of the Environment and Energy, in co-operation with the Ontario Ministry of Natural Resources, have established guidelines for the treatment of stormwater effluent as part of a provincial strategy for the management of urban watersheds. These guidelines are to be considered in conjunction with Watershed, Subwatershed and Stormwater Management Plans as an integral part of the planning process. In developing these guidelines the Ministry's have adopted a tiered approach in which guidelines are developed specifically for specially designated areas with a general set of guidelines for all other areas. Specially designated areas include those areas with special recreation (e.g. swimming) and other designated uses. For these areas directives will be established in consultation with the Conservation Authority, MNR and MOEE.

### **G.2 Specially Designated Areas**

Guidelines have been developed for the Ottawa and Bay of Quinte RAP programs to protect swimming based recreational activities and habitat. Consequently, they have adopted average constituent concentrations for a stormwater discharge event at the point of release of based on:

- i) bathing beach criteria for E. coli of 100 counts/dL (with four exceedances permissible during the swimming season); and,
- ii) total suspended solids concentrations of [TSS] = 25 mg/L (with four exceedances allowed during the swimming season).

Although the City of Cornwall does not currently have officially designated swimming areas along streams which drain through the City, direct water contact is common particularly among children and anglers. In addition, swimming and other water based recreational activities occur along the Cornwall waterfront which receives discharges from streams draining through the City. Consequently, concern with regard to the protection of human health and wildlife from exposure to contaminants in urban runoff have led to the recommendation that the Cornwall RAP adopt a guideline for Upper Fly Creek of:

*[TSS] = 25 mg/L as an average event concentration with four exceedances being allowed between May 1 and October 31, the biologically most active period of the year.*

This guideline is to apply to the effluent from the Fly Creek Stormwater Pond based on the following rationale:

- i) the existing stormwater detention facility has the capacity, through retrofit, to provide this level of treatment; and,
- ii) a Subwatershed Plan for the management of drainage within the Upper Fly Creek drainage area has been completed in the form of the current study.

The above criteria also apply to any other watersheds within the municipal boundaries of the City of Cornwall wherein the capacity for this level of treatment is considered practical and feasible or necessary for the protection of designated habitats or future bathing areas (these watercourses are referred to as 'protected' areas in this text). In 'protected' drainage basins where a Subwatershed Plan does not yet exist, proponents of developments exceeding 5 ha in area must prepare a Stormwater Management Plan to demonstrate compliance with the above criteria. Proponents of developments of areas of 0.5 to 5 ha must demonstrate that the best available technology for on-site control has been employed (with the goal of zero increase in runoff rate and volume to the extent feasible). The Conservation Authority may require the contribution of funds toward the design, construction and operation of a centralized facility in lieu of site specific works. Development applications for areas of less than 0.5 ha will be considered on a case-by-case basis. All remaining areas within the municipal boundaries of the City of Cornwall will be required to meet the general MOEE/MNR stormwater guidelines

outlined in the following section.

### **G.3 General Guidelines**

The general guidelines for stormwater treatment were developed based on four principles:

- a) the initial storm runoff is typically higher in pollutants as it flushes debris and other matter which has accumulated during dry weather periods and re-suspends material deposited in the storm drainage system;
- b) prevention of contamination of surface drainage, through the use of source controls, must be employed to minimize the quantity of materials being entrained by drainage waters;
- c) volume controls be employed through the use of source controls to minimize the quantity of water requiring treatment and thereby increase the treatment efficiency of adopted mitigation measures; and,
- d) the highly dis-continuous but on-going nature of runoff processes requires that the control of stormwater be approached from a volume, rate, frequency and duration perspective.

The intention of these guidelines is to encourage proponents of new developments to investigate new and innovative technologies for the management of stormwater while providing a reference framework. The guidelines, as presented in Table G.1, are for new developments equal to or exceeding 0.5 ha in area and located in drainage basins not designated as protected. Developments smaller than 0.5 ha in area will be considered on a case-by-case basis. The Conservation Authority may require the proponent of any size of development to contribute to funding for the design, construction and operation of a centralized BMP facility(ies) in lieu of site specific works.

#### **■ Buffer Zones**

A distance of 30 horizontal meters of land from a waterbody must be retained with indigenous vegetation where feasible. Where no or poor vegetation cover exists, due to land management practices, revegetation will be required. Buffers will be established through the Subdivision and Site plan agreements.

More stringent buffer requirements may be necessary to protect specially designated areas. This may include fencing of these buffers prior to construction to ensure their continued

Table G.1 General Stormwater Management Guidelines For New Developments

COMPONENT	GUIDELINE
Flood Hazard	▶ zero increase in flow rate for the 1:5 to 1:100 year design event
Low Flow Control	▶ for creeks with groundwater exfiltration based low flow systems: minimize decrease in the infiltration component of the hydrologic budget as feasible and practical ▶ for creeks with surface water based low flow systems: maintain low flow volume, frequency and duration
Erosion Potential	▶ for erosion susceptible streams: minimize change in instream erosion potential under ultimate land use conditions to within 10% of that determined for a stable channel form for all flows equal to or less than 1:2 year flow but greater than the lowest level of stream competence - for developments >5 ha use Distributed Runoff Control <sup>1</sup> approach for a 25 mm storm - for developments of 0.5 to 5 ha, control post-development flows to 10% of pre-development rate for a 25 mm precipitation event with zero runoff source control of the first 5 mm of any event as feasible (*Note: 5 mm source control is not discounted from the 25 mm storm).
Water Quality Control	▶ adopted a 30 m buffer zone around streams and lakes; ▶ for developments exceeding 5 ha discharging to non-water contact receiving water bodies provide storage volume sufficient to contain a 25 mm precipitation event with release over 24 hours - for developments of 0.5 - 5 ha, use lot level and conveyance controls to the extent feasible; ▶ for developments exceeding 5 ha discharging to water contact receiving water bodies provide sufficient control of effluent to produce an average event concentration of [TSS]=25 mg/L with no more than 4 exceedances from May 1 to October 31 inclusive; ▶ sediment controls must be in place during all phases of development and construction

Note: For erosion susceptible streams the erosion control criteria will take precedence over water quality criteria should a conflict in BMP design occur based on these two criteria.

1. Distributed Runoff Control (MacRae, C.R. (1992), "An Alternate Design Approach for the Control of Instream Erosion Potential in Urbanizing Watersheds," Proc., 6th Intern. Conf. on Urban Storm Drainage, Marsalek, J. and Torno, H. (eds.), IAHR/QAWQ, Niagara Falls, Ont., Sept. 12-17), pp. 1086-1091.

protection. Once development activities have been completed, the municipality/Conservation Authority will assume ownership and responsibility for the management of established buffers.

#### ■ **Setbacks**

Zoning by-laws should be used to identify specific setbacks for lots. These setbacks are required for the protection of areas adjacent to buffers.

Site plan controls adopted in official plans can be used to:

- 1) specify the location and maintenance of buffers and type of vegetation cover;
- 2) control alteration to elevation or contour of the land during development; and,
- 3) specify the location of buildings, fences or structures requiring on-site setbacks.

#### ■ **Volume/Water Quality Controls**

Source controls should be used to minimize the alteration of the components in the hydrologic budget. This aspect of a stormwater management plan will affect all aspects of the management plan (flood hazard, baseflow control, erosion potential, and water quality control) and it should be considered as a first priority. Zero change in infiltration, evapotranspiration, and surface runoff components of the hydrologic budget would be preferable, however, this objective may be impractical for areas with relatively impermeable soils or high water tables. Consequently, volume controls will have to be specified on a case-by-case basis, preferably as part of a Watershed or Sub-watershed Plan.

The selection of a 25 mm precipitation event is based on providing effective treatment of 98 % of all storm events. Rare flood flow events, those events equal to or exceeding the 1:2 year return period, are not considered to be of major importance in the delivery of pollutants and their impact on habitat or human health. Frequent runoff events during periods of low flow in the receiving stream are considered to be the greater management concern.

Instream erosion potential has been found to increase significantly following a 10 percent increase in basin imperviousness. This increase in erosion potential has been attributed with the de-stabilization of the stream channel and the subsequent loss of habitat and property, and damage to riparian structures. Following urbanization, the geomorphically significant flows have been found to be sub-bankfull events which occur several times per year. These events have a return period of less than one year. Consequently, control of instream erosion does not conflict with mitigation of flood hazard. It may, however, conflict with water quality control guidelines, in which case the erosion control guidelines should take precedence in erosion sensitive streams with high habitat value.

### ■ Sediment Controls

Sediment and upland erosion may increase by a thousand fold or more during the construction phase. These sediments are considered to be a contaminant because of aggradation and subsequent destabilization of the receiving stream, burial of spawning beds, aesthetic degradation of the channel, and stress on aquatic organisms due to high suspended sediment concentrations. Sediments may also transport nutrients, trace metals and organic pollutants to the receiver. Consequently, sediment and erosion control mitigation measures must be in place during all phases of development and construction.

Techniques for sediment and erosion control are provided in the UDIC (1987) publication entitled "Guidelines on Erosion and Sediment Control for Urban Construction Sites". The 40 microns guideline (coarse silt size fraction) was adopted based on best professional judgement as the smallest particle size which can be effectively trapped using the control mechanisms described in the above Guidelines.

Soil erosion by-laws are an effective means of implementing sediment erosion control guidelines.

## SECTION IV

### ROADWAY DESIGN STANDARDS

#### IV.1 Roadways

Roadways in a subdivision shall be organized in an appropriate hierarchy, as outlined in the Official Plan. In all cases, local roadways shall be designed to discourage through or transient traffic. P-loops, crescents, and cul-de-sacs can be used to emphasize local roadways.

Provisions must be made for the extension of roadways into adjacent subdivisions or developments. The Official Plan may also require the extension of arterial or collector roadways through a subdivision.

The Official Plan requires that the traffic carrying capacity of arterial roadways be protected. As such, the number of roadways intersecting arterial roadways shall be reduced to the minimum necessary to provide reasonable, controlled access.

#### IV.2 Major Roadways, Railways, and Incompatible Uses

A subdivision should provide suitable buffers adjacent to major streets, railway lines, or incompatible uses. Reverse lot frontages, single loaded roadways, berming, fencing or additional depth lots may be used to deal with this incompatibility.

Any subdivision or development within 300 meters of the mainline C.N. track or Highway #401 will require the submission of a noise impact study, as outlined in the Official Plan. Such a study will outline the methods necessary to reduce noise levels to the target ranges.

#### IV.3 Intersections

Local roadway intersections with other local or collector roadways shall be at least 60 meters apart. Local and collector roadway intersections with arterial roadways shall be at least 250 meters apart.

TEE intersections are preferred with roadways intersecting at right angles. CROSS intersections are discouraged. The through roadway shall retain its cross-section at an intersection, while the centerline elevation of the intersection roadway shall be coincidental with the edge of pavement of the through roadway. The gutter shall be graded to provide positive drainage to an appropriate catchbasin.

Unless specified otherwise, the Developer is responsible for modifications (i.e. auxiliary lanes, etc.) along arterial roadways at intersections with collector and/or local roadways. These modifications may include traffic control devices (i.e. signs, signals, beacons, etc.) if deemed necessary by the Transportation Engineer.

#### IV.4 Street Lighting

The developer is responsible for the design of all municipal street lighting systems within the subdivision. Electrical design must be undertaken by a qualified Electrical Engineer and a report shall be submitted to the Transportation Engineer for approval. A list of minimum criteria and approved hardware is available from the Transportation Engineer. The developer shall have the installation supervised by the Engineering Consultant. The contractor shall obtain permits for all work requiring hydro inspections and shall file applications for inspection with the Electrical Safety Authority as necessitated by the progress of the work.

## IV.5 Sidewalks

Sidewalks shall be provided as listed in Table IV.1.

Table IV.1 - City of Cornwall Subdivision Sidewalk Requirements		
Roadway Class	No. of Sidewalks	Comments
Local	0	Crescents, P-loops, or cul-de-sacs less than 150 m in length only
Local	1	All other roadways not covered above <ul style="list-style-type: none"><li>• A sidewalk is required if it forms part of a sidewalk "system" regardless of the street length or number of proposed units.</li><li>• A sidewalk is required if there are more than 40 residential units proposed to be constructed.</li></ul>
Collector	2	One, if A.A.D.T. less than 2500 estimated and pedestrian generator or walkway do not exist.
Arterial	2	- - -

In other words, if a cul-de-sac has a walkway at the end which leads to a school for example, the street should have a sidewalk regardless of the number of units or street length in order to tie the walkway into the existing sidewalk system.

Minimum sidewalk width shall be 1.5 meters located 0.8 meters from the property line, with a 2.0% crossfall. Minimum sidewalk thickness shall be 125mm. Location shall be based on expected pedestrian volume flows. Sidewalks shall be continuous through all crossings and driveways, complete with access ramps containing wire mesh. If driveway locations are not known, sidewalk thickness shall be increased by 150mm. In addition, sidewalks shall be required to connect the proposed development to the existing sidewalk network outside of the development site.

## IV.6 Curbs

Unless specified otherwise, all curbs shall be constructed as per O.P.S.D. 600.04. All curbs are to be placed full height without depressions at driveways, unless otherwise directed by City Engineering Department.

## IV.7 Driveway Entrances

All driveway entrances shall be constructed as per the supplied City of Cornwall Driveway Entrance Standards.

A maximum of one (1) driveway entrance may be provided per lot, however high density development or development fronting an arterial roadway may require shared driveway entrances or a parallel service road.

Driveway widths for residential applications are subject to the regulations of the Zoning By-law. Driveway entrances on corner lots shall have a minimum distance between nearest limit of driveway to the nearest corner property bar of 6.0 meters. Driveways shall not be constructed within an intersection.

## IV.8 Walkways

Walkways shall be located on a 3.0 meter right-of-way. Where utilities are present, a 6.0 meter right-of-way shall be required. A 1.8 meter concrete footpath shall be constructed along the centerline.

The right-of-way shall be lined on both sides with a 1.2 meter high vinyl coated chain link fence to meet the current O.P.S.S. To discourage loitering, landscaping must be provided in the right-of-way to the satisfaction of the City.

**IV.9 Easements**

The minimum easement width required for storm or sanitary sewers, or watermains shall be 6.0 meters. The minimum rear yard catchbasin easement shall be 3.0 meters.

**IV.10 Fencing**

Collector and arterial roadways shall be fenced with a 1.8 meter high berm or fence to provide sight and sound attenuation. Parks shall be fenced with a 1.2 meter high chain link fence to the satisfaction of the Public Works Department.

**IV.11 Roadway Signs**

Traffic control and street name signs shall be required at all intersections within the subdivision, and at other locations as required by the Transportation Engineer. The signs shall be located, supplied and installed by City forces at the developer's expense.

Developers are encouraged to make use of the supplied list of street names which possess a degree of significance to the local community. The street name itself shall be limited to a maximum of 12 letters and shall be unilingual in either french or english. All names and associated nomenclature (i.e. road, avenue, crescent, etc.) are subject to approval by the Transportation Engineer.

<b>Name</b>	<b>Significance</b>	<b>Name</b>	<b>Significance</b>
<i>Adelaide</i>		<i>Hitchcock</i>	Business, Wilbur
<i>Ashcroft</i>		<i>Hodge</i>	Business, Andres, miller
<i>Atchison</i>	Business, William, saw mill	<i>Hurteau</i>	Medicine
<i>Ballard</i>	Business, pottery	<i>MacNish</i>	Clergy, St. John's (1872-1903)
<i>Barnhart</i>	Business	<i>McNiff</i>	Patrick, surveyor
<i>Bethune</i>	Clergy, First Presbyterian Church	<i>McIntosh</i>	
<i>Bruce</i>	Business, Peggy & Alexander, Innkeepers	<i>Matheson</i>	Educator
<i>Bruneau</i>	Clergy	<i>Monarch</i>	
<i>Caldwell</i>	Principal of CCVS	<i>Mountain</i>	Clergy
<i>Denny</i>	Business, bank manager	<i>Peachy</i>	R.E.
<i>Derochie</i>	Business, Joseph & Walter, foundry	<i>Philpotts</i>	
<i>Dickinson</i>	Business, Noah	<i>Radley</i>	
<i>Eadie</i>		<i>Rossmore</i>	Hotel
<i>Emprey</i>	Jacob	<i>Simcoe</i>	Lieutenant Governor
<i>Emard</i>	Medicine	<i>St.Jean</i>	
<i>Flack</i>	Business, Albert & David	<i>Baptiste</i>	
<i>Gault</i>	Business, Andrew & Robert, cotton mill	<i>Stone</i>	Business, Joel, distillery
<i>Glencoe</i>		<i>Thornley</i>	
<i>Harkness</i>	Graham, historian	<i>Turner</i>	Colonel C.B.
		<i>Weber</i>	Photography
		<i>Woodward</i>	

**IV.12 Cornwall Transit**

The roadway system must be designed to recognize the current and future needs of the public transit system, including the provision of adequate pedestrian access to transit facilities. The developer is responsible for the provision of separate bus bays and bus stop amenities (i.e. shelters, seating, etc.) along existing and future bus routes which arise as a result of the proposed development. Location and proposed designs are to be approved by Cornwall Transit.

#### **IV.13 Asphalt Pavement Design**

Roadways shall be centered on the road allowance and shall be asphalt. Roadway width is measured from edge of asphalt to edge of asphalt. Subdrain may be required where a high watertable is prevalent. Asphalt crossfall is to be 2.0%, while subgrade crossfall is to be 3.0%. The right-of-way shall be cleared, grubbed and stripped. Pavement design shall be based on a Soils Report prepared by a qualified Geotechnical Engineer or Table IV.2.

<b>Table IV.2 - Asphalt Pavement Design Standards</b>					
<b>Roadway</b>	<b>Gran. B</b>	<b>Gran. A</b>	<b>HL-8</b>	<b>HL-4</b>	<b>HL-3</b>
Local	300mm	150mm	50mm	---	40mm
Collector	450mm	150mm	40mm	40mm	40mm
Arterial	450-600mm	150mm	40mm	40mm	40mm
Industrial	450-600mm	150mm	40mm	40mm	40mm

Surface course asphalt, HL-3, shall be laid one year after the binder course asphalt, HL-8 and HL-4.

#### **IV.14 Vertical & Horizontal Alignment**

Vertical curves are required when the algebraic difference of the road grades is less than two.

Compound, reverse and broken back horizontal curves shall be avoided.

#### **IV.15 Construction**

Construction of the roadways shall comply with the Ontario Provincial Standard Drawings and approved detail drawings.

All iron works shall be adjusted to proper base asphalt elevation and shall be re-adjusted to final elevation with the placement of the final lift. All curbs behind iron works will be constructed just prior to final lift of asphalt, in which case asphalt curbs shall be required.

#### **IV.16 Testing & Inspection**

The City requires full-time inspection by a qualified Consulting Engineer and will periodically inspect the works. Compaction Reports prepared by a qualified Geotechnical Engineer shall be submitted for subbase Granular "B", Granular "A" and asphalt.

#### **IV.17 Concrete**

Concrete shall be as specified below. Fly ash will not be accepted in the mix. Provide the Engineer with the mix design prior to placing any concrete, as per O.P.S.S. Form 904.

Compressive Strength:	32 MPa minimum
Cement Content:	385 kg minimum per c.m.
Coarse Aggregate:	19mm maximum
Water/Cement Ratio:	0.43 maximum
Slump:	70mm ± 20*
Air Content:	7% ± 1.5%

\* For curb machine, slump shall be 30mm ± 10mm.

**Burlap Curing will be required as follows:**

- i) When the air temperature is less than 27°C, two layers of damp burlap shall be carefully laid on the surface of the concrete. Strips shall overlap by 75mm and shall be held down as required against displacement by wind or otherwise. The burlap shall be maintained in place and kept thoroughly wet for a minimum of 24 hours. Once the burlap is removed after a 24 hour period, curing will continue with the application of curing compound. Application of curing compound will be strictly enforced. Curing compound must meet the requirements of O.P.S.S. 1315 and be applied at a rate of not less than 1 litre per 5 square metre of exposed surface.
- ii) When the air temperature at any time during the day will exceed 27°C, two layers of burlap will be required as described above but for a four day period. Curing compound will not be required.

During hot weather, the Contractor must cool down the forms and aggregate as outlined in O.P.S.S. 904.

During cold weather, the Contractor must place and protect concrete in accordance with O.P.S.S. 904.07.03.08 or latest accepted revision.

At no time will water be added to the concrete on site. Concrete which is unworkable or that is too stiff to produce a satisfactory product is to be discarded.

Coarse aggregate for concrete must be non-reactive and non-expansive material.

Supply and place steel wire mesh (No. 9: 150mm X 150mm) reinforcing at all driveway entrances, sidewalk ramps, and where trees are adjacent to the sidewalk.

## Table 4.3 - Roadway Design Summary

Description	Local	Cul-de-Sac	Collector	Arterial		Industrial	
				Undivided	Divided	Local	Collector
<b>Classification</b>	ULU 50	ULU 40	UCU 50	UAU 60	UAD 70	RLU 50	RCU 60
<b>R.O.W. Width (m)</b>	20	R=17	25	30	36	30	36
<b>Asphalt Width (m)</b>	8	R=13	10	14	7X2	7.5	9
<b>Minimum Corner Radius (m)</b> at intersection with local at intersection with collector at intersection with arterial Island in Cul-de-Sac Lead-in to Cul-de-Sac	9 9 11	9 9 10 8 13	9 11 compound	10 compound compound	10 compound compound	15 compound	15 compound
<b>Daylighting at Corners Along Street</b>	5	5	5	10	10	15	15
<b>Minimum / Maximum Grades (%)</b>	0.5/6	0.5/6	0.5/6	0.5/6	0.5/3	0.5/6	0.5/6
<b>Minimum Vertical Curve Length (m)</b>	50	40	50	60	70	50	60
<b>Minimum Crest Coefficient, k</b>	20	10	20	35	60	20	35
<b>Minimum Sag Coefficient, k</b>	11	7	11	20	25	11	20
<b>Minimum Horizontal Radius (m)</b> at Normal Crown (-2%) at Super Elevation (2%)	105 85	60 50	105 85	180 150	260 200	140 110	220 165
<b>Minimum Tangent (m)</b> between Reverse Curves at intersections	15 10	15 10	30 10	50 20	50 30	30 20	50
<b>Sidewalks</b>	One Side	One Side if >150 m	Both Sides	Both Sides	Both Sides	None	One Side

## SECTION V

### STANDARD DETAILS

The following are the more common standard details used in the City of Cornwall. The details included are current O.P.S.D. with occasional modifications as noted, and some City of Cornwall (CC-\_\_\_\_) details.

This is not intended to be a complete package for use in every case. It will be necessary to use current/latest accepted, revised standard O.P.S.D. not included in this package or to develop site specific details as required.

SECTION V: STANDARD DETAILS		
C.C. NO.	TITLE	MODIFICATION
<a href="#">CC-101</a>	<a href="#">Typical Subdivision Service Layout 20.0 m Road Reserve 8.6 m Pavement</a>	
<a href="#">CC-102</a>	<a href="#">Typical Subdivision Service Layout 25.0 m Road Reserve 10.6 m Pavement</a>	
<a href="#">CC-103</a>	<a href="#">Urban Roadway - Typical Cross-Section</a>	
<a href="#">CC-104</a>	<a href="#">Rural Roadway - Typical Cross-Section</a>	
<a href="#">CC-105</a>	<a href="#">Typical Trench for Service Connection</a>	
<a href="#">CC-106</a>	<a href="#">Storm Sewer Design Chart</a>	
<a href="#">CC-107</a>	<a href="#">Sanitary Sewer Design Chart</a>	
<a href="#">CC-108</a>	<a href="#">Rainfall Intensity Duration Curve</a>	
<a href="#">CC-109</a>	<a href="#">Lot Grading - Preservation Format</a>	
<a href="#">CC-110</a>	<a href="#">Typical Detail - Rear Lot Drainage Conventional House Type</a>	
<a href="#">CC-111</a>	<a href="#">Typical Detail - Front Lot Drainage Conventional</a>	
<a href="#">CC-112</a>	<a href="#">Standard Driveway Entrance - Type A - High Volume Access Signalized</a>	
<a href="#">CC-113</a>	<a href="#">Standard Driveway Entrance - Type B - High Volume Access</a>	
<a href="#">CC-114</a>	<a href="#">Standard Driveway Entrance - Type C - Low Volume Access (Urban Road Section)</a>	
<a href="#">CC-115</a>	<a href="#">Standard Driveway Entrance - Type D - Low Volume Access (Rural Road Section)</a>	
<a href="#">CC-116</a>	<a href="#">Standard Driveway Entrance - Type E - Urban Private Driveway Entrance</a>	
<a href="#">CC-117</a>	<a href="#">Standard Driveway Entrance - Type F - Urban Private Entrance (Monolithic Sidewalk)</a>	
<a href="#">CC-118</a>	<a href="#">Standard Driveway Entrance - Type G - Rural Section</a>	
<a href="#">CC-119</a>	<a href="#">Standard Driveway Entrance - Type H - Rural Section</a>	
<a href="#">CC-120</a>	<a href="#">Standard Driveway Entrance - Type I - Semi Rural Section</a>	
<a href="#">CC-121</a>	<a href="#">Cathodic Protection of New Non-Metallic Piping</a>	

SECTION V: STANDARD DETAILS		
C.C. NO.	TITLE	MODIFICATION
<a href="#">CC-122</a>	<a href="#">Sanitary, Storm and Water Service Connections Location Sheet</a>	
<a href="#">CC-123</a>	<a href="#">Site Plan Information and Service Connection Locations</a>	
<a href="#">CC-124</a>	<a href="#">Supermailbox with Sidewalk</a>	
<a href="#">CC-125</a>	<a href="#">Supermailbox without Sidewalk</a>	
<a href="#">CC-126</a>	<a href="#">Supermailbox in Concrete Walkway</a>	
<a href="#">CC-127</a>	<a href="#">Catchbasin Setback for Concrete Curb and Gutter</a>	
<a href="#">CC-128</a>	<a href="#">Transition Point Treatment - New Road to Existing Road</a>	
<a href="#">CC-129</a>	<a href="#">Pavement Widening</a>	
<a href="#">Schedule A</a>	<a href="#">Lateral Bedding and Cover Material (By-law No. 001-2000)</a>	
<a href="#">Schedule B</a>	<a href="#">House Storm Connection With Sump Pump (By-law No. 001-2000)</a>	
<a href="#">Schedule C</a>	<a href="#">Storm Drain Connection By Gravity (By-law No. 001-2000)</a>	

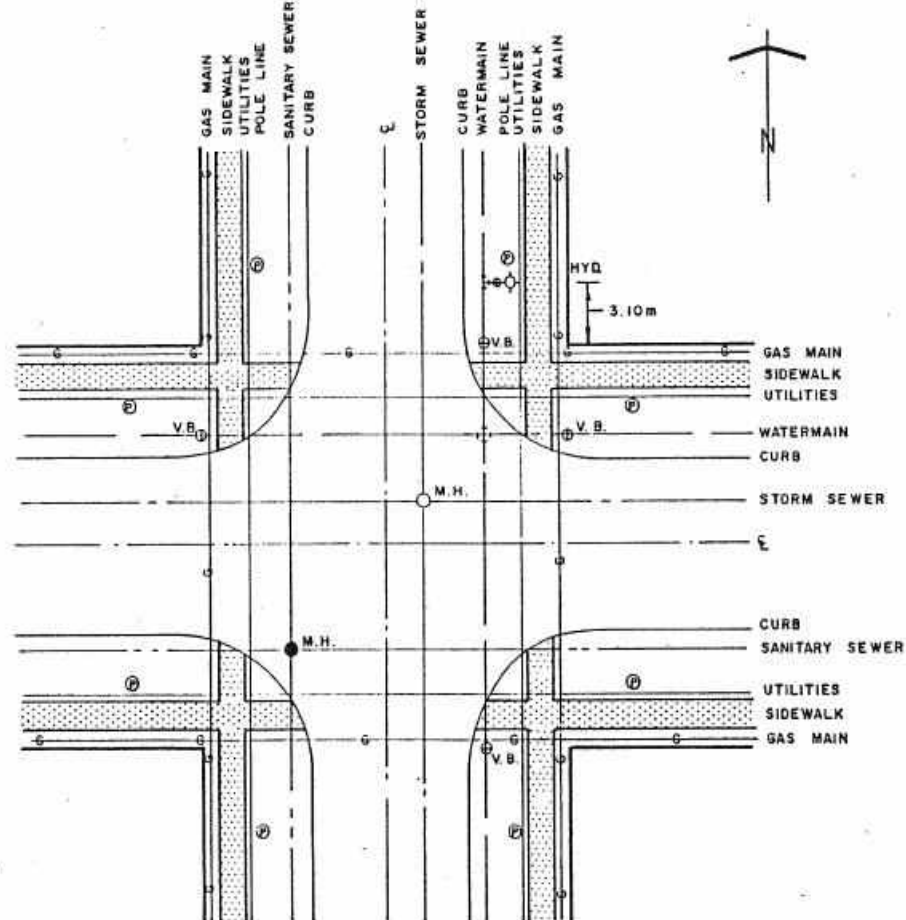
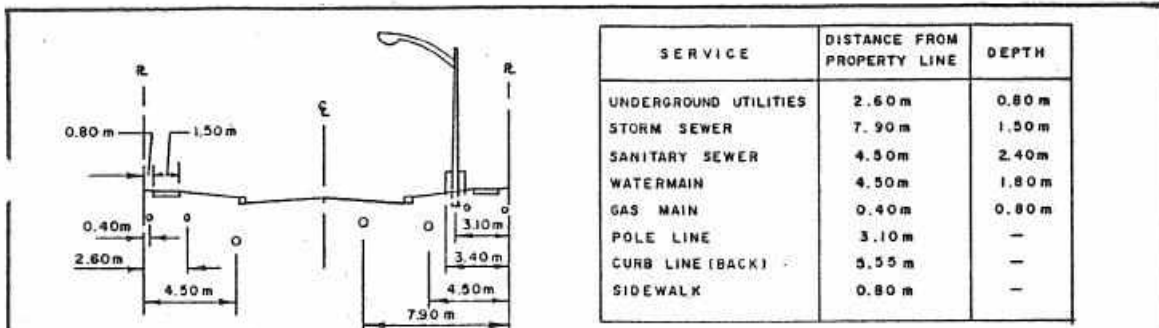
SECTION V: STANDARD DETAILS		
OPSD NO.	TITLE	MODIFICATION
<a href="#">300.010</a>	<a href="#">Side Road Intersection on Fill</a>	
<a href="#">300.020</a>	<a href="#">Side Road Intersection on Earth Cut</a>	
<a href="#">301.010</a>	<a href="#">Rural Entrances to Road on Fill</a>	
<a href="#">301.020</a>	<a href="#">Rural Entrances to Road in Earth Cut</a>	
<a href="#">310.010M</a>	<a href="#">Concrete Sidewalk</a>	Granular base shall be 100mm crushed Granular "A". Welded wire mesh No.9 150 X 150 shall be placed at driveway. Sidewalk thickness shall be 125mm including at driveways, unless specified otherwise. Sidewalk width shall be 1.5m unless specified otherwise.
<a href="#">310.020M</a> & <a href="#">310.010M</a>	<a href="#">Concrete Sidewalk Adjacent to Curb &amp; Gutter</a>	Granular base shall be 100mm crushed Granular "A". The concrete shall be 32 MPa. The 4% maximum crossfall on the sidewalk is changed to 7% maximum. Granular base shall be 150mm wider on both sides of sidewalk. Steel wire mesh shall be placed at all driveway entrances and sidewalk ramps. Concrete sidewalk thickness shall be 125mm. Note 1 is deleted.
<a href="#">310.030 M</a>	<a href="#">Concrete Sidewalk Ramps at Intersection</a>	The directional/parallel grooves shall be spaced 150mm from centre to centre.
<a href="#">310.040</a>	<a href="#">Utility Isolation in Sidewalks</a>	
<a href="#">310.050M</a>	<a href="#">Sidewalk Driveway Entrance Detail</a>	Concrete shall be 32 MPa. All driveways shall be reinforced with steel mesh. The transition section shall be a maximum of 21% for a distance of 500m. The granular base shall be 100mm of Granular "A". The 8.0m maximum is changed to variable. The minimum driveway width shall be 3.0m. Sidewalk shall be 125mm thick with No.9 150 X 150 welded wire mesh. Where there is a boulevard, the sidewalk shall not be depressed unless indicated on the Contract Drawings, or as directed by the Engineer.
<a href="#">351.010 M</a>	<a href="#">Urban Residential Entrance with Boulevard</a>	The 4% maximum sidewalk slope is changed to 7% maximum. The boulevard asphalt taper shall be as per CC-116. Minimum driveway width shall be 3m. Minimum length of curb depression shall be 5m for local and collector streets, 6m for arterial streets, unless otherwise specified by City by-law(s).
<a href="#">400.020 M</a>	<a href="#">Cast Iron, Square Frame with Square Flat Grate for Catch Basins, Herring Bone Openings</a>	Frames and grates shall conform to O.P.S.S. Form 1850.
<a href="#">401.010 M</a>	<a href="#">Manhole, Cast Iron, Cover and Square Frame</a>	Frames and covers shall conform to O.P.S.S. Form 1850.
<a href="#">403.010</a>	<a href="#">Ditch Inlet, Galvanized Steel, Honey Comb Grating</a>	
<a href="#">404.020</a>	<a href="#">Safety Platforms, Aluminum for Circular Manhole</a>	

SECTION V: STANDARD DETAILS		
OPSD NO.	TITLE	MODIFICATION
<a href="#">405.010</a>	<a href="#">Manhole Steps</a>	
<a href="#">501.010 M</a>	<a href="#">Bus Bays</a>	Where a gutter is used, it shall be 0.5m wide. Curb radius at beginning and end of bus bay is 100m and 25m at loading area. Sidewalk width of 2.4m is changed to varies.
<a href="#">513.03</a>	<a href="#">Concrete Toe Walls</a>	
<a href="#">600.040 M</a>	<a href="#">Concrete Barrier Curb with Standard Gutter</a>	Additional thickness where sidewalk is adjacent to curb is not required.
<a href="#">600.110 M</a>	<a href="#">Concrete Barrier Curb</a>	Additional thickness where sidewalk is adjacent to curb is not required.
<a href="#">604.010 M</a>	<a href="#">90 Degree Outlet for Concrete Curb and Gutter</a>	The asphalt spillway is not required.
<a href="#">605.030</a>	<a href="#">45 Degree Outlet for Concrete Curb and Gutter</a>	
<a href="#">605.040</a>	<a href="#">Asphalt Spillways for Cut or Fill</a>	
<a href="#">608.010</a>	<a href="#">Method of Termination for Curb and Gutters</a>	
<a href="#">610.010 M</a>	<a href="#">Catchbasin Frame with Grate Installation at Curb and Gutter</a>	The asphalt in lieu of concrete is deleted and the concrete gutter shall be placed adjacent to catchbasin frame. There shall be expansion joint material placed between frame and concrete and 300 mm from frame and either side.
<a href="#">701.010 M</a>	<a href="#">Precast Manhole, 1200 mm Diameter</a>	Adjustment units shall range from 50 mm minimum to 250 mm maximum.
<a href="#">701.011 M</a>	<a href="#">Precast Manhole, 1500 mm Diameter</a>	Adjustment units shall range from 50 mm minimum to 250 mm maximum.
<a href="#">701.012 M</a>	<a href="#">Precast Manhole, 1800 mm Diameter</a>	Adjustment units shall range from 50 mm minimum to 250 mm maximum.
<a href="#">701.013 M</a>	<a href="#">Precast Manhole, 2400 mm Diameter</a>	Adjustment units shall range from 50 mm minimum to 250 mm maximum.
<a href="#">701.021</a>	<a href="#">Manhole Benching Details</a>	
<a href="#">701.030</a>	<a href="#">1200 mm Diameter Precast Concrete Manhole (components)</a>	
<a href="#">701.040</a>	<a href="#">1500 mm Diameter Precast Concrete Manhole (components)</a>	
<a href="#">701.050</a>	<a href="#">1800 mm Diameter Precast Concrete Manhole (components)</a>	
<a href="#">701.060</a>	<a href="#">2400 mm Diameter Precast Concrete Manhole (components)</a>	
<a href="#">704.010 M</a>	<a href="#">Manhole and Catchbasin Precast Concrete Adjustment Units</a>	Maximum height of total adjacent units for manholes and catchbasins shall be 225 mm.

SECTION V: STANDARD DETAILS		
OPSD NO.	TITLE	MODIFICATION
<a href="#">705.010 M</a>	<a href="#">600 mm X 600 mm Precast Concrete Catchbasin</a>	Where there are no subdrains on the roadway, CB to have 3.0 of 100 mm dia. perforated pipe with end cap and backfilled with Granular "A" with 50 mm under and 150 mm thick around top and sides. Pipe to be parallel to the curb on both sides to catchbasin. Set centre of pipe 200 mm below subgrade.
<a href="#">705.030</a>	<a href="#">Precast Concrete Ditch Inlet 600 mm X 600 mm</a>	
<a href="#">708.020 M</a>	<a href="#">Pipe Support at Catchbasin and Manhole</a>	First pipe joint shall be minimum 0.5 meters from structure wall.
<a href="#">708.03</a>	<a href="#">Catchbasin Connection Flexible Pipe Sewer</a>	
<a href="#">802.010 M</a>	<a href="#">Flexible Pipe Embedment and Backfill - Earth Excavation</a>	Embedment material shall be Granular "A".
<a href="#">802.020</a>	<a href="#">Flexible Pipe-Arch Embedment and Backfill - Earth Excavation</a>	
<a href="#">802.030 M</a>	<a href="#">Rigid Pipe Bedding, Cover and Backfill - Type 1 or 2 Soil - Earth Excavation</a>	Class B - Granular Foundation - is to be used unless otherwise specified. Bedding material shall be Granular "A". Cover material shall be Granular "A" for pipes 750 mm or less. For pipes over 750 mm, cover material shall be approved native material, free of all stones over 100 mm in diameter.
<a href="#">802.031 M</a>	<a href="#">Rigid Pipe Bedding, Cover and Backfill - Type 3 Soil - Earth Excavation</a>	Class B - Granular Foundation - is to be used unless otherwise specified. Bedding material shall be Granular "A". Cover material shall be Granular "A" for pipes 750 mm or less. For pipes over 750 mm, cover material shall be approved native material, free of all stones over 100 mm in diameter.
<a href="#">803.030</a>	<a href="#">Frost Treatment - Pipe Culverts</a>	
<a href="#">810.010</a>	<a href="#">Rip Rap Treatment For Sewer &amp; Culvert Outlets</a>	
912.101	Guide Rail System, Steel Beam, Rail, Component	
<a href="#">912.140</a>	<a href="#">Guide Rail System, Steel Beam, Wood Post Assembly Installation - Single Rail</a>	
<a href="#">912.532</a>	<a href="#">Guide Rail System, Steel Beam, Barricade, Installation</a>	
<a href="#">913.101</a>	<a href="#">Guide Rail System, Cable, Three and Six Cable, Component - Cable Fittings</a>	
<a href="#">913.102</a>	<a href="#">Guide Rail System, Cable, Three and Six Cable, Component - Concrete Anchor Blocks</a>	

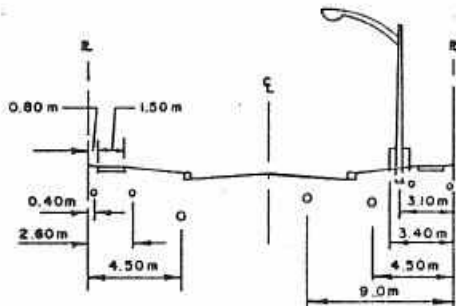
SECTION V: STANDARD DETAILS		
OPSD NO.	TITLE	MODIFICATION
<a href="#">913.130</a>	<a href="#">Guide Rail System, Cable Three Cable - Wood Post Installation - Shoulder</a>	
<a href="#">971.101</a>	<a href="#">Fence, Highway, Installation</a>	
<a href="#">972.130</a>	<a href="#">Fence, Chain Link, Installation</a>	
<a href="#">1003.010</a>	<a href="#">Manhole Drop Structure Tee</a>	
<a href="#">1003.030</a>	<a href="#">Internal Drop Structure for Existing Maintenance Hole</a>	
<a href="#">1006.010 M</a>	<a href="#">Sewer Service Connections</a>	All bedding material shall be "A"; vertical risers shall only be used when approved. Note F is deleted.
<a href="#">1006.020 M</a>	<a href="#">Sewer Service Connections for Flexible Pipe</a>	Note F is deleted. All service connections must be made with approved factory made tees for all pipe sizes, unless stated otherwise.
<a href="#">1102.02 M</a>	<a href="#">Watermain Bedding Details</a>	Bedding and cover material shall be Granular "A". There shall be a minimum of 150 mm of bedding material below the pipe, and a minimum of 300 mm of granular "A" on the top.
<a href="#">1104.010 M</a>	<a href="#">Standard Water Service Connection, 20mm and 25mm Diameter</a>	Minimum 0.5 metre distance between adjacent taps. Tapping saddle required on Class 100 (DR 28) PVC watermain service connections. Bedding and cover material shall be Granular "A". There shall be a minimum of 100mm of bedding material below the service and 150mm of cover material on the top of the service.
<a href="#">1104.020 M</a>	<a href="#">Water Service Connection Detail; 32, 38 and 50mm Diameter</a>	Bedding and cover material shall be Granular "A". There shall be a minimum of 100mm of bedding material below the service and 150mm of cover material on the top of the service.
<a href="#">1105.010 M</a>	<a href="#">Hydrant Installation</a>	Distance between valve and hydrant will vary. Drain hole must be plugged.
<a href="#">2220.01</a>	<a href="#">Pole Hand Hole Locations</a>	
<a href="#">2225.01 M</a>	<a href="#">Concrete Lighting Pole</a>	Use Type B, tapered elliptical bracket. Pole backfill shall be stone dust. Pole length shall be as indicated in drawings or specifications.
<a href="#">2250.01</a>	<a href="#">Aluminum Tapered Elliptical Bracket (Mounting Details)</a>	
<a href="#">2410.01 M</a>	<a href="#">Spun Concrete Pole</a>	Hand hole and aperture locations and details shall be for all classes of poles used for street lighting.
<a href="#">2420.01</a>	<a href="#">1.8 m or 2.4 m Aluminum Tapered Elliptical Bracket</a>	
<a href="#">2501.01</a>	<a href="#">Single Member Arm and Signal Head</a>	

SECTION V: STANDARD DETAILS		
OPSD NO.	TITLE	MODIFICATION
<a href="#">2501.02</a>	<a href="#">Aluminum Single Member Arm Attachment Details</a>	
<a href="#">2505.01</a>	<a href="#">Traffic Signal Pedestrian Head and Push Button Mounted on Pole</a>	
<a href="#">2522.01</a>	<a href="#">Traffic Signal Hanger Detail</a>	
<a href="#">2524.01 M</a>	<a href="#">Traffic Signal Double Arm Bracket</a>	Stainless steel mounting bands shall be 19mm.
<a href="#">2528.01</a>	<a href="#">Traffic Signal Equipment Pole Wiring Diagram</a>	
<a href="#">2529.07</a>	<a href="#">Signal Wiring Using 19C Cable Tapped 2 to 8 Phase</a>	

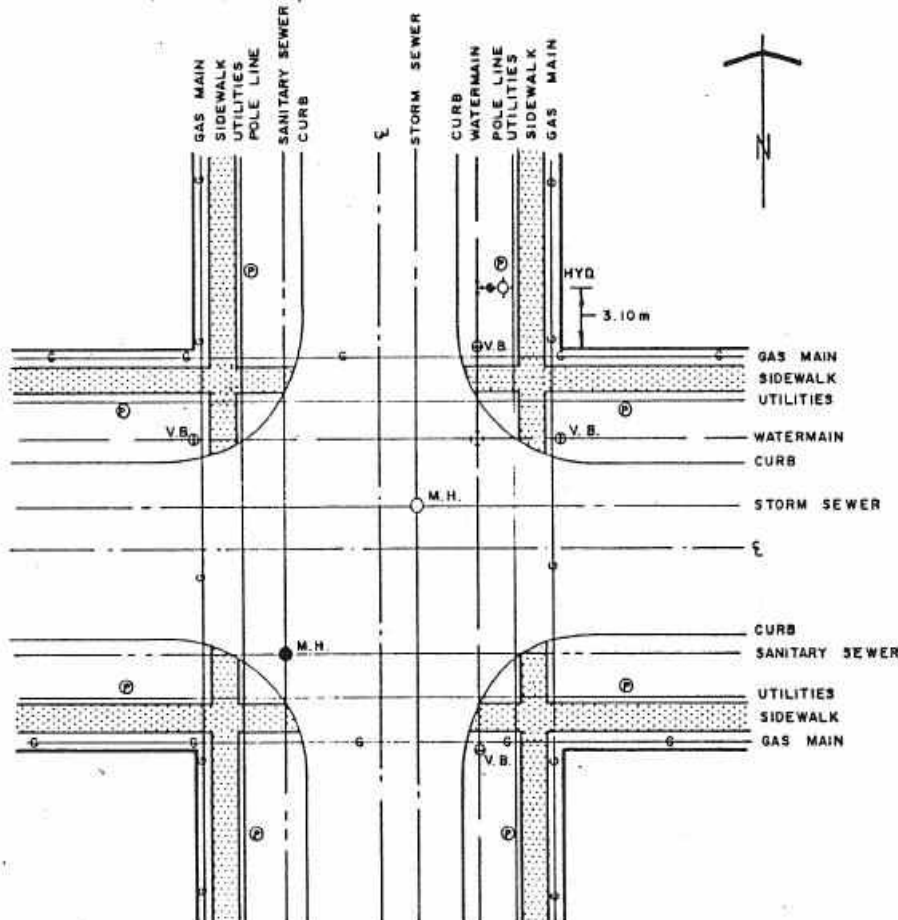


- NOTES:**
1. FIRE HYDRANTS SHALL BE 3.10 METRES FROM THE PROPERTY LINE.
  2. UTILITY BOXES SHALL BE LOCATED IMMEDIATELY ABOVE THE UNDERGROUND UTILITIES.
  3. WATER SERVICE STAND PIPES SHALL BE LOCATED AT THE PROPERTY LINE.
  4. UTILITIES CORRIDOR TO BE USED BY BELL, POWER, AND CABLEVISION COMPANIES.
  5. WHEN A GAS MAIN OR UTILITY CROSSES A ROADWAY AT MID BLOCK, IT MUST BE AT A DEPTH OF 1.2m BELOW FINISHED ROAD ELEVATION. ALSO WHEN CROSSING AT AN INTERSECTION, THE GAS MAIN OR UTILITY MUST BE AT A DEPTH OF 1.2m BELOW FINISHED ROAD ELEVATION, FROM PROPERTY LINE TO PROPERTY LINE.
  6. TREES SHALL BE 3.1 METRES FROM PROPERTY LINE.

<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT  TYPICAL SUBDIVISION, SERVICE LAYOUT 20.0m ROAD RESERVE, 8.0m PAVEMENT	DRAWN BY: <i>R. Seward</i> DATE: 89-01-04
	SCALE: N.T.S. CC-101

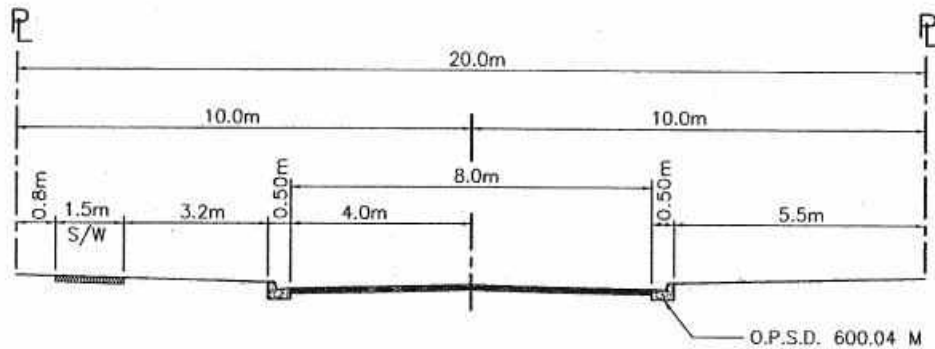


SERVICE	DISTANCE FROM PROPERTY LINE	DEPTH
UNDERGROUND UTILITIES	2.60 m	0.80 m
STORM SEWER	9.0 m	1.50 m
SANITARY SEWER	4.50 m	2.40 m
WATERMAIN	4.50 m	1.80 m
GAS MAIN	0.40 m	0.80 m
POLE LINE	3.10 m	-
CURB LINE (BACK)	7.05 m	-
SIDEWALK	0.80 m	-

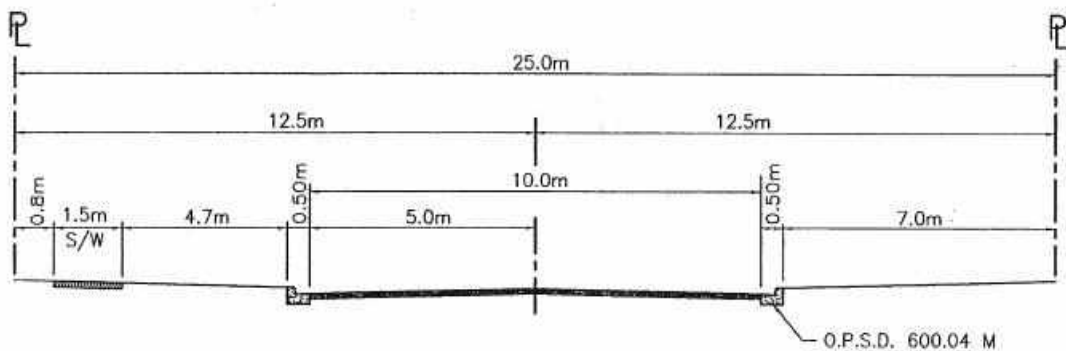


- NOTES:
1. FIRE HYDRANTS SHALL BE 3.10 METRES FROM THE PROPERTY LINE.
  2. UTILITY BOXES SHALL BE LOCATED IMMEDIATELY ABOVE THE UNDERGROUND UTILITIES.
  3. WATER SERVICE STAND PIPES SHALL BE LOCATED AT THE PROPERTY LINE.
  4. UTILITIES CORRIDOR TO BE USED BY BELL, POWER, AND CABLEVISION COMPANIES.
  5. WHEN A GAS MAIN OR UTILITY CROSSES A ROADWAY AT MID BLOCK, IT MUST BE AT A DEPTH OF 1.2m BELOW FINISHED ROAD ELEVATION. ALSO WHEN CROSSING AT AN INTERSECTION, THE GAS MAIN OR UTILITY MUST BE AT A DEPTH OF 1.2 m BELOW FINISHED ROAD ELEVATION, FROM PROPERTY LINE TO PROPERTY LINE.
  6. TREES SHALL BE 3.1 METRES FROM PROPERTY LINE.

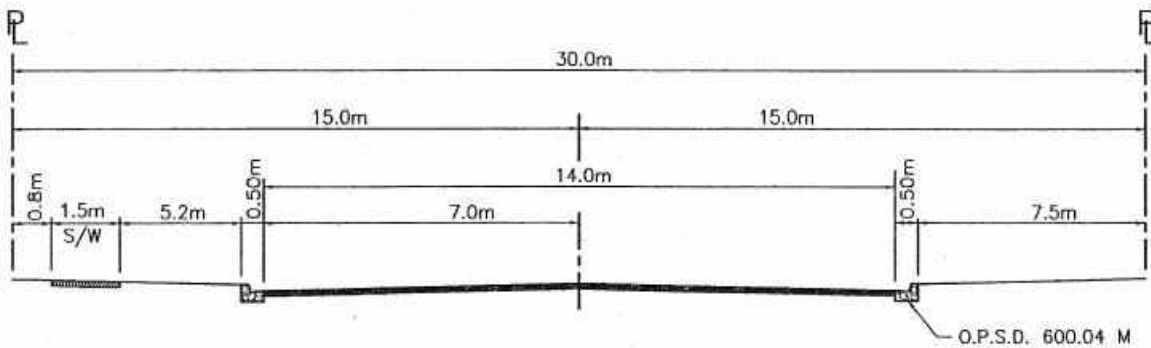
<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: <i>R. Seward</i> DATE: 89-01-06
	SCALE: N.T.S. CC-102
TYPICAL SUBDIVISION, SERVICE LAYOUT 25.0m ROAD RESERVE, 10.0m PAVEMENT	



**URBAN LOCAL RESIDENTIAL**  
BITUMINOUS PAVEMENT



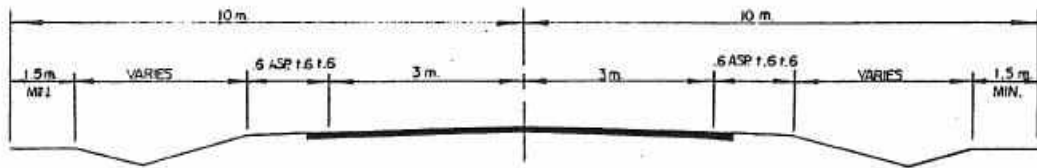
**COLLECTOR STREET**  
BITUMINOUS PAVEMENT



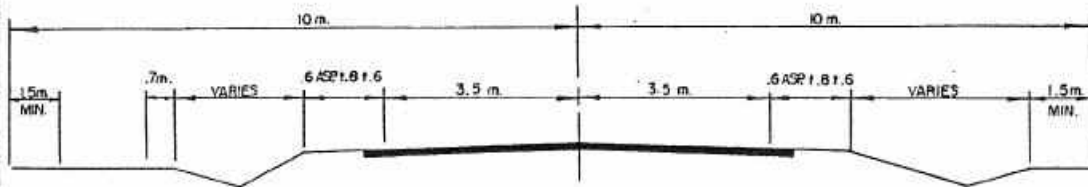
**ARTERIAL STREET**  
BITUMINOUS PAVEMENT

<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: A.J.A.
	DATE: 03-01-24
URBAN ROADWAY TYPICAL CROSS-SECTION	SCALE: N.T.S.
	<b>CC-103</b>

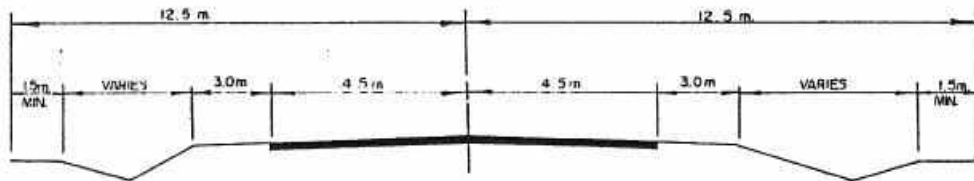
42



200 - 1000 VPD. RURAL  
BITUMINOUS PAVEMENT

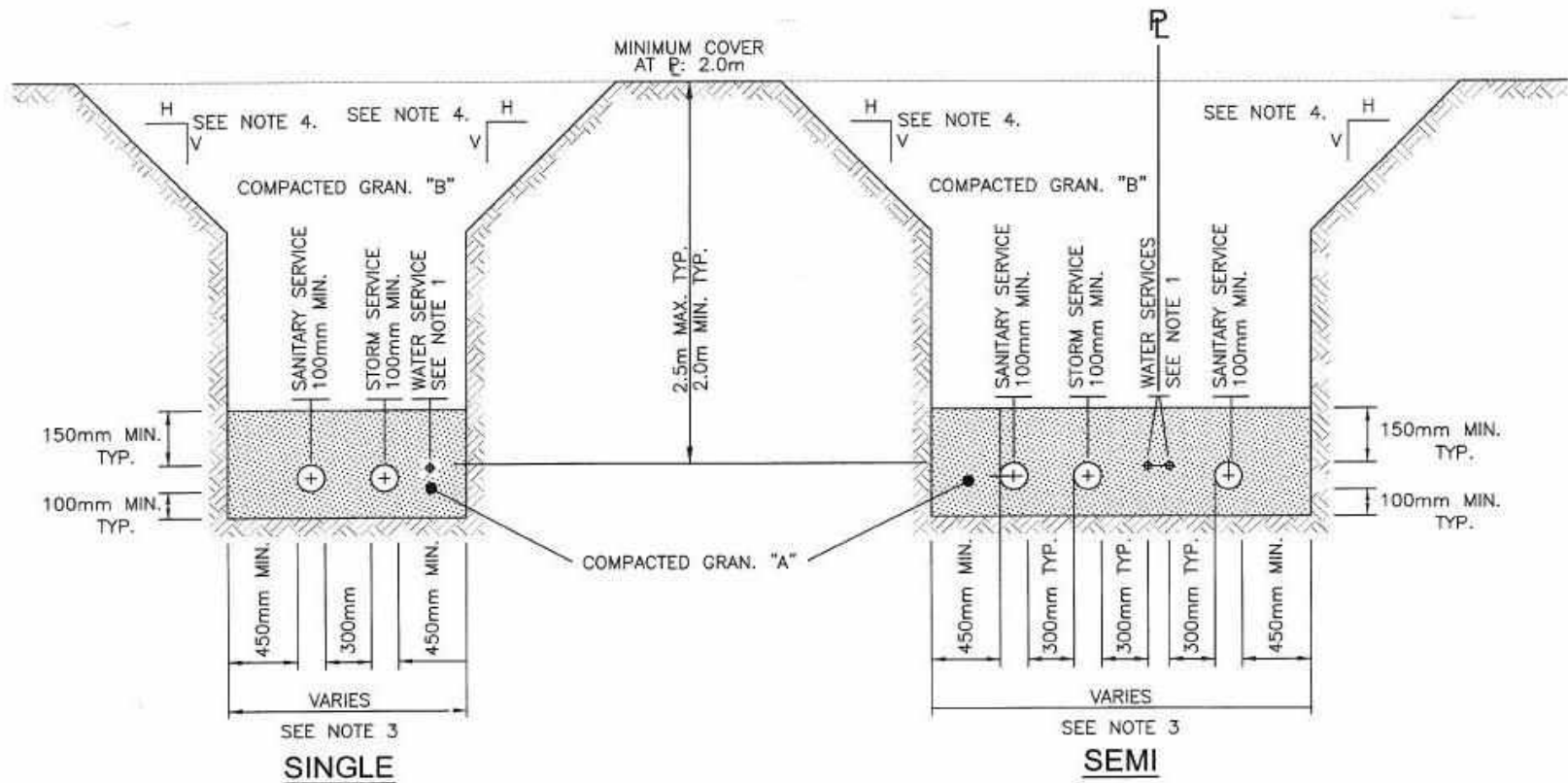


1000 - 3000 VPD. RURAL  
BITUMINOUS PAVEMENT



COLLECTOR & LOCAL INDUSTRIAL COMMERCIAL  
BITUMINOUS PAVEMENT

		CITY OF CORNWALL ENGINEERING DEPARTMENT	DRAWN BY: <i>R. M. Thomas</i>
			DATE: 85-03-22
DATE	BY	RURAL ROADWAY TYPICAL CROSS SECTION	SCALE: N.T.S.
REVISIONS			CC - 104



- NOTES:**
1. WATER SERVICE CONNECTION:  
A. 20mm $\phi$  SERVICE FOR EACH UNIT;  
B. FOR ALL OTHER BUILDINGS, APPROVAL OF SERVICE SIZE WILL BE GIVEN ON APPLICATION.
  2. MINIMUM SLOPE FOR SEWER CONNECTION FROM PROPERTY LINE TO HOUSE TO BE 2.00%
  3. TRENCH WIDTH SHALL MEET THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT.
  4. TRENCH SLOPE SHALL MEET THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT.

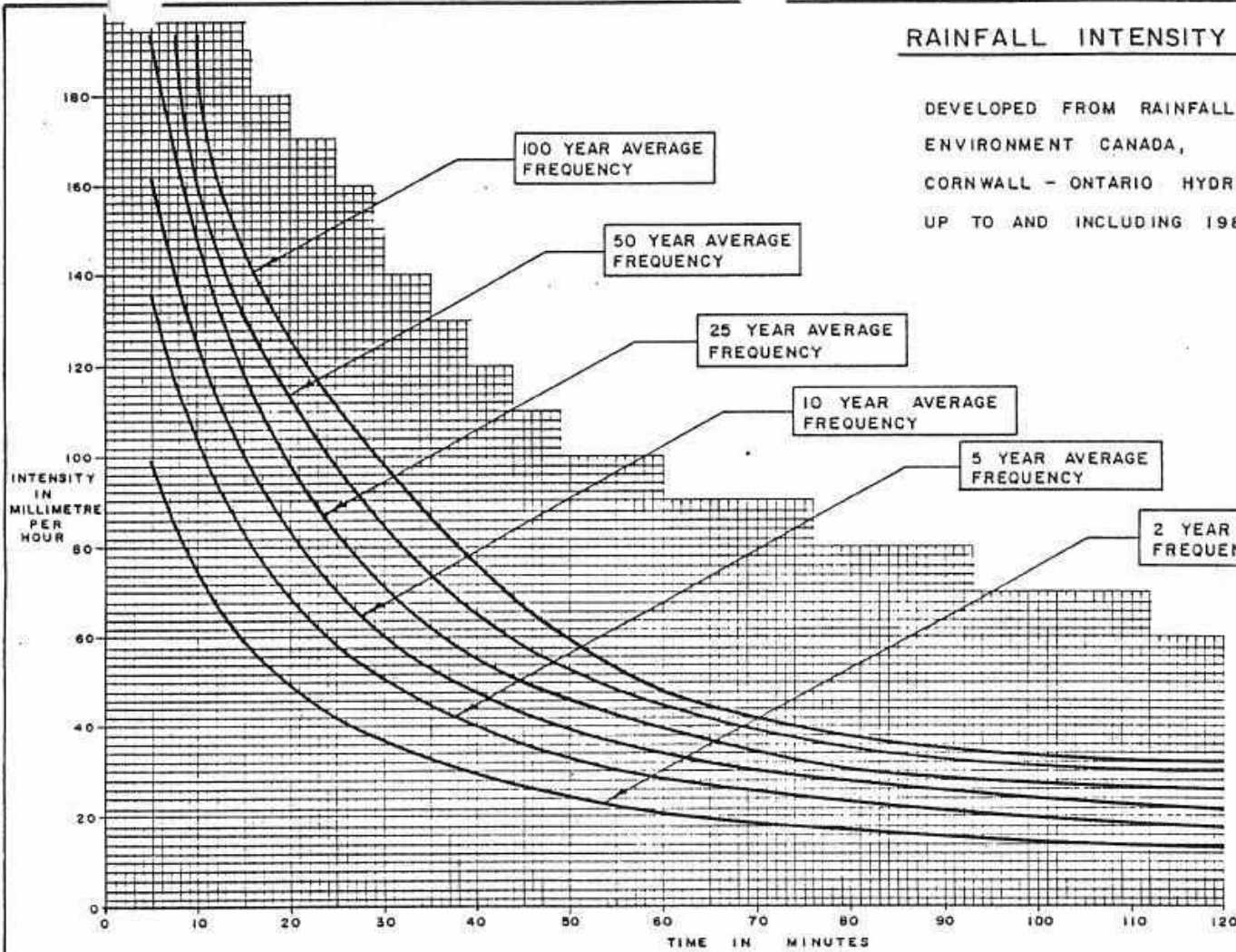
CITY OF CORNWALL ENGINEERING DEPARTMENT	DRAWN BY: A.J.A.
	DATE: 08-02-26
TYPICAL TRENCH FOR SERVICE CONNECTION	SCALE: N.T.S.
	CC-105



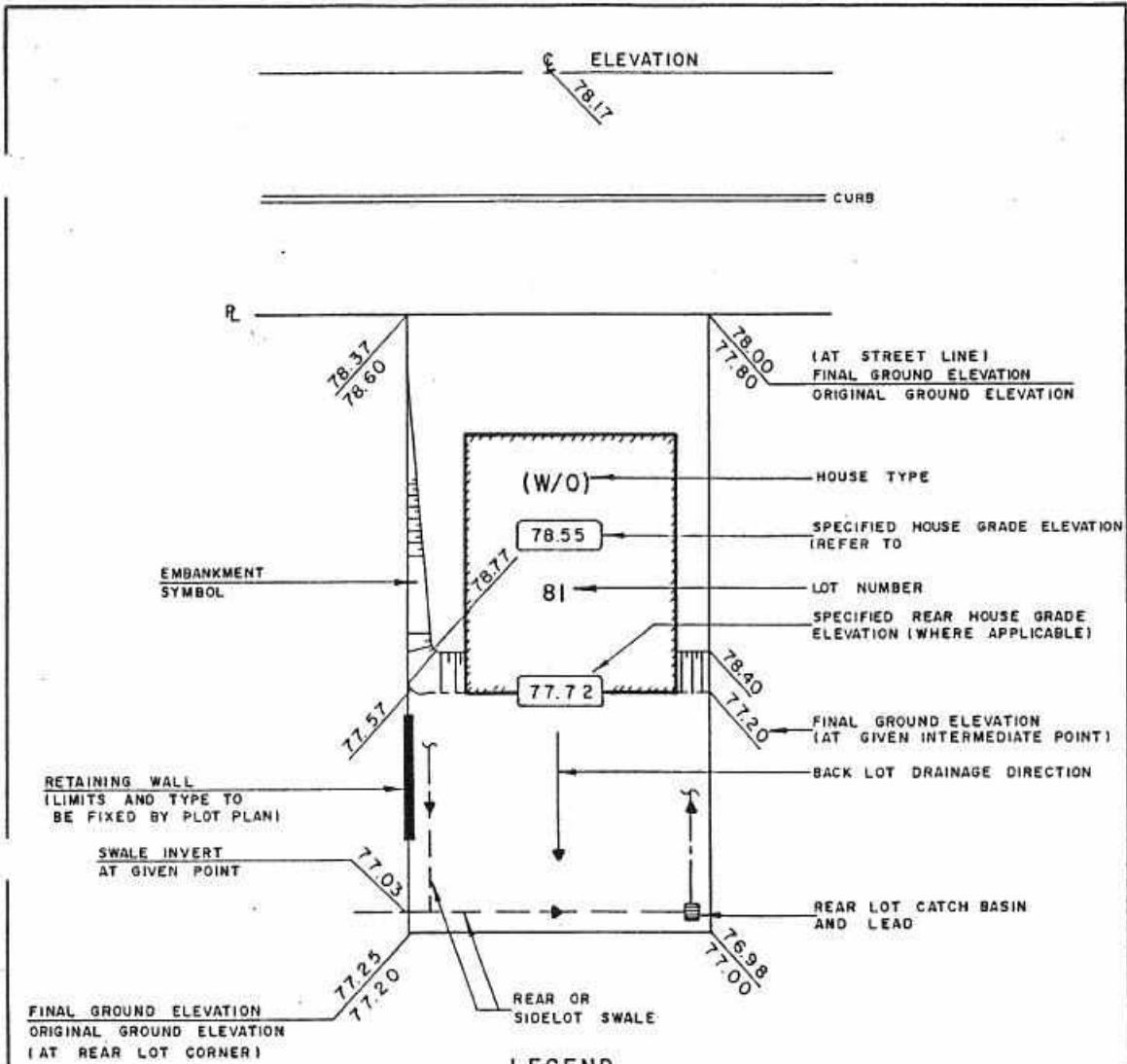


# RAINFALL INTENSITY DURATION CURVE

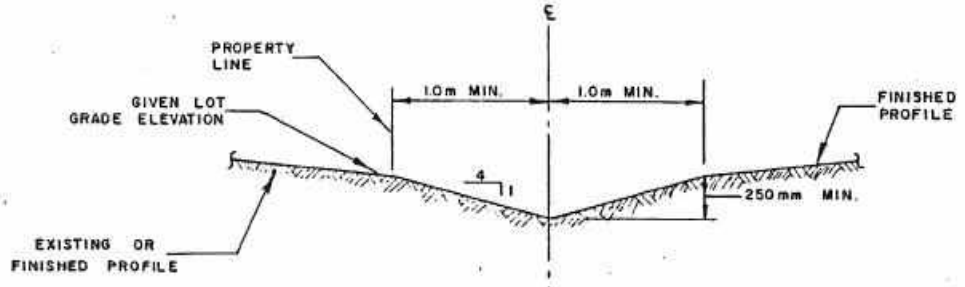
DEVELOPED FROM RAINFALL RECORDING BY:  
 ENVIRONMENT CANADA,  
 CORNWALL - ONTARIO HYDRO  
 UP TO AND INCLUDING 1985



CITY OF CORNWALL ENGINEERING DEPARTMENT	DRAWN BY: <i>R. Edward</i>
	DATE: 89-01-05
RAINFALL INTENSITY DURATION CURVE	SCALE: N. T. S.
	CC - 108

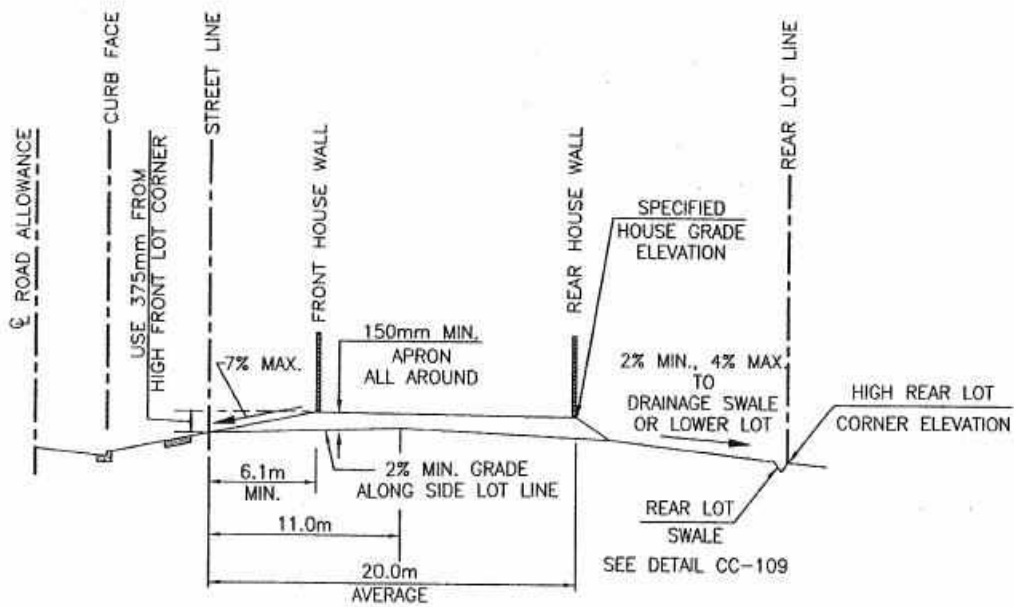


**LEGEND**

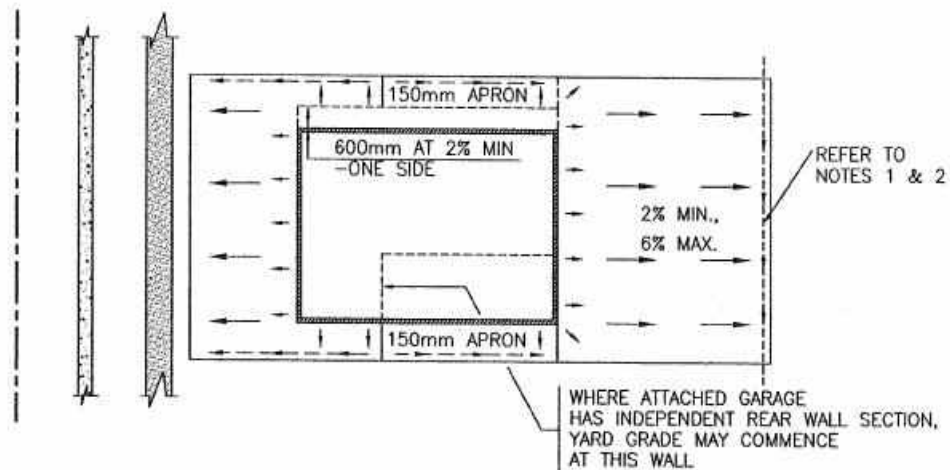


**TYPICAL SWALE DETAIL**  
(MINIMUM GRADE - 1%)

<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: <i>R. Seward</i>
	DATE: 88-03-17
LOT GRADING PRESENTATION FORMAT	SCALE: N.T.S.
	CC-109



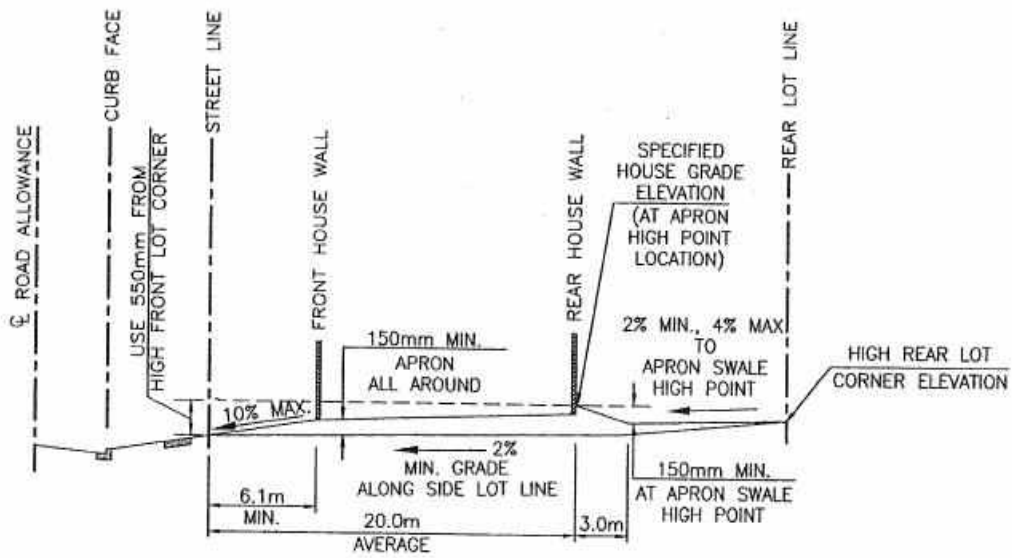
**ELEVATION**



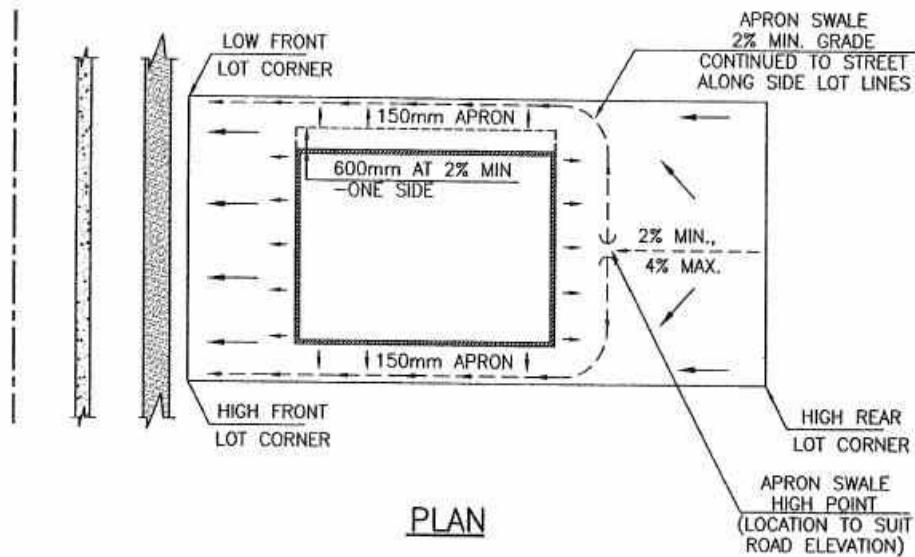
**PLAN**

- NOTES**
1. REAR LOT SWALE REQUIRED WHEN GRADE EXCEEDS 3%, OR WHEN OTHERWISE SPECIFIED.
  2. REAR LOT SWALE: 1% MINIMUM GRADE, UNLESS OTHERWISE NOTED ON PLAN.

CITY OF CORNWALL ENGINEERING DEPARTMENT	DRAWN BY: A.J.A.
	DATE: 03-01-24
TYPICAL DETAIL REAR LOT DRAINAGE CONVENTIONAL HOUSE TYPE	SCALE: N.T.S.
	CC-110

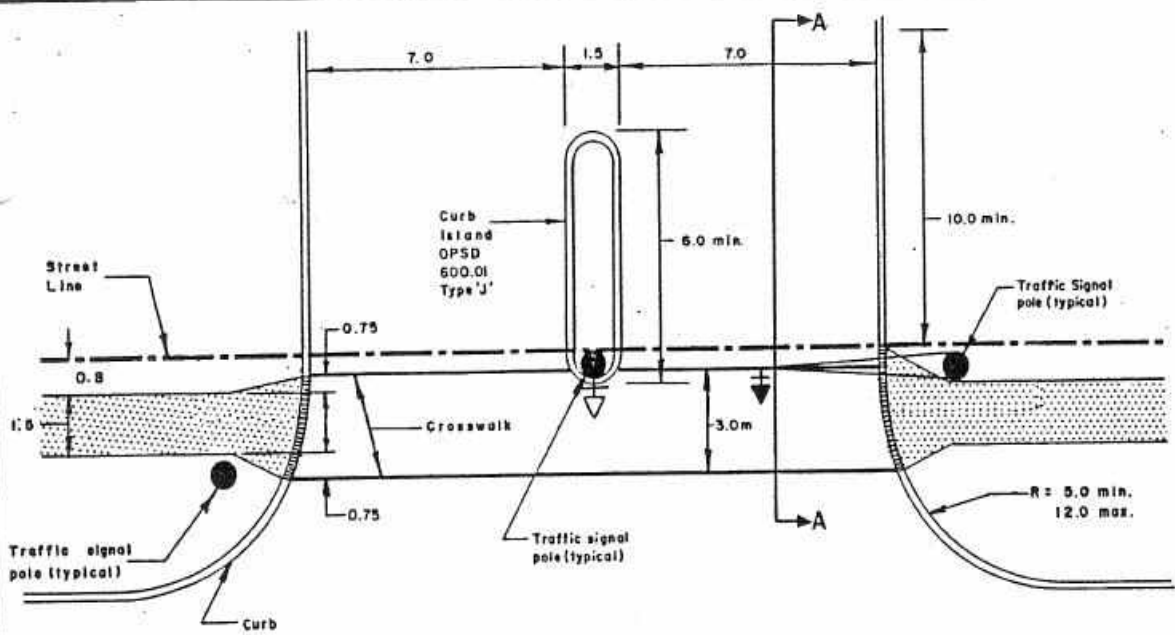


**ELEVATION**

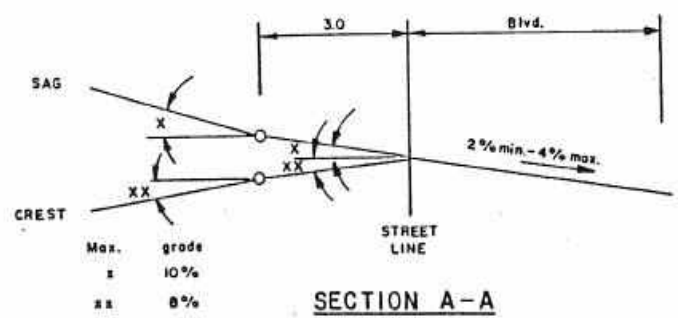


**PLAN**

<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: A.J.A.
	DATE: 03-01-24
TYPICAL DETAIL FRONT LOT DRAINAGE CONVENTIONAL & SPLIT BUNGALOW HOUSE TYPE	SCALE: N.T.S.
	<b>CC-111</b>



PLAN

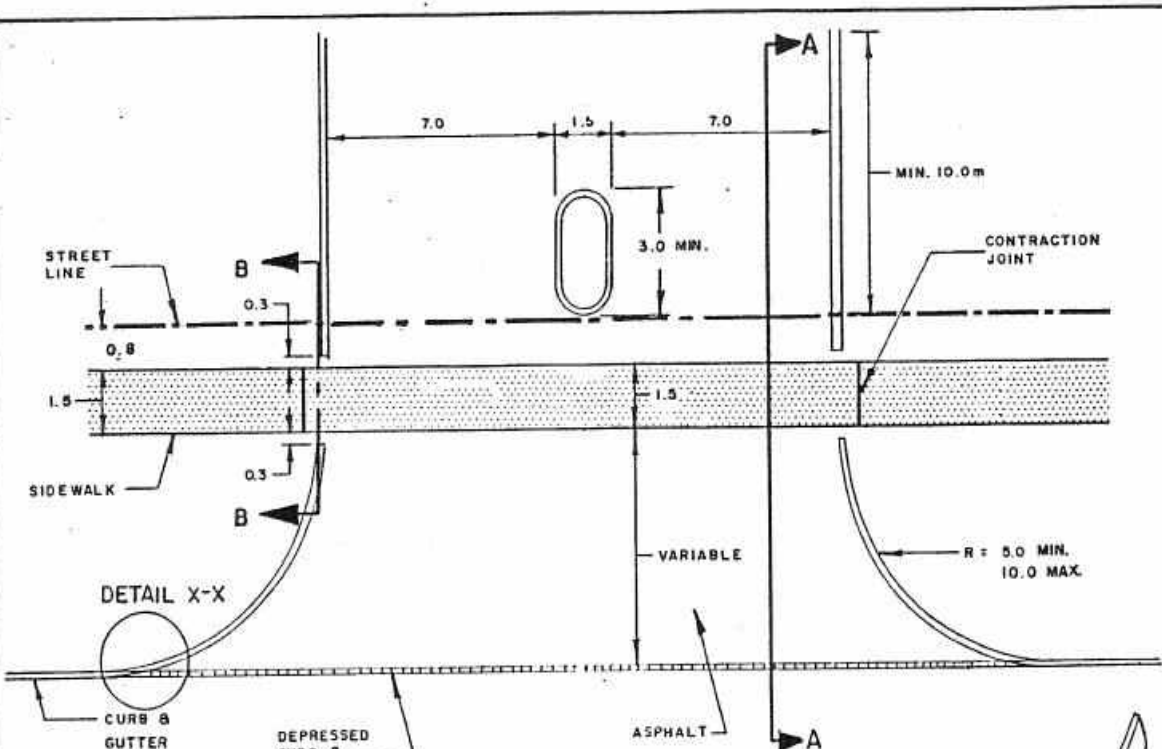


SECTION A-A

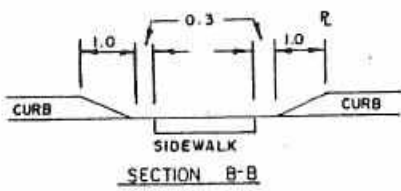
- NOTES:
1. For use only at signalized major access points to community plazas or major industrial plants. MTO traffic control signal warrants must be satisfied.
  2. Dimensions in "m" except as noted.
  3. Hazard marker and keep right signs required on island.



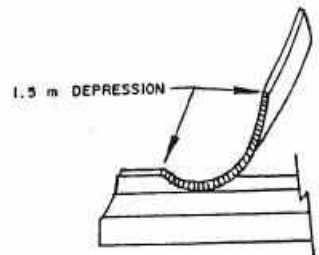
<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: <i>R. Savard</i>
	DATE: 89 - 02 - 14
STANDARD DRIVEWAY ENTRANCE TYPE 'A' HIGH VOLUME ACCESS SIGNALIZED	SCALE: N. T. S.
	C.C - 112



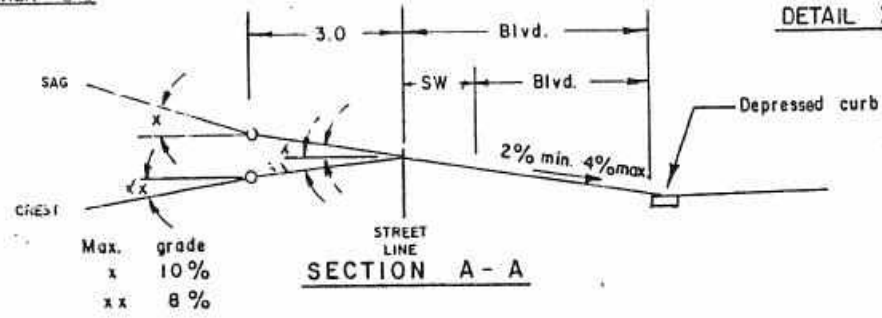
PLAN



SECTION B-B



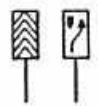
DETAIL X-X



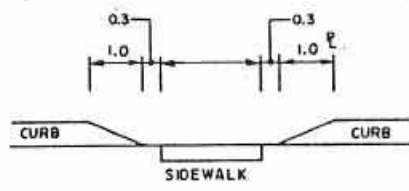
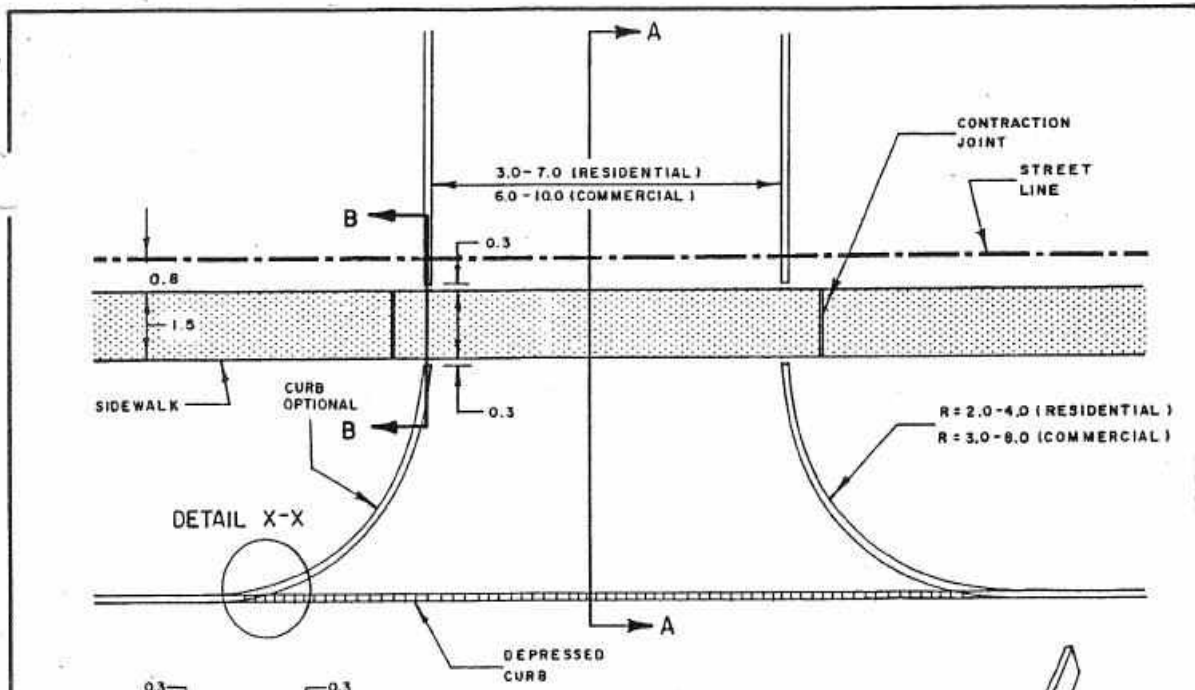
SECTION A-A

NOTES:

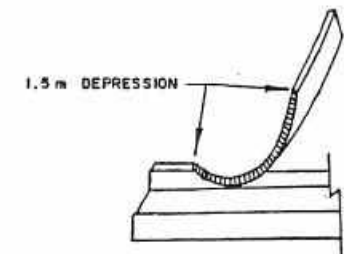
1. Island required when total width exceeds 10.0m.
2. Dimensions in 'm' except as noted.
3. Hazard marker and keep right signs required on island.



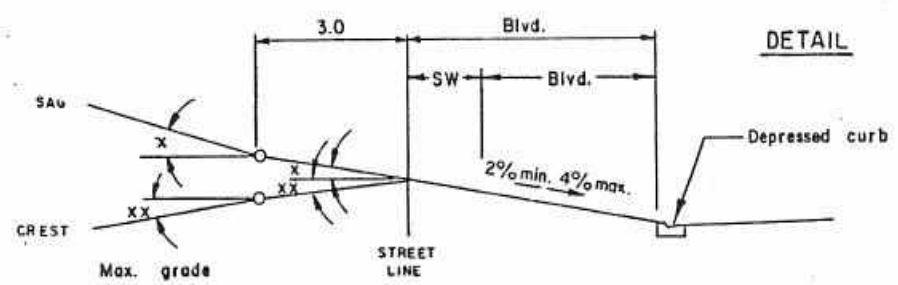
<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: <i>R. Seward</i> DATE: 89-01-30
	SCALE: N. T. S. CC-113
STANDARD DRIVEWAY ENTRANCE TYPE 'B' HIGH VOLUME ACCESS	



SECTION B-B



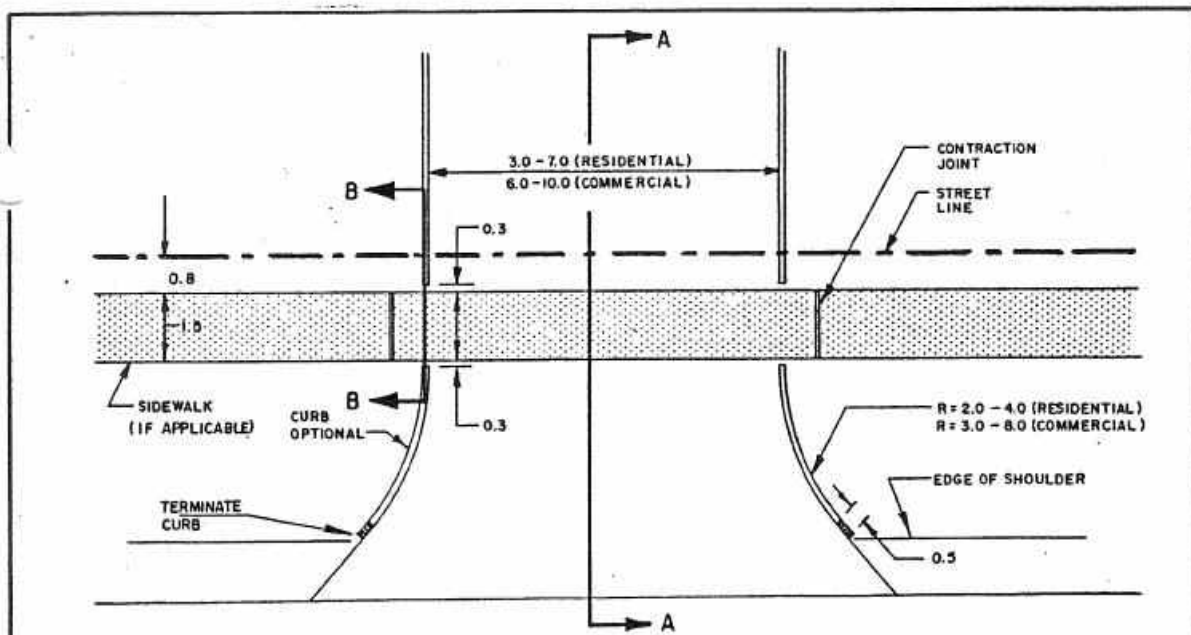
DETAIL X-X



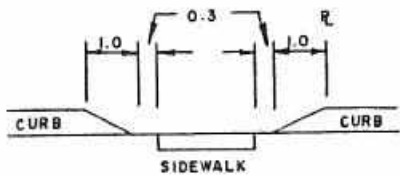
SECTION A-A

- NOTES: 1. Commercial for plazas, industrial sites, schools, apartments (above 30 units).  
 2. Residential refers to apartments or complexes with 6 to 30 units.  
 3. Dimensions in "m" except as noted

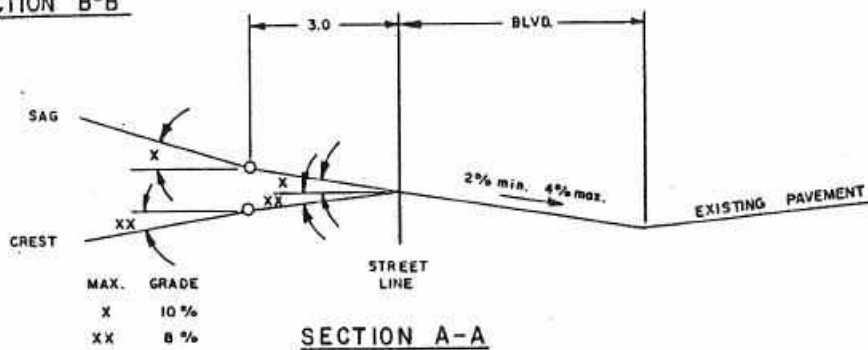
	<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: <i>R. Seward</i> DATE: 89-01-31
	STANDARD DRIVEWAY ENTRANCE TYPE 'C' LOW VOLUME ACCESS	SCALE: N.T.S. CC-114



PLAN



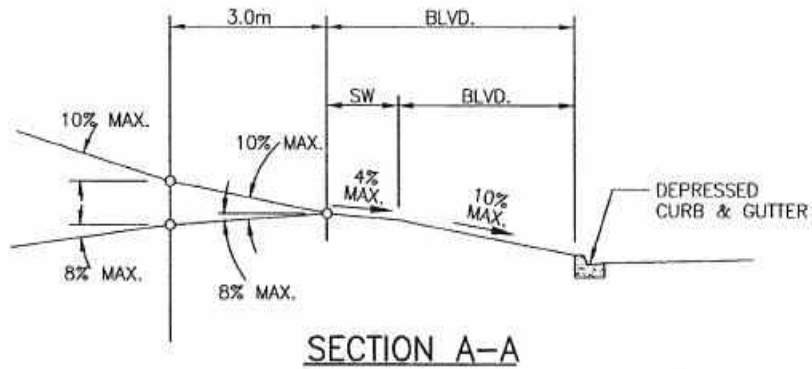
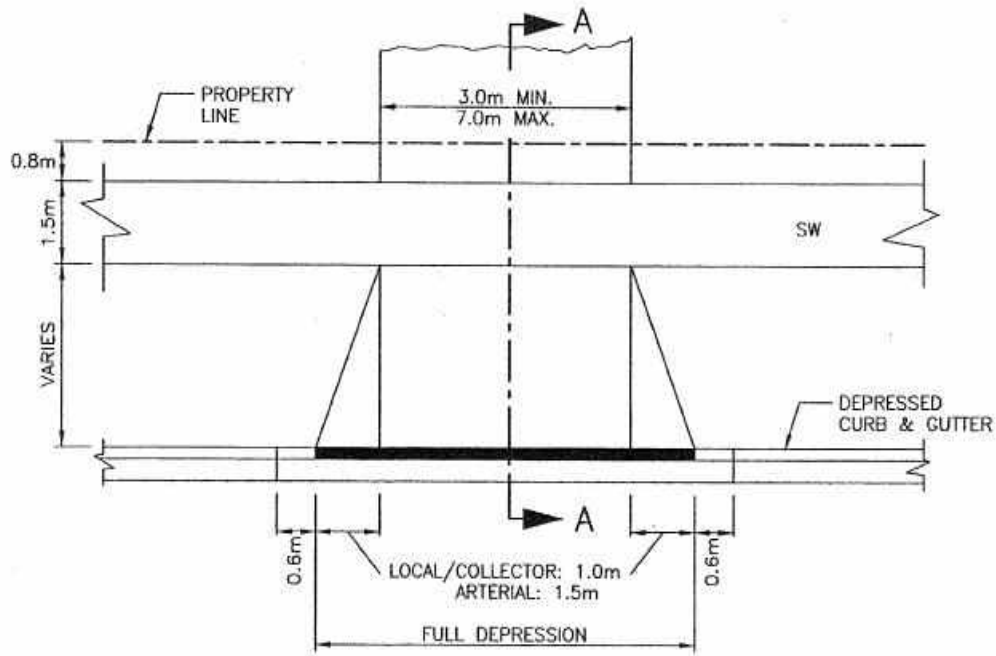
SECTION B-B



SECTION A-A

- NOTES
1. Commercial for plazas, industrial sites, schools, apartments (above 30 units)
  2. Residential refers to apartments or complexes with 6 to 30 units.
  3. Dimensions in "m" except as noted.

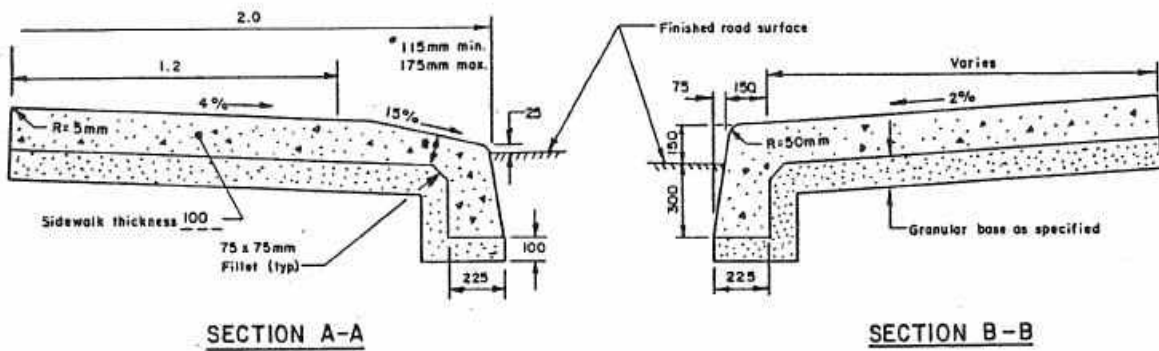
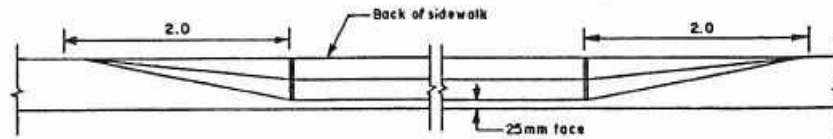
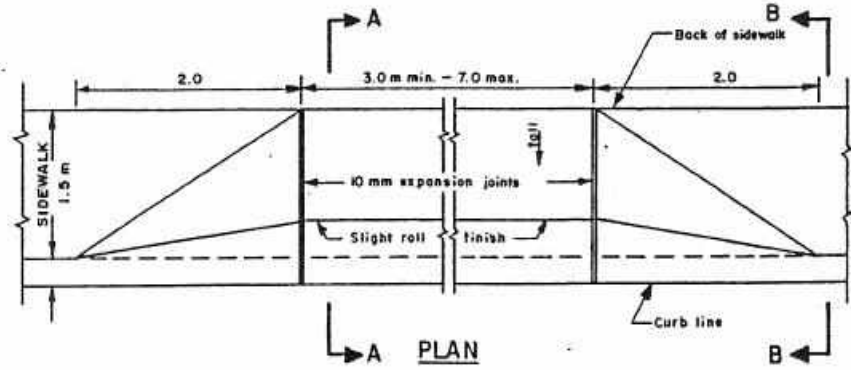
	<b>CITY OF CORNWALL</b>	DRAWN BY: J.N.O.
	ENGINEERING DEPARTMENT	DATE: 89-07-27
	STANDARD DRIVEWAY ENTRANCE	SCALE: N.T.S.
	TYPE 'D' LOW VOLUME ENTRANCE (RURAL ROAD SECTION)	CC - 115



- NOTES:**
1. FOR PRIVATE DWELLINGS AND UTILITY ENTRANCES.
  2. DRIVEWAY/UTILITY CLEARANCES—THE MINIMUM CLEARANCE FROM THE EDGE OF THE DRIVEWAY TO ABOVE AND BELOW GROUND UTILITIES SHALL BE AS FOLLOWS:
    - a) UTILITY POLES—STREET LIGHTS: 1.0m
    - b) HYDRO VAULTS, GAS PEDESTALS: 1.0m
    - c) TREES, HYDRANTS: 1.2m
    - d) UTILITY PEDESTALS (EXCEPT GAS) AND HANDHOLES: 0.6m

<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: A.J.A.
	DATE: 03-01-24
STANDARD DRIVEWAY ENTRANCE TYPE 'E' URBAN PRIVATE DRIVEWAY ENTRANCE	SCALE: N.T.S.
	CC-116

CS

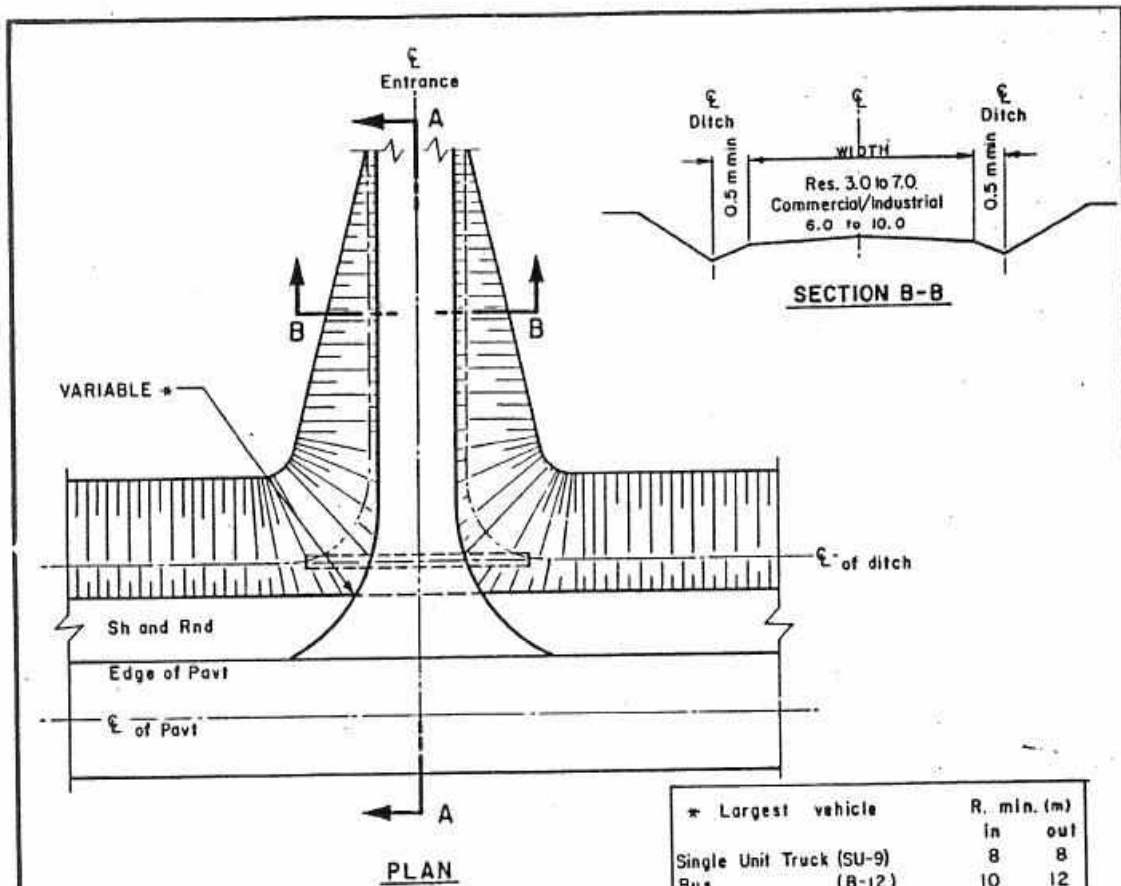


NOTE: All dimensions are in millimetres or metres unless otherwise shown.

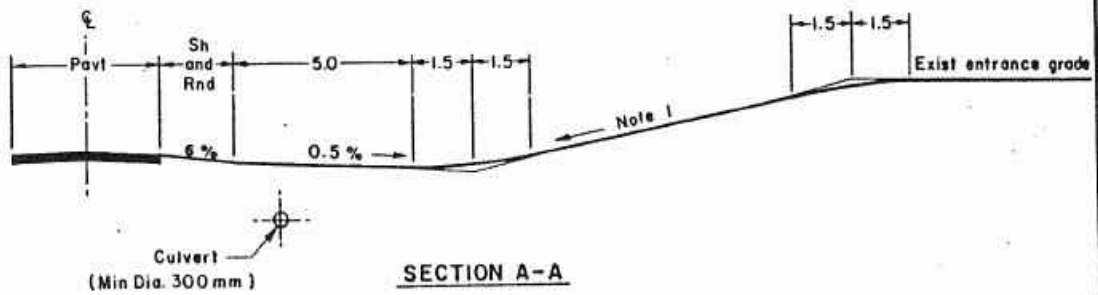
CITY OF CORNWALL  
ENGINEERING DEPARTMENT

STANDARD DRIVEWAY ENTRANCE  
URBAN PRIVATE ENTRANCE (MONOLITHIC SIDEWALK)  
TYPE 'F'

DRAWN BY: J.N.B.  
DATE: 89-07-25  
SCALE: N.T.S.  
CC-117



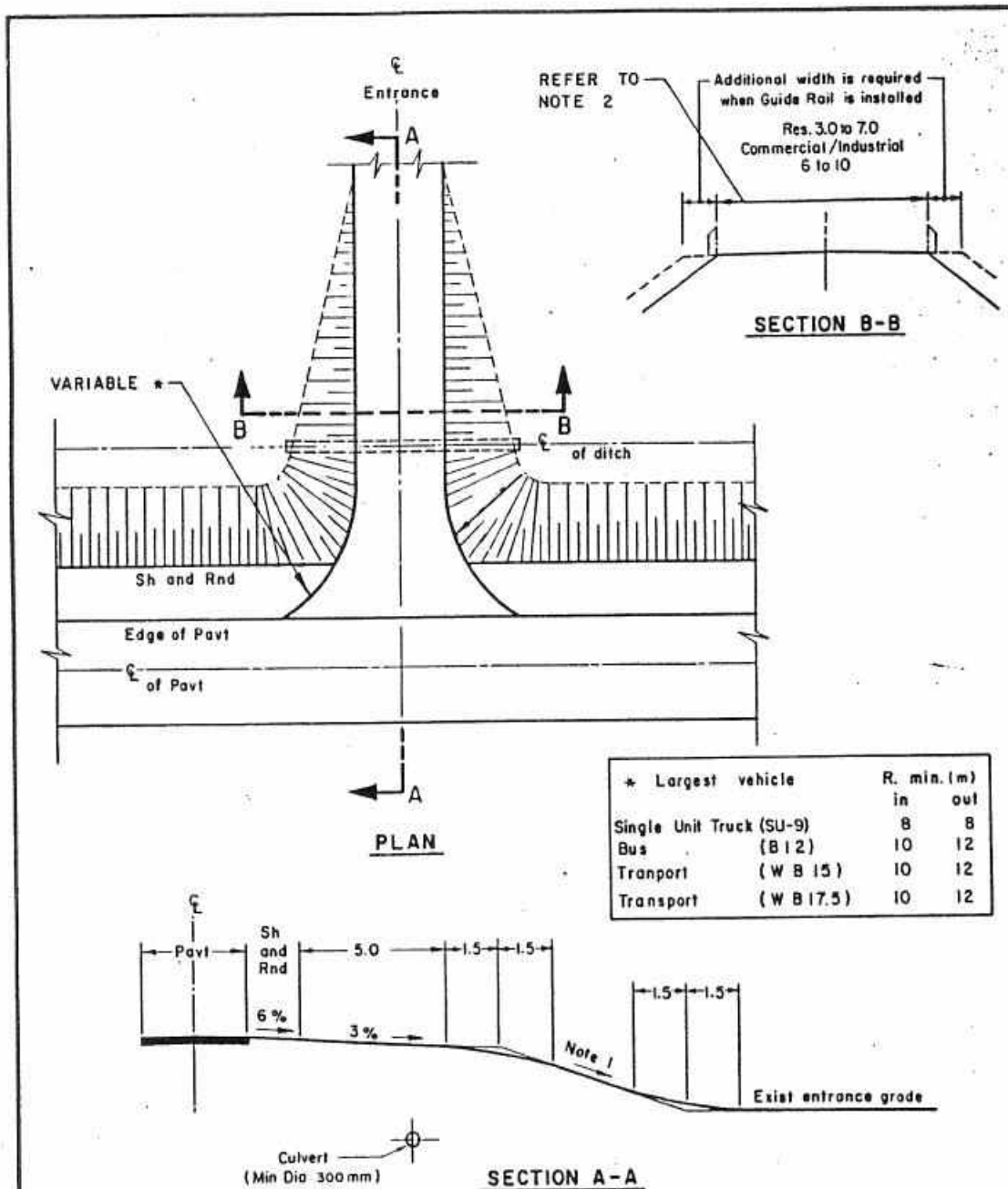
* Largest vehicle	R. min. (m)	
	in	out
Single Unit Truck (SU-9)	8	8
Bus (B-12)	10	12
Transport (W B-15)	10	12
Transport (W B-17.5)	10	12



**NOTE:**

1. Maximum gradient = 10%.
2. All dimensions are in millimetres or metres unless otherwise shown.
3. In extreme cases, width may be increased to 15.0m with approval from Traffic Section.

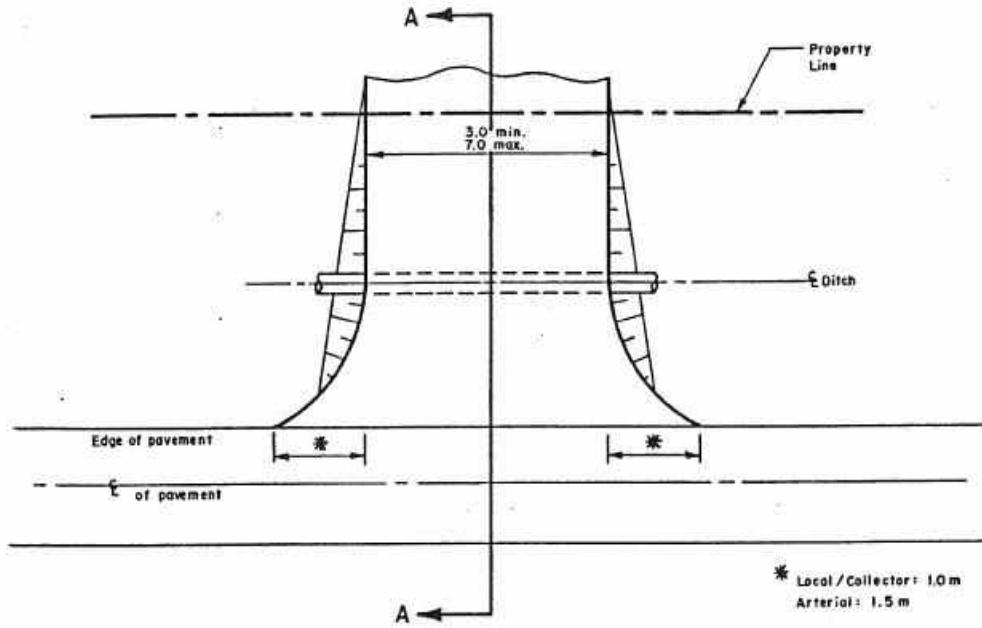
<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT STANDARD DRIVEWAY ENTRANCE TYPE 'G' RURAL SECTION	DRAWN BY: J.N.O.
	DATE: 89-07-26
	SCALE: N.T.S.
	CC - 118



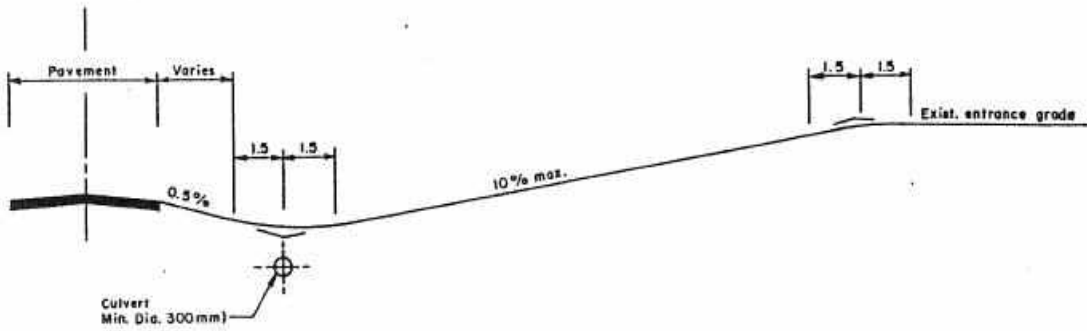
**NOTE:**

1. All dimensions are in millimetres or metres unless otherwise shown.
2. Maximum gradients = 10%.
3. In extreme cases, width may be increased to 1.5m with approval from Traffic Section.

<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT STANDARD DRIVEWAY ENTRANCE TYPE 'H' RURAL SECTION	DRAWN BY: J.N.O.
	DATE: 89-07-26
	SCALE: N.T.S.
	CC - 119



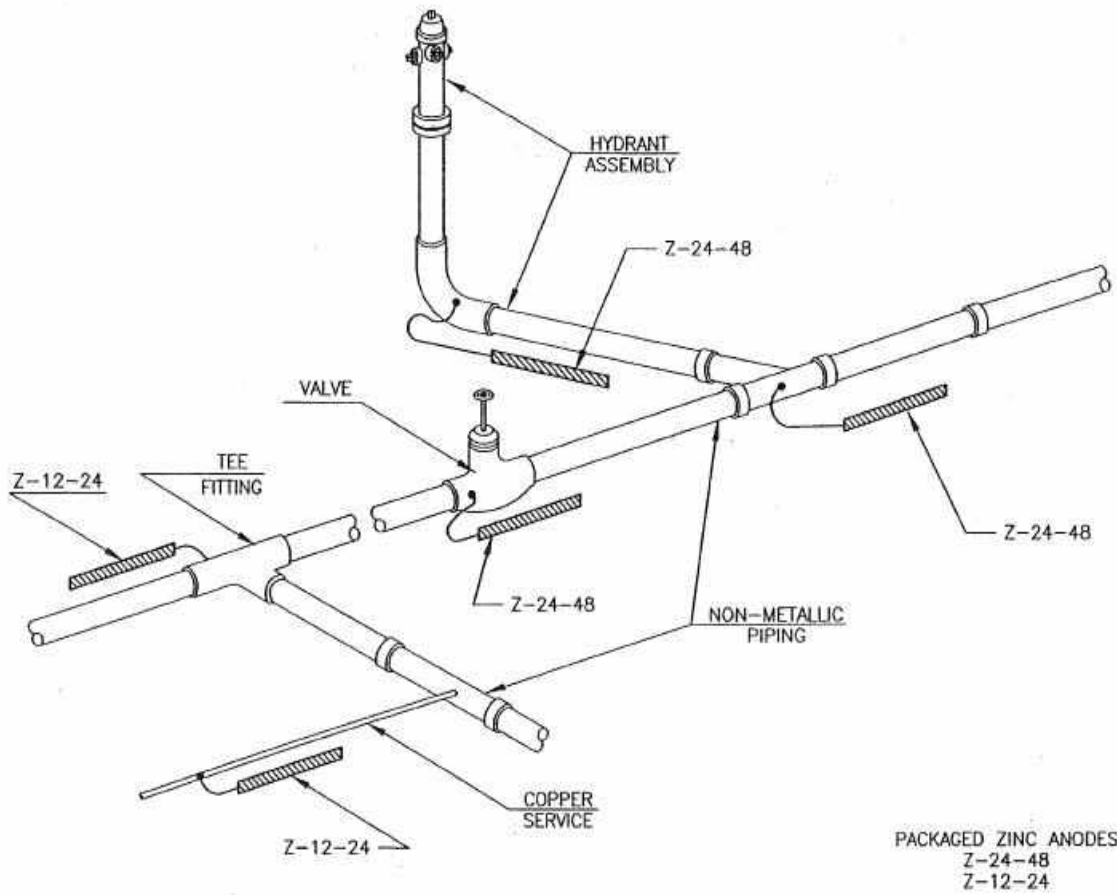
PLAN



SECTION A-A

- NOTE: 1. All dimensions are in millimetres or metres unless otherwise shown.  
2. Typically used on streets with "temporary asphalt".

	<b>CITY OF CORNWALL</b>	DRAWN BY: J.N.O.
	ENGINEERING DEPARTMENT	DATE: 89-07-28
	PRIVATE DRIVEWAY ENTRANCE TYPE "I"	SCALE: N.T.S.
	SEMI-RURAL SECTION	CC - 120



**NOTES:**

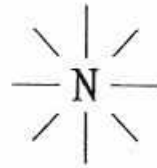
1. INSTALL COROSION PROTECTION SYSTEM OF NO. 12 ZINC ANODE FOR FITTINGS 300mm OR SMALLER, AND 24 lbs. FOR LARGER FITTINGS FROM CORROSION SERVICE COMPANY LTD., OR APPROVED EQUIVALENT.
2. ANODES TO BE CADWELDED DIRECTLY TO CAST IRON FITTINGS BODY AND THE COMPLETED CONNECTION SHALL BE SEALED WITH A LIBERAL APPLICATION OF T.C. MASTIC TAPECOAT OR APPROVED EQUIVALENT.
3. EACH ZINC ANODE SHALL BE PLACED HORIZONTALLY AT THE SPRINGLINE OF THE PIPE, PARRALLEL TO AND A MINIMUM OF 0.5m FROM THE PIPE. IT SHALL THEN BE SOAKED UNTIL SATURATED TO ENSURE IMMEDIATE OPERATION.

<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: A.J.A.
	DATE: 03-01-24
CATHODIC PROTECTION OF NEW NON-METALLIC PIPING	SCALE: N.T.S.
	CC-121

DATE: \_\_\_\_\_

NAME OF STREET: \_\_\_\_\_

ENTERED BY: \_\_\_\_\_



LOT NO: \_\_\_\_\_

HOUSE NO.: \_\_\_\_\_

WATER SERVICE

TYPE: \_\_\_\_\_

SIZE: \_\_\_\_\_

INVERT: \_\_\_\_\_

SANI. SERVICE

TYPE: \_\_\_\_\_

SIZE: \_\_\_\_\_

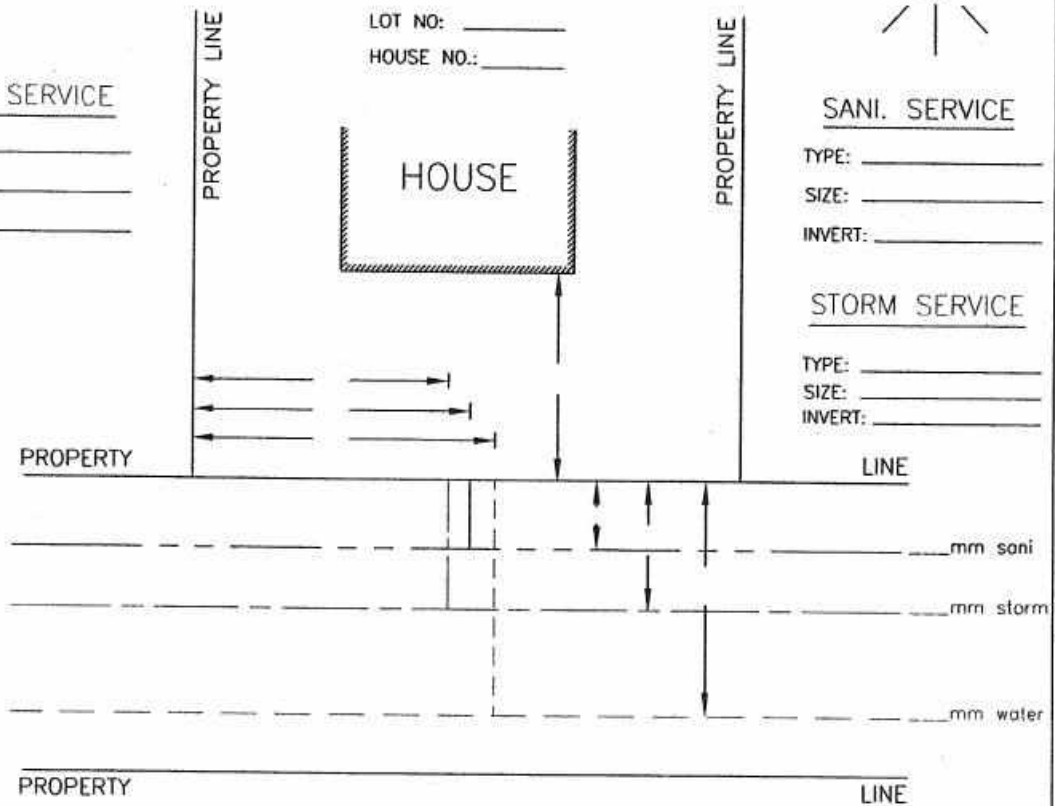
INVERT: \_\_\_\_\_

STORM SERVICE

TYPE: \_\_\_\_\_

SIZE: \_\_\_\_\_

INVERT: \_\_\_\_\_



NOTES:

1. SHOW PLAN LOCATION OF SEWERS AND WATERMAINS. SPECIFY TYPE AND SIZE.  
 USE SYMBOLS INDICATED HERE:
 

STORM SEWER	_____
SANITARY SEWER	_____
COMBINED SEWER	_____
WATERMAIN	_____
2. a) SHOW SERVICE CONNECTIONS. INDICATE TYPE, SIZE, STATION OF TAP-IN AT THE MAIN;  
 b) SPECIFY A GEODETIC ELEVATION OF THE SANITARY AND STORM SERVICE AT THE LOT LINE. (INVERT)
3. TO DISTINGUISH BETWEEN THE SERVICES AT LOT LINE, USE THE FOLLOWING COLOUR CODE:
 

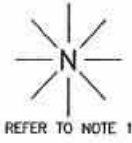
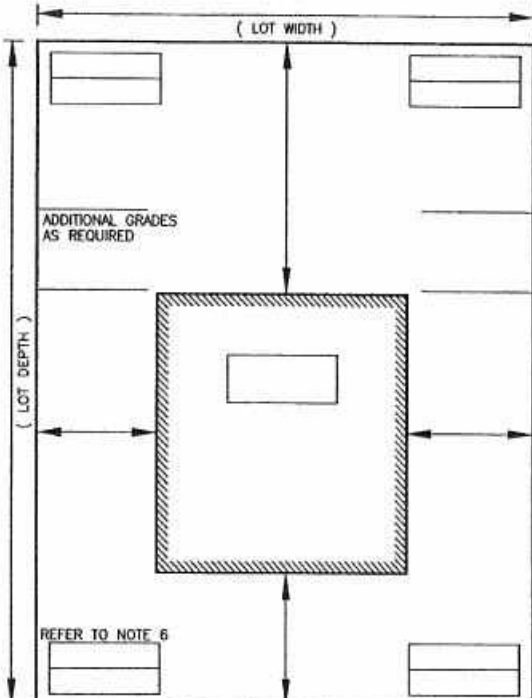
STORM	.....	GREEN
SANITARY	.....	RED
WATER	.....	BLUE
4. TIE-IN SERVICES AT LOT LINE BY USING PROPERTY BARS, OFFSETS FROM BUILDING CORNERS TO EACH SERVICE AND IF NO HOUSES EXIST, USE MANHOLES AND/OR CATCHBASINS. IF NO BUILDING OR STRUCTURES EXIST, USE THE HORIZONTAL DISTANCES FROM THE MAIN OF THE SEWERS OR WATERMAIN TO THE SERVICE AT LOT LINE.

CITY OF CORNWALL ENGINEERING DEPARTMENT	
SANITARY, STORM AND WATER SERVICE CONNECTIONS LOCATION SHEET	
SCALE: Not To Scale	CC-122

LOT NO. \_\_\_\_\_

PLAN NO. \_\_\_\_\_

HOUSE NO. \_\_\_\_\_  
(FOR INTERNAL USE ONLY)



REFER TO NOTE 1

**SANITARY**  
 MATERIAL: \_\_\_\_\_  
 COLOUR: \_\_\_\_\_  
 SIZE: \_\_\_\_\_  
 INVERT: \_\_\_\_\_

**STORM**  
 MATERIAL: \_\_\_\_\_  
 COLOUR: \_\_\_\_\_  
 SIZE: \_\_\_\_\_  
 INVERT: \_\_\_\_\_

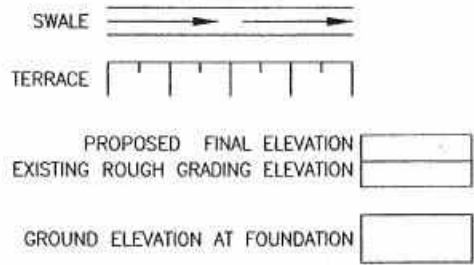
**WATER**  
 MATERIAL: \_\_\_\_\_  
 SIZE: \_\_\_\_\_  
 INVERT: \_\_\_\_\_

DRIVEWAY: 

RIGHT	_____
LEFT	_____

N.T.S.

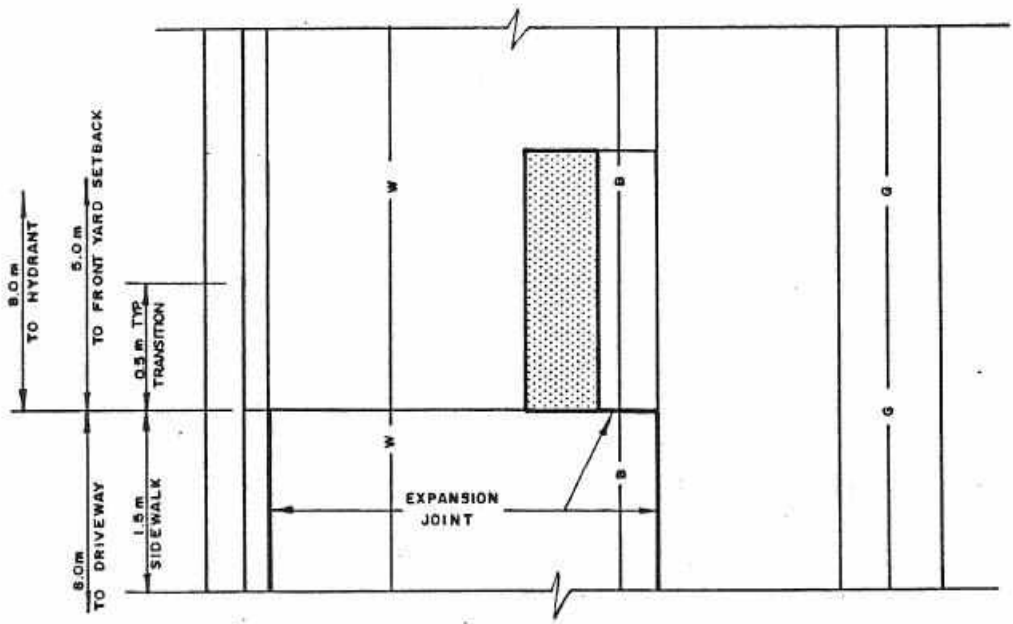
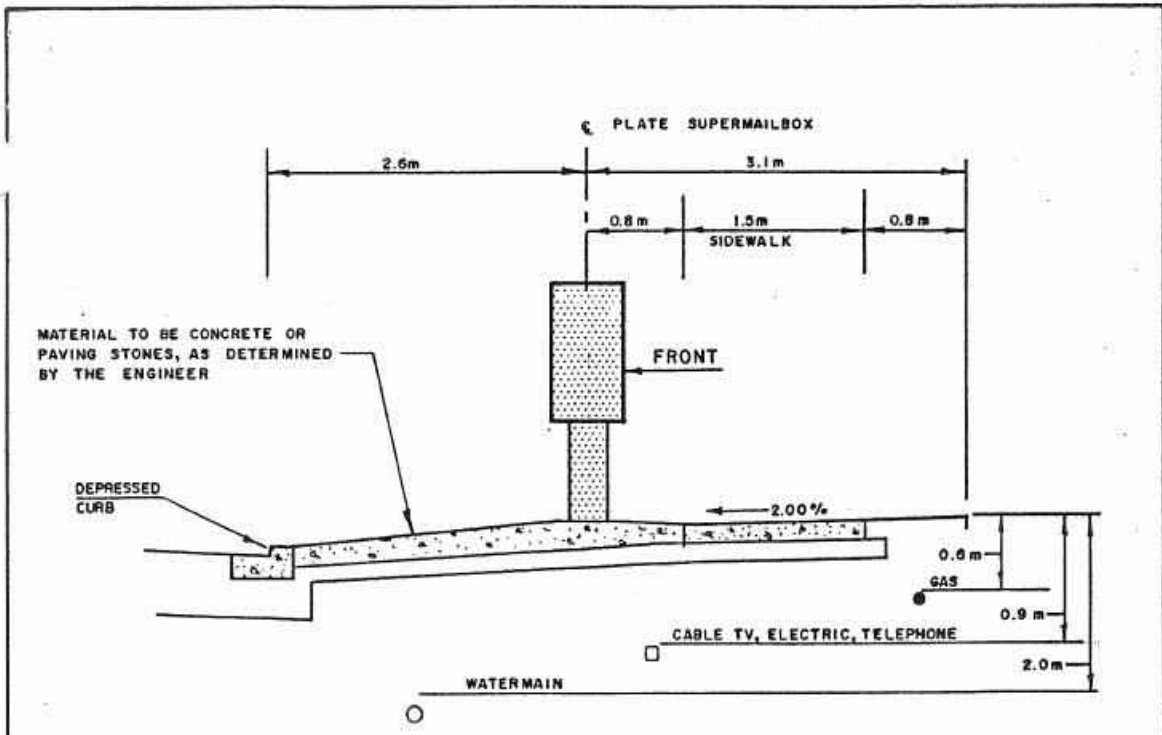
**LEGEND**



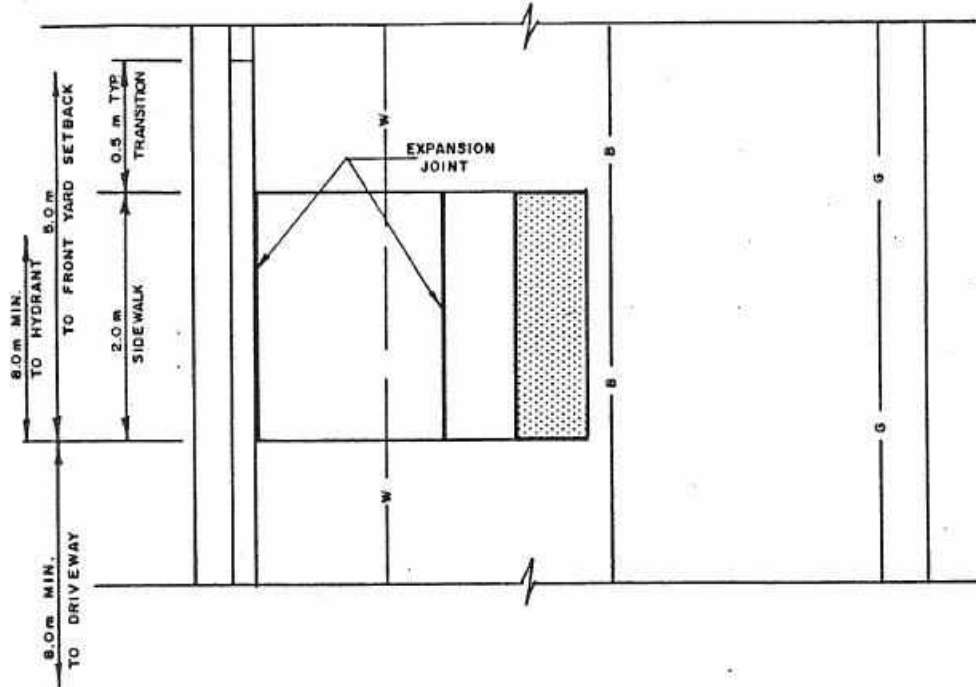
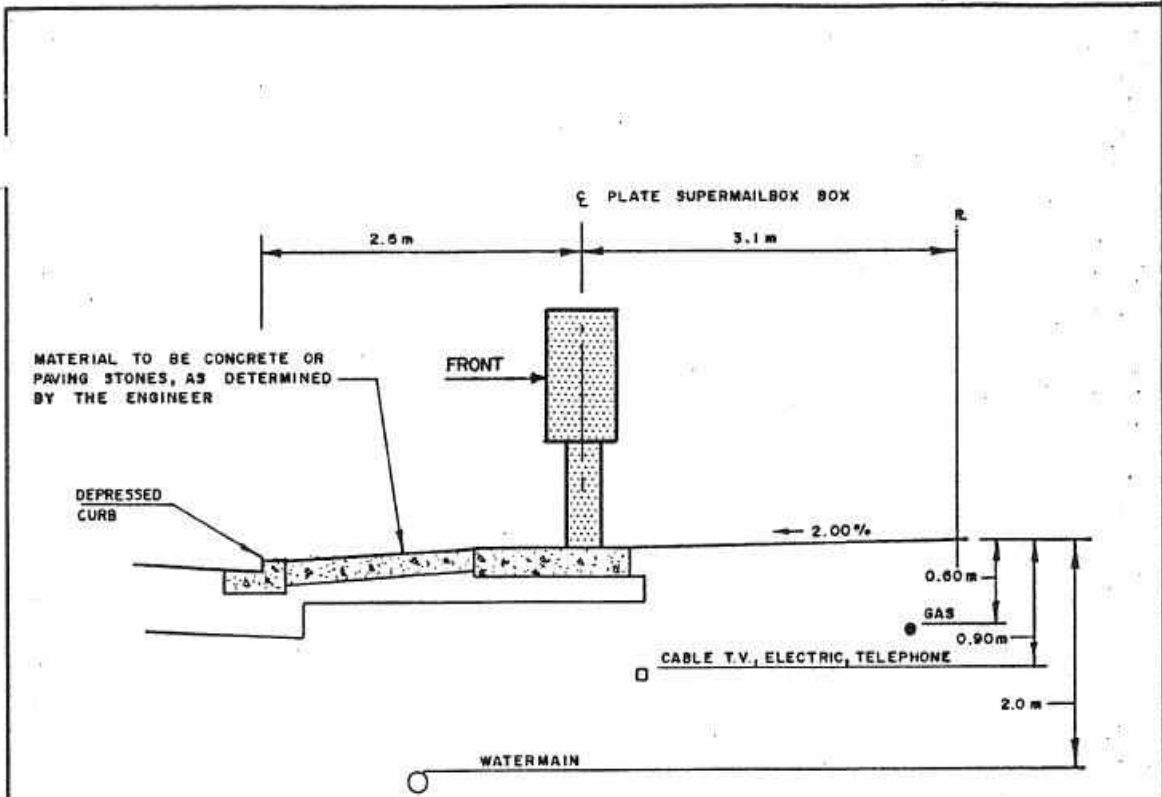
STREET NAME \_\_\_\_\_

- NOTES: (PLEASE READ CAREFULLY)**
1. INDICATE APPROXIMATE DIRECTION OF NORTH BY DRAWING AN ARROW.
  2. SHOW PLAN LOCATION ABOVE OF SERVICES AND SPECIFY MATERIAL, COLOUR AND SIZE. USE LINE SYMBOLS INDICATED HERE:  
 STORM SEWER \_\_\_\_\_ SANITARY SEWER \_\_\_\_\_ COMBINED SEWER \_\_\_\_\_ WATERMAIN \_\_\_\_\_
  3. a) SHOW SERVICE CONNECTION ABOVE. INDICATE MATERIAL, COLOUR, SIZE AND STATION OF TAP-IN AT THE MAIN  
 b) SPECIFY GEODETIC ELEVATION OF THE SANITARY AND STORM SERVICE AT THE LOT LINE. (INVERT OF SERVICES).
  4. TO DISTINGUISH BETWEEN THE SERVICES AT THE LOT LINE, USE THE FOLLOWING COLOUR CODE:  
 STORM -GREEN, SANITARY -RED, WATER- BLUE.
  5. TIE-IN SERVICES AT THE LOT LINE BY USING PROPERTY BARS.
  6. THE OWNER AND/OR AGENT IS RESPONSIBLE TO ENSURE THAT THE FINAL LOT GRADING ELEVATIONS, AS INDICATED ON THIS FORM, ARE ADHERED TO. IT IS UNDERSTOOD THAT THE ABOVE INFORMATION HAS BEEN PROVIDED FROM OFFICE RECORDS AND REPRESENTS THE APPROXIMATE LOCATION AND ELEVATIONS.
  7. THE CITY OF CORNWALL SHALL NOT BE HELD RESPONSIBLE FOR ANY ERRORS OR OMISSIONS OF THE INFORMATION PROVIDED.

<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT  SITE PLAN INFORMATION	DRAWN BY: A.J.A.
	DATE: 03-01-24
	SCALE: N.T.S.
	<b>CC-123</b>



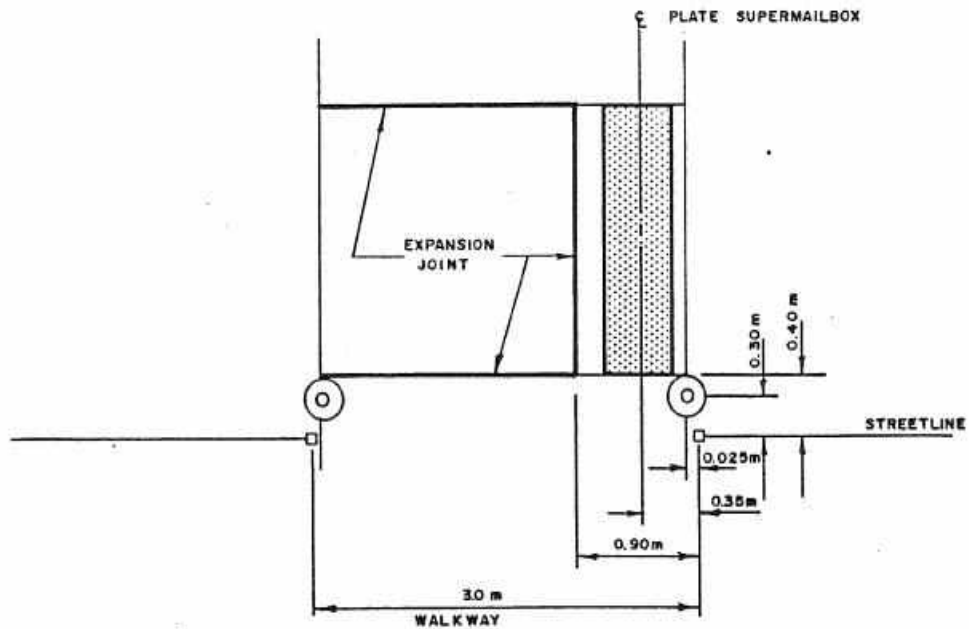
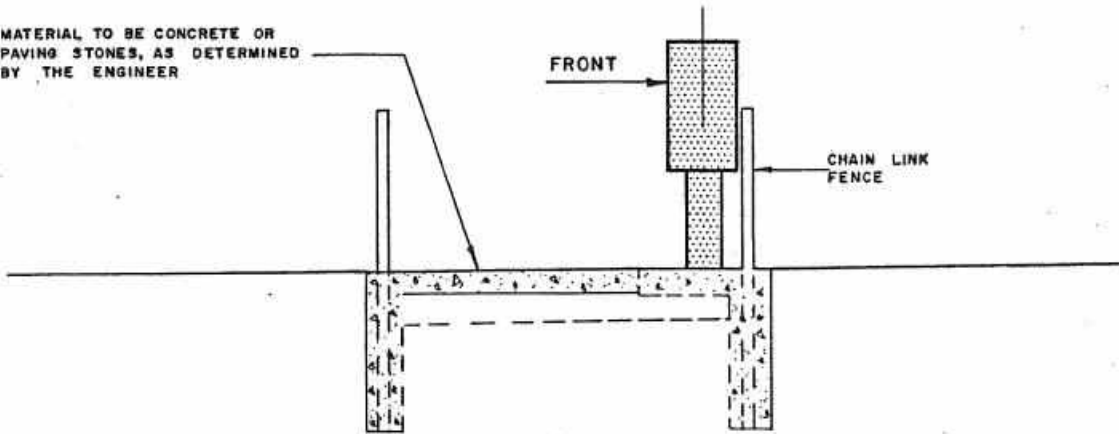
CITY OF CORNWALL ENGINEERING DEPARTMENT  SUPERMAILBOX WITH SIDEWALK	DRAWN BY: <i>R. Seward</i> DATE: 88-05-04
	SCALE: N.T.S. CC-124



CITY OF CORNWALL ENGINEERING DEPARTMENT	DRAWN BY: <i>R. Seward</i>
	DATE: 88-05-04
SUPERMAILBOX WITHOUT SIDEWALK	SCALE: N. T. S.
	CC-125

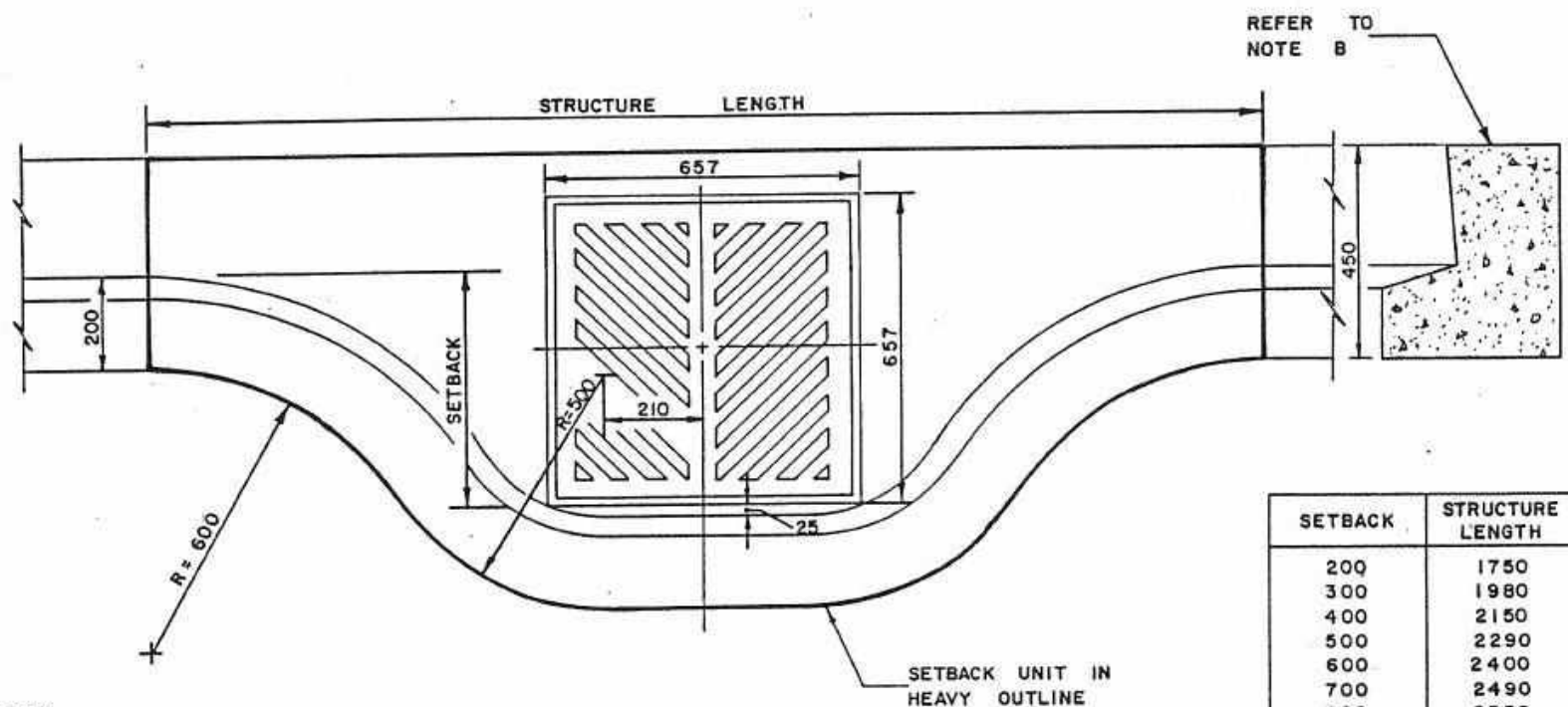
64

MATERIAL TO BE CONCRETE OR  
PAVING STONES, AS DETERMINED  
BY THE ENGINEER



CITY OF CORNWALL ENGINEERING DEPARTMENT	DRAWN BY: <i>R. Seward</i>
	DATE: 88-05-04
SUPERMAILBOX IN CONCRETE WALKWAY	SCALE: N.T.S.
	CC-126

LS

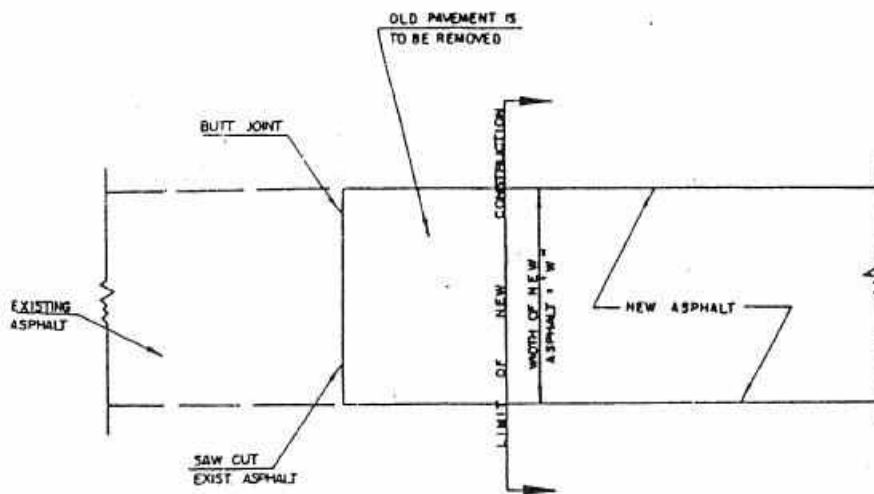


SETBACK	STRUCTURE LENGTH
200	1750
300	1980
400	2150
500	2290
600	2400
700	2490
800	2550
900	2590
1000	2610
1100	2620
1200	2620

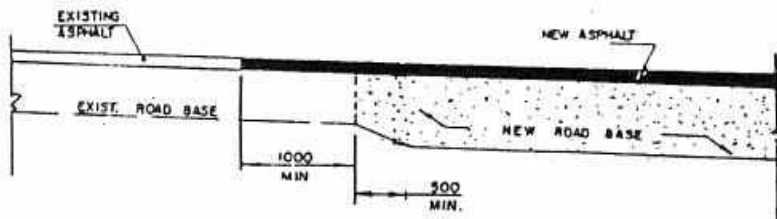
**NOTES:**

- A. CONCRETE TO BE 25 MPa COMPRESSION STRENGTH AFTER 28 DAYS. THE NOMINAL MAXIMUM SIZE OF COARSE AGGREGATE SHALL BE 19mm, UNLESS OTHERWISE SPECIFIED.
- B. FOR TYPE 'C' CONCRETE CURB AND GUTTER, REFER TO OPSD - 600.01
- C. CATCH BASIN FRAME AND GRATE IS PER OPSD - 400.01
- D. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
- E. 12mm BITUMINOUS FIBRE EXPANSION JOINT MATERIAL TO BE PLACED AT ENDS OF STRUCTURE, UNLESS OTHERWISE SPECIFIED.

<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT  CATCHBASIN SETBACK FOR CONCRETE CURB AND GUTTER	DRAWN BY: <i>R. Savard</i>
	DATE: 85-02-05
	SCALE: N. T. S.
	CC-127

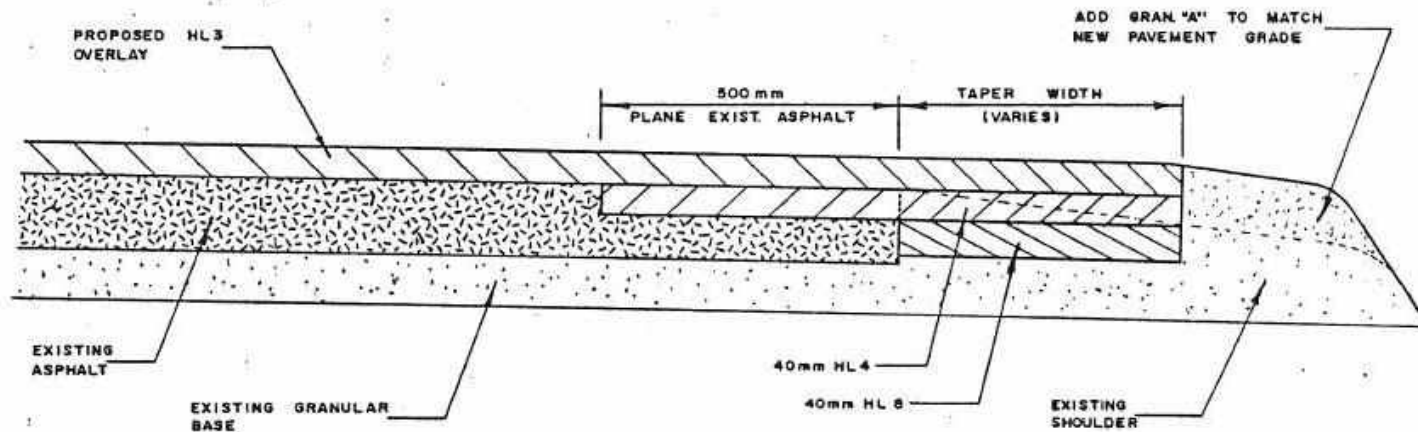


PLAN



ELEVATION

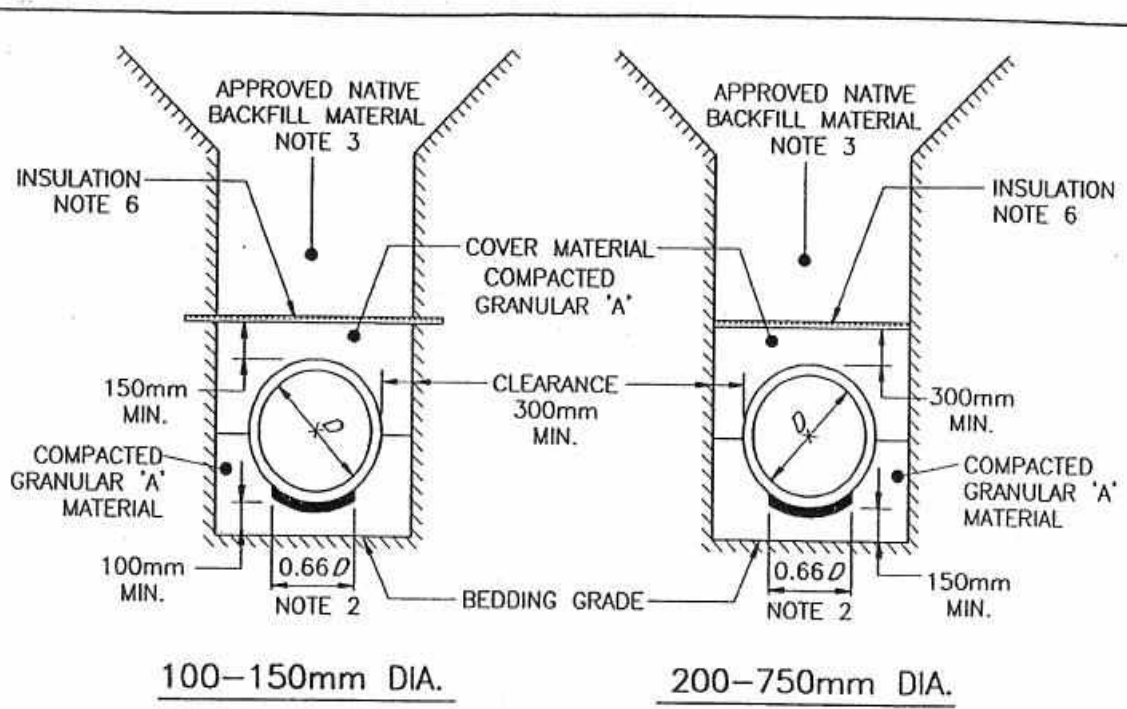
		<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: <i>A. H. Thomas</i>
84 01 24	<i>ATG</i>		DATE: DEC. 4, 1975
DATE	BY	TRANSITION POINT TREATMENT NEW ROAD TO EXISTING ROAD	SCALE: N.T.S.
REVISIONS			CC - 128



TAPERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING :

1. GRADE EXISTING GRANULAR ALONG EDGE OF PAVEMENTS 80mm DEEP x TAPER WIDTH TO EDGE OF SHOULDER
2. REMOVE ASPHALT BY PLANING ALONG EDGE OF PAVEMENT 40mm DEEP x 0.5mm WIDE.
3. PLACE AND COMPACT HL4 40mm THICK x TAPER WIDTH.
4. PLACE AND COMPACT HL4 40mm THICK FROM OUTSIDE EDGE OF TAPER TO PLANED EDGE.
5. FOLLOWING PLACEMENT OF HL3 OVERLAY ON ROADWAY, ADD GRAN. "A" ON SHOULDER. GRADE TO MATCH NEW PAVEMENT ELEVATION.
6. THE COST FOR TAPER CONSTRUCTION EXCLUDING GRAN. "A" IS TO BE INCLUDED IN THE UNIT BID PRICE FOR HL4.
7. THE COST FOR GRAN. "A" IS TO BE PAID BY THE ITEM FOR GRAN. "A".

CITY OF CORNWALL ENGINEERING DEPARTMENT	DRAWN BY: <i>R.L.</i>
	DATE: 87-06-24
PAVEMENT WIDENING	SCALE: N.T.S.
	CC - 129



**NOTES:**

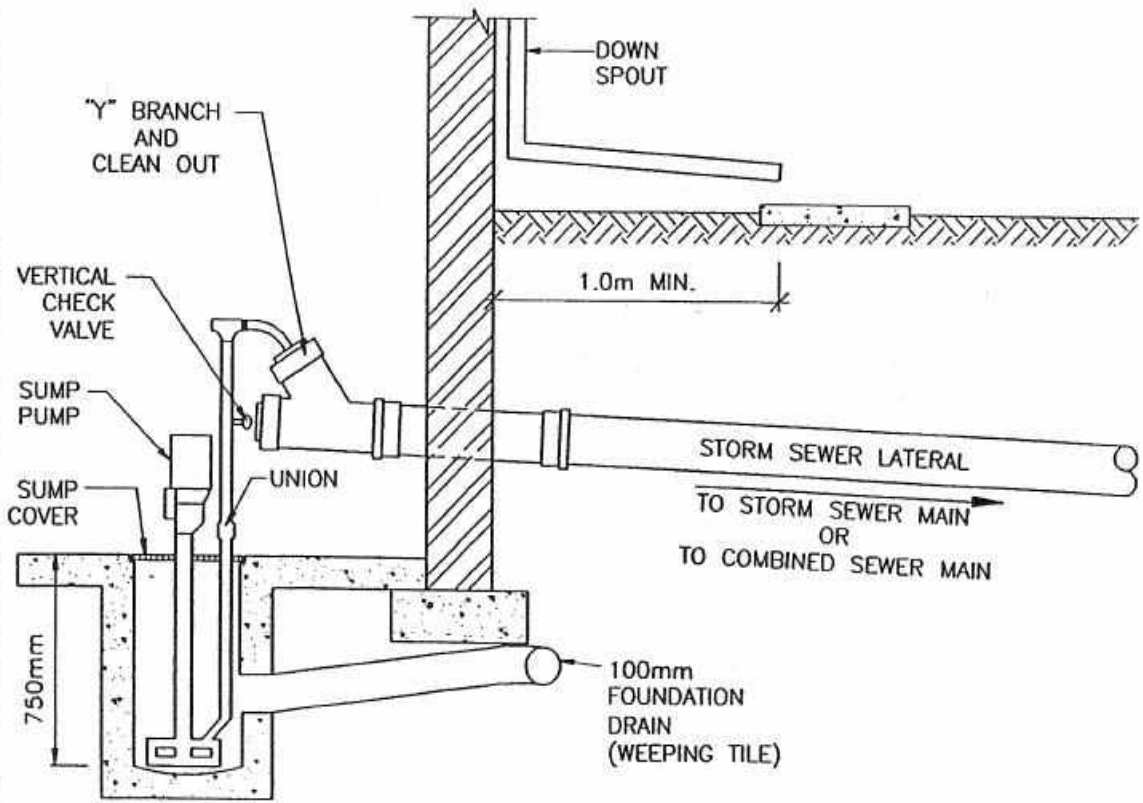
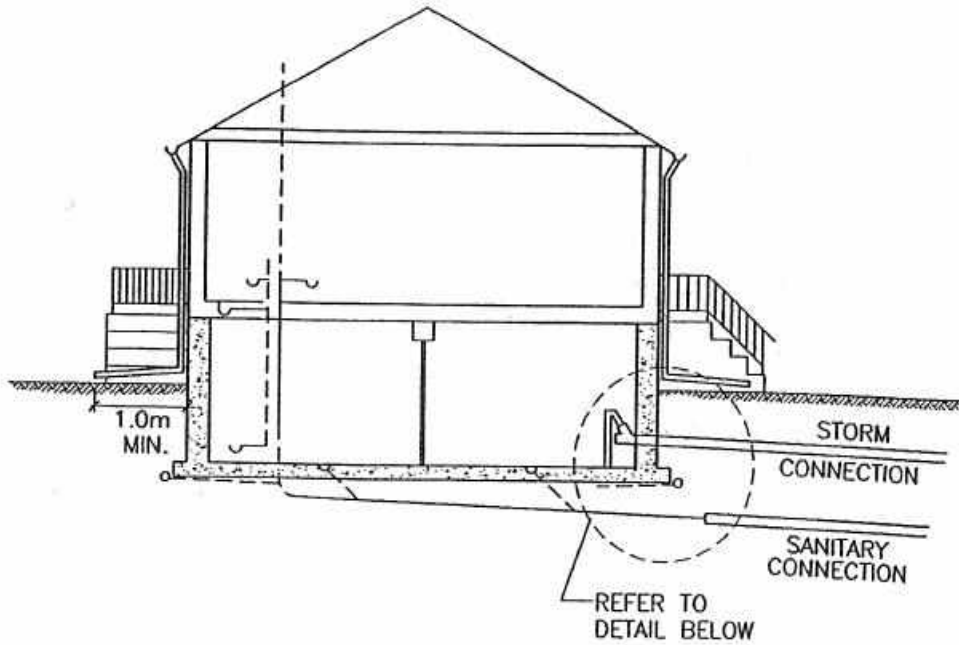
1. THIS STANDARD TO BE APPLIED IN STABLE CONDITIONS OR AFTER TRENCH HAS BEEN BROUGHT TO STABLE CONDITIONS.
2. THE PIPE BED IS TO BE CAREFULLY SHAPED TO RECEIVE THE BOTTOM OF THE PIPE.
3. BACKFILL SHALL BE APPROVED NATIVE MATERIAL OR APPROVED IMPORTED MATERIAL AND SHALL MEET THE REQUIREMENTS OF OPSS 514.
4. GRANULAR 'A' SHALL BE COMPACTED TO 100% STANDARD PROCTOR DENSITY.
5. BACKFILL MATERIAL SHALL BE PLACED IN 300mm LIFTS AND COMPACTED TO 95% STANDARD PROCTOR DENSITY.
6. RIGID HIGH DENSITY STYROFOAM INSULATION SHALL BE INSTALLED ON TOP OF THE COVER MATERIAL WHERE THE DEPTH FROM THE FINISHED SURFACE TO TOP OF PIPE IS LESS THAN 1.35m. THE THICKNESS OF THE INSULATION SHALL BE AS PER TABLE 1. THE WIDTH SHALL BE 1.2m.
7. ALL TRENCHES AND OTHER EXCAVATIONS SHALL MEET THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT.
8. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

**TABLE 1.**

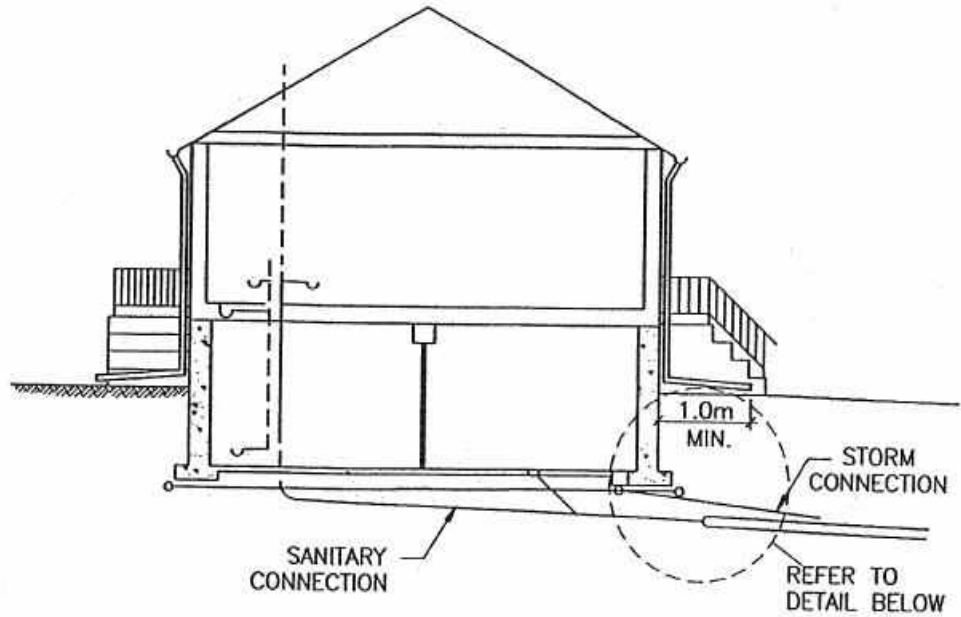
INSULATION REQUIREMENT	
DEPTH OF COVER	INSULATION THICKNESS
1.35m	NOT REQUIRED
1.34m-1.0m	25mm
0.99m-.075m	50mm

CITY OF CORNWALL ENGINEERING DEPARTMENT	DRAWN BY: A.J.A.
	DATE: 99-12-07
LATERAL BEDDING AND COVER MATERIAL	SCALE: N.T.S.
	SCHEDULE A

L4

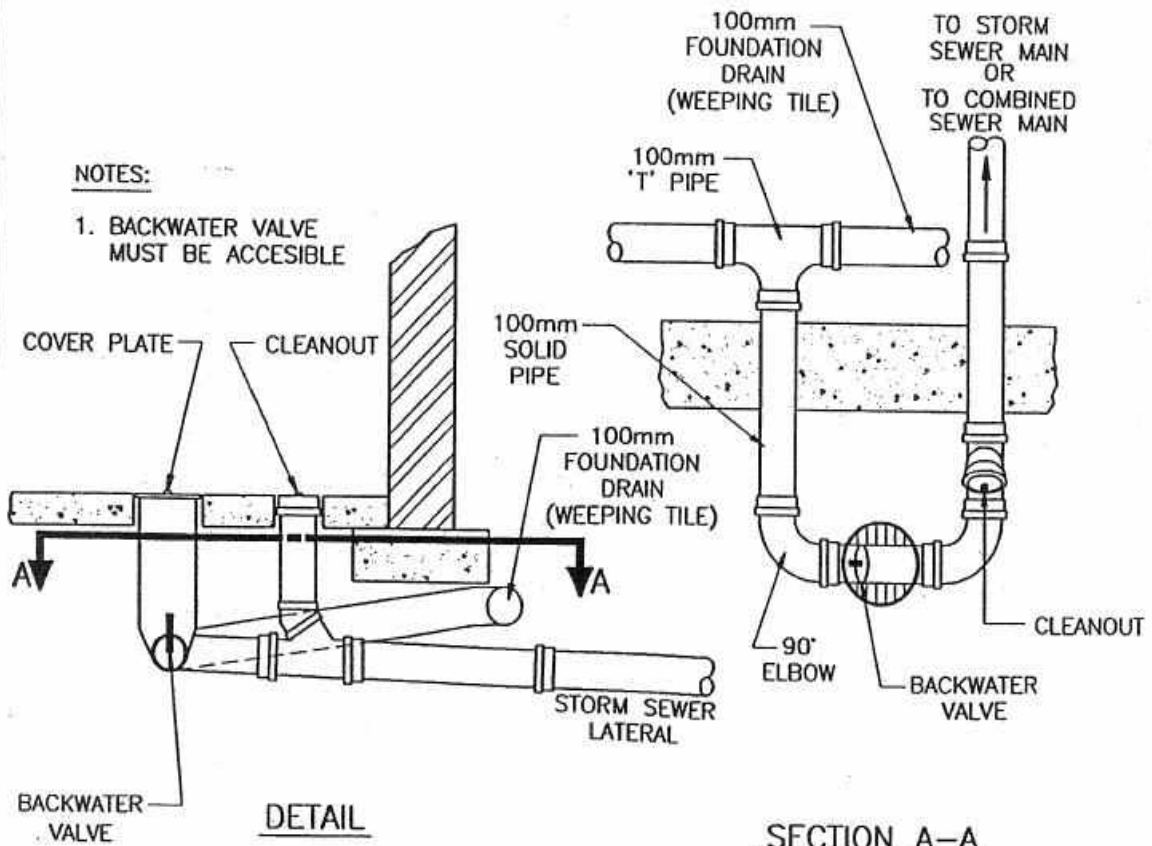


<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT	DRAWN BY: A.J.A.
	DATE: 99-12-07
HOUSE STORM CONNECTION WITH SUMP PUMP	SCALE: N.T.S.
	<b>SCHEDULE B</b>

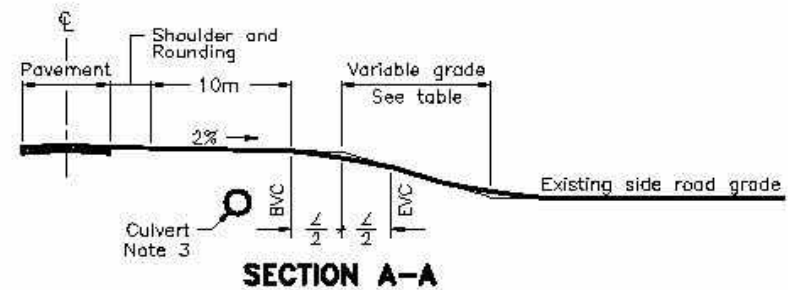
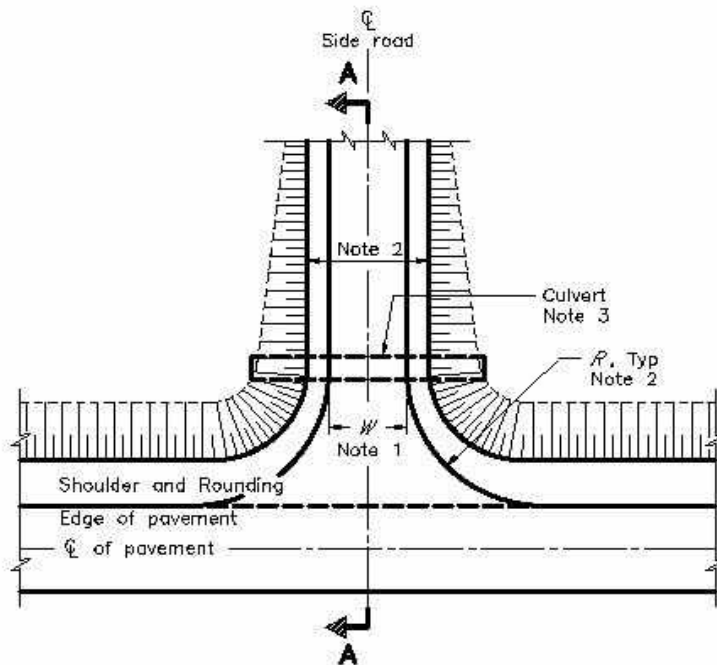


**NOTES:**

1. BACKWATER VALVE MUST BE ACCESSIBLE



CITY OF CORNWALL ENGINEERING DEPARTMENT	DRAWN BY: A.J.A.
	DATE: 99-12-07
STORM DRAIN CONNECTION BY GRAVITY	SCALE: N.T.S.
	SCHEDULE C



GRADE TABLE	
Downgrade %	L m
3	4
4	8
5	12
6	16
7	20
8	24
9	28
Max 10	32

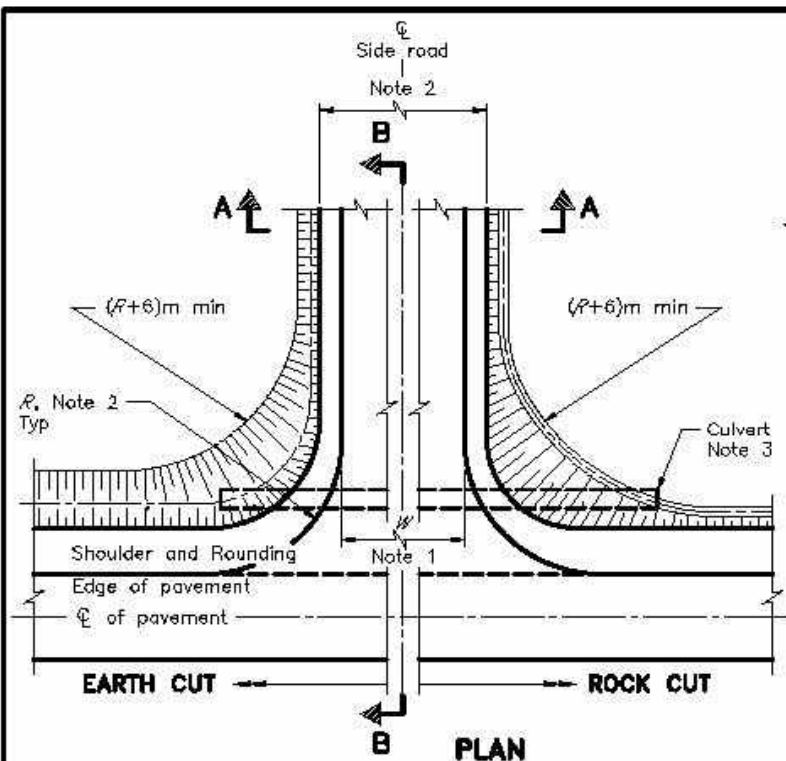
**NOTES:**

- 1 When curb and gutter is specified, *W* shall be 8.5m minimum. Taper to existing pavement width at 1:25 along each pavement edge.
- 2 Side road radii and pavement and shoulder widths as specified.
- 3 Culvert type, dimensions, and location shall be as specified.
- A Where steel beam guide rail is specified, width of rounding shall be 1.0m.
- B All dimensions are in millimetres unless otherwise shown.

**LEGEND:**

- L* - Length of vertical curve
- R* - Side road radius
- W* - Pavement width

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2008	Rev 1	
<b>SIDE ROAD INTERSECTION</b>	<hr style="border: none; border-top: 1px dashed black;"/> <hr style="border: none; border-top: 1px dashed black;"/>		
FILL	<b>OPSD 300.010</b>		

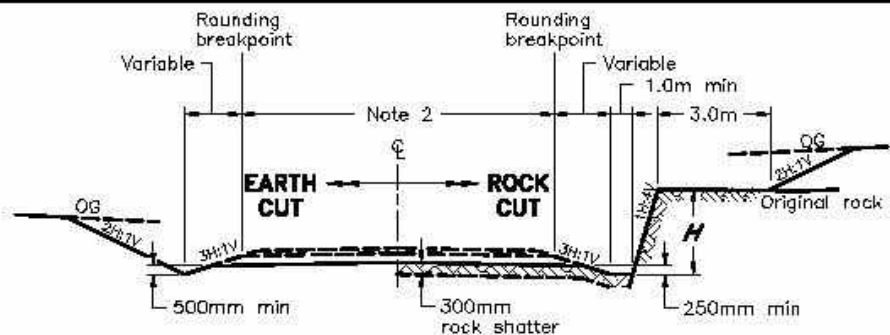


**NOTES:**

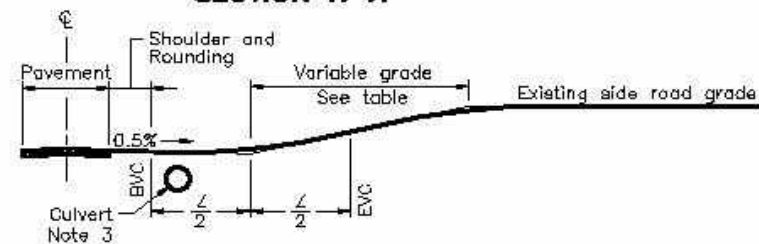
- 1 When curb and gutter is specified,  $W$  shall be 8.5m minimum. Taper to existing pavement width at 1:25 along each pavement edge.
- 2 Side road radii and pavement and shoulder widths as specified.
- 3 Culvert type, dimensions, and location shall be as specified.
- A All dimensions are in millimetres unless otherwise shown.

**LEGEND:**

- $H$  - Height of rock face
- $L$  - Length of vertical curve
- $R$  - Side road radius
- $W$  - Pavement width

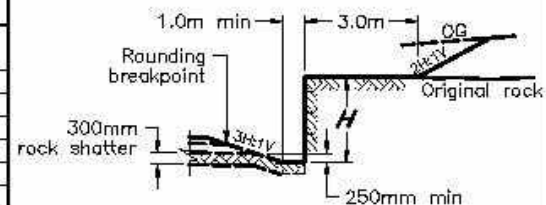


**SECTION A-A**



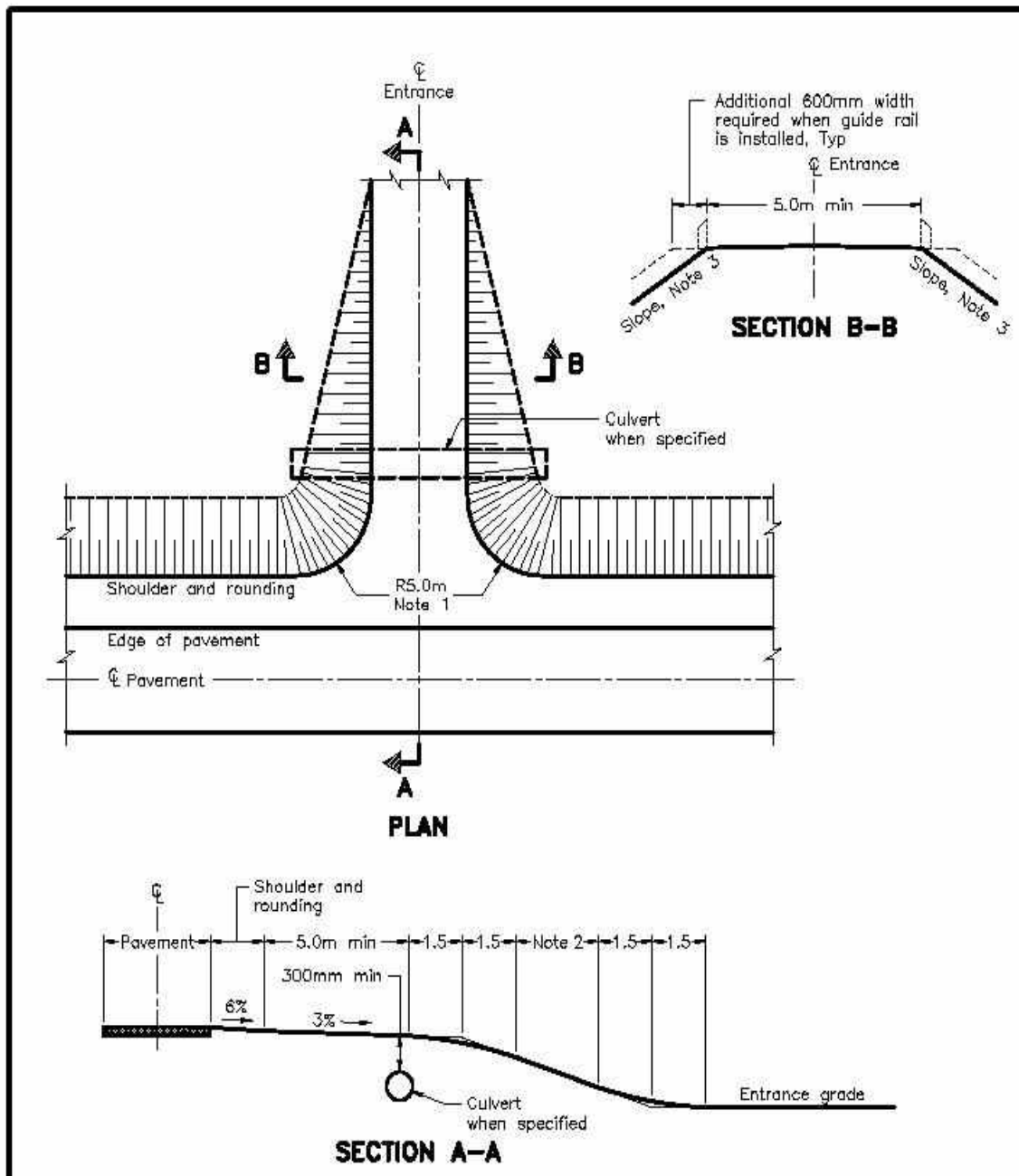
**SECTION B-B**


GRADE TABLE	
Upgrade %	L m
1	6
2	10
3	14
4	18
5	22
6	26
7	30
8	34
9	38
Max 10	42

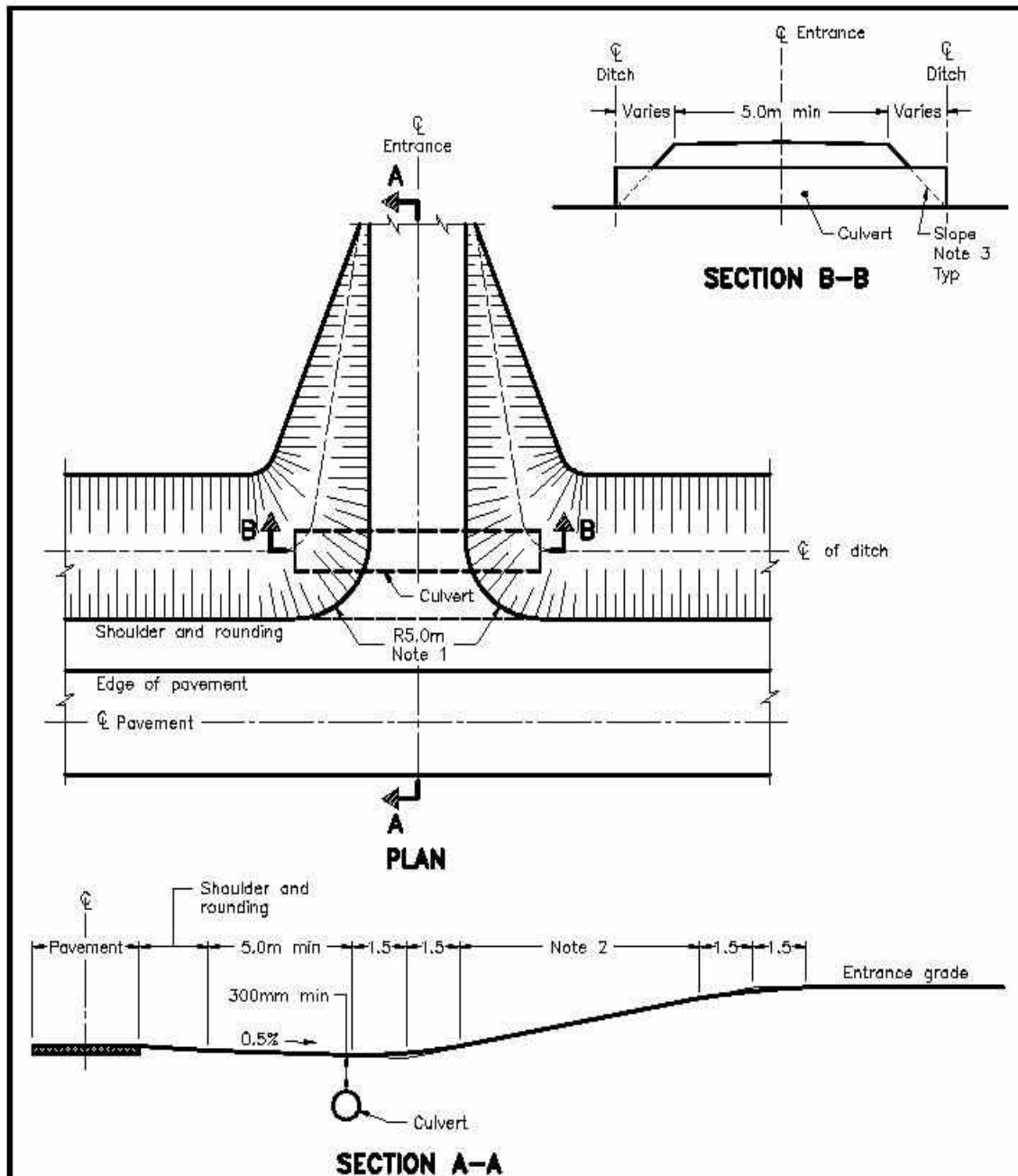


**ALTERNATIVE ROCK CUT DETAIL when specified**

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2008	Rev 1	
<b>SIDE ROAD INTERSECTION</b>			
<b>CUT</b>			
<b>OPSD 300.020</b>			




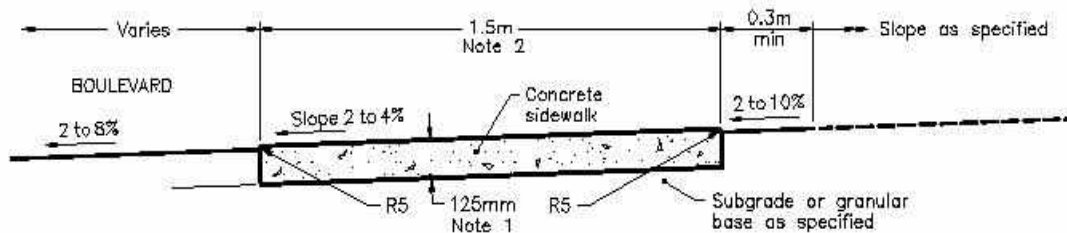
ONTARIO PROVINCIAL STANDARD DRAWING		Nov 2005	Rev 1	
<b>RURAL ENTRANCES TO ROADS ON FILL</b>		_____ _____		
		<b>OPSD – 301.010</b>		



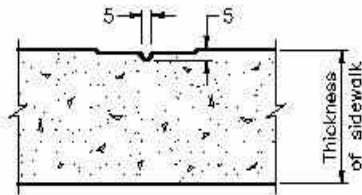
**NOTES:**

- 1 Radius shall be 8.0m when entrance is used for farm equipment.
  - 2 Maximum gradient: 6% for residential entrances and 10% for farm and field entrances.
  - 3 Slope shall be 3H:1V or flatter when specified.
- A All dimensions are in metres unless otherwise shown.

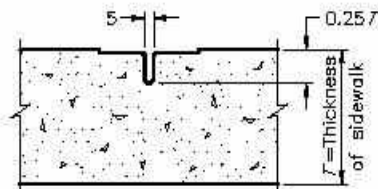
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2005	Rev 1	
<b>RURAL ENTRANCES TO ROADS IN EARTH CUT WITH CULVERT INSTALLATION</b>			
<b>OPSD - 301.020</b>			



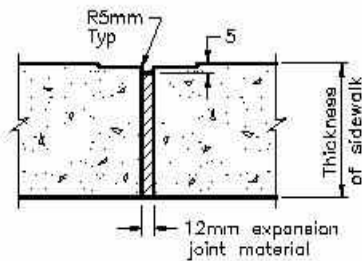
**TYPICAL SECTION**



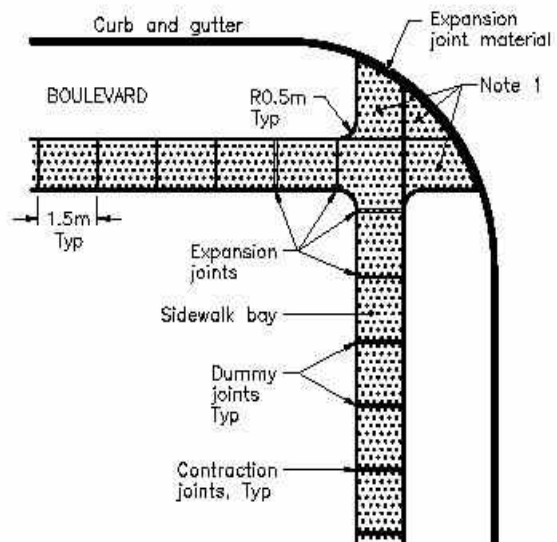
**DUMMY JOINT**



**CONTRACTION JOINT**



**EXPANSION JOINT**



**JOINT LAYOUT**

**NOTES:**

- 1 Sidewalk thickness at residential driveways and adjacent to curb shall be 150mm. At commercial and industrial driveways, the thickness shall be 200mm.
- 2 Sidewalk width shall be increased to 2.4m at schools, bus stops, and other high pedestrian areas.

- A This OPSD to be read in conjunction with OPSD-310.030.
- B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

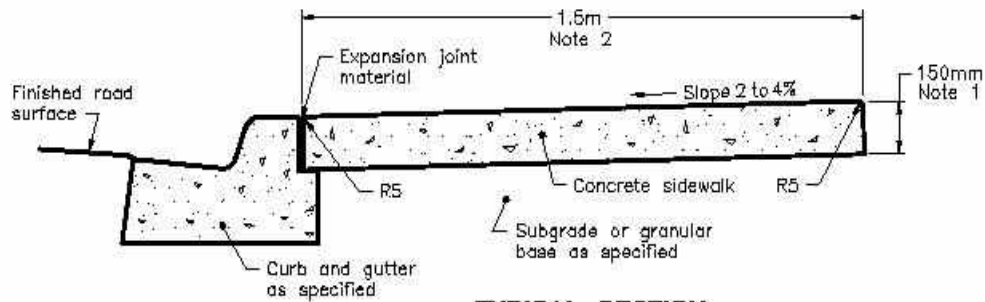
Nov 2005

Rev 1

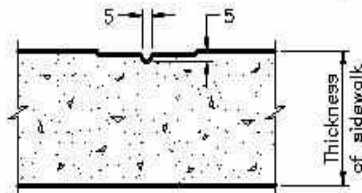
**CONCRETE SIDEWALK**

**OPSD - 310.010**

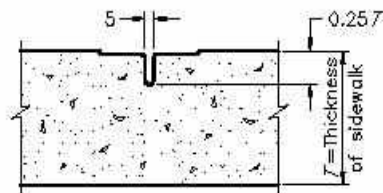




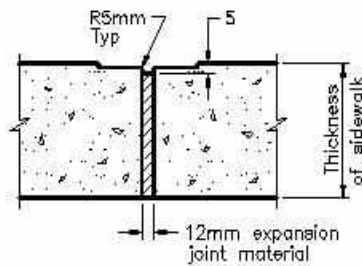
**TYPICAL SECTION**



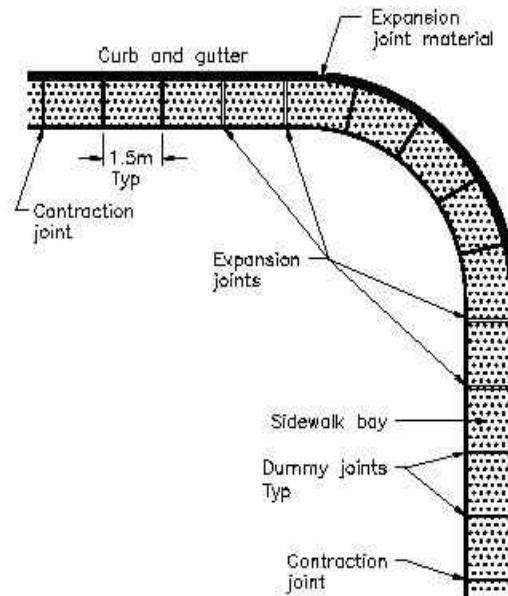
**DUMMY JOINT**



**CONTRACTION JOINT**



**EXPANSION JOINT**



**JOINT LAYOUT**

**NOTES:**

- 1 At commercial and industrial driveways, the thickness shall be 200mm.
- 2 Sidewalk width shall be increased to:
  - 1.8m on major roadways
  - 2.4m at schools, bus stops, and other high pedestrian areas.

A This OPSD to be read in conjunction with OPSD-310.030.

B All dimensions are in millimetres unless otherwise shown.

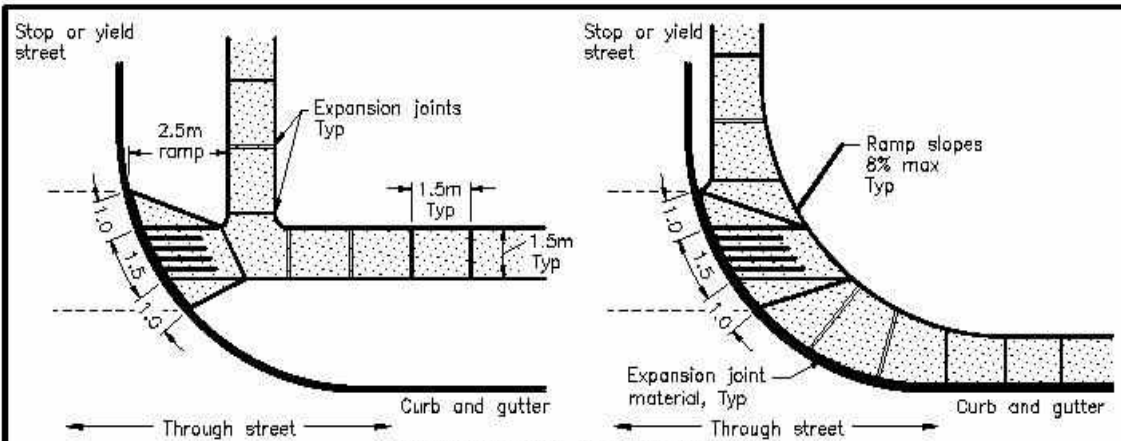
ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2005 Rev 1

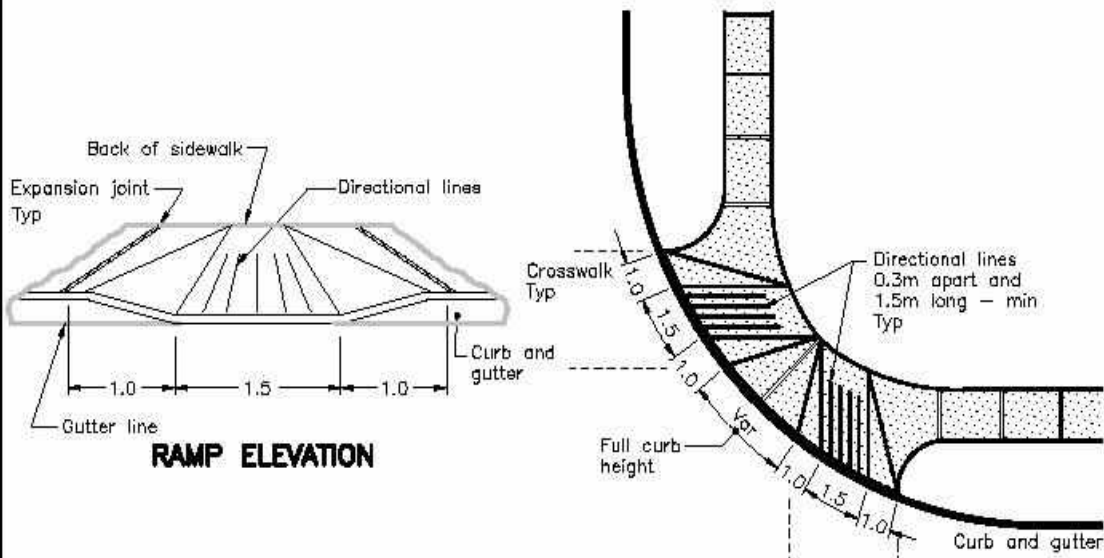
**CONCRETE SIDEWALK  
ADJACENT TO CURB AND GUTTER**

OPSD - 310.020

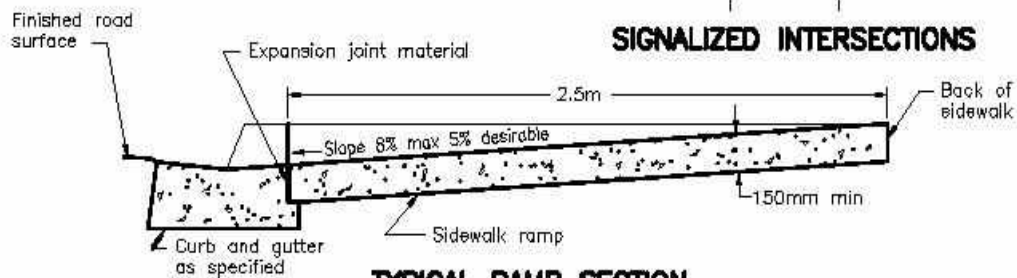




**UNSIGNALIZED INTERSECTIONS**



**SIGNALIZED INTERSECTIONS**

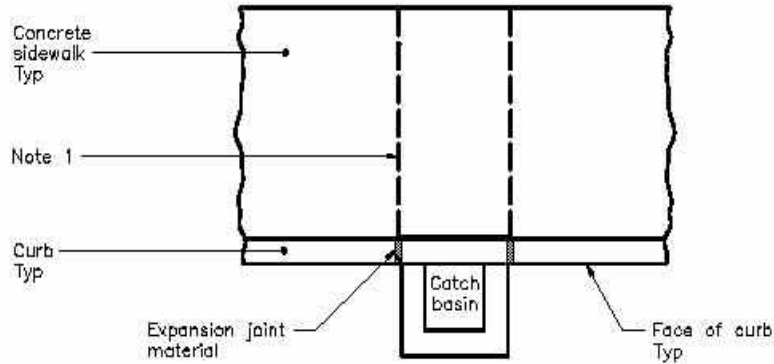


**TYPICAL RAMP SECTION**

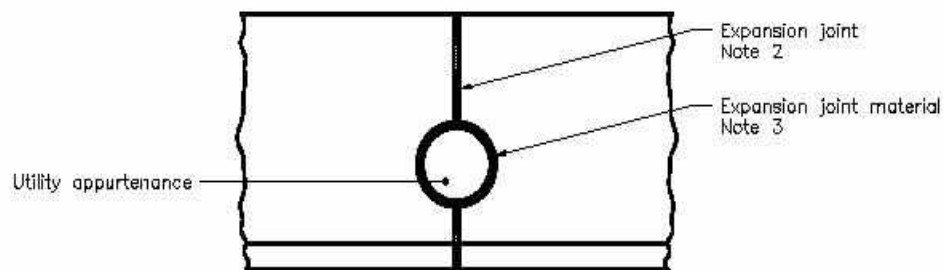
**NOTES:**

- A Directional lines shall be 10x10mm made with grooving tool having a 15mm radius.
- B All dimensions are in millimetres or metres unless otherwise shown.

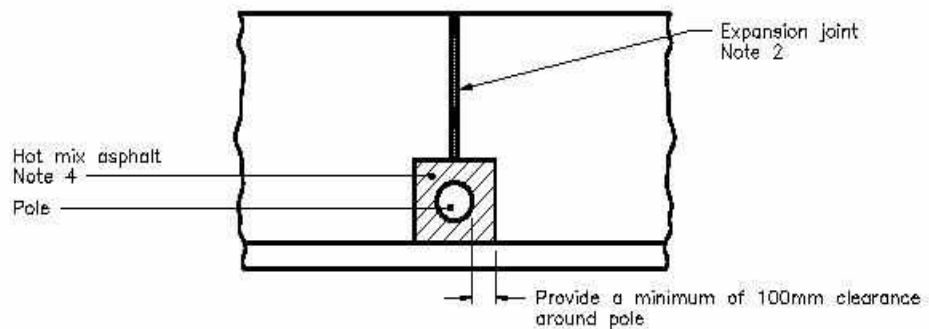
ONTARIO PROVINCIAL STANDARD DRAWING	1993 10 01 Rev	
<b>CONCRETE SIDEWALK RAMPS AT INTERSECTIONS</b>	Date	
<b>OPSD - 310.030</b>		



**CATCH BASIN**



**UTILITY APPURTENANCE**



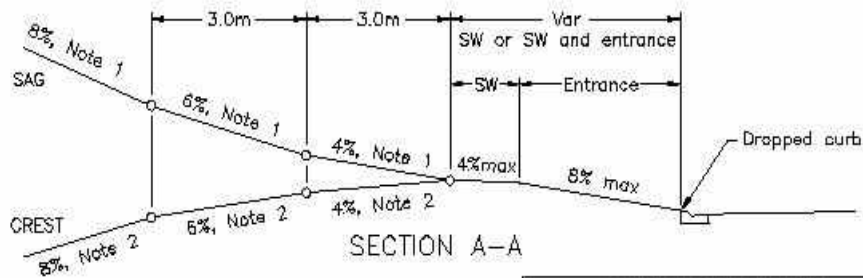
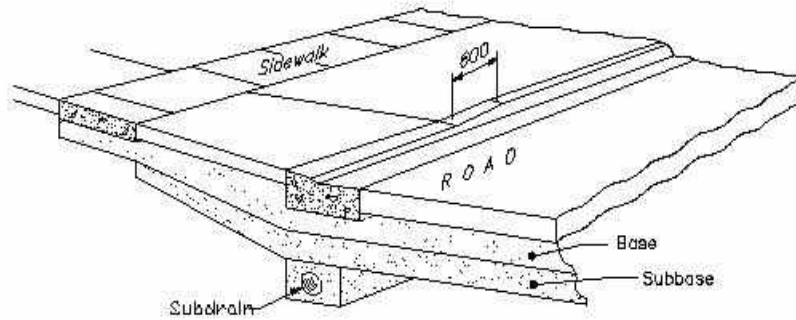
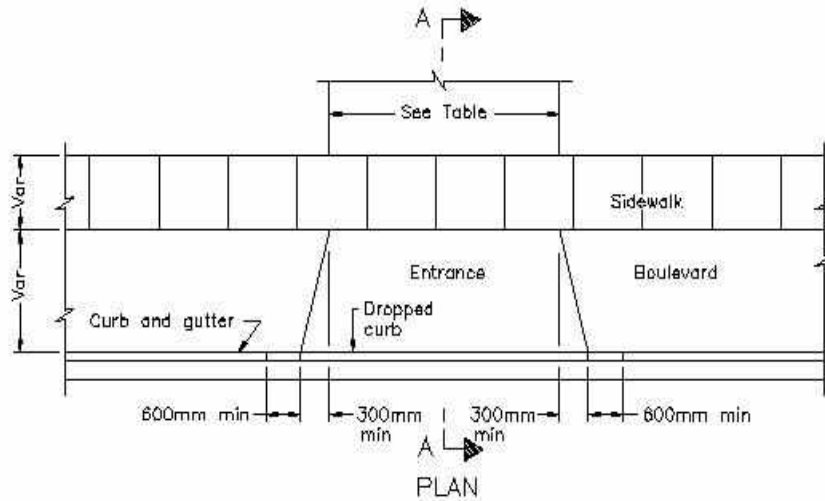
**UTILITY POLE**

**NOTES:**

- 1 Expansion joint through sidewalk is required when curb and gutter is poured integral with sidewalk.
- 2 Adjust joints to coincide with centre of utility, with minimum slab length of 1m.
- 3 Expansion joint material shall be placed around Utility appurtenance flush with concrete surface.
- 4 For concrete alternative use expansion joint material around boxout.
- A For expansion joint detail, see OPSD-310.010.
- B All dimensions are in millimetres unless otherwise shown.

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>		Nov 2005	Rev 1	
<b>UTILITY ISOLATION IN CONCRETE SIDEWALKS</b>				
		<b>OPSD - 310.040</b>		





NOTES:

- 1 Maximum upgrade shall be 10%.
- 2 Maximum downgrade shall be 8%.
- A All dimensions are in millimetres unless otherwise shown.

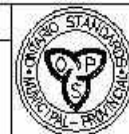
DRIVEWAY DIMENSIONS				
LAND USE	WIDTH m			
	Single		Double	
	min	max	min	max
Residential	3.0	4.3	6.0	7.3

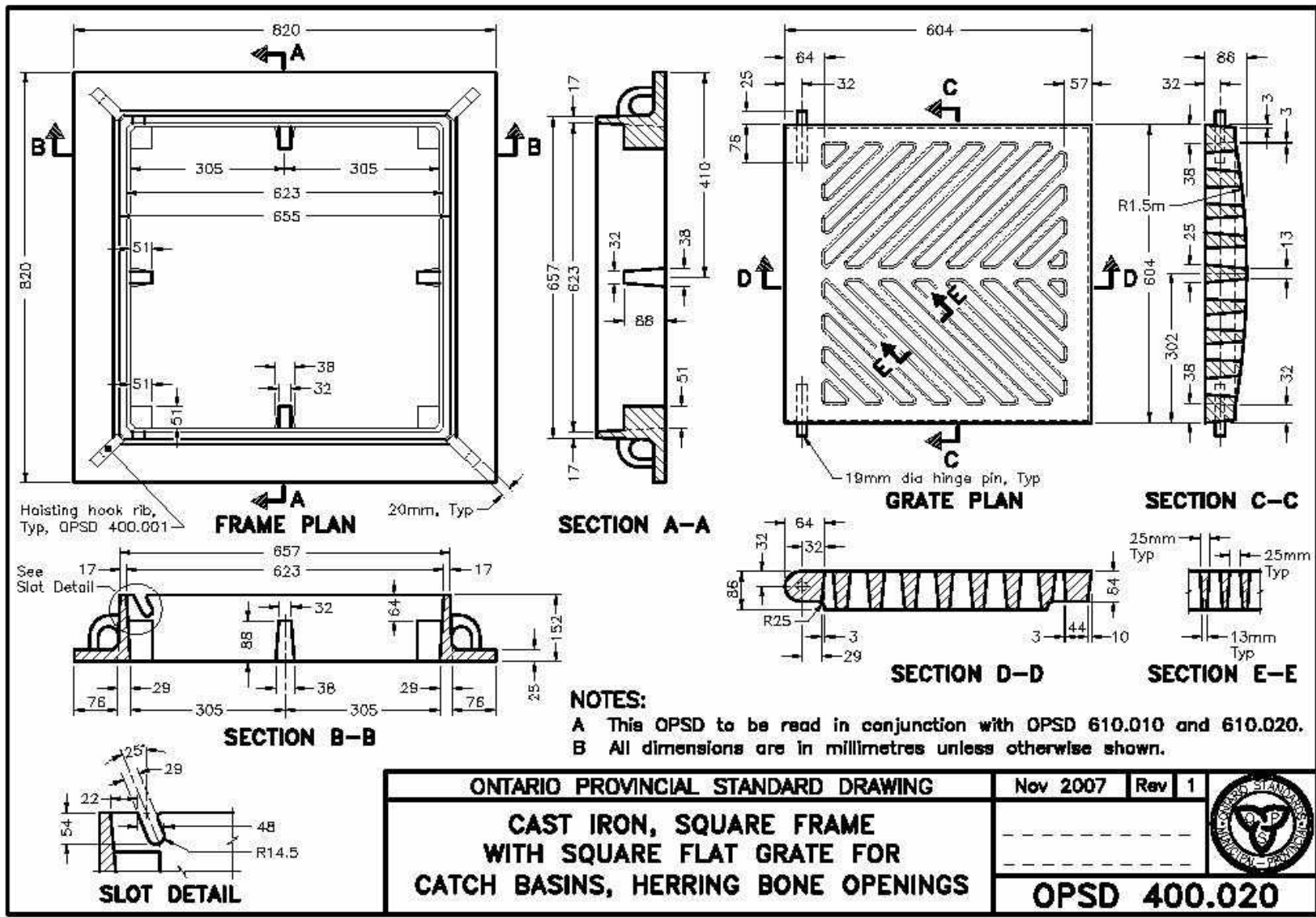
ONTARIO PROVINCIAL STANDARD DRAWING

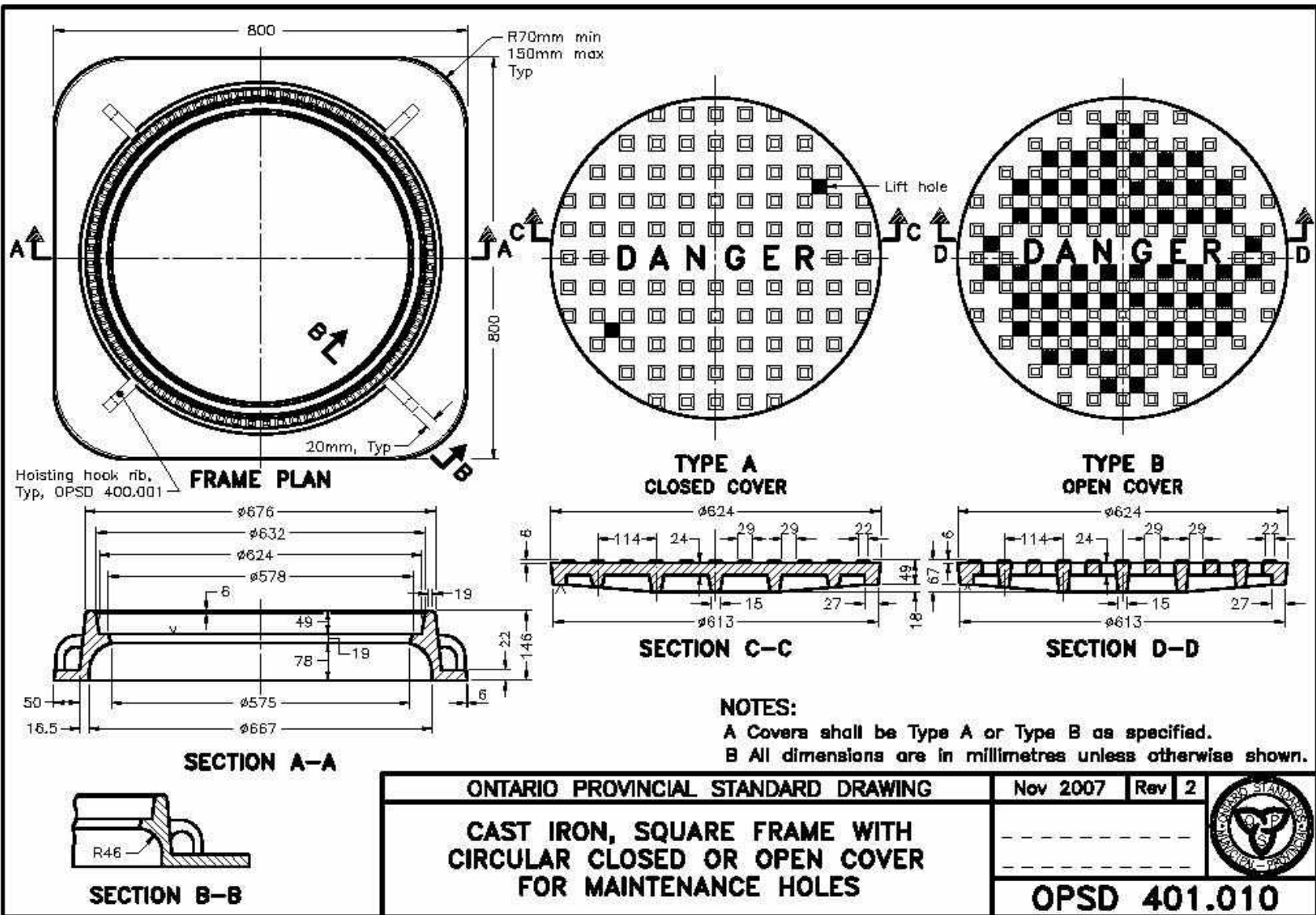
April 1999 Rev

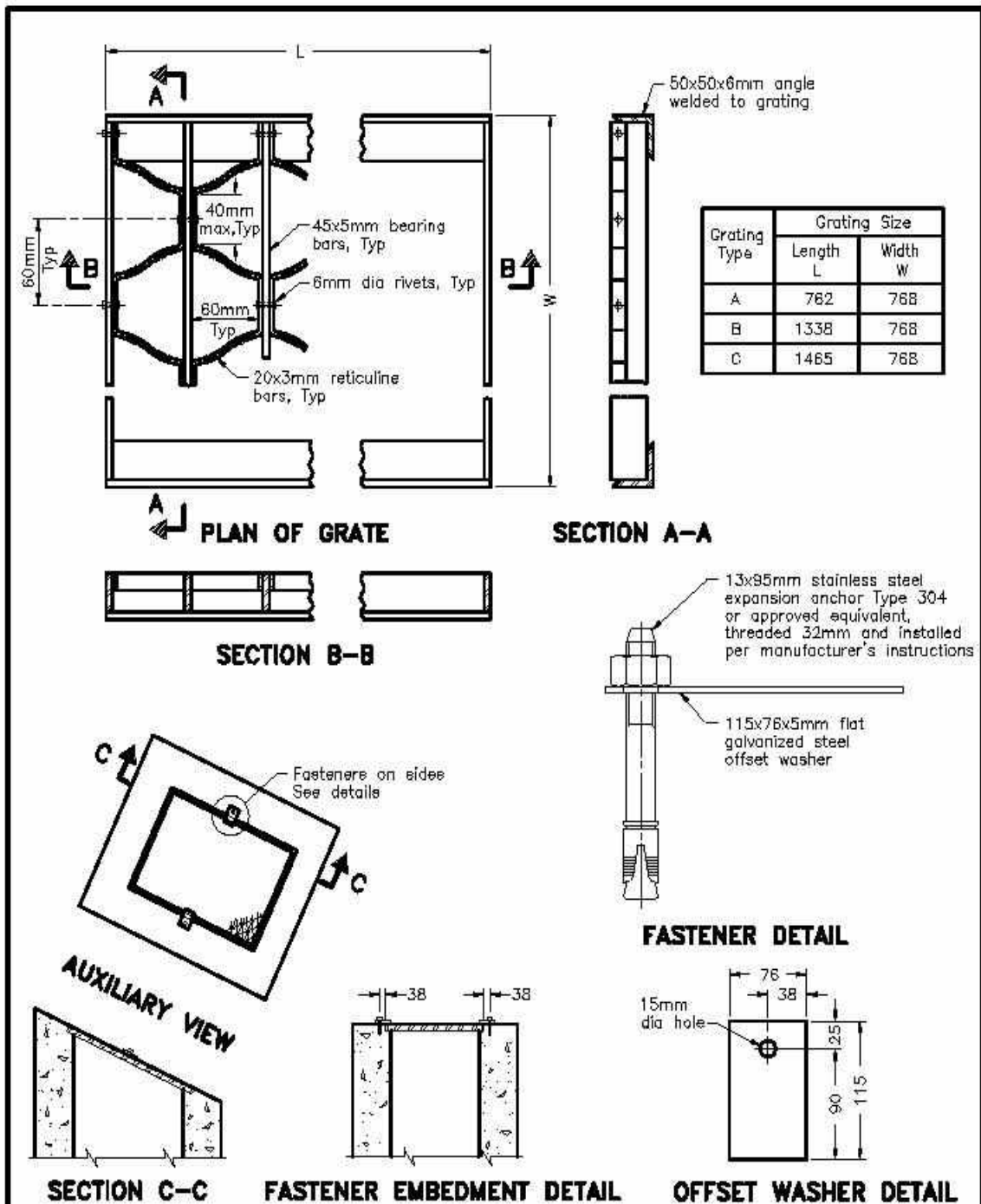
URBAN RESIDENTIAL  
ENTRANCE

OPSD - 351.010







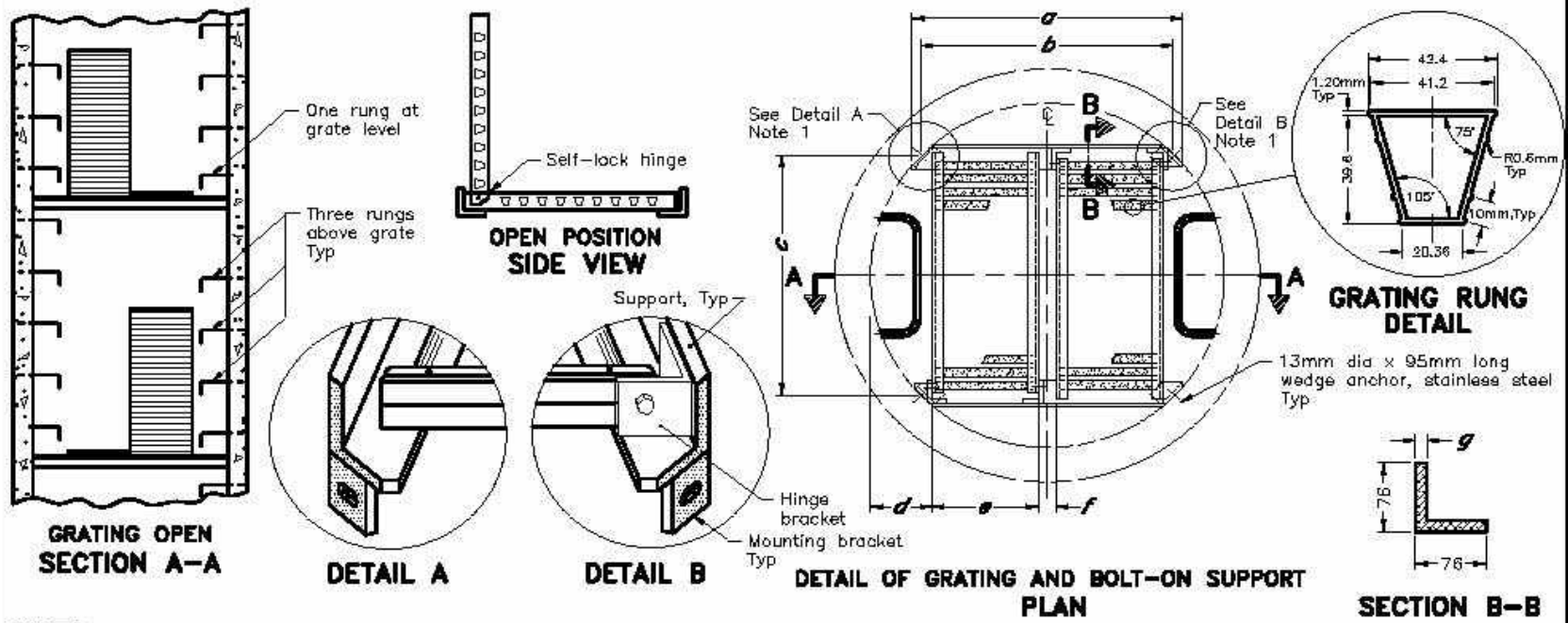


**NOTES:**

A Fastener to be inserted to maintain minimum concrete cover requirements.

B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2007	Rev 1	
<b>GALVANIZED STEEL HONEYCOMB GRATING FOR DITCH INLETS</b>			
		<b>OPSD 403.010</b>	

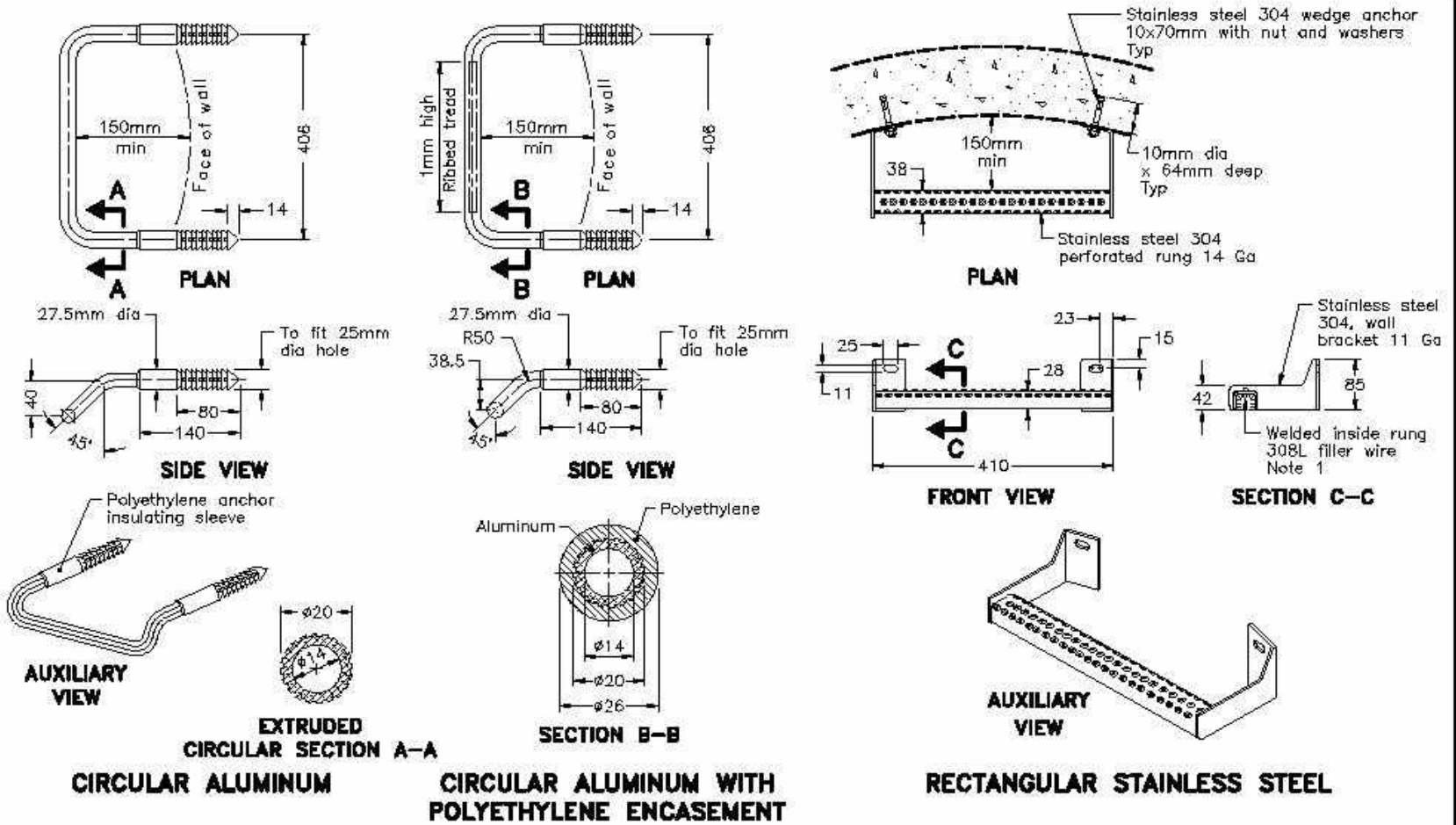


**NOTES:**

- 1 All hinge brackets and mounting brackets shall be welded all around to support angle.
- A All aluminum in contact with concrete shall be thoroughly coated with asphalt paint.
- B Maintenance hole depth between 5.0m and 10.0m, grate shall be placed at midpoint. Maintenance hole depth between 10.0m and 15.0m, grates shall be placed at third-points.
- C All fasteners shall be 304 stainless steel.
- D All welding shall be according to CSA W47.2 and W59.2.
- E All dimensions are in millimetres unless otherwise shown.

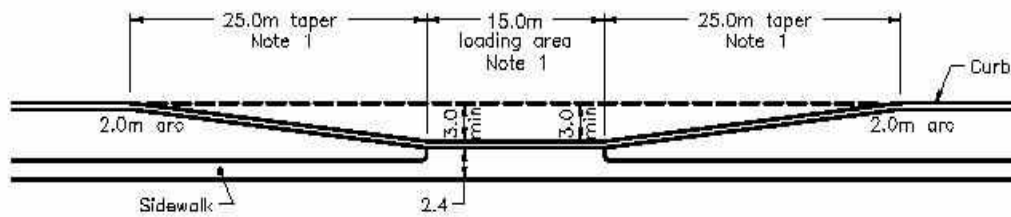
MH Diameter	No of Grates	a	b	c	d	e	f	g
1200	2	900	850	850	225	352	65	10
1500	2	1128	1078	1078	311	419	65	12
1800	3	1344	1293	1293	308	360	65	12
2400	4	1774	1724	1724	401	360	65	12

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2008	Rev 2	
<b>ALUMINUM SAFETY PLATFORM FOR CIRCULAR MAINTENANCE HOLES</b>			
<b>OPSD 404.020</b>			

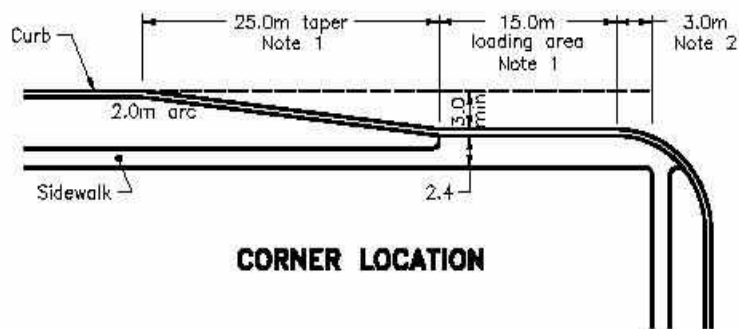


**NOTE:**  
 1 The company undertaking welded fabrication shall be certified according to CSA W47.1. All welding shall be according to CSA W59.  
 A All dimensions are in millimetres unless otherwise shown.

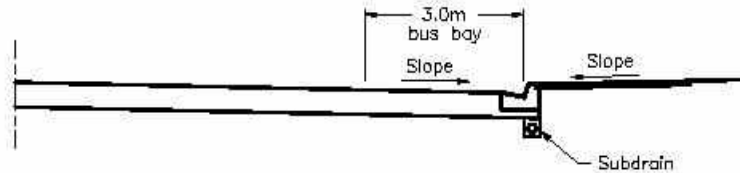
ONTARIO PROVINCIAL STANDARD DRAWING		Nov 2008	Rev 2	
<b>MAINTENANCE HOLE STEPS</b>				
HOLLOW				
<b>OPSD 405.010</b>				



**BETWEEN INTERSECTIONS**




**CORNER LOCATION**

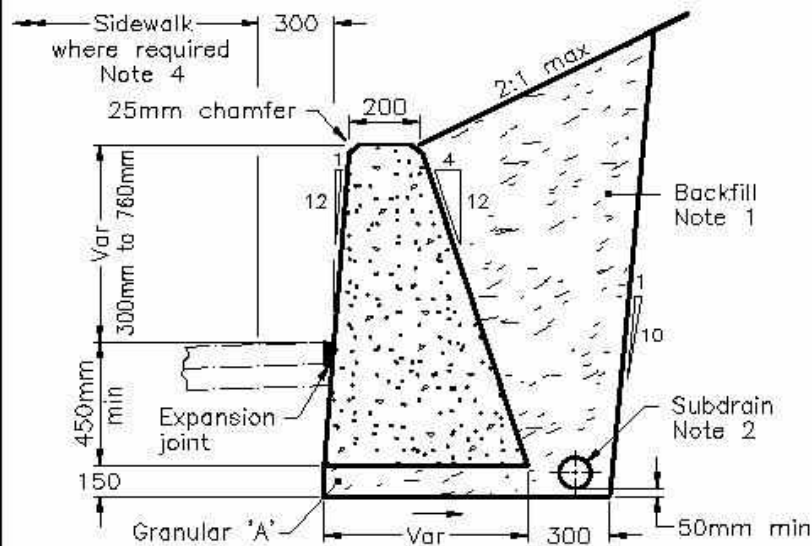


**TYPICAL CROSS SECTION**

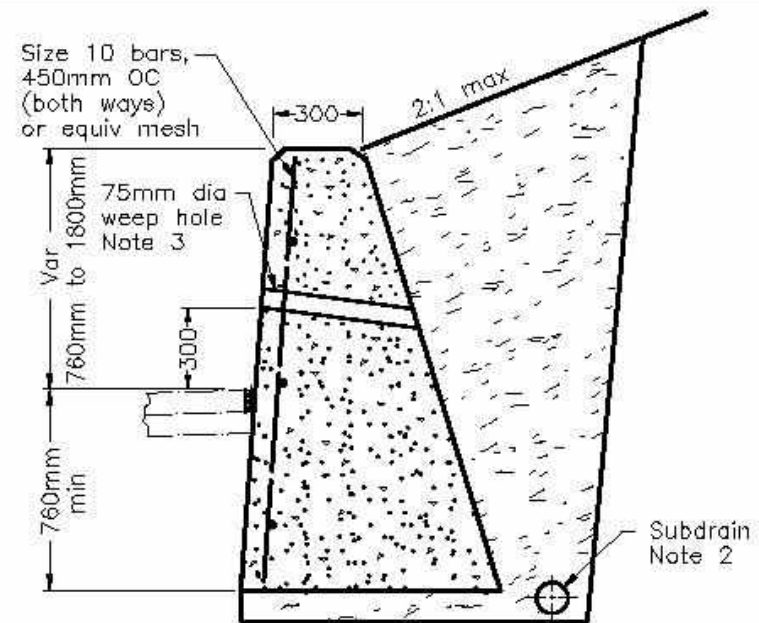
**NOTES:**

- 1 Where the use of articulated buses is anticipated, the bus bay dimensions shall be increased to provide a 25.0m loading area and 35.0m tapers.
  - 2 When the bus bay surface is concrete on an asphalt road, it shall be extended by 3.0m.
- A All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2004	Rev 0	
<b>BUS BAYS</b>			
<b>OPSD - 501.010</b>			



**TYPE 'A'**



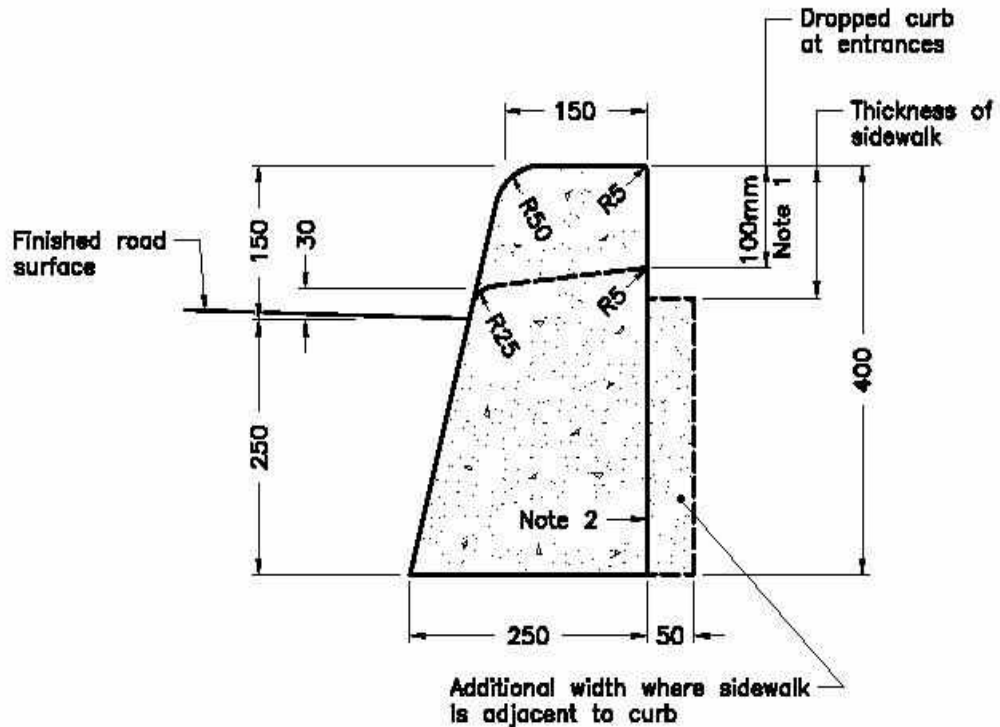
**TYPE 'B'**  
AS TYPE 'A' UNLESS OTHERWISE SHOWN

**NOTES:**

- 1 All excavation for toe walls to be backfilled with granular material.
  - 2 Perforated pipe subdrain 150mm dia (perforations down) to be used only as shown on plans or as specified.
  - 3 Weep holes shall be placed so that the top of the weeper on the inside and the bottom of the weeper on the outside are level.
  - 4 Sidewalk and expansion joint as OPSD-303.03.
- A Maximum length of toe wall sections to be 6.0m. 13mm 'Flexcell' (or equivalent) expansion joint material to be placed between adjacent sections.
- B Class of concrete: 20MPa.
- C All reinforcing bars to have 75mm cover.
- D All dimensions are in millimetres or metres unless otherwise shown.


ONTARIO PROVINCIAL STANDARD DRAWING		Date	1984 10 01	Rev
<b>CONCRETE TOE WALLS</b>		Date _____		
		<b>OPSD - 513.03</b>		

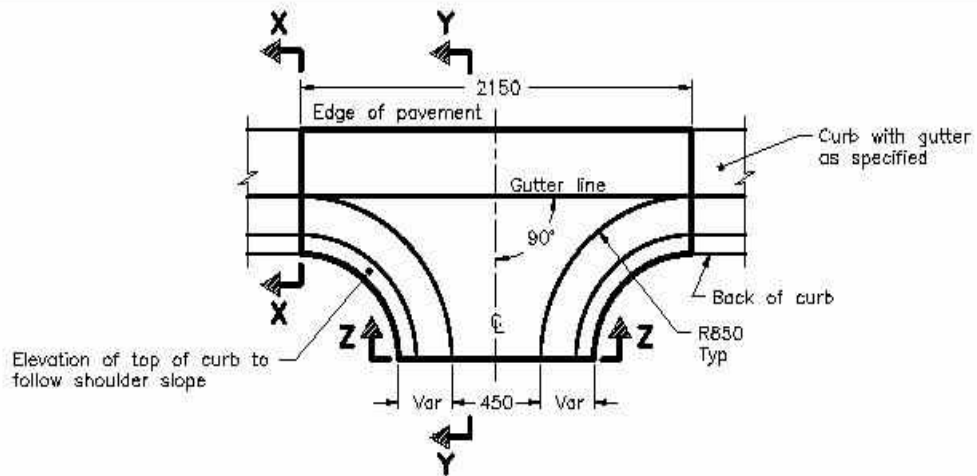




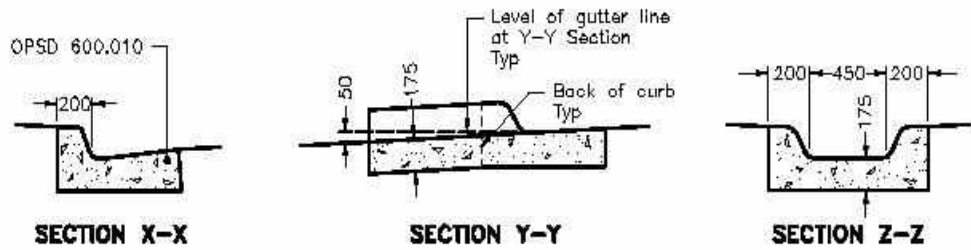
**NOTES:**

- 1 Where sidewalk is continuously adjacent, reduce the dropped curb at entrances to 75mm.
  - 2 For slipforming procedure, a 5% batter is acceptable.
- A Treatment at entrances shall be according to OPSD 351.010.  
 B Outlet treatment shall be according to the OPSD 610 Series.  
 C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.  
 D All dimensions are in millimetres unless otherwise shown.

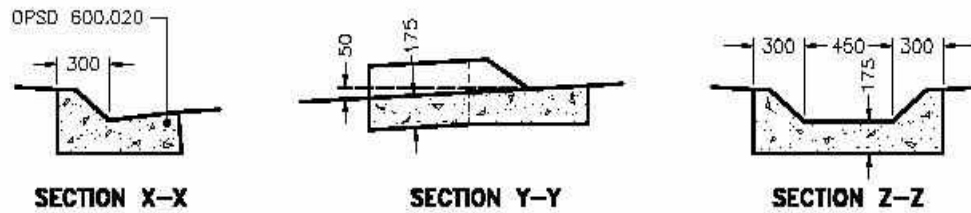
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1	
<b>CONCRETE BARRIER CURB</b>			
<b>OPSD 600.110</b>			



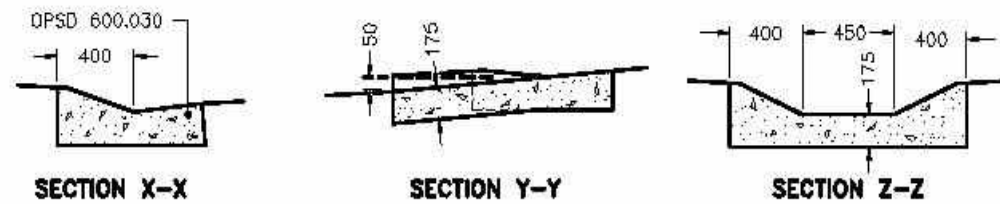
**TYPICAL PLAN VIEW**



**BARRIER CURB with GUTTER**



**SEMI-MOUNTABLE CURB with GUTTER**

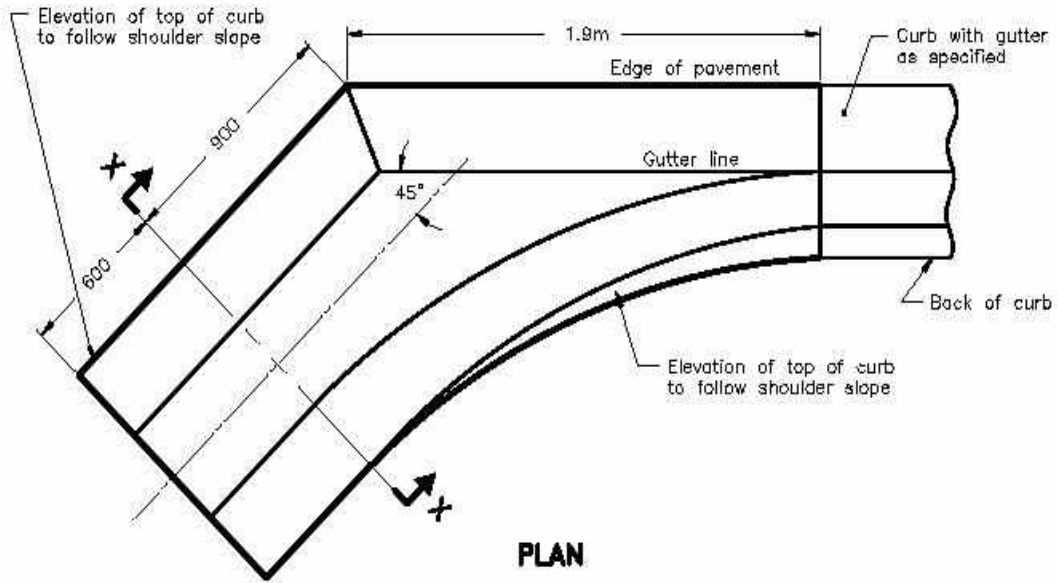


**MOUNTABLE CURB with GUTTER**

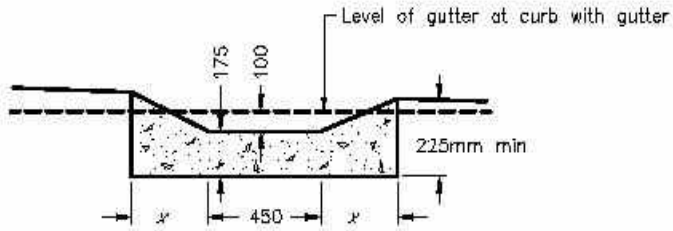
**NOTES:**

- A For spillway details refer to OPSD 605.040.
- B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1	
<b>90° CONCRETE OUTLET</b>			
FOR CONCRETE CURB WITH GUTTER			
<b>OPSD 604.010</b>			



**PLAN**



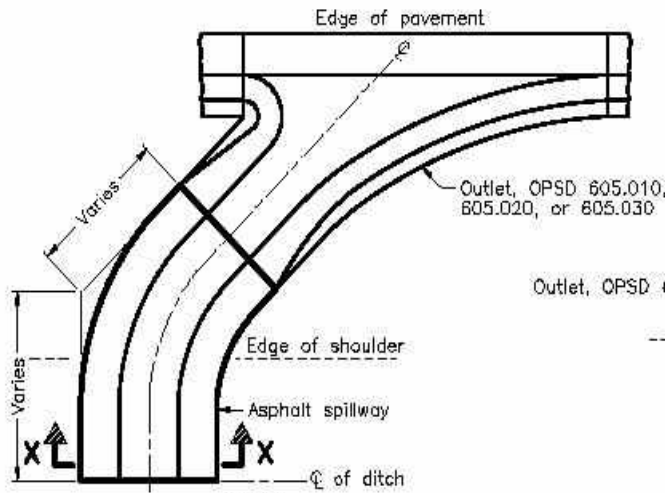
**SECTION X-X**

CURB with GUTTER Type	<i>x</i>
Barrier	200
Semi-Mountable	300
Mountable	400

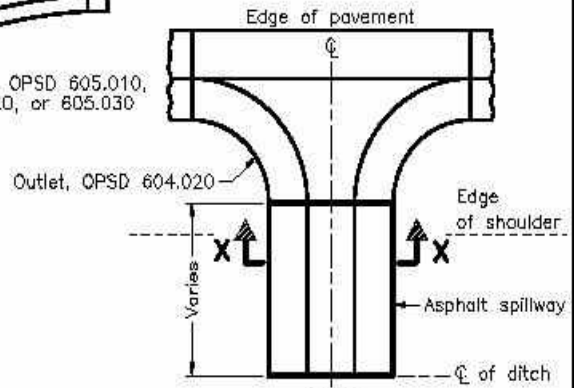
**NOTES:**

A All dimensions are in millimetres unless otherwise shown.

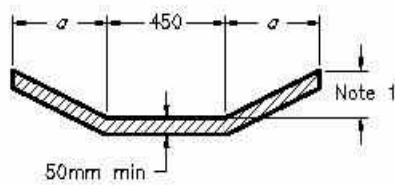
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1	
<b>45° CONCRETE OUTLET FOR CONCRETE CURB WITH GUTTER AT END OF RUN</b>		<b>OPSD 605.030</b>	



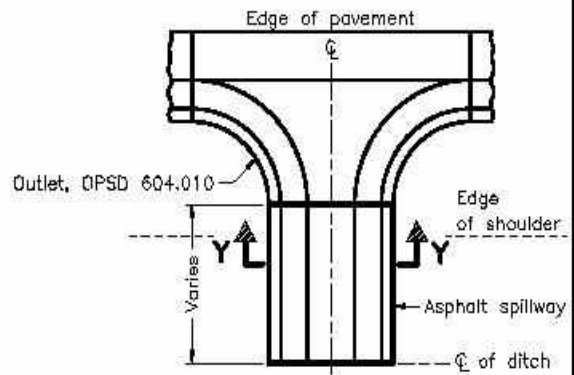
**PLAN  
WITH 30° or 45° ASPHALT  
OR CONCRETE OUTLET**



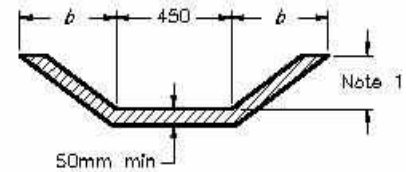
**PLAN  
WITH 90° ASPHALT OUTLET**



**SECTION X-X**



**PLAN  
WITH 90° CONCRETE OUTLET**



**SECTION Y-Y**

Outlet OPSD	Curb or Gutter Type	a	b
604.020 605.020	B	400	—
605.010 605.030	Barrier	200	—
	Semi-mountable	300	—
604.010	Mountable	400	—
	Barrier	—	200
	Semi-mountable	—	300
	Mountable	—	400

**NOTES:**

- 1 Depression of spillway to coincide with outlet end of gutter outlet.
- 2 All dimensions are in millimetres unless otherwise shown.

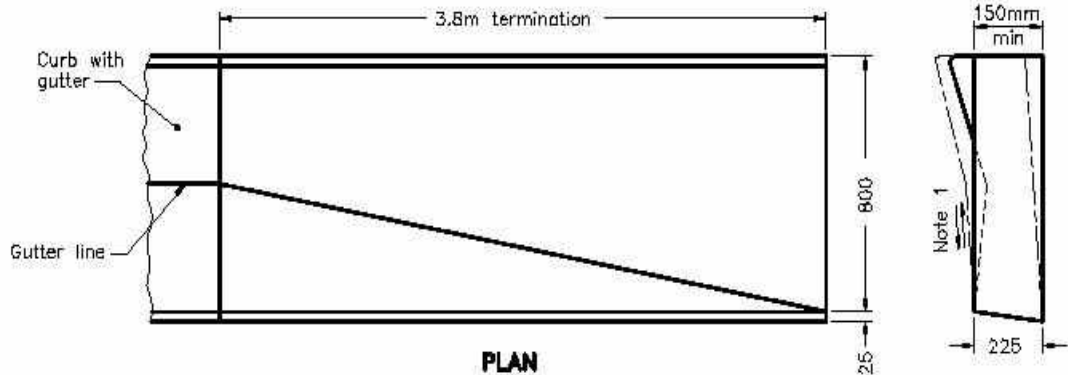
ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2007 Rev 1



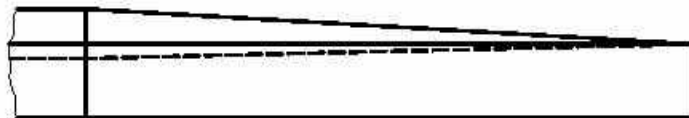
**ASPHALT SPILLWAYS**

**OPSD 605.040**

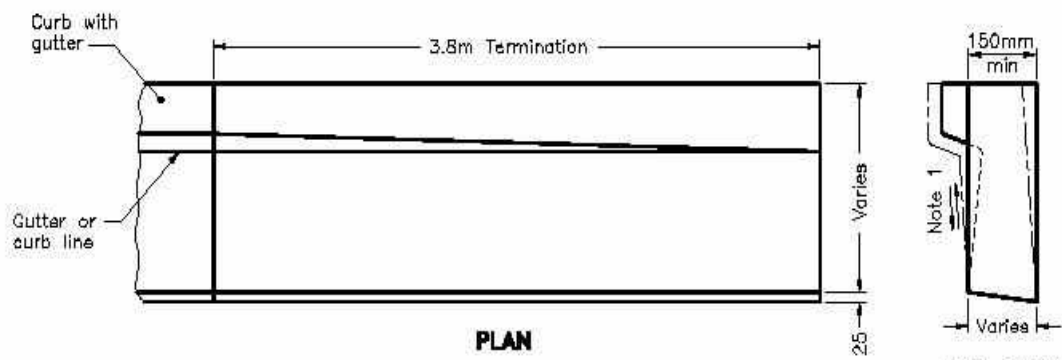


PLAN

END VIEW



ELEVATION  
MOUNTABLE CURB WITH GUTTER



PLAN

END VIEW

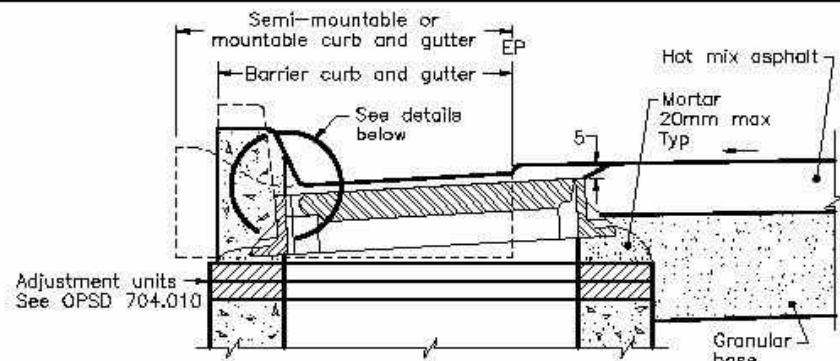


ELEVATION  
BARRIER AND SEMI-MOUNTABLE CURB WITH GUTTER

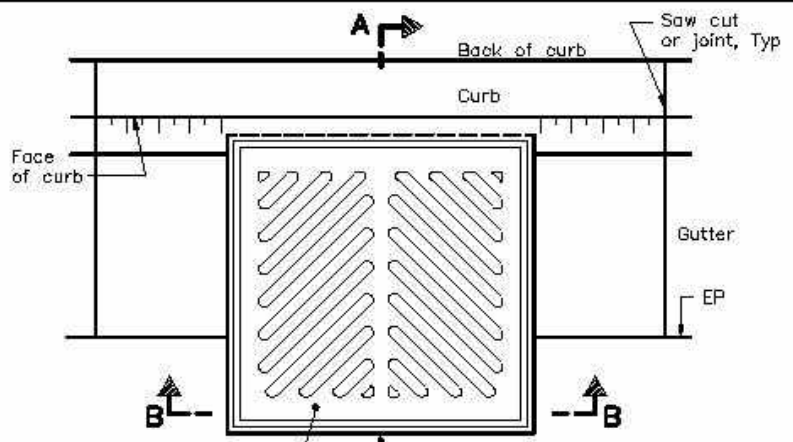
**NOTES:**

- 1 Slope to match existing shoulder.
- A This drawing is to be read in conjunction with OPSD 600 series curb with gutter drawings.
- B All dimensions are in millimetres unless otherwise shown.

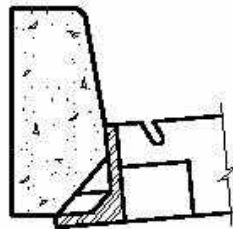
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1	
<b>METHOD OF TERMINATION</b>			
FOR CONCRETE CURB WITH GUTTER			
<b>OPSD 608.010</b>			



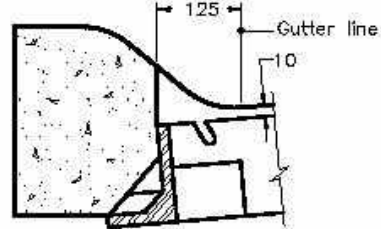
**SECTION A-A**



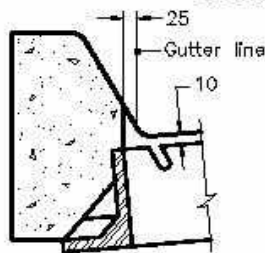
**PLAN**



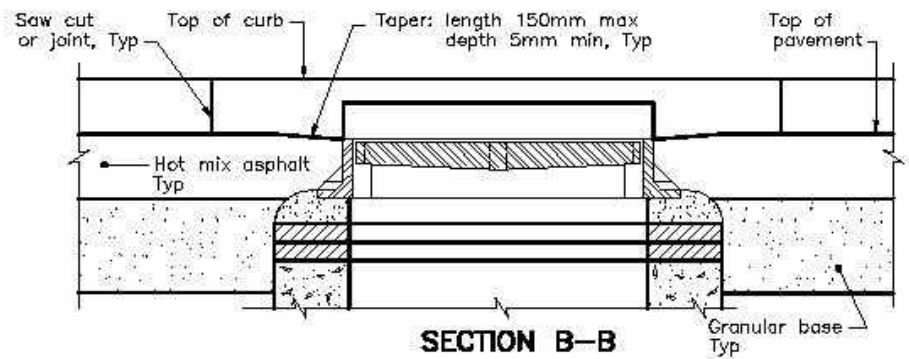
**BARRIER CURB**



**SEMI-MOUNTABLE or MOUNTABLE CURB AND GUTTER**



**BARRIER CURB AND GUTTER**



**SECTION B-B**

**NOTE:**  
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2000	Rev 0	
<b>CATCH BASIN FRAME WITH GRATE INSTALLATION AT CURB AND GUTTER</b>	-----		
<b>OPSD - 610.010</b>			

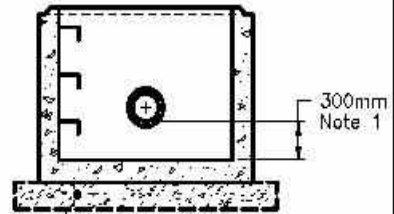
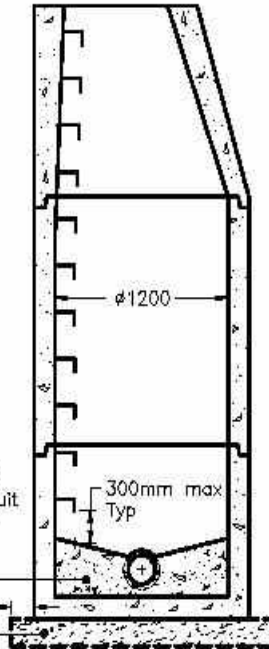
Tapered top  
See alternative C

Riser sections  
as required

Monolithic base with inlet  
and outlet openings to suit  
See alternatives A and B

Bench or sump  
as specified

300mm, Typ  
Granular bedding



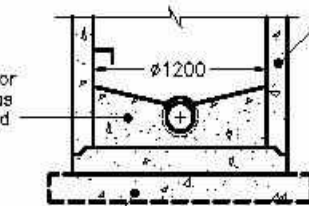
Granular  
bedding

**SUMP DETAIL**

**ALTERNATIVES**

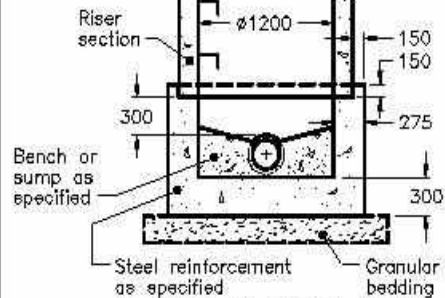
Bottom riser section with  
inlet and outlet openings to suit

Bench or  
sump as  
specified



Granular  
bedding

**A PRECAST SLAB BASE**

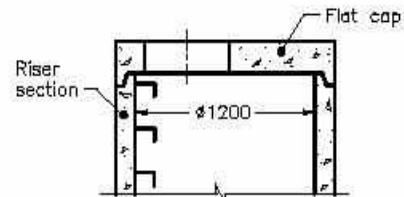


Bench or  
sump as  
specified

Steel reinforcement  
as specified

Granular  
bedding

**B CAST-IN-PLACE BASE**



Riser  
section

Flat cap

**C PRECAST FLAT CAP**

**NOTES:**

- 1 The sump is measured from the lowest invert.
- A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
- B Precast concrete components according to OPSD-701.030, 701.031, or 701.032.
- C Structure exceeding 5.0m in depth to include safety platform according to OPSD-404.020.
- D Pipe support according to OPSD-708.020.
- E For benching and pipe opening details, see OPSD-701.021.
- F For adjustment unit and frame installation see OPSD-704.010.
- G All dimensions are nominal.
- H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2004 | Rev 3

**PRECAST CONCRETE  
MAINTENANCE HOLE  
1200mm DIAMETER**



**OPSD - 701.010**

Tapered top  
See alternative D  
and E

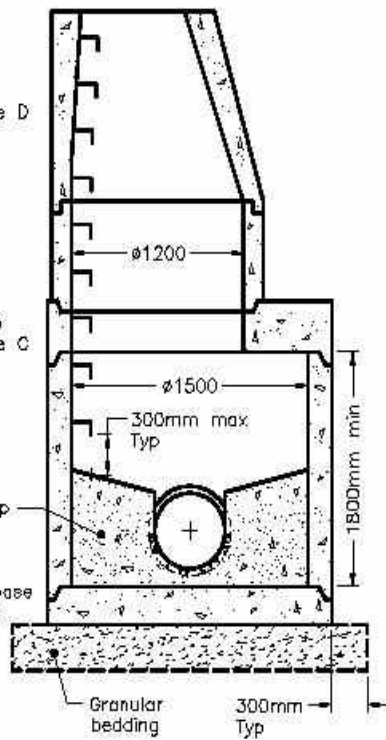
Riser sections  
as required

Transition slab  
See alternative C

Riser sections  
as required

Bench or sump  
as specified  
Note 1

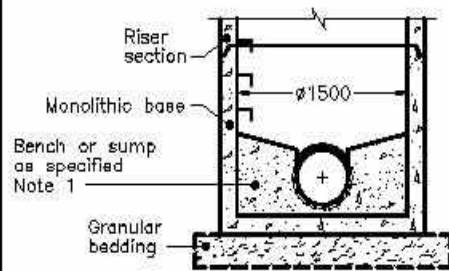
Precast slab base  
See alternative  
A and B



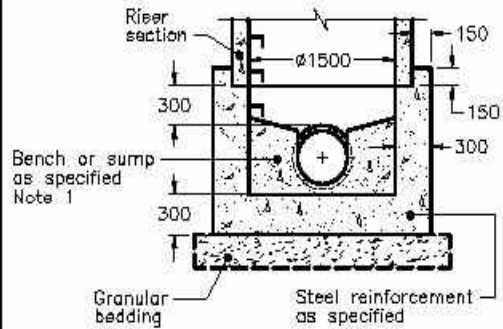
**NOTES:**

- 1 For sump detail see OPSD-701.010.
- A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
- B Precast concrete components according to OPSD-701.030, 701.031, 701.040, 701.041, 703.011, 703.021, and 706.010.
- C Structures exceeding 5.0m in depth to include safety platform according to OPSD-404.020 or 404.021.
- D Pipe support according to OPSD-708.020.
- E For benching and pipe opening details, see OPSD-701.021.
- F For adjustment unit and frame installation see OPSD-704.010.
- G All dimensions are nominal.
- H All dimensions are in millimetres unless otherwise shown.

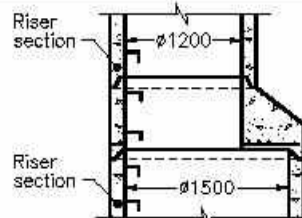
**ALTERNATIVES**



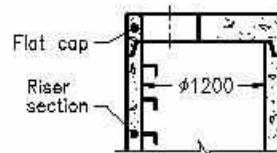
**A PRECAST MONOLITHIC BASE**



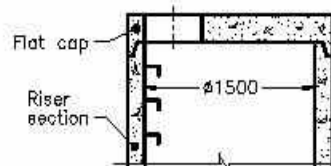
**B CAST-IN-PLACE BASE**



**C TAPERED TRANSITION SLAB**



**D 1200mm PRECAST FLAT CAP**



**E 1500mm PRECAST FLAT CAP**

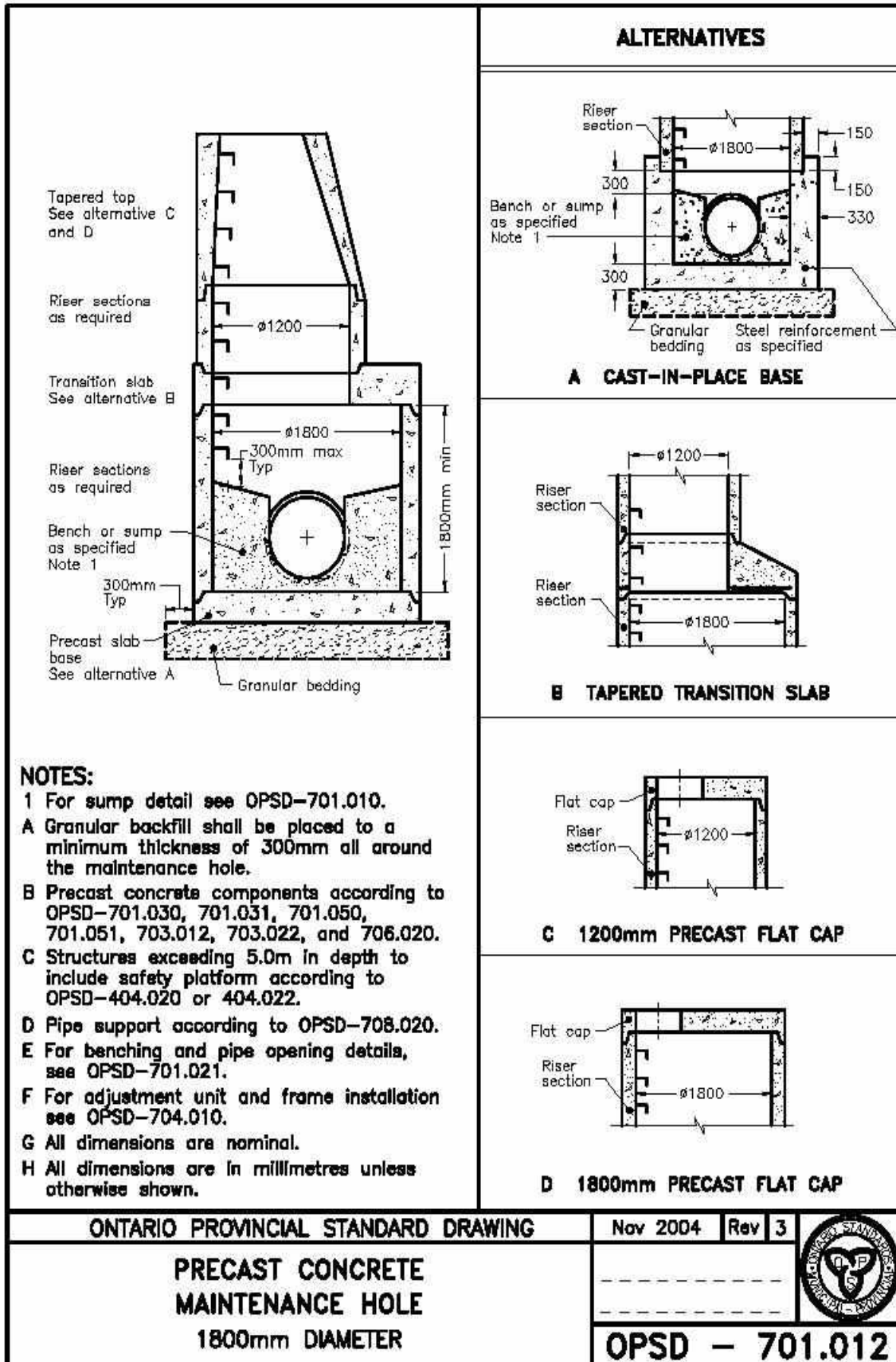
ONTARIO PROVINCIAL STANDARD DRAWING

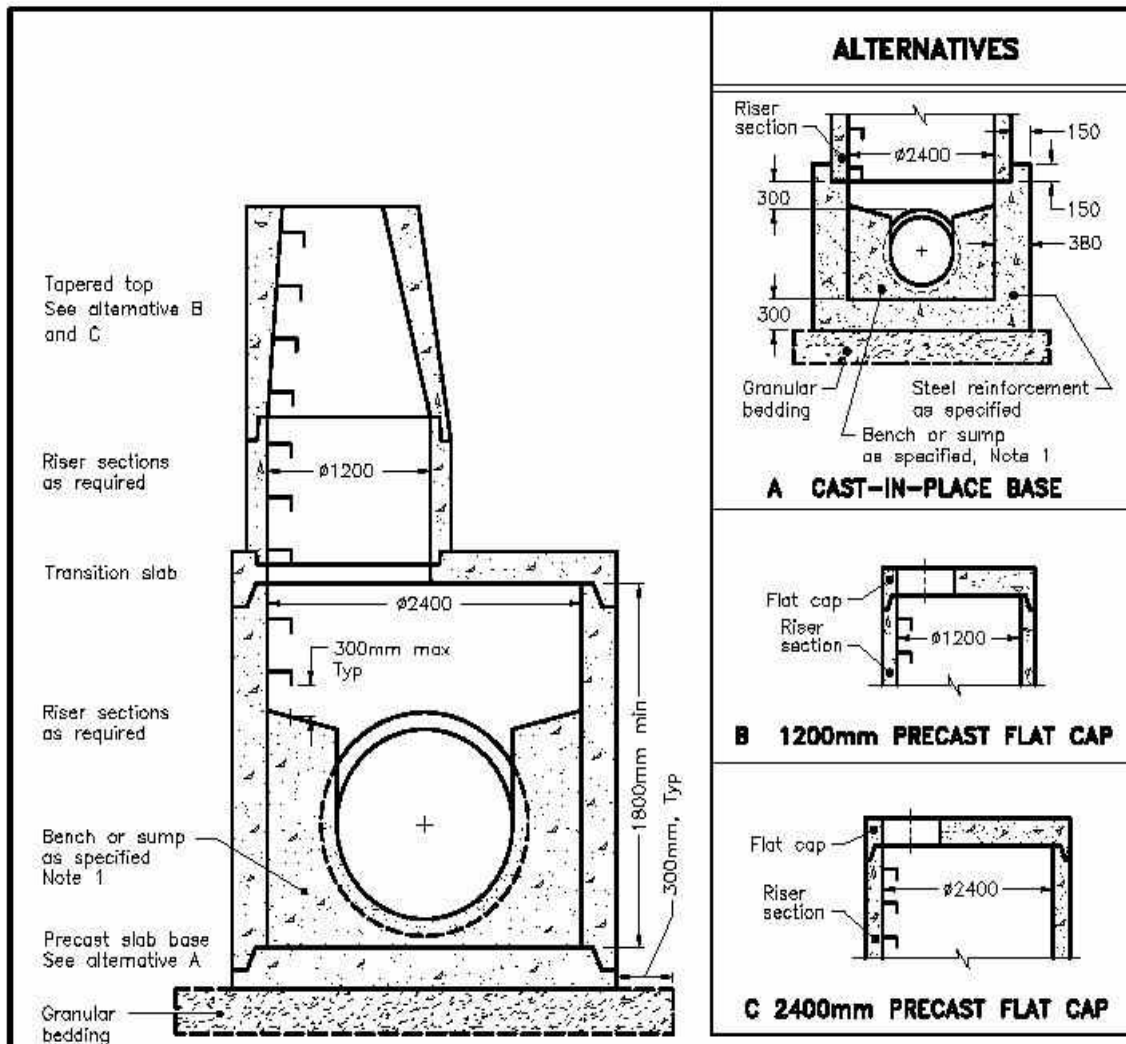
Nov 2004 Rev 3

**PRECAST CONCRETE  
MAINTENANCE HOLE  
1500mm DIAMETER**



**OPSD - 701.011**

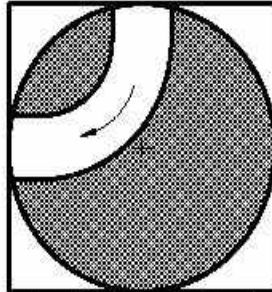




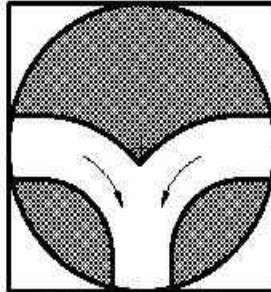
**NOTES:**

- 1 For sump detail see OPSD-701.010.
- A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
- B Precast concrete components according to OPSD-701.030, 701.031, 701.060, 701.061, 703.013, 703.023, 706.030, and 706.031.
- C Structures exceeding 5.0m in depth to include safety platform according to OPSD-404.020.
- D Pipe support according to OPSD-708.020.
- E For benching and pipe opening details, see OPSD-701.021.
- F For adjustment unit and frame installation see OPSD-704.010.
- G All dimensions are nominal.
- H All dimensions are in millimetres unless otherwise shown.

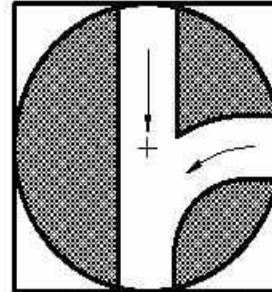
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2004	Rev 3	
<b>PRECAST CONCRETE MAINTENANCE HOLE</b> 2400mm DIAMETER			
<b>OPSD - 701.013</b>			



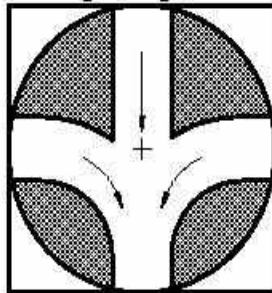
1. Right angle bend



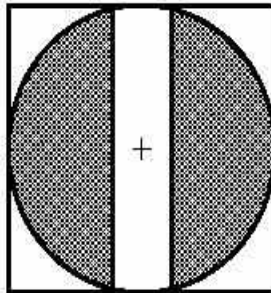
2. Tee connection



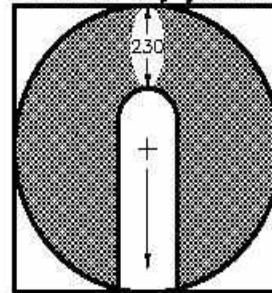
3. Three way junction



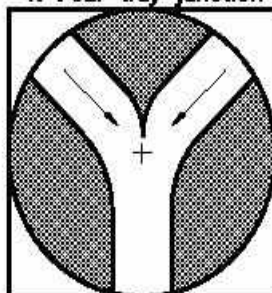
4. Four way junction



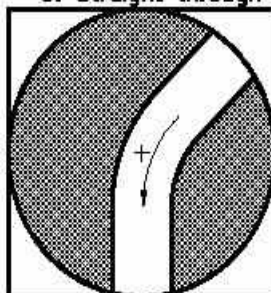
5. Straight through



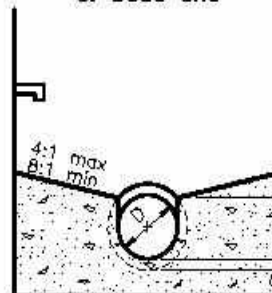
6. Dead end



7. Wye connection



8. 45° bend



Section

Maintenance Hole Diameter	MAXIMUM SIZE HOLE IN THE WALL IN PRECAST RISER SECTIONS				
	No. 1-4	No. 5 & 6	No. 8	No. 7	
				Inlet Hole	Outlet Hole
1200	700	860	780	700	860
1500	860	1220	960	860	1170
1800	1220	1485	1220	1220	1485
2400	1485	2020	1760	1485	2020
3000	1930	2450	2300	1930	2450
3600	2195	3085	2730	2195	3085

**NOTES:**

- A Concrete for benching to be 30MPa.
- B Benching to be given wood float finish, channel to be given steel trowel finish.
- C Benching slope and height to be as specified.
- D All dimensions are nominal.
- E All dimensions are in millimetres unless otherwise shown.

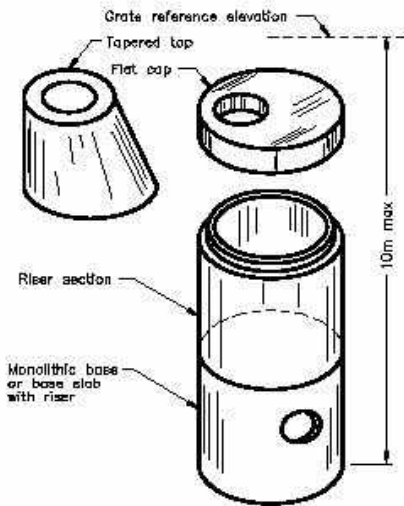
ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2004 Rev 2

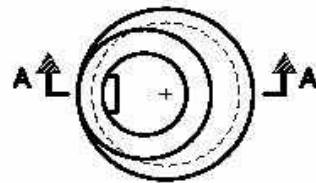
**MAINTENANCE HOLE BENCHING  
AND PIPE OPENING DETAILS**



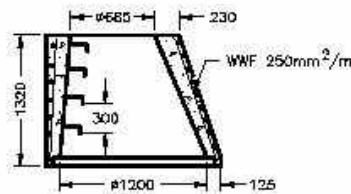
**OPSD - 701.021**



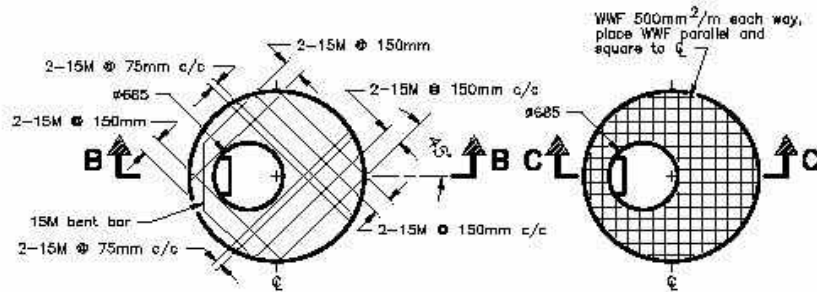
**1200mm DIAMETER  
MAINTENANCE HOLE**



**PLAN OF TAPERED TOP**

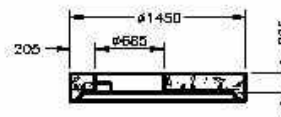


**SECTION A-A**

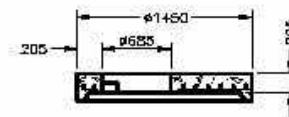


**PLAN OF FLAT CAP  
WITH REINFORCING STEEL BARS**

**PLAN OF FLAT CAP  
WITH WWF**



**SECTION B-B**

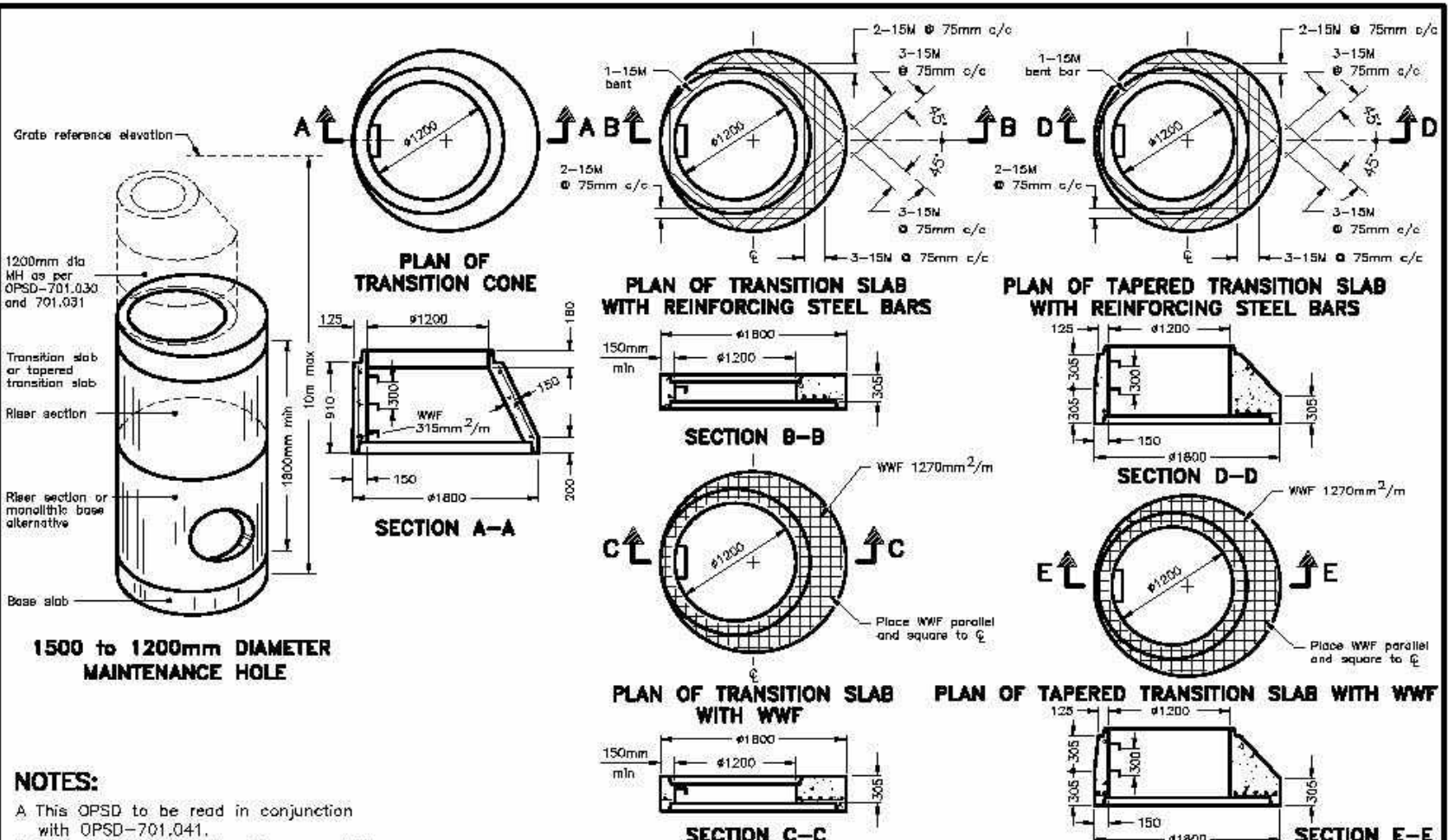


**SECTION C-C**

**NOTES:**

- A This drawing to be read in conjunction with OPSD-701.031 and OPSD-701.032.
- B Centre reinforcing steel in riser  $\pm 20$ mm. All other reinforcing steel shall have 25mm minimum cover.
- C Steps according to OPSD-405.010 or OPSD-405.020.
- D All dimensions are nominal.
- E All dimensions are in millimetres unless otherwise shown.

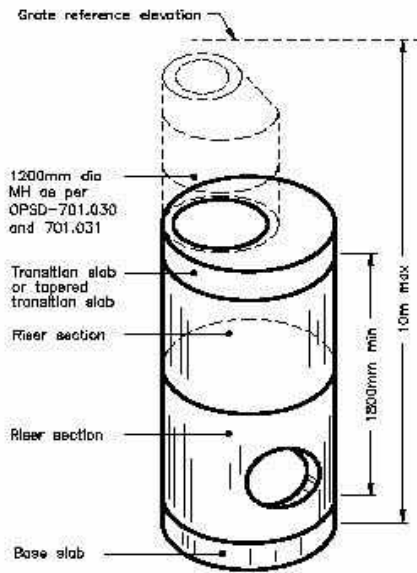
<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>		Nov 2004	Rev 2	
<b>PRECAST CONCRETE MAINTENANCE HOLE COMPONENTS</b>				
<b>1200mm DIAMETER TAPERED TOP AND FLAT CAP</b>		<b>OPSD - 701.030</b>		



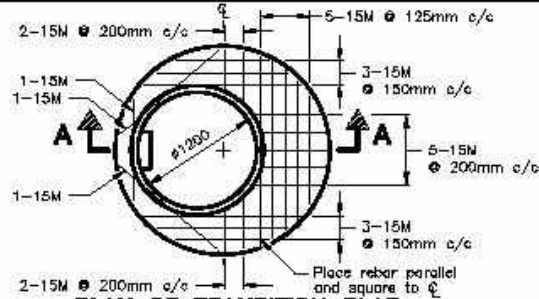
**1500 to 1200mm DIAMETER MAINTENANCE HOLE**

- NOTES:**
- A This OPSD to be read in conjunction with OPSD-701.041.
  - B Centre reinforcing in transition cone  $\pm 25$ mm. All other reinforcing steel shall have 25mm minimum cover.
  - C Steps according to OPSD-405.010 or OPSD-405.020.
  - D All dimensions are nominal.
  - E All dimensions are in millimetres unless otherwise shown.

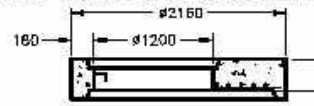
<b>ONTARIO PROVINCIAL STANDARD DRAWING</b> <b>PRECAST CONCRETE</b> <b>MAINTENANCE HOLE COMPONENTS</b> <b>1500mm DIAMETER</b> <b>TRANSITION CONE AND SLABS</b>	<table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px;">Nov 2004</td> <td style="padding: 2px;">Rev 2</td> </tr> </table>	Nov 2004	Rev 2	
Nov 2004	Rev 2			
<b>OPSD - 701.040</b>				



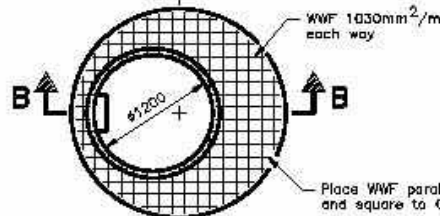
**1800 to 1200mm DIAMETER  
MAINTENANCE HOLE**



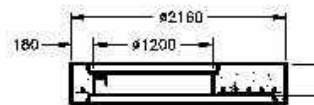
**PLAN OF TRANSITION SLAB  
WITH REINFORCING STEEL BARS**



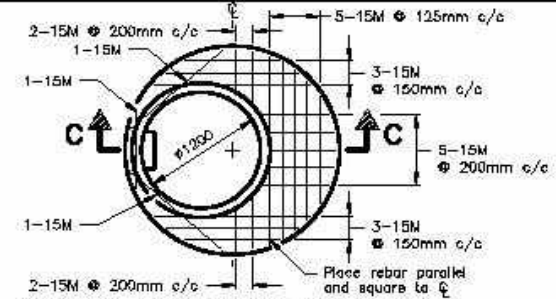
**SECTION A-A**



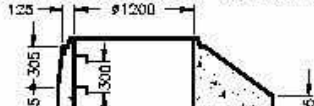
**PLAN OF TRANSITION SLAB  
WITH WWF**



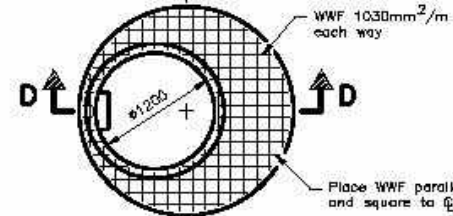
**SECTION B-B**



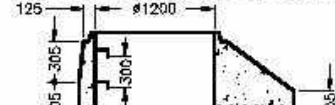
**PLAN OF TAPERED TRANSITION SLAB  
WITH REINFORCING STEEL BARS**



**SECTION C-C**



**PLAN OF TAPERED TRANSITION SLAB WITH WWF**

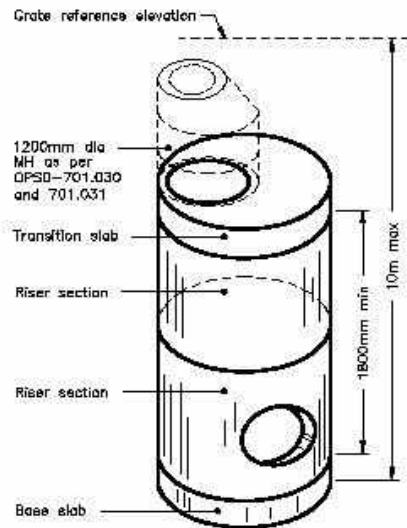


**SECTION D-D**

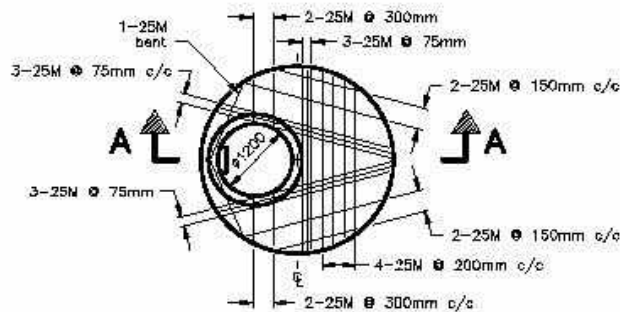
**NOTES:**

- A This OPSD to be read in conjunction with OPSD-701.051.
- B All reinforcing steel shall have 25mm minimum cover.
- C Steps according to OPSD-405.010 or OPSD-405.020.
- D All dimensions are nominal.
- E All dimensions are in millimetres unless otherwise shown.

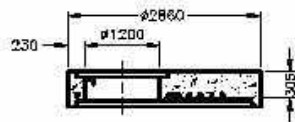
<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>		Nov 2004	Rev 2	
<b>PRECAST CONCRETE MAINTENANCE HOLE COMPONENTS</b>				
<b>1800mm DIAMETER TRANSITION SLABS</b>				<b>OPSD - 701.050</b>



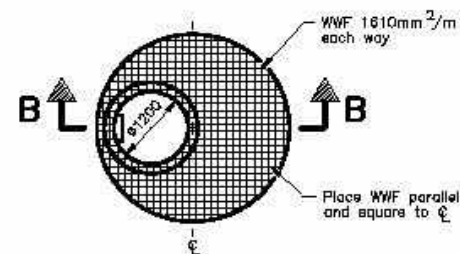
**2400 to 1200mm DIAMETER MAINTENANCE HOLE**



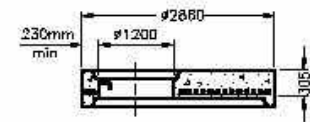
**PLAN OF TRANSITION SLAB WITH REINFORCING STEEL BARS**



**SECTION A-A**




**PLAN OF TRANSITION SLAB WITH WWF**

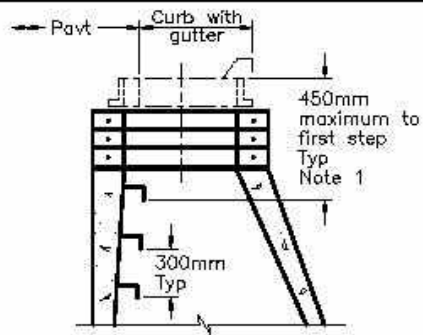


**SECTION B-B**

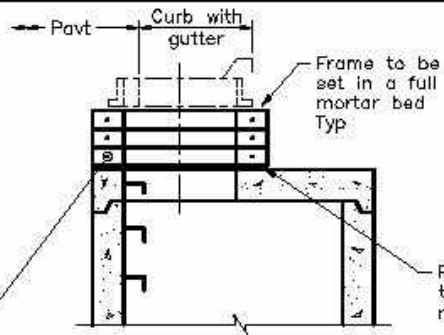
**NOTES:**

- A This OPSD to be read in conjunction with OPSD-701.061.
- B All reinforcing steel shall have 25mm minimum cover.
- C Steps according to OPSD-405.010 or OPSD-405.020.
- D All dimensions are nominal.
- E All dimensions are in millimetres unless otherwise shown.

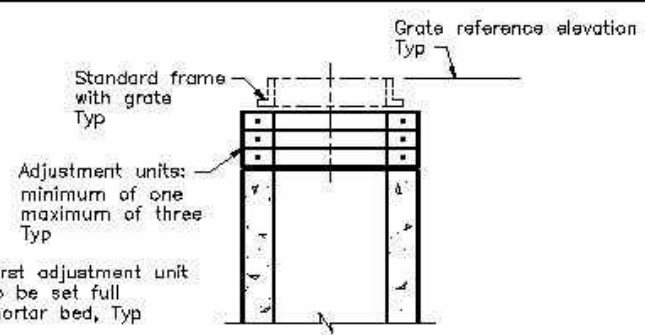
<b>ONTARIO PROVINCIAL STANDARD DRAWING</b> <b>PRECAST CONCRETE</b> <b>MAINTENANCE HOLE COMPONENTS</b> <b>2400mm DIAMETER</b> <b>TRANSITION SLAB</b>	Nov 2004 ----- ----- <b>OPSD - 701.060</b>	Rev 2 ----- ----- 
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**SECTION THROUGH TAPER TOP**

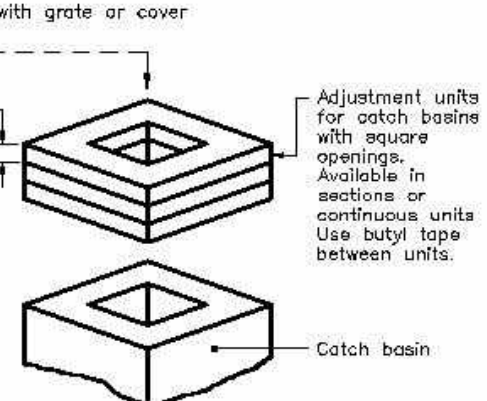
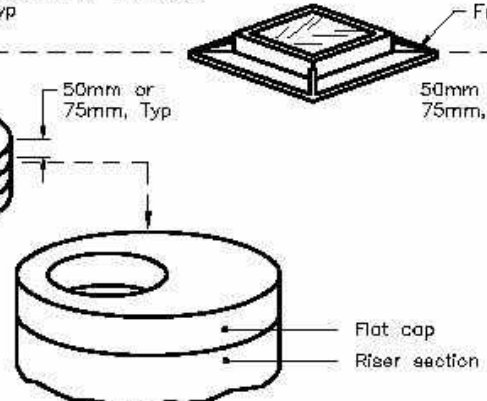
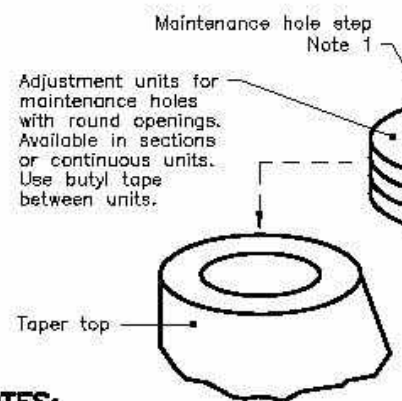


**SECTION THROUGH FLAT CAP**



**SECTION THROUGH CATCH BASIN**

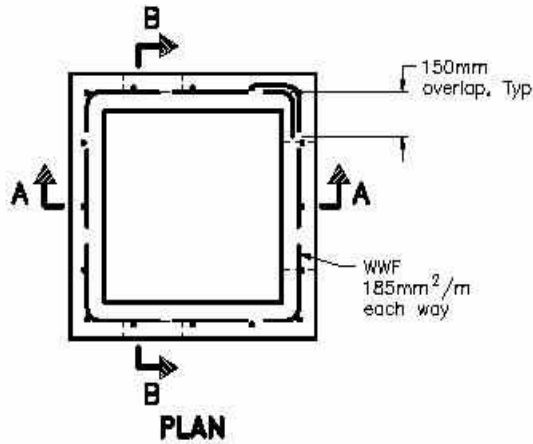
Reinforce each adjustment unit with a minimum of 1 wire with an end area of at least 15mm<sup>2</sup>. Lap wire 150mm or butt weld. Note 2, Typ



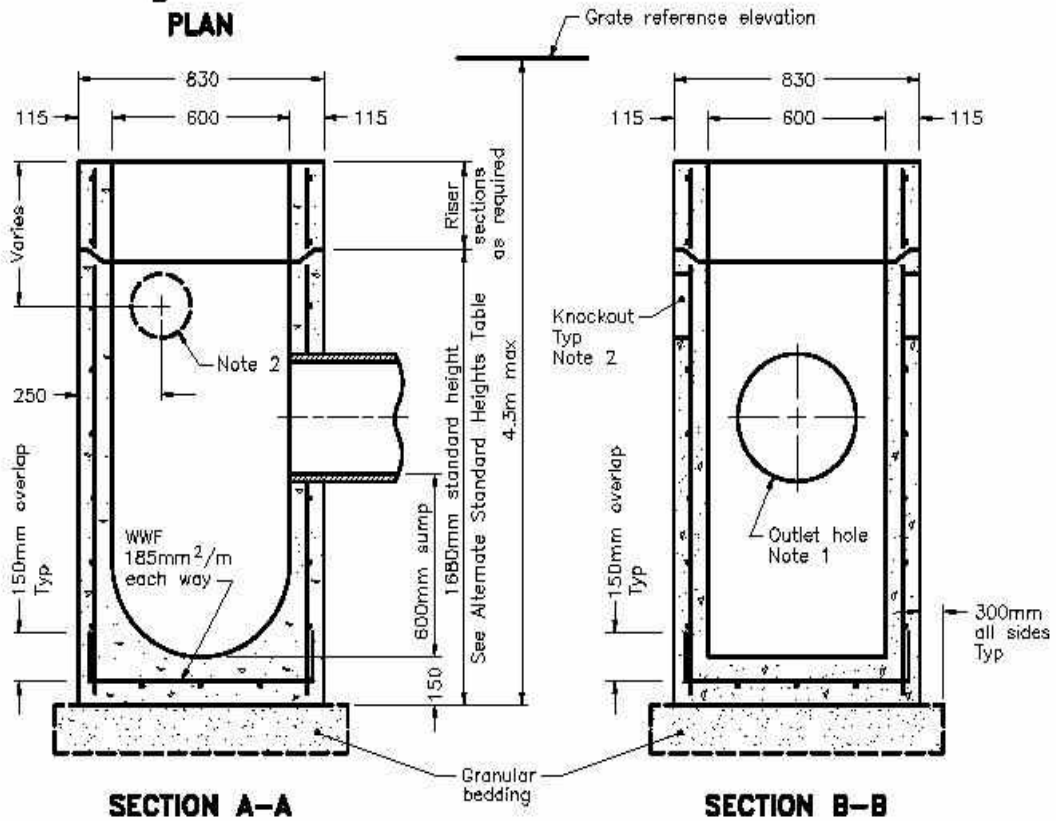
**NOTES:**

- 1 If first step is in an adjustment unit, the adjustment unit shall be of the type manufactured with a step in place.
- 2 Centre reinforcing in adjustment unit  $\pm 10$ mm.
- A Adjustment units shall not extend beyond the outside edge of the structure.
- B All dimensions are in millimetres unless otherwise shown.

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2004	Rev 1	
<b>PRECAST CONCRETE ADJUSTMENT UNITS FOR MAINTENANCE HOLES, CATCH BASINS, AND VALVE CHAMBERS</b>	-----		
<b>OPSD - 704.010</b>			




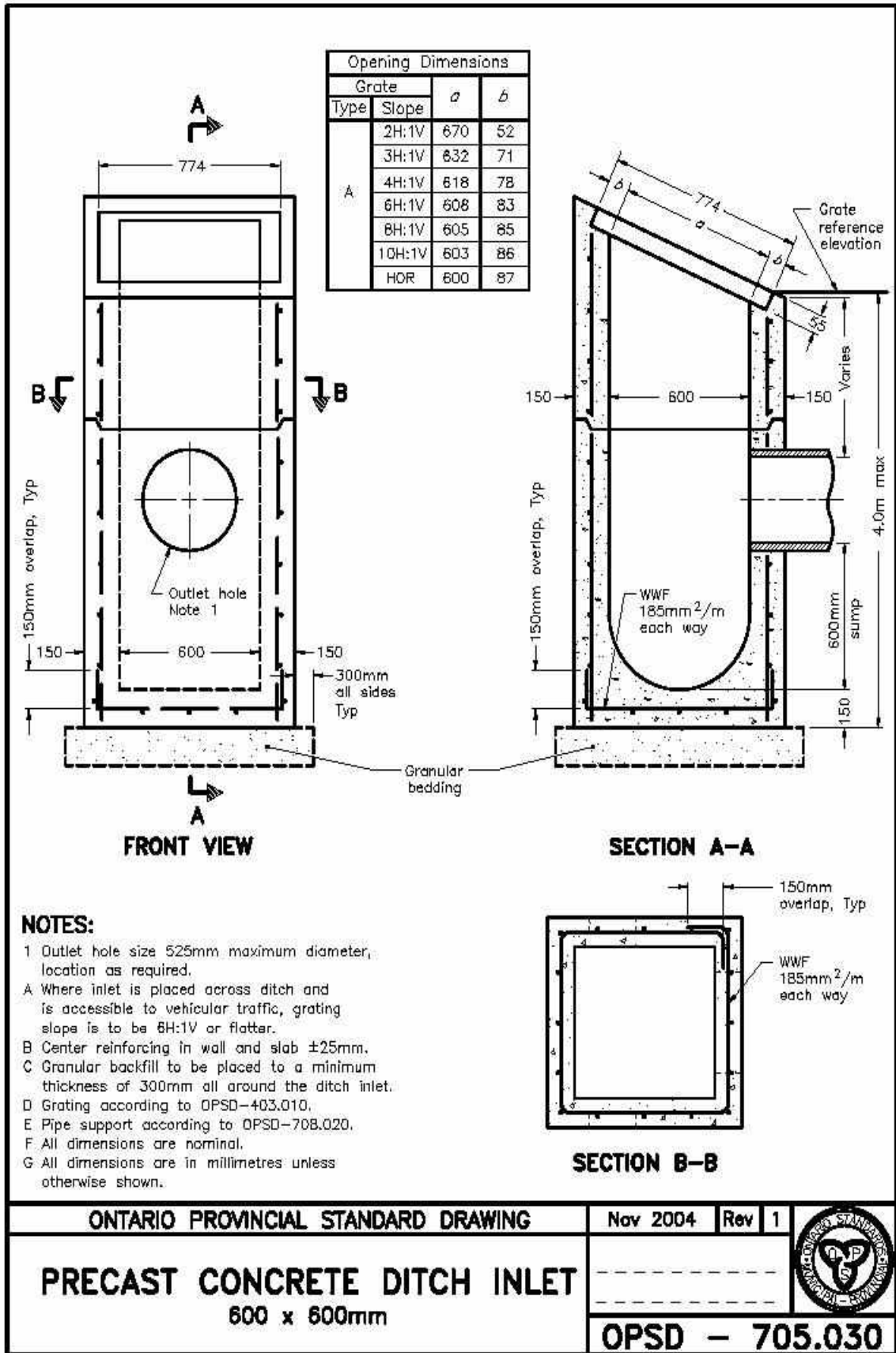
ALTERNATE STANDARD HEIGHTS	
ALTERNATIVE	DIMENSION
A	1980
B	1830
C	1520

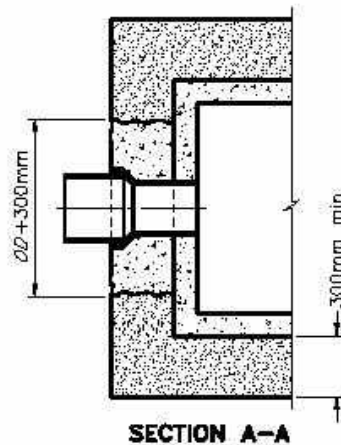


**NOTES:**

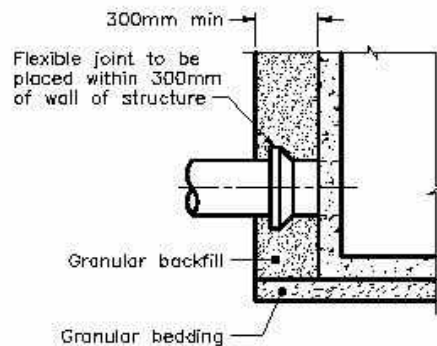
- 1 Outlet hole size 525mm diameter maximum, location as required.
- 2 200mm diameter knockout to accommodate subdrain. Knockout to be 60mm deep.
- A Centre reinforcing in base slab and walls  $\pm 20$ mm.
- B Granular backfill to be placed to a minimum thickness of 300mm all around the catch basin.
- C Frame, grata, and adjustment units shall be installed according to OPSD-704.010.
- D Pipe support according to OPSD-708.020.
- E All dimensions are nominal.
- F All dimensions are in millimetres unless otherwise shown.

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2004	Rev 1	
<b>PRECAST CONCRETE CATCH BASIN</b>			
600x600mm	<b>OPSD - 705.010</b>		

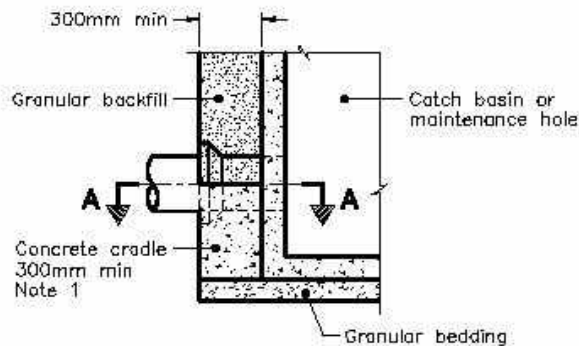




SECTION A-A



ELEVATION  
FLEXIBLE JOINT  
RIGID AND FLEXIBLE PIPE



ELEVATION  
CONCRETE CRADLE  
RIGID PIPE

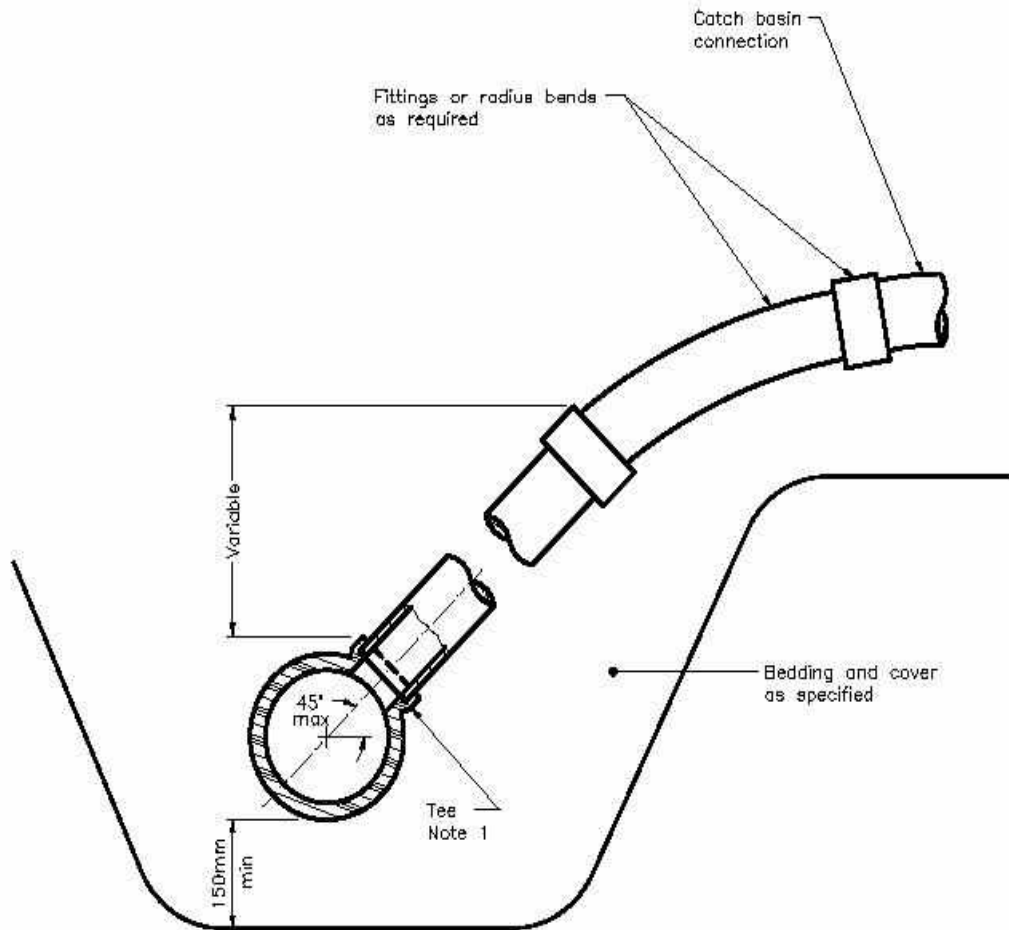
For installation of these connectors refer to manufacturer's instructions.  
A full length of pipe may be used in conjunction with a flexible, watertight connector.

FLEXIBLE, WATERTIGHT CONNECTOR  
RIGID AND FLEXIBLE PIPE

**NOTES:**

- 1 Pipe to be supported with concrete or unshrinkable fill to the first pipe joint.
- A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2008	Rev 2	
SUPPORT FOR PIPE AT CATCH BASIN OR MAINTENANCE HOLE		-----	
OPSD 708.020			



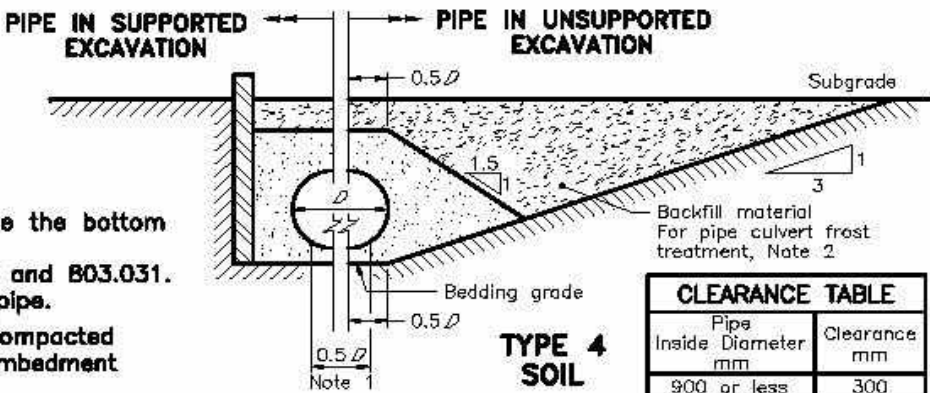
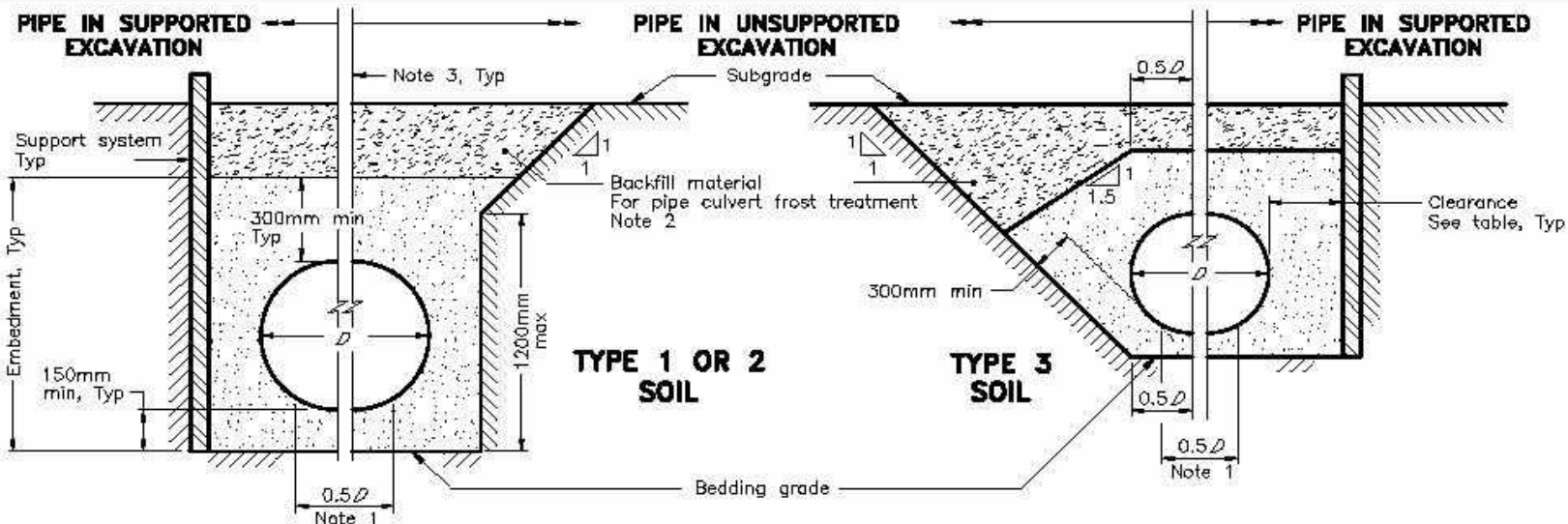
**NOTES:**

1 For sewer mains 450mm in diameter or less or where catch basin connection is more than half diameter of sewer main, use factory made tees.

A Maintenance holes shall be used at the main sewer to connect sewer connections greater than 300mm.

B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1	
<b>CATCH BASIN CONNECTION FOR FLEXIBLE MAIN PIPE SEWER</b>	_____ _____		
<b>OPSD 708.030</b>			

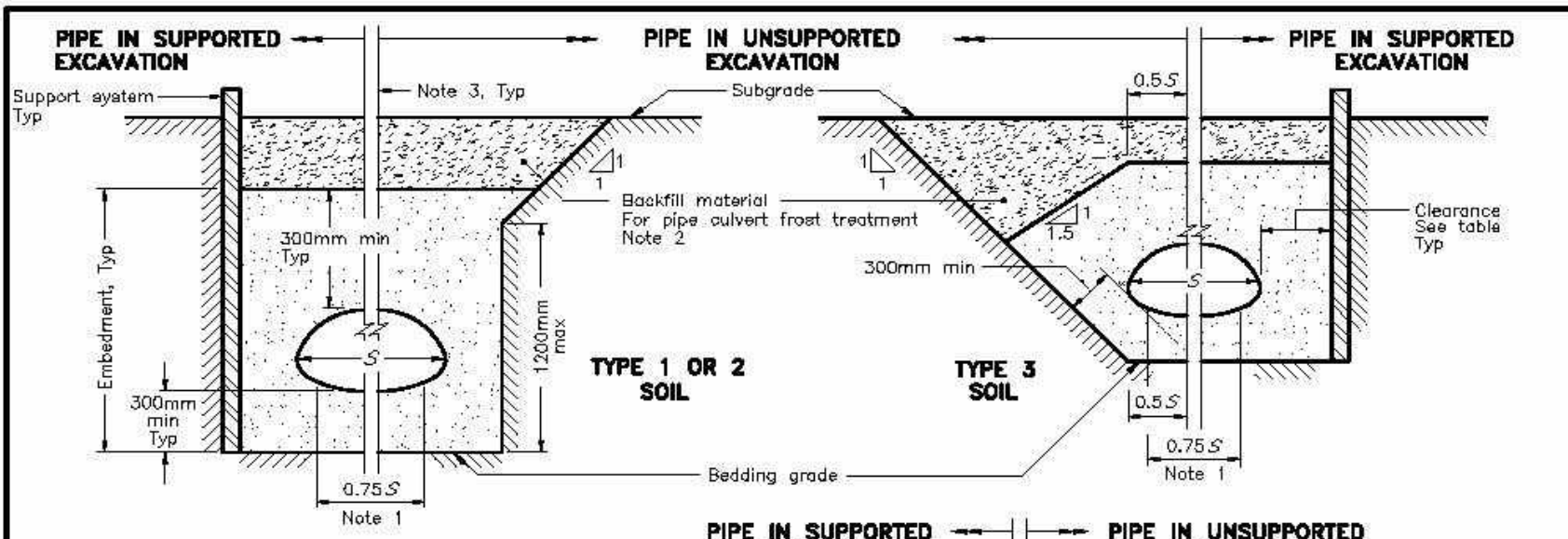


**LEGEND:**  
 $D$  - Inside diameter

- NOTES:**
- 1 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
  - 2 Pipe culvert frost treatment according to OPSD-803.030 and B03.031.
  - 3 Condition of trench is symmetrical about centreline of pipe.
- A** Granular material placed in the haunch area shall be compacted prior to placing and compacting the remainder of the embedment material.
- B** Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
- C** All dimensions are in metres unless otherwise shown.

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2005	Rev 1	
<b>FLEXIBLE PIPE EMBEDMENT AND BACKFILL EARTH EXCAVATION</b>	-----		
<b>OPSD - 802.010</b>			



**LEGEND:**

S - Span of pipe arch

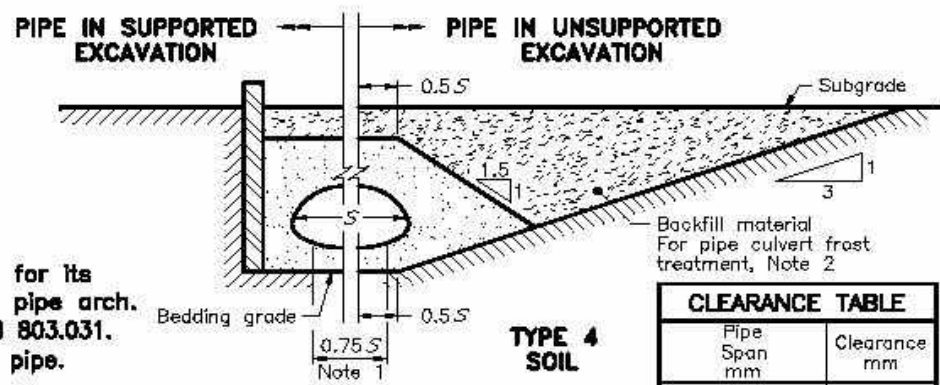
**NOTES:**

- 1 For width  $0.75S$ , granular material to be uncompacted for its full depth and fine graded to shape of bottom of the pipe arch.
- 2 Pipe culvert frost treatment according to OPSD-803.030 and 803.031.
- 3 Condition of trench is symmetrical about centreline of pipe.

A Granular material placed in the haunch area shall be compacted prior to placing and compacting the remainder of the embedment material.

B Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.

C All dimensions are in metres unless otherwise shown.



CLEARANCE TABLE	
Pipe Span mm	Clearance mm
900 or less	300
Over 900	500

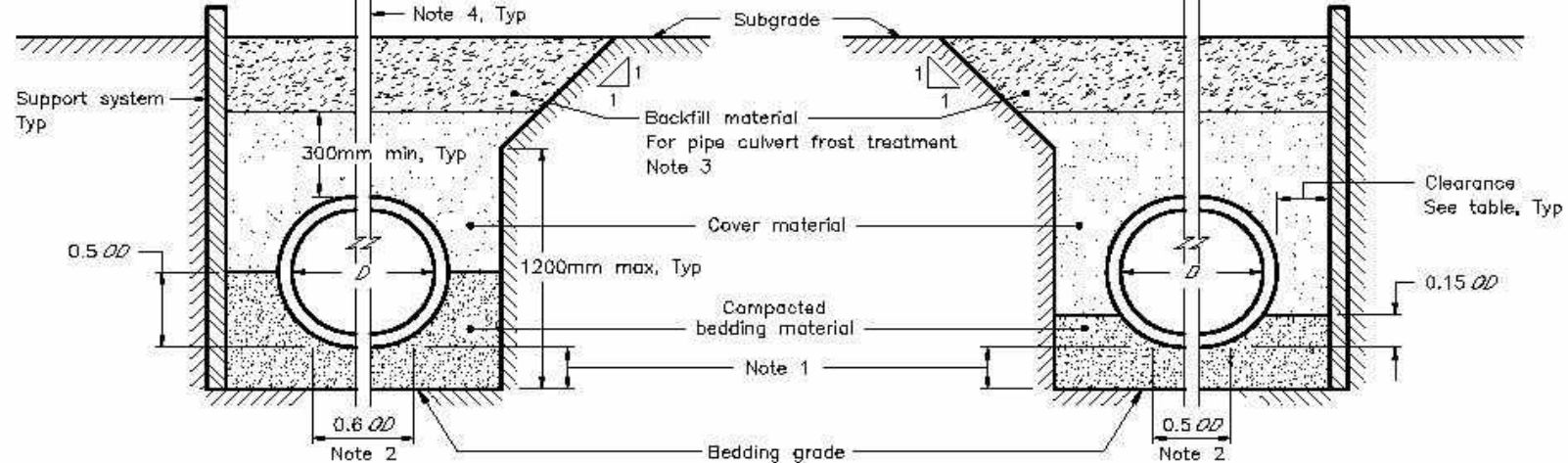
<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2005	Rev 1	
<b>FLEXIBLE PIPE ARCH EMBEDMENT AND BACKFILL EARTH EXCAVATION</b>			
<b>OPSD - 802.020</b>			

PIPE IN SUPPORTED EXCAVATION

PIPE IN UNSUPPORTED EXCAVATION

PIPE IN UNSUPPORTED EXCAVATION

PIPE IN SUPPORTED EXCAVATION



**CLASS B BEDDING**

**CLASS C BEDDING**

**NOTES:**

- 1 The minimum bedding depth below the pipe shall be  $0.15D$  in no case shall this dimension be less than 150mm or greater than 300mm.
- 2 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
- 3 Pipe culvert frost treatment according to OPSD-803.030 and 803.031.
- 4 Condition of trench is symmetrical about centreline of pipe.
- A Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
- B All dimensions are in metres unless otherwise shown.

**LEGEND:**

- $D$  - Inside diameter
- $OD$  - Outside diameter

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

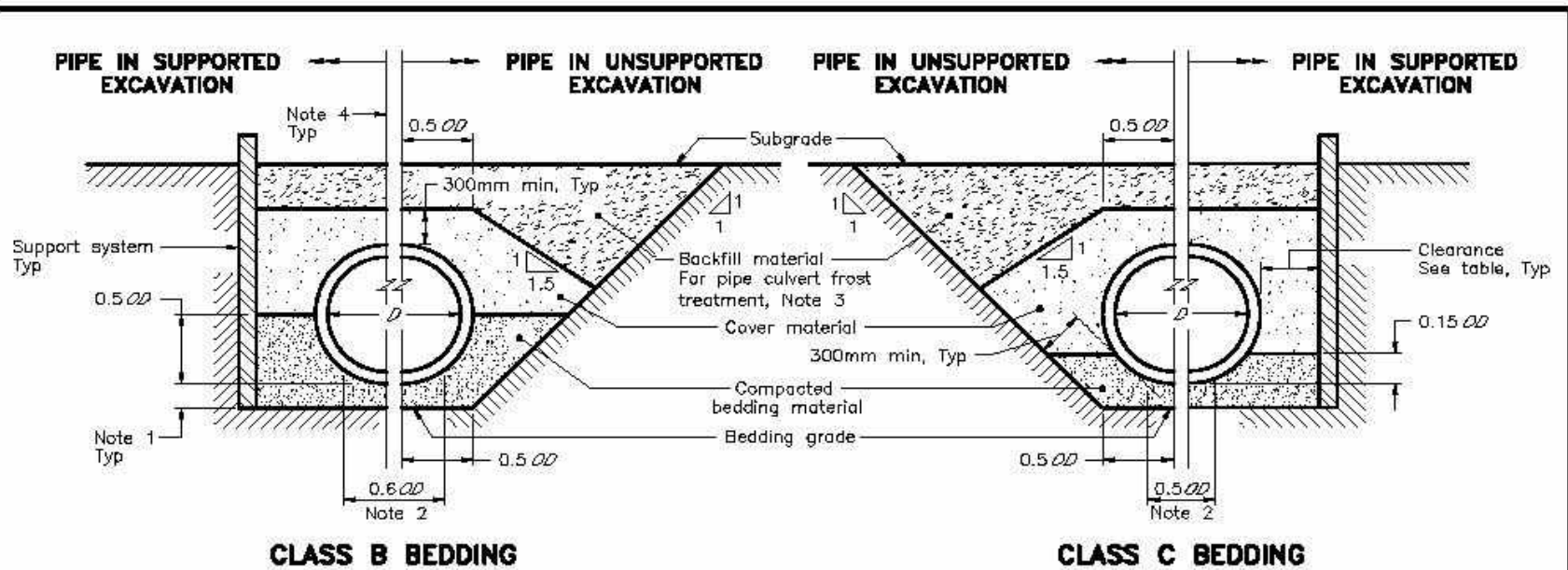
ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2005 Rev 1

**RIGID PIPE BEDDING,  
COVER, AND BACKFILL  
TYPE 1 OR 2 SOIL - EARTH EXCAVATION**

**OPSD - 802.030**





**NOTES:**

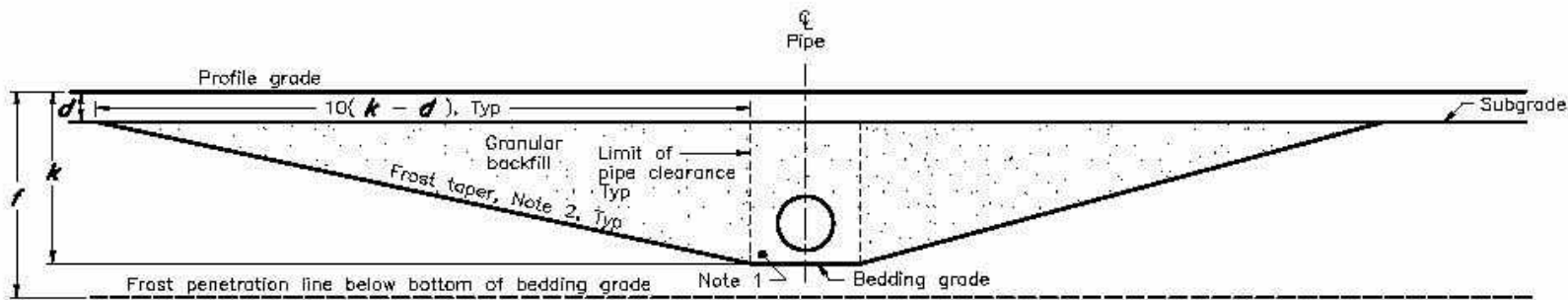
- 1 The minimum bedding depth below the pipe shall be  $0.15OD$  in no case shall this dimension be less than 150mm or greater than 300mm.
- 2 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
- 3 Pipe culvert frost treatment according to OPSD-803.030 and 803.031.
- 4 Condition of trench is symmetrical about centreline of pipe.
- A Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
- B All dimensions are in metres unless otherwise shown.

**LEGEND:**

- $D$  - Inside diameter
- $OD$  - Outside diameter

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2005   Rev   1	
<b>RIGID PIPE BEDDING, COVER, AND BACKFILL</b>		
<b>TYPE 3 SOIL - EARTH EXCAVATION</b>		
<b>OPSD - 802.031</b>		



**FROST TREATMENT – RIGID AND FLEXIBLE PIPE**

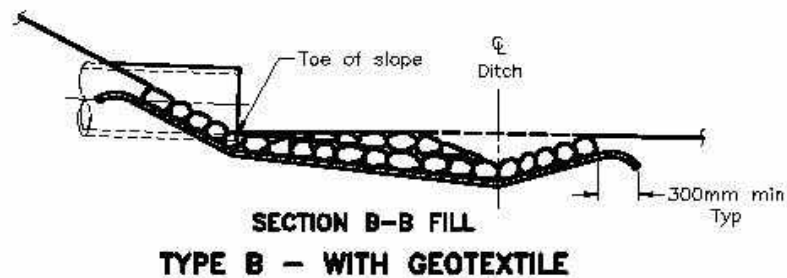
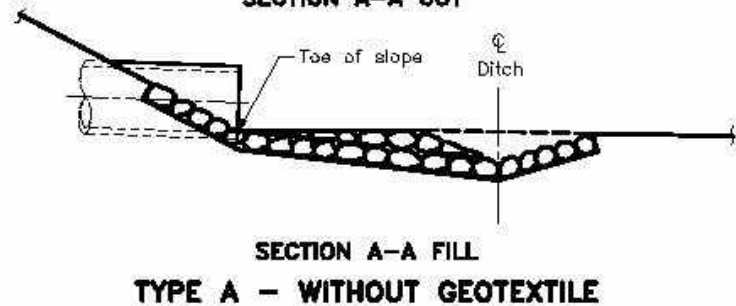
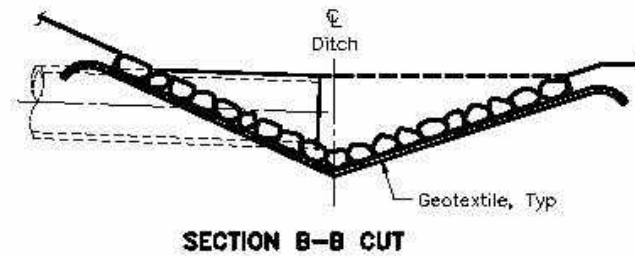
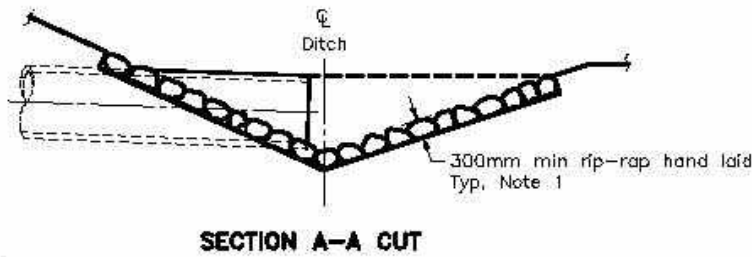
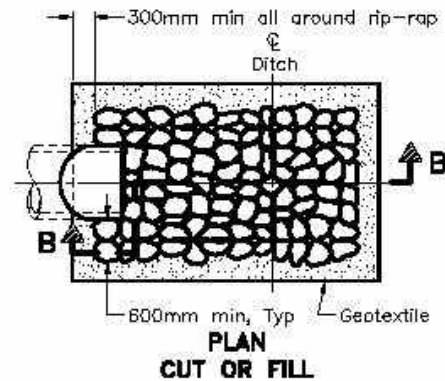
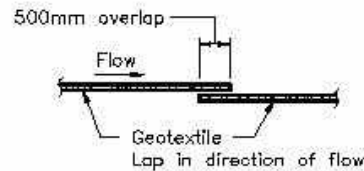
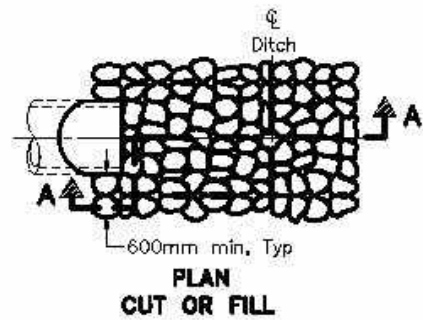
**NOTES:**

- 1 Pipe embedment or bedding, cover, and backfill according to:
  - a) Flexible – OPSD-802.010, 802.013, 802.014, 802.020, 802.023, and 802.024
  - b) Rigid – OPSD-802.030, 802.031, 802.032, 802.033, 802.034, 802.050, 802.051, 802.052, 802.053, and 802.054.
- 2 Frost tapers start at bedding grade.
- A Frost tapers are not required in rock embankment.

**LEGEND:**

- d* –depth of roadbed granular
- k* –depth of frost treatment
- f* –depth of frost penetration

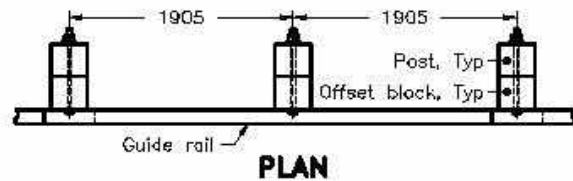
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2005	Rev 1	
<b>FROST TREATMENT – PIPE CULVERTS</b>	-----		
<b>FROST PENETRATION LINE BELOW BEDDING GRADE</b>	-----		
<b>OPSD – 803.030</b>			



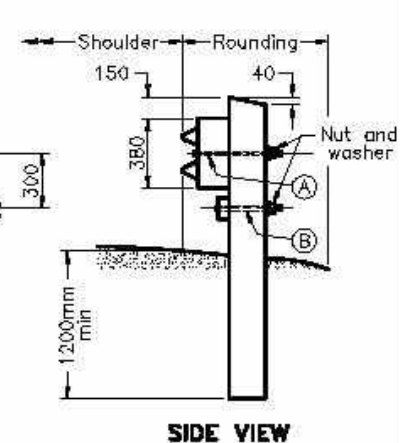
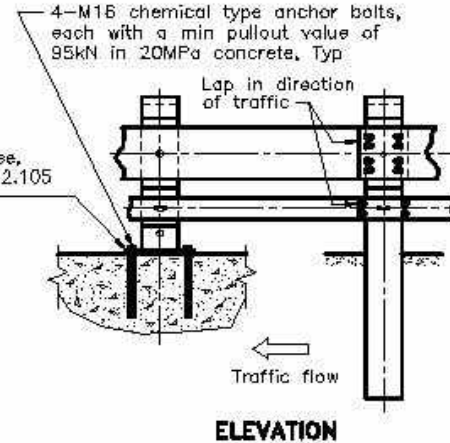
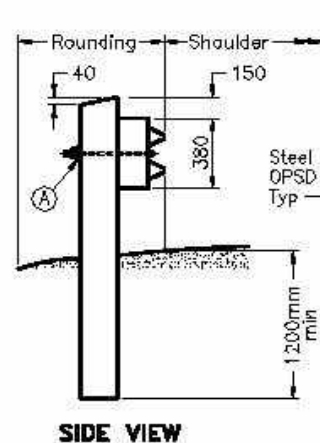
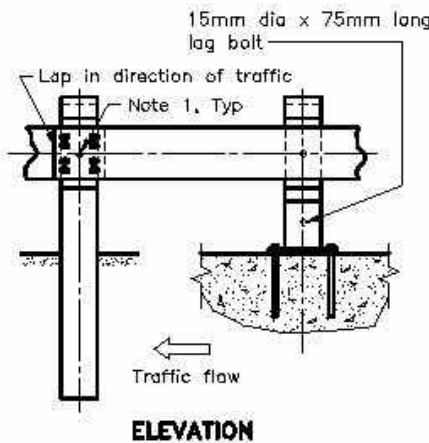
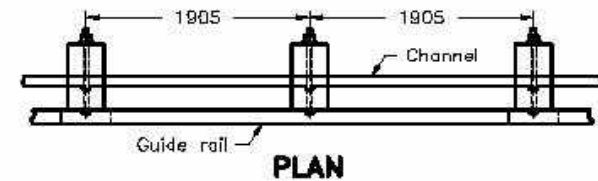
**NOTES:**

- 1 The thickness of the rip-rap layer shall be at least 1.5 times the rip-rap mean diameter.
- A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING		Nov 2007	Rev 1	
<b>RIP-RAP TREATMENT FOR SEWER AND CULVERT OUTLETS</b>				
<b>OPSD 810.010</b>				



POST BOLT AND HOLE	
Hole Dia	Post Bolt Size and Type
(A) 18	16x460 BH
(B) 18	16x310 CaB



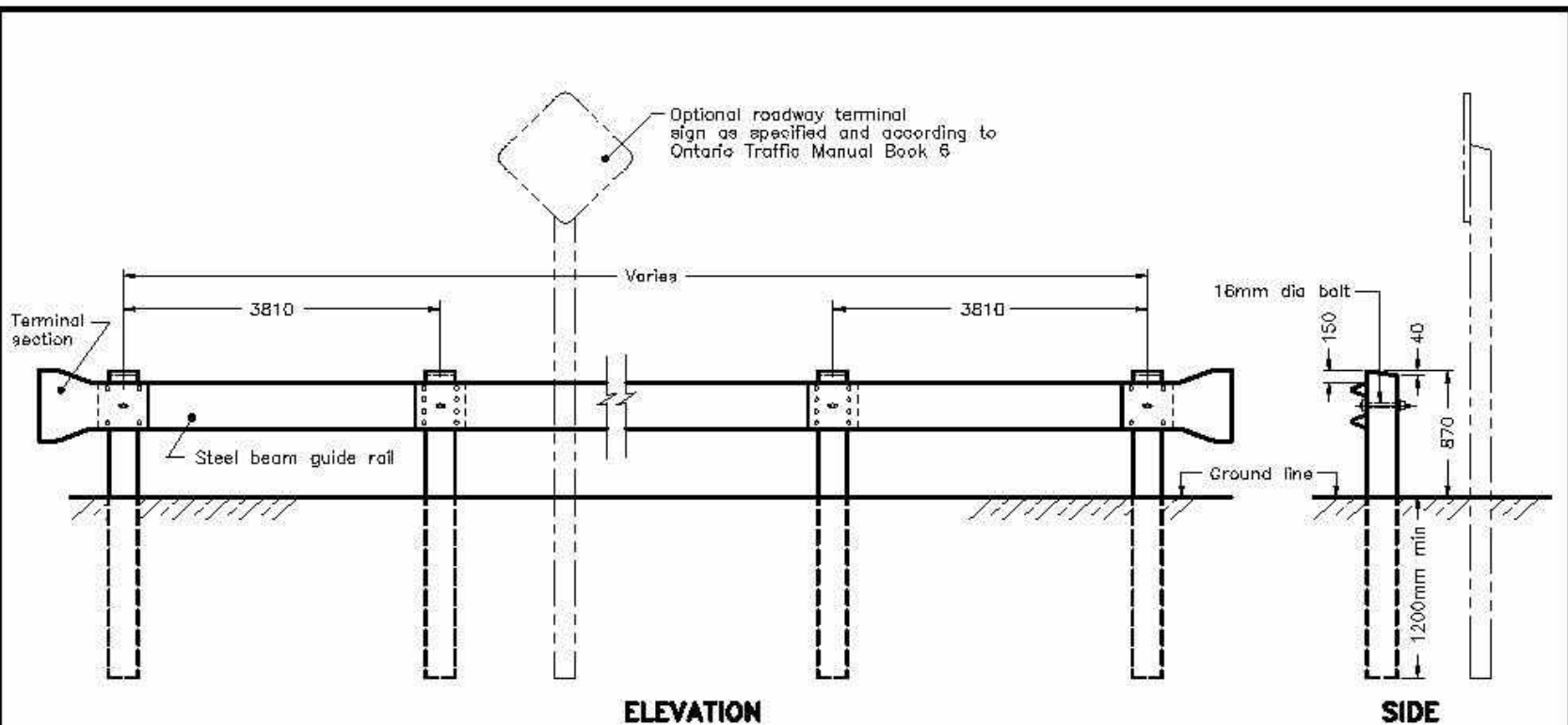
**SINGLE RAIL**

**SINGLE RAIL WITH CHANNEL**

**NOTES:**

- 1 Washer shall not be installed at front face of rail. One bolt located at centre of steel beam guide rail.
- A Wooden posts and offset blocks:  
Size 200x200mm nominal, 190x190mm ±1.5mm dressed, tops to have 25mm chamfer.
- B Steel beam guide rail mounting heights shall be as specified.
- C This OPSD to be read in conjunction with OPSD 912.101 and 912.102.
- D All dimensions are in millimetres unless otherwise shown.

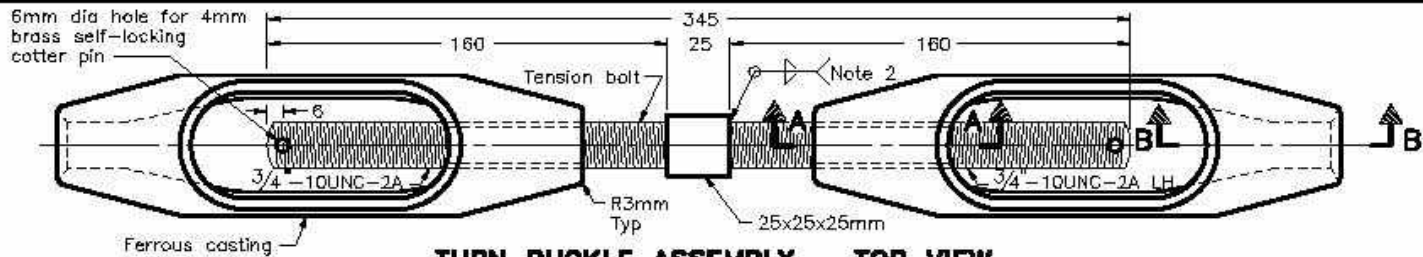
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2008	Rev 1	
<b>GUIDE RAIL SYSTEM, STEEL BEAM WOODEN POST ASSEMBLY INSTALLATION – SINGLE RAIL</b>			
<b>OPSD 912.140</b>			



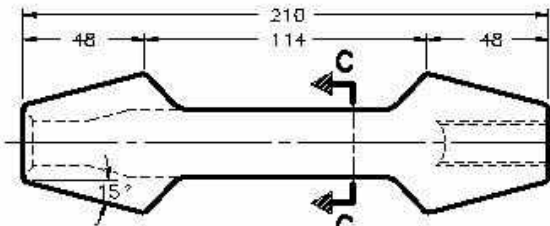
**NOTES:**

- A Steel beam guide rail mounting heights shall be as specified.
- B This OPSD to be read in conjunction with OPSD 912.101.
- C Posts: Size 200x200mm nominal, 190x190mm  $\pm$ 1.5mm dressed, tops to have 25mm chamfer.
- D All dimensions are in millimetres unless otherwise shown.

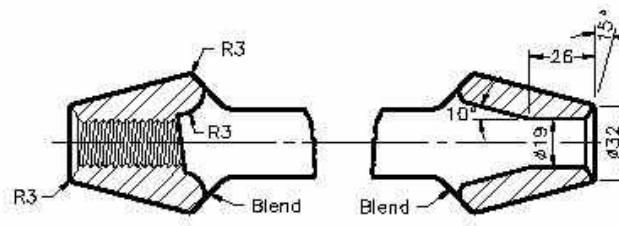
<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2008	Rev 1	
<b>GUIDE RAIL SYSTEM, STEEL BEAM BARRICADE INSTALLATION</b>			
<b>OPSD 912.532</b>			



**TURN BUCKLE ASSEMBLY - TOP VIEW**

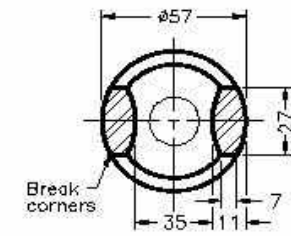


**END FITTING - SIDE VIEW**

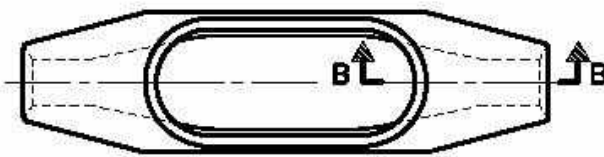


**SECTION A-A**

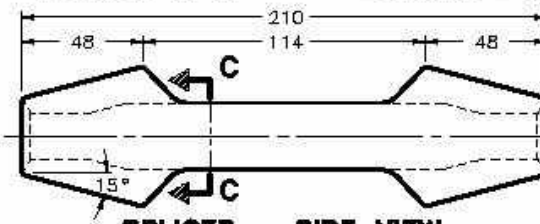
**SECTION B-B**



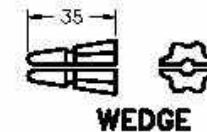
**SECTION C-C**



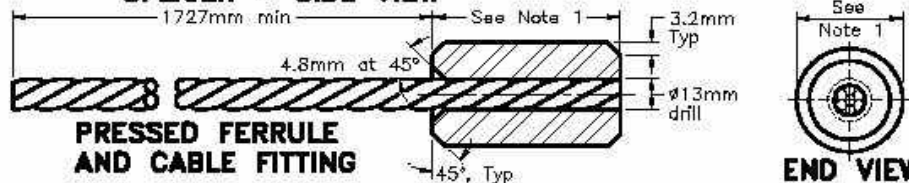
**SPLICER - TOP VIEW**



**SPLICER - SIDE VIEW**



**WEDGE**



**PRESSED FERRULE AND CABLE FITTING**

**END VIEW**

**NOTES:**

1 Uncompressed ferrule: length 90mm, diameter 30mm.  
Compressed ferrule: length 100mm min,  
diameter 25mm min.

2 As an option, a square or hex nut may be welded to a 3/4"-10UNC-2A threaded bar.

A Dimensions of ferrous castings to have tolerance of  $\pm 0.7$ mm.

B All dimensions are in millimetres unless otherwise shown.

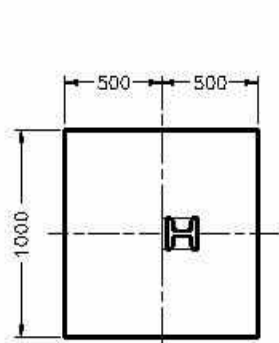
ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2008 Rev 1

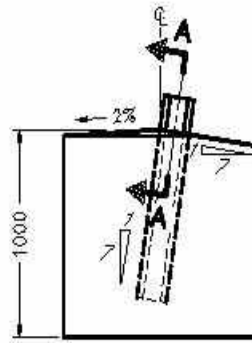
GUIDE RAIL SYSTEM, CABLE  
COMPONENT - CABLE FITTINGS



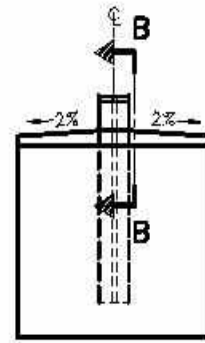
OPSD 913.101



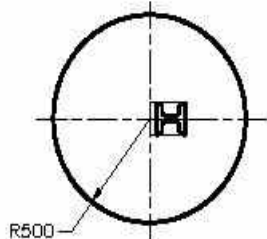
TOP



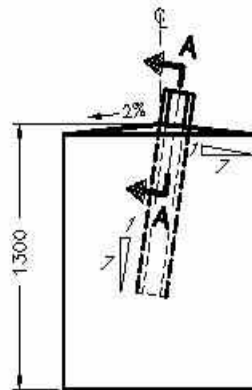
FRONT  
CUBICAL ANCHOR BLOCK



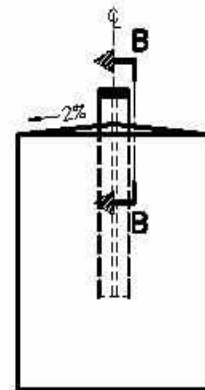
SIDE



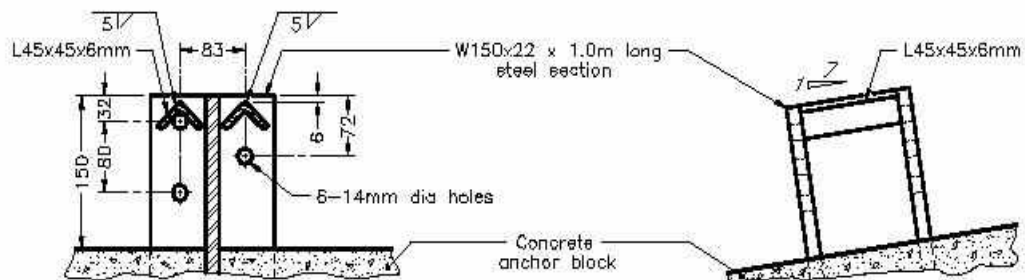
TOP



FRONT  
CYLINDRICAL ANCHOR BLOCK



SIDE




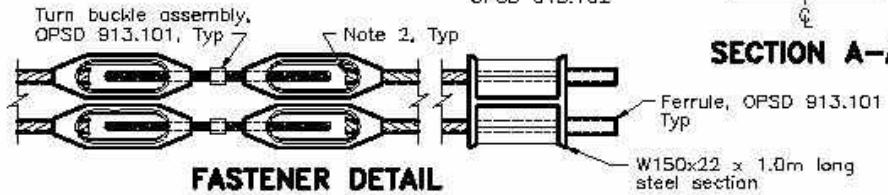
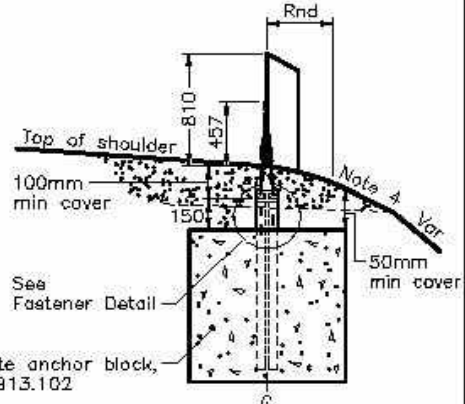
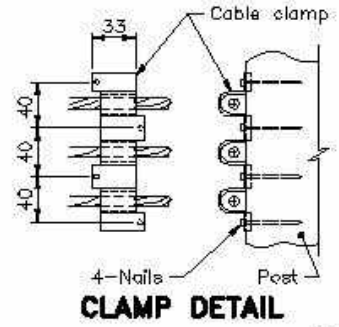
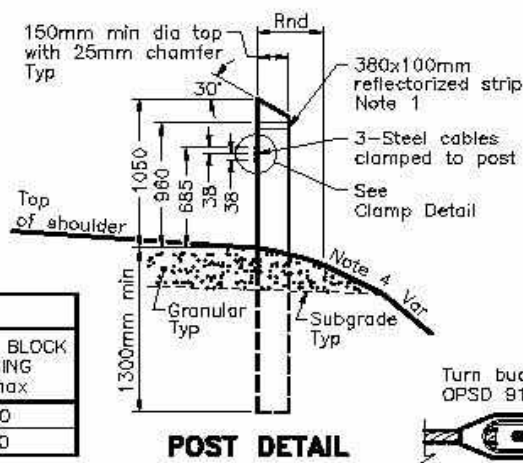
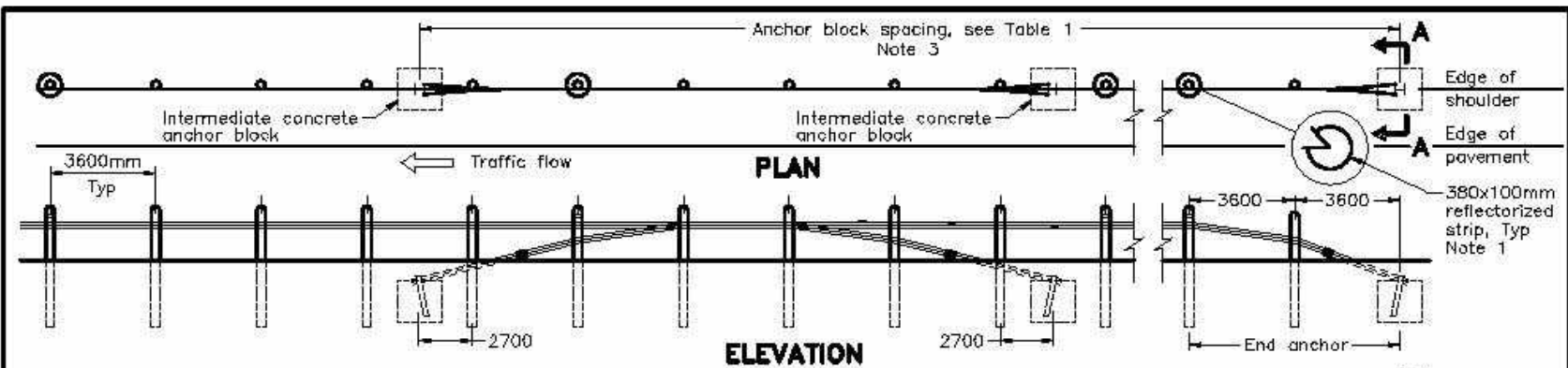
SECTION A-A

SECTION B-B

**NOTES:**

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2008	Rev 1	
<p align="center"><b>GUIDE RAIL SYSTEM, CABLE COMPONENT - CONCRETE ANCHOR BLOCKS</b></p>	<p align="center"><b>OPSD 913.102</b></p>		

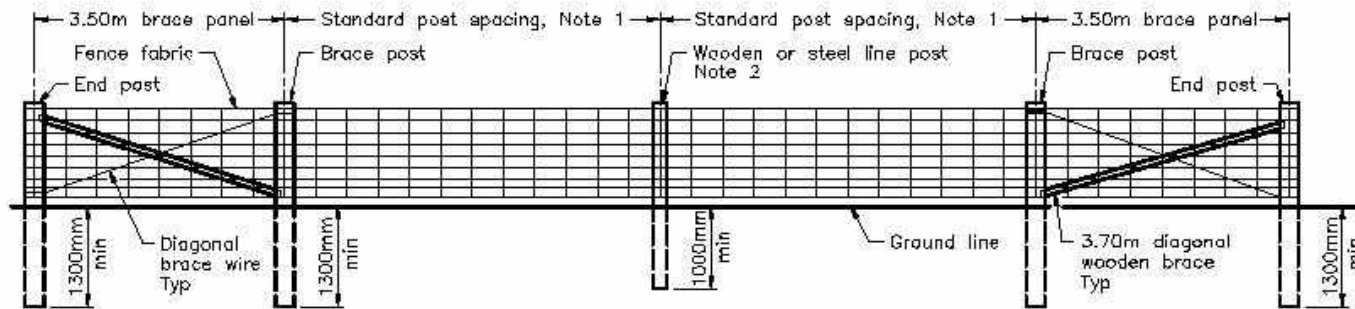


RADIUS OF CURVATURE m	ANCHOR BLOCK SPACING m max
Over 600	300
250 to 600	100

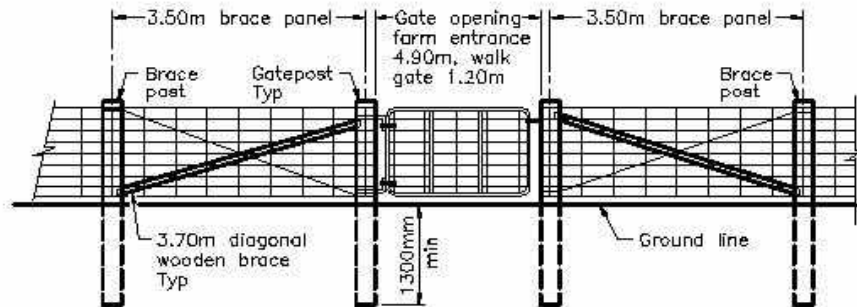
**NOTES:**

- 1 Reflectorized strips as specified.
  - 2 Ends of cable strands shall protrude past the end of the wedge 10mm.
  - 3 Minimum installation length of 46.8m.
  - 4 Slope 3H:1V or flatter when specified.
- A All dimensions are in millimetres unless otherwise shown.

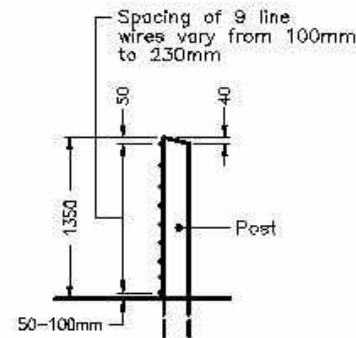
<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2008	Rev 1	
<b>GUIDE RAIL SYSTEM, CABLE INSTALLATION – SHOULDER</b>	<div style="border-bottom: 1px dashed black; width: 100%; height: 10px;"></div>		
<b>OPSD 913.130</b>			



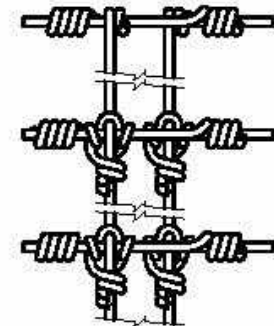
**HIGHWAY FENCE  
IN EARTH, SHALE, LOOSE ROCK, OR FRIABLE ROCK**



**GATE DETAIL**



**WIRE SPACING DETAIL**

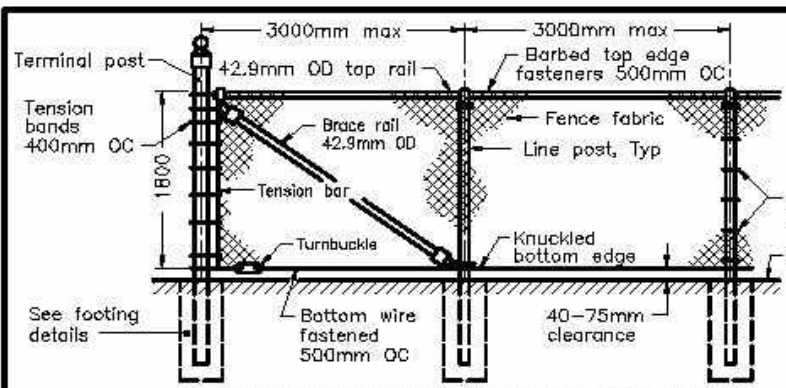


**SPLICING DETAIL**

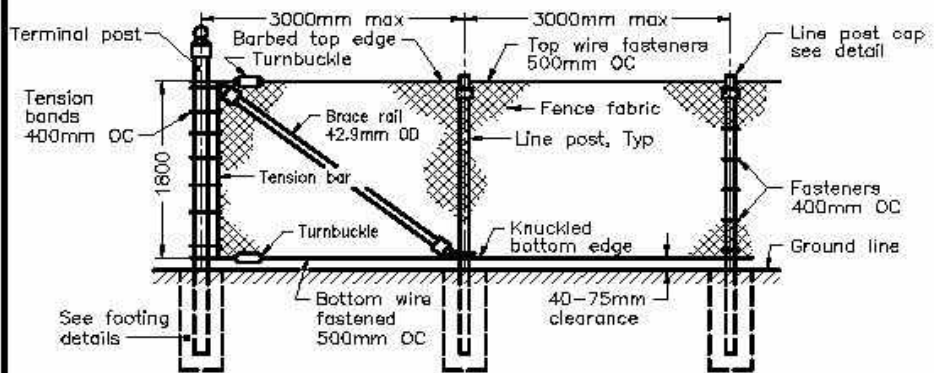
**NOTES:**

- 1 Standard post spacing shall be 6.0m for wooden post to wooden post and 5.0m for steel post to steel or wooden post.
- 2 Ratio of steel posts to wooden posts shall be 3:1.
- A All dimensions are in millimetres unless otherwise shown.

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>		Nov 2008	Rev 2	
<b>FENCE, HIGHWAY IN EARTH, SHALE, LOOSE ROCK, OR FRIABLE ROCK INSTALLATION</b>		-----		
		<b>OPSD 971.101</b>		

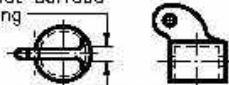


**CHAIN-LINK FENCE WITH TOP RAIL**



**CHAIN-LINK FENCE WITH TOP WIRE**

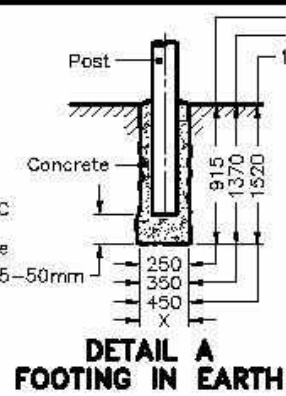
10mm flat surface for drilling



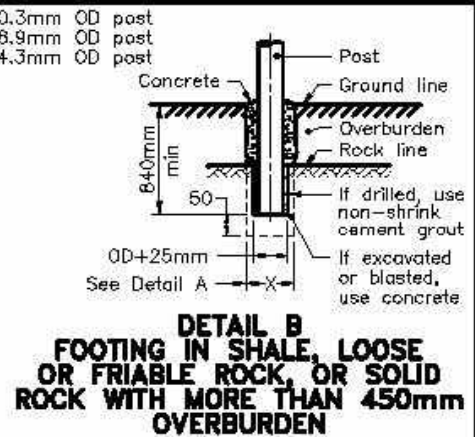
**62mm ID LINE POST CAP DETAIL**

**NOTE:**

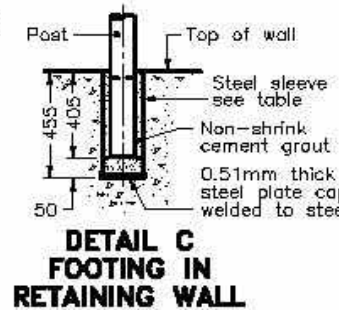
A Fence as viewed from the roadway.  
 B All dimensions are in millimetres unless otherwise shown.



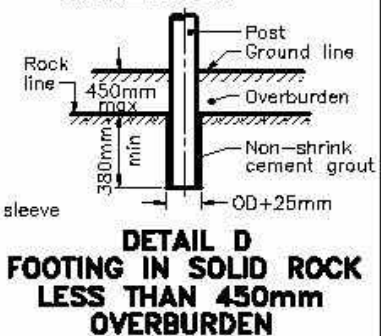
**DETAIL A FOOTING IN EARTH**



**DETAIL B FOOTING IN SHALE, LOOSE OR FRIABLE ROCK, OR SOLID ROCK WITH MORE THAN 450mm OVERBURDEN**



**DETAIL C FOOTING IN RETAINING WALL**



**DETAIL D FOOTING IN SOLID ROCK LESS THAN 450mm OVERBURDEN**


Post Type	OD	Post Length		Sleeves OD
		Standard Walls m	Retaining Walls m	
Line post	60.3	2.6	2.0	88.9
Terminal post	88.9	2.9	2.3	114.3

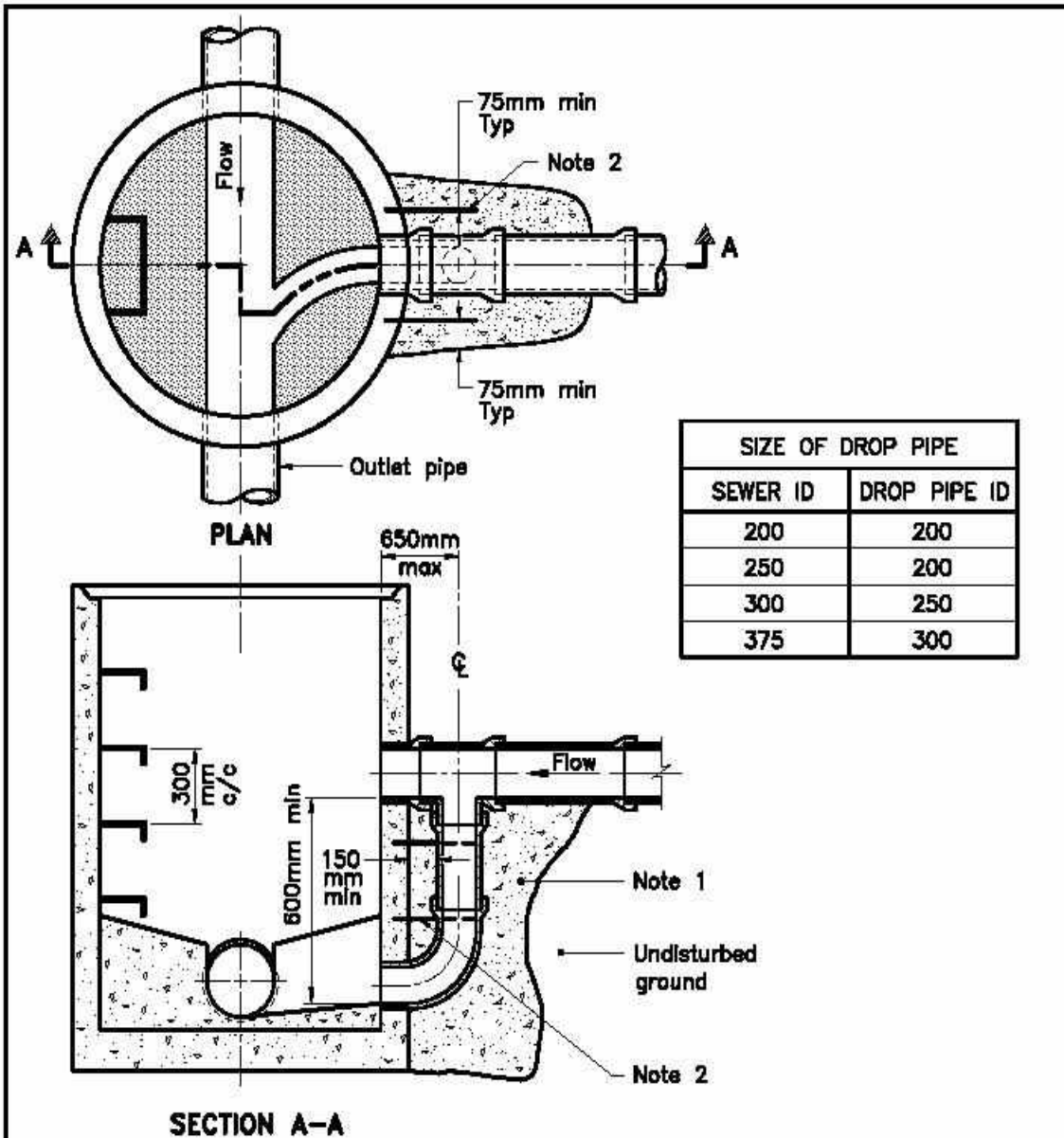
**ONTARIO PROVINCIAL STANDARD DRAWING**

**FENCE, CHAIN-LINK  
INSTALLATION - ROADWAY**

Nov 2005 Rev 1


**OPSD - 972.130**

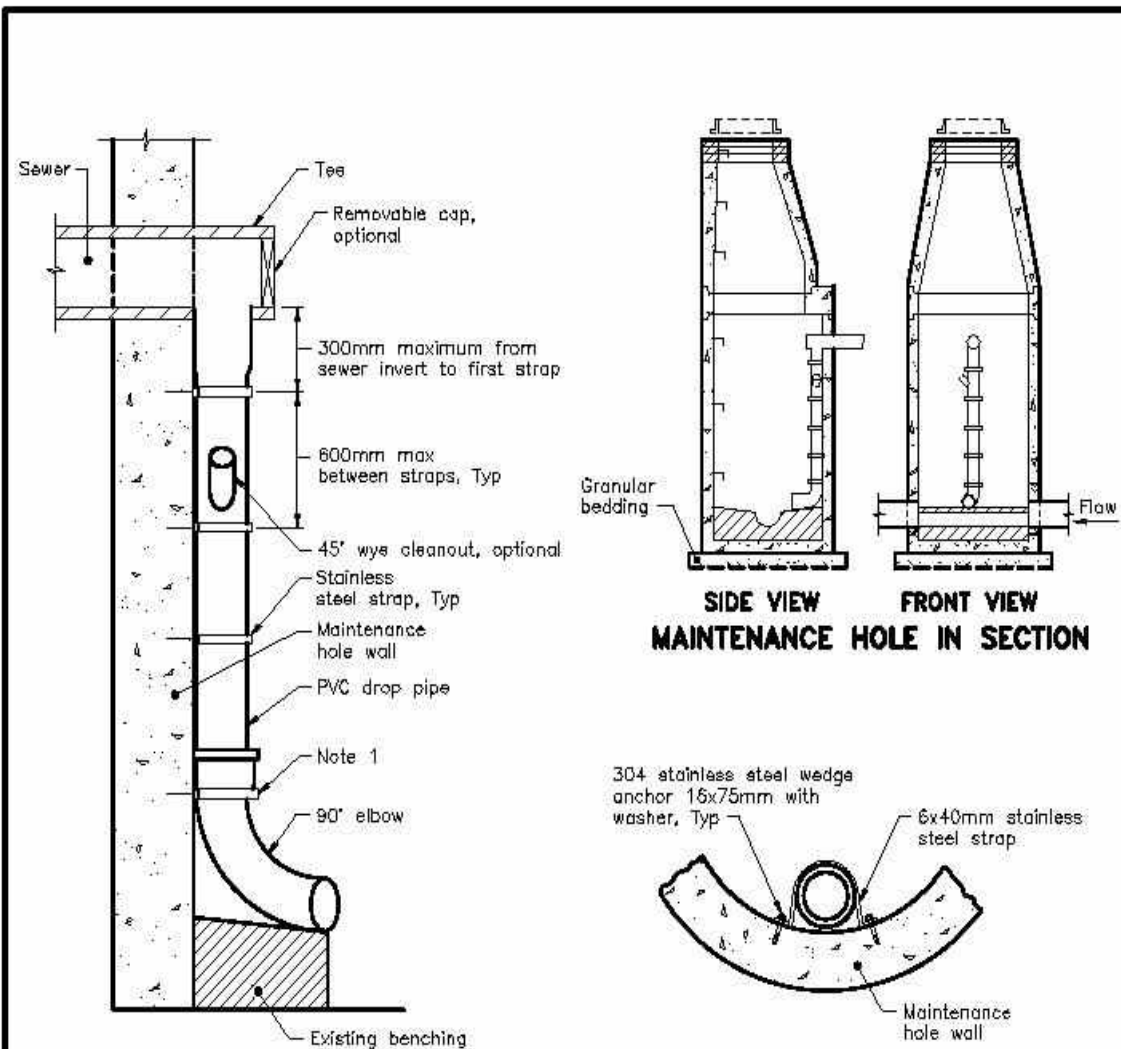




**NOTES:**

- 1 Concrete to be placed to undisturbed ground and the outside face of the maintenance hole, but there shall be a minimum of 150mm of 15MPa concrete around the drop pipe.
  - 2 Concrete shall be secured to the maintenance hole with 450mm long, 13mm diameter threaded rods and drilled expansion anchors down either side of the drop pipe at 300mm centres.
- A All dimensions are in millimetres unless otherwise shown.

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2005	Rev 1	
<b>CAST-IN-PLACE MAINTENANCE HOLE DROP STRUCTURE TEE</b>	-----		
<b>OPSD - 1003.010</b>			




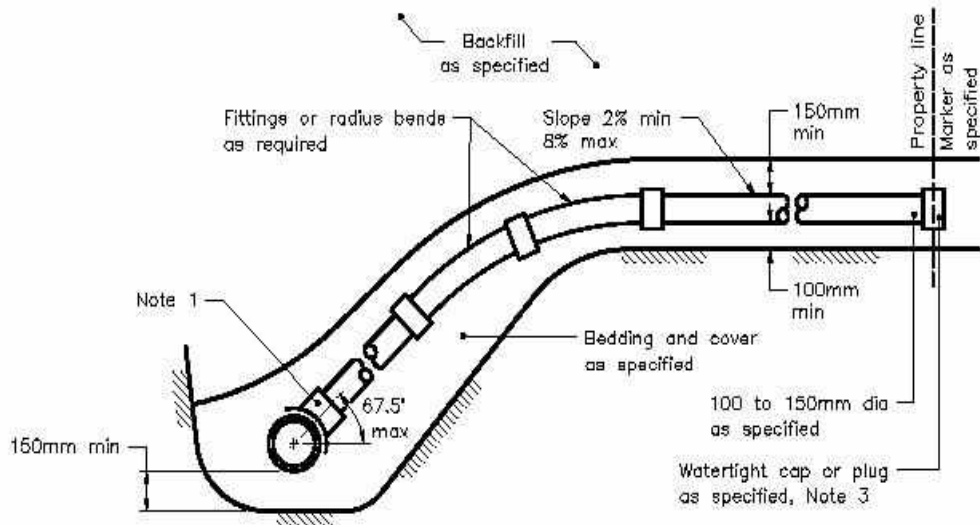
**INTERNAL DROP STRUCTURE DETAIL**

**FASTENER DETAIL**

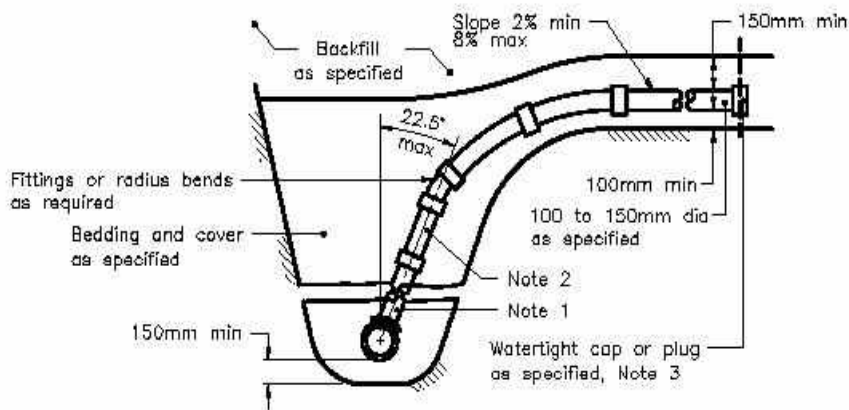
**NOTES:**

- 1 At the elbow, a stainless steel strap is required at bottom of bell.
- A Internal drop structure shall be used on existing maintenance holes 1500mm diameter and larger with a minimum height of 600mm from the inlet pipe invert to the top of benching. The existing benching shall be modified as required.
- B Drop pipe shall be one size smaller than the incoming sewer with a minimum 150mm diameter and maximum of 375mm diameter.
- C Straps shall not be placed within 150mm of any maintenance hole section joint.
- D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2008	Rev 2	
INTERNAL DROP STRUCTURE			
FOR EXISTING MAINTENANCE HOLES	OPSD 1003.030		




**CONNECTION WITHOUT VERTICAL RISER**

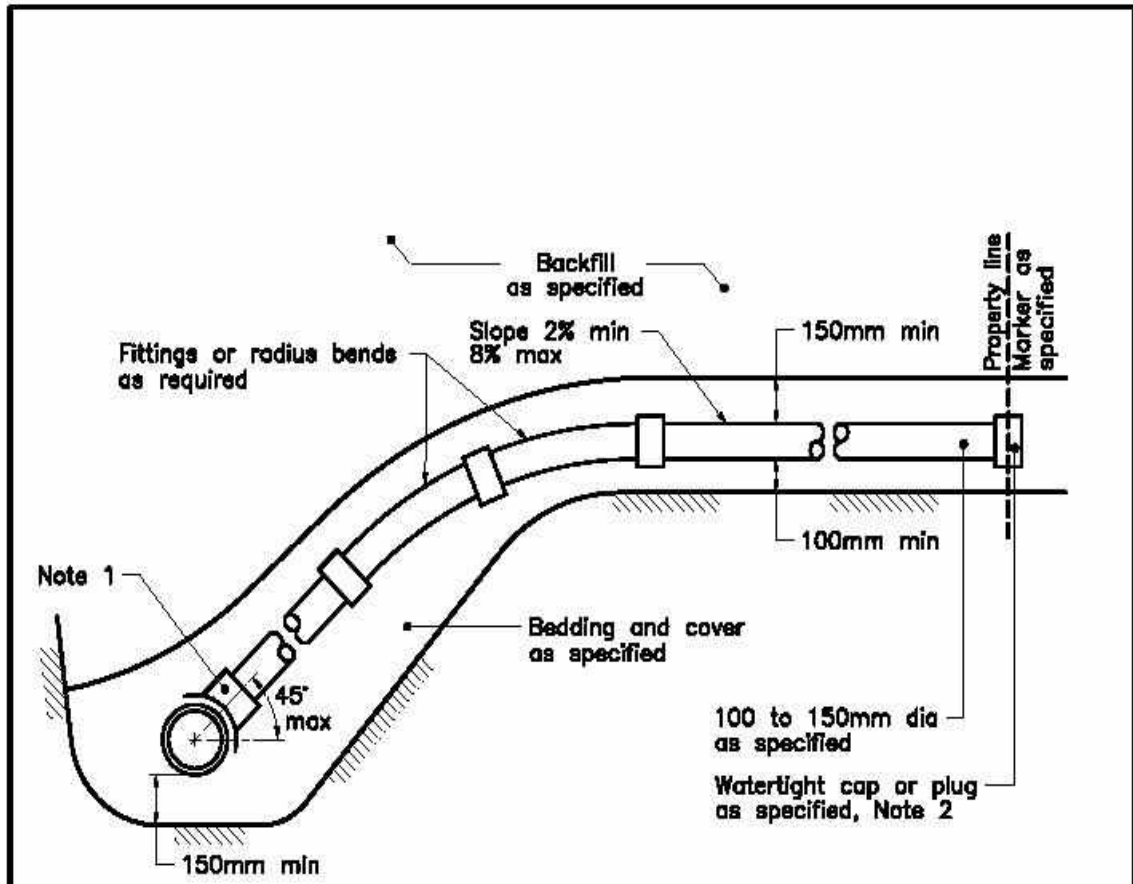


**CONNECTION WITH VERTICAL RISER**

**NOTES:**

- 1 Service connections to the main pipe sewer shall be made using factory made tees, strap-on-saddles, or other approved saddles.  
Factory made tees shall be used for all service connections where the diameter of the main pipe sewer is:
  - a) less than 450mm; or
  - b) less than twice the diameter of the service connection.
- 2 Vertical risers shall be as specified.
- 3 Cap or plug at property line shall be adequately braced to withstand testing pressures.
- A Maintenance holes shall be used at the main sewer to connect service connections greater than or equal to 200mm.
- B For new construction, saddles must be installed on the main pipe before that pipe is laid.
- C Approved cut-in tool must be used for field made connections.
- D All dimensions are in millimetres unless otherwise shown.

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Nov 2005	Rev 1	
<b>SEWER SERVICE CONNECTIONS FOR RIGID MAIN PIPE SEWER</b>			
<b>OPSD - 1006.010</b>			

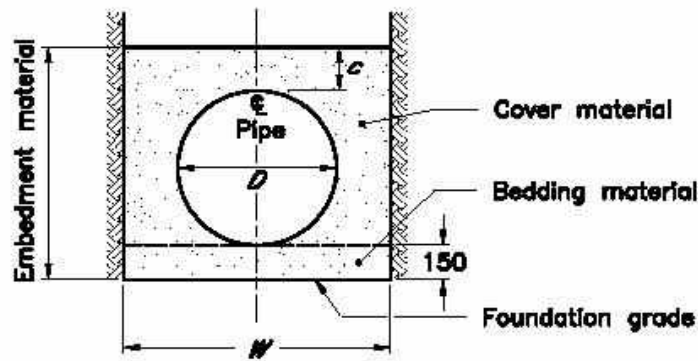


**NOTES:**

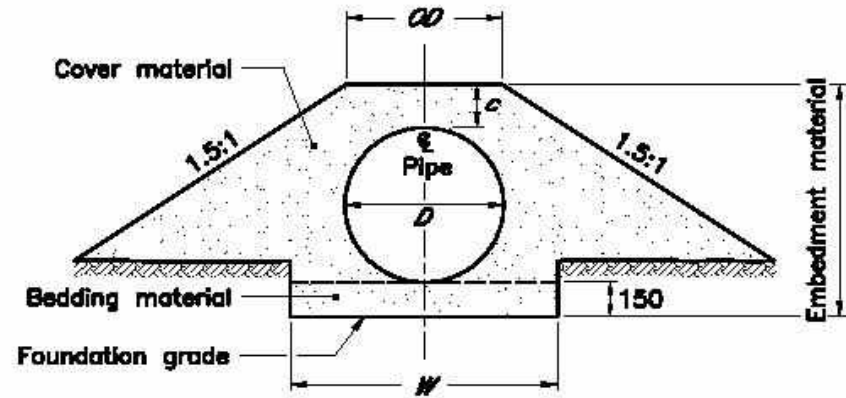
- 1 Service connections to the main pipe sewer shall be made using factory made tees or wyes, strap-on-saddles, or other approved saddles. Factory made tees or wyes shall be used for all service connections where the diameter of the main pipe sewer is:
    - a) less than 450mm; or
    - b) less than twice the diameter of the service connection.
  - 2 Cap or plug at property line shall be adequately braced to withstand testing pressures.
- A Maintenance holes shall be used at the main sewer to connect service connections greater than or equal to 200mm.  
 B For new construction, saddles must be installed on the main pipe before that pipe is laid.  
 C Approved cut-in tool must be used for field made connections.  
 D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2005	Rev 1	
<b>SEWER SERVICE CONNECTIONS FOR FLEXIBLE MAIN PIPE SEWER</b>			
<b>OPSD - 1006.020</b>			

**PIPE IN TRENCH**



**PIPE IN EMBANKMENT**



**EARTH AND ROCK EXCAVATION**

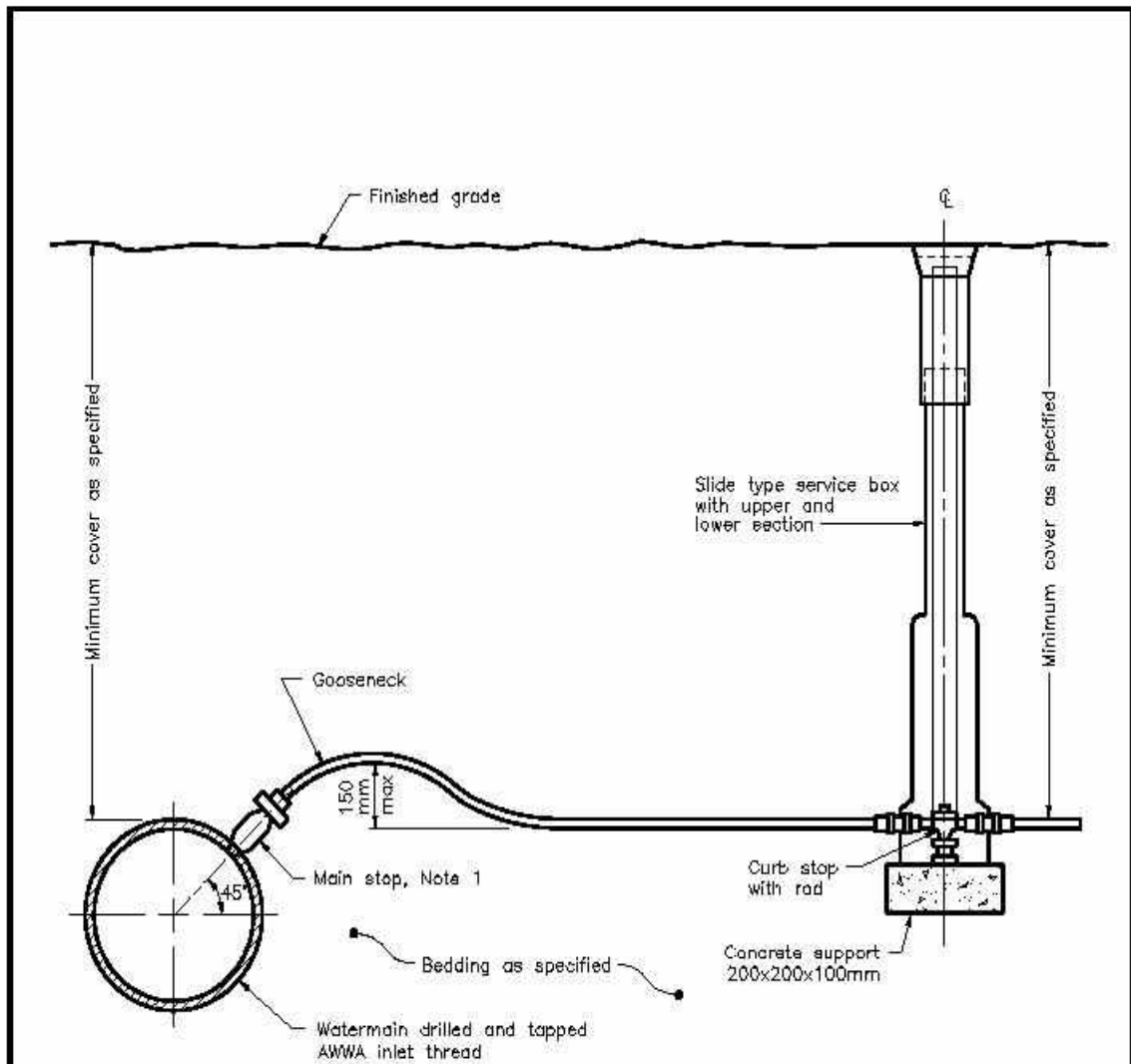
**NOTES:**

- A Backfill according to OPSD-803.04.
- B All dimensions are in millimetres unless otherwise shown.

**LEGEND:**

- $\text{Ø}$  - Outside diameter
- $D$  - Inside diameter
- $W$  - Minimum width of bedding  
 $D+800\text{mm}$  for  $D \leq 1000\text{mm}$   
 $1.67 \times D$  for  $D > 1000\text{mm} \ \& \ < 1800\text{mm}$   
 $D+1200\text{mm}$  for  $D \geq 1800\text{mm}$ .
- $c$  - Pipe Diameter  $< 600\text{mm}$   $c=300\text{mm}$ ,  
 Pipe Diameter  $\geq 600\text{mm}$   $c = \frac{D_{i\phi}}{4} + 300$

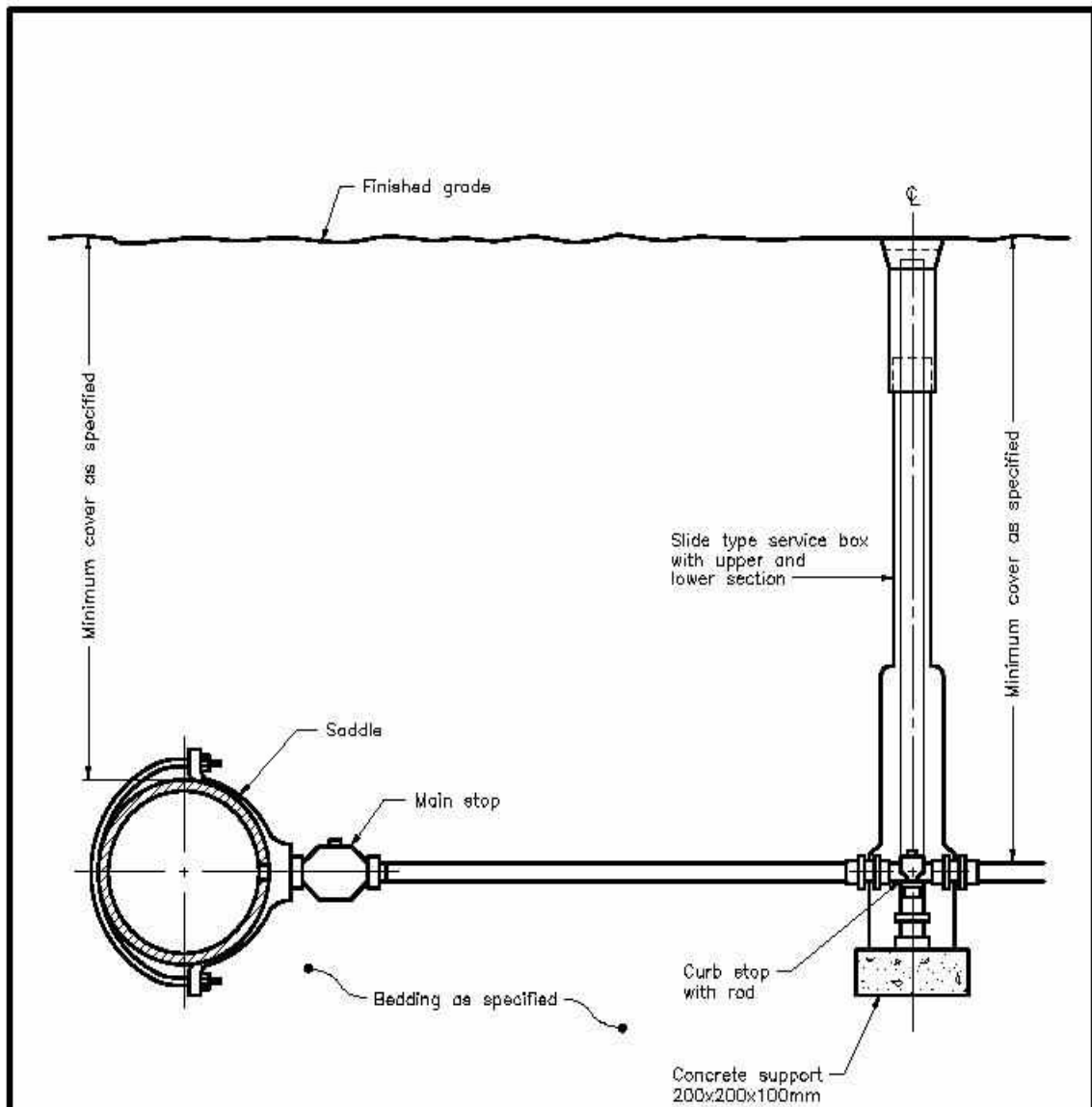
ONTARIO PROVINCIAL STANDARD DRAWING	Date	1992 03 12	Rev	1
<b>BEDDING FOR PRESSURIZED CONDUITS</b>	Date _____			
<b>FLEXIBLE PIPE</b>	<b>OPSD - 1102.02</b>			



**NOTES:**


- 1 For plastic service pipes, install main stop at 15° above horizontal with a minimum 1.2m long gooseneck.
- A Service connections to plastic watermains to be made using service saddles or factory made tees.
- B Couplings shall not be permitted unless the service length exceeds 20m between the main stop and curb stop.
- C All water services to be installed 90° to the longitudinal axis of the watermain.
- D All dimensions are in millimetres unless otherwise shown.

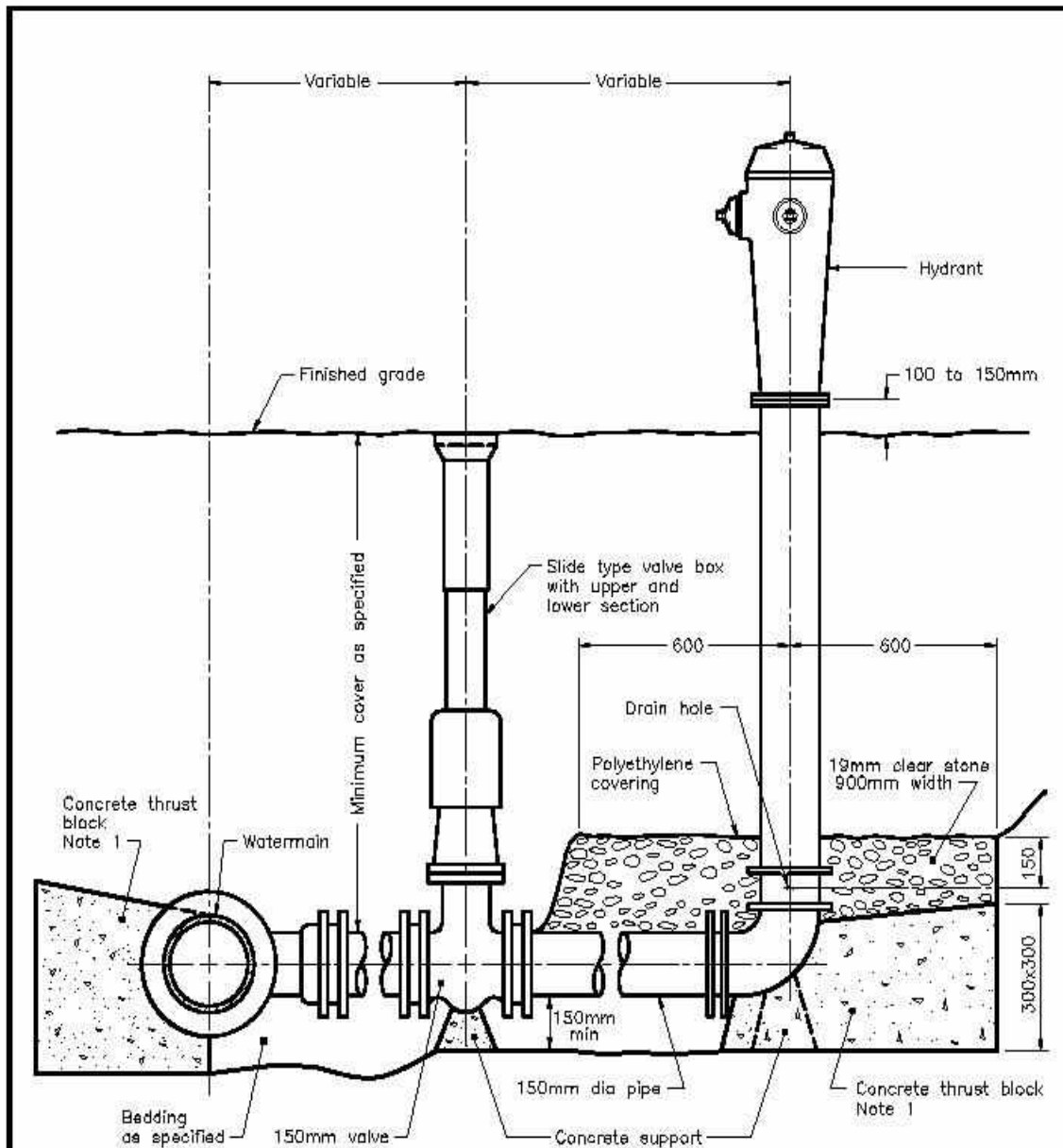
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 2	
<b>WATER SERVICE CONNECTION</b>			
19 and 25mm DIAMETER SIZES	<b>OPSD 1104.010</b>		



**NOTES:**

- A Any junction made in service pipe between main stop and curb stop to be made with approved couplings.
- B All water services to be installed 90° to the longitudinal axis of the watermain.
- C All dimensions are in millimetres unless otherwise shown.

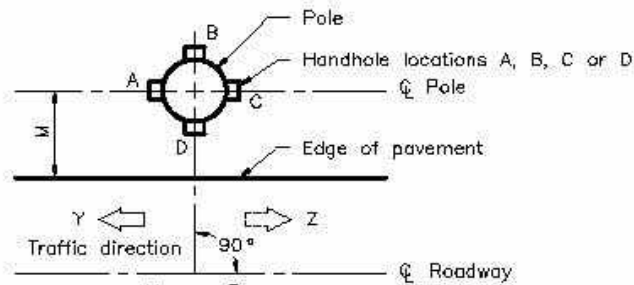
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1	
<b>WATER SERVICE CONNECTION</b> 32, 38, and 50mm DIAMETER SIZES			
<b>OPSD 1104.020</b>			



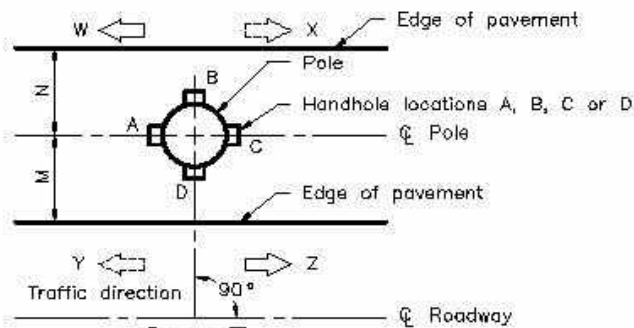
**NOTES:**

- 1 All concrete thrust blocks to be poured against undisturbed ground.
- A Bond breaker to be used between the concrete and the fittings and appurtenances.
- B Bolts and nuts for buried flange to flange connections are to be stainless steel.
- C When required, flange of standpipe extensions not to be in frost zone.
- D This OPSD is to be read in conjunction with OPSD 1103.010 and 1103.020.
- E All dimensions are in millimetres unless otherwise shown.

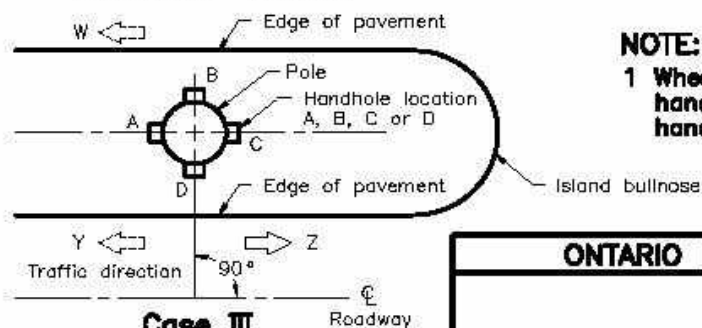
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1	
<b>HYDRANT INSTALLATION</b>			
<b>OPSD 1105.010</b>			



**Case I  
Along roadways**



**Case II  
Continuous median**



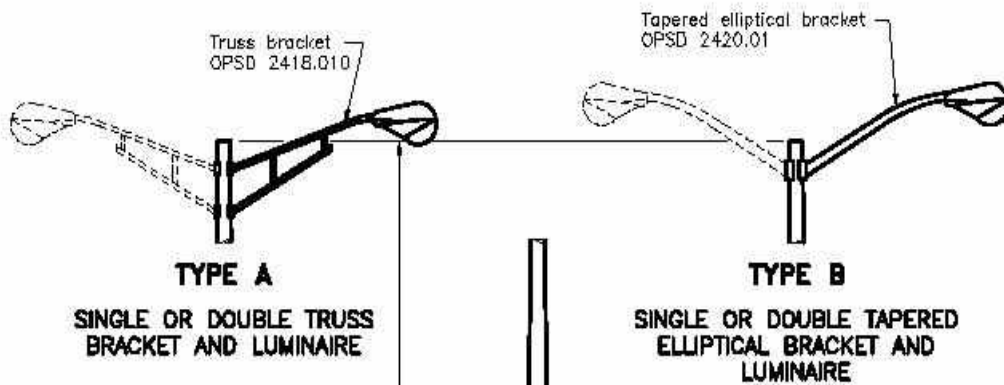
**Case III  
Islands and bullnoses**

Type of pole	Pole use	Case	Traffic direction	Handhole location
Concrete	Lighting	I	Y	A
		I	Z	C
		II	X and Y or W and Z	A or C
		II	W and Y	A
		II	X and Z	C
Steel or aluminum	Lighting (along roadway)	I	Y	B
		I	Z	B
		II	X and Y or W and Z	B or D for M=N B for N > M D for M > N
	Lighting (on structures)	I	Y	D
		I	Z	D
		II	X and Y or W and Z	B or D for M=N B for N > M D for M > N
Sectional steel	Lighting and traffic signals	I	Y	A (or B; Note 1)
		I	Z	C (or B; Note 1)
		II	W and Z or X and Y	A or C
		II	W and Y	A
		II	X and Z	C
		III	W and Z	A
III	W and Y	A		

**NOTE:**

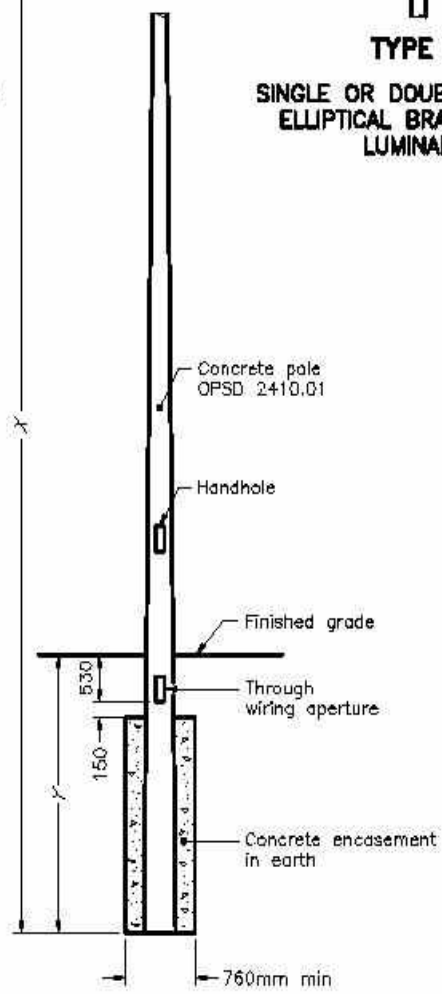
1 Where externally mounted traffic signal equipment interferes with the preferred handhole location, the pole shall be rotated 90° to give the alternative handhole location as indicated.

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Date	1985 04 15	Rev
<b>POLE HANDHOLE LOCATIONS</b>	Date _____		
	<b>OPSD – 2220.01</b>		



CONCRETE LIGHTING POLE Installation Data

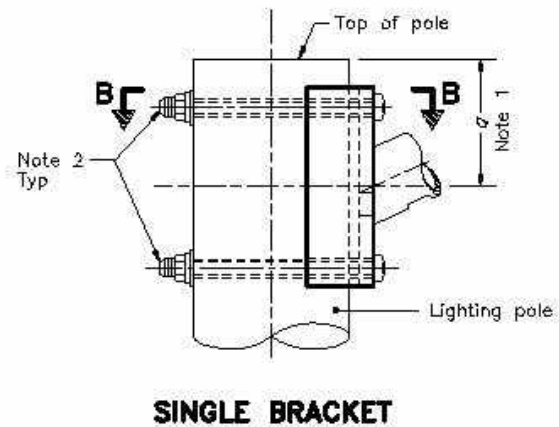
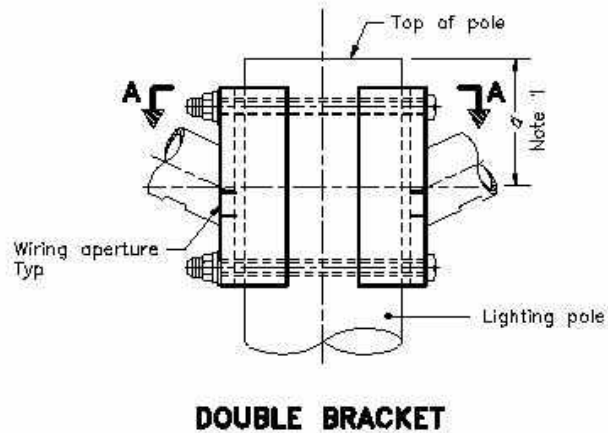
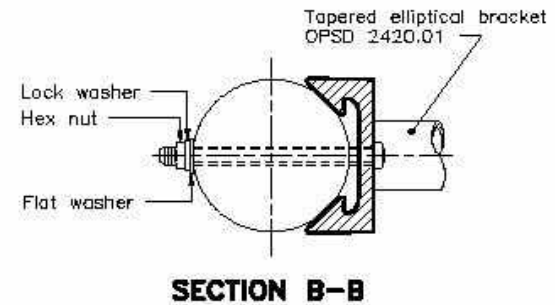
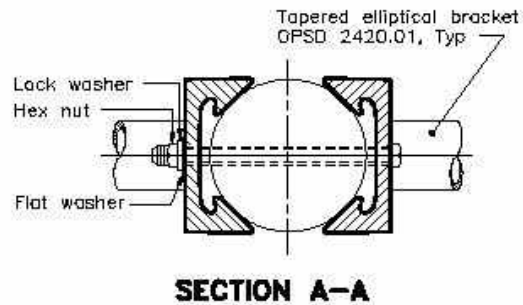
$X$ Pole Length m	$Y$ Burial Depth m
9.0	1.65
10.7	1.65
12.5	2.00
14.0	2.00
15.8	2.30
18.3	3.20
21.3	3.20



**NOTES:**

- A For installation in rock, this OPSD to be read in conjunction with OPSD 2200.02.
- B All dimensions are in millimetres unless otherwise shown.

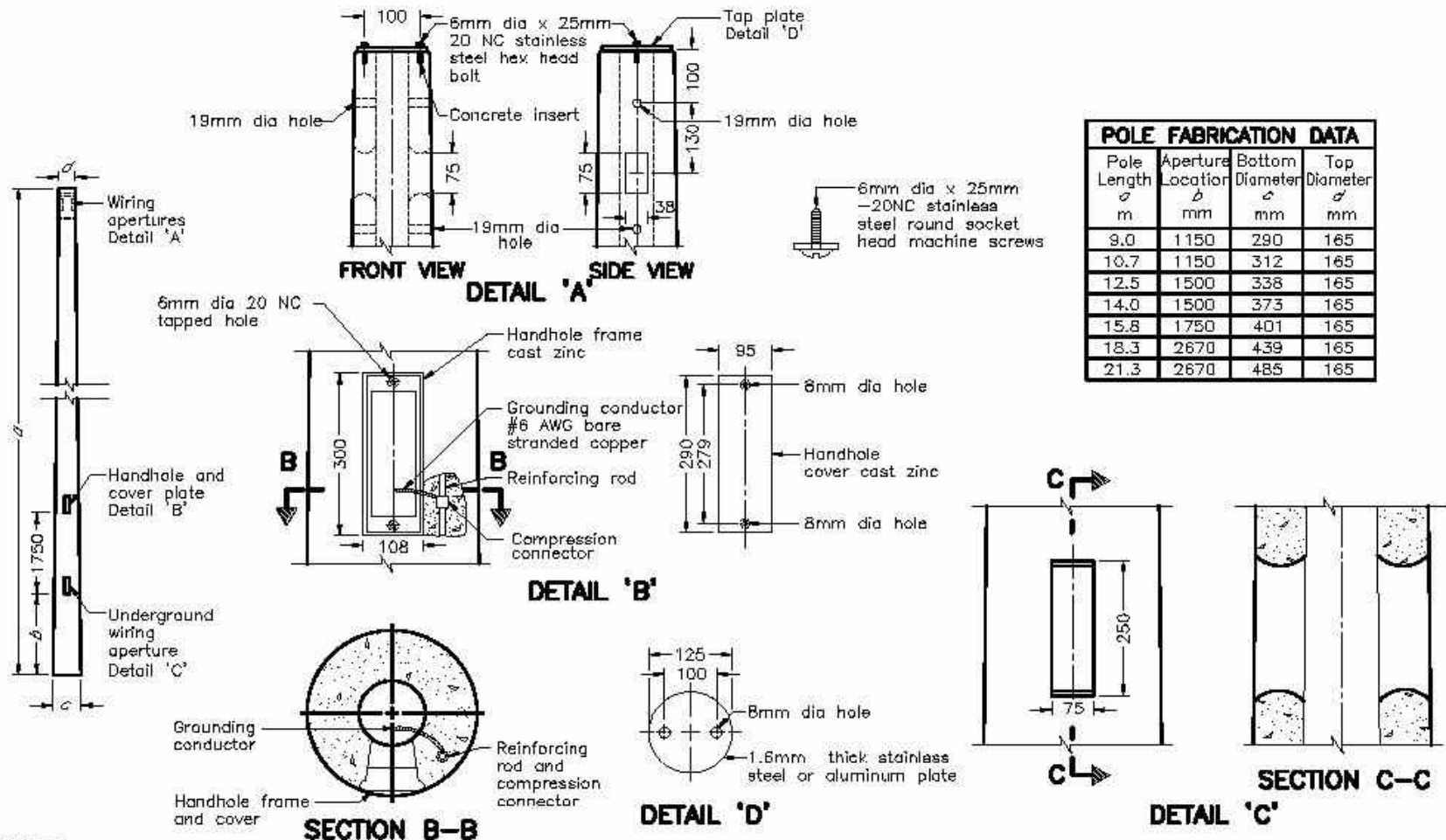
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 0	
<b>CONCRETE LIGHTING POLE DIRECT BURIED</b>			
<b>OPSD 2225.010</b>			



**NOTES:**


- 1 For sectional steel poles dimension  $a=300\text{mm}$ .  
For all other metal poles and concrete poles, dimension  $a=230\text{mm}$ .
- 2 16mm dia galvanized steel square head bolt. Bolt length to suit pole.

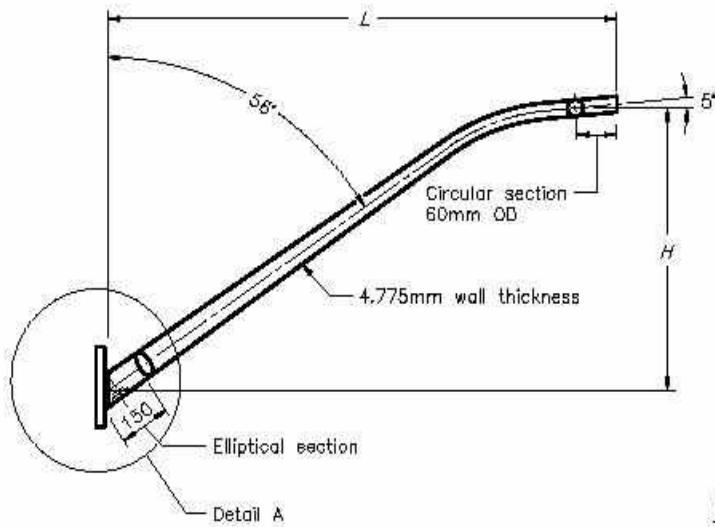
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2008	Rev 5	
<b>ALUMINUM TAPERED ELLIPTICAL BRACKETS ON METAL AND CONCRETE POLES</b>	-----		
MOUNTING DETAILS	<b>OPSD 2250.01</b>		



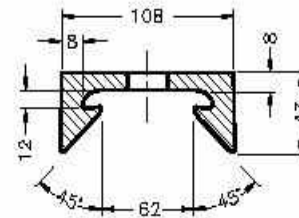
POLE FABRICATION DATA			
Pole Length <i>a</i> m	Aperture Location <i>b</i> mm	Bottom Diameter <i>c</i> mm	Top Diameter <i>d</i> mm
9.0	1150	290	165
10.7	1150	312	165
12.5	1500	338	165
14.0	1500	373	165
15.8	1750	401	165
18.3	2670	439	165
21.3	2670	485	165

**NOTE:**  
 A All dimensions are in millimetres or metres unless otherwise shown.

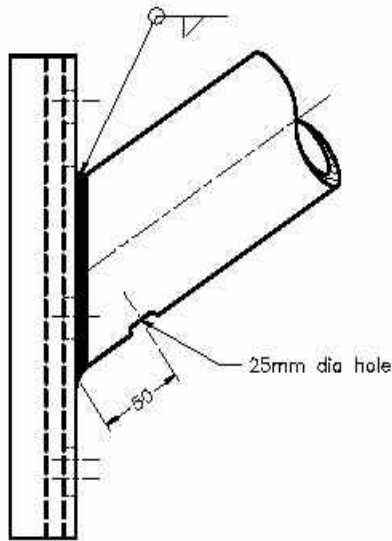
ONTARIO PROVINCIAL STANDARD DRAWING		1993 12 15	Rev 2
<b>SPUN CONCRETE POLE CLASS 'D'</b>		Date _____	
		<b>OPSD - 2410.01</b>	



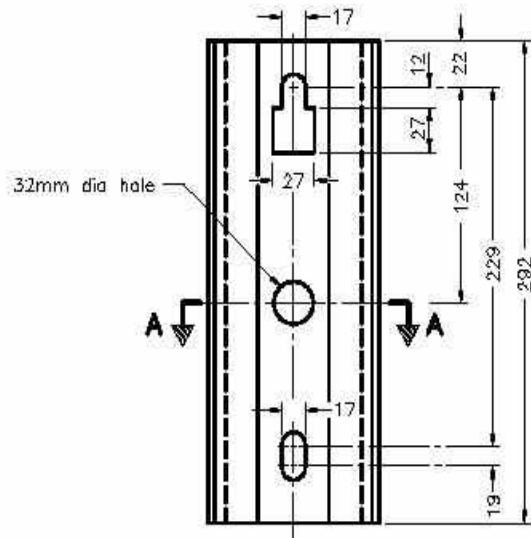
DIMENSION	BRACKET	
	1.8m	2.4m
L	1.8m	2.4m
H	0.9m	1.2m
Elliptical Section	64x108 mm OD	70x125 mm OD



**SECTION A-A**



**DETAIL A**

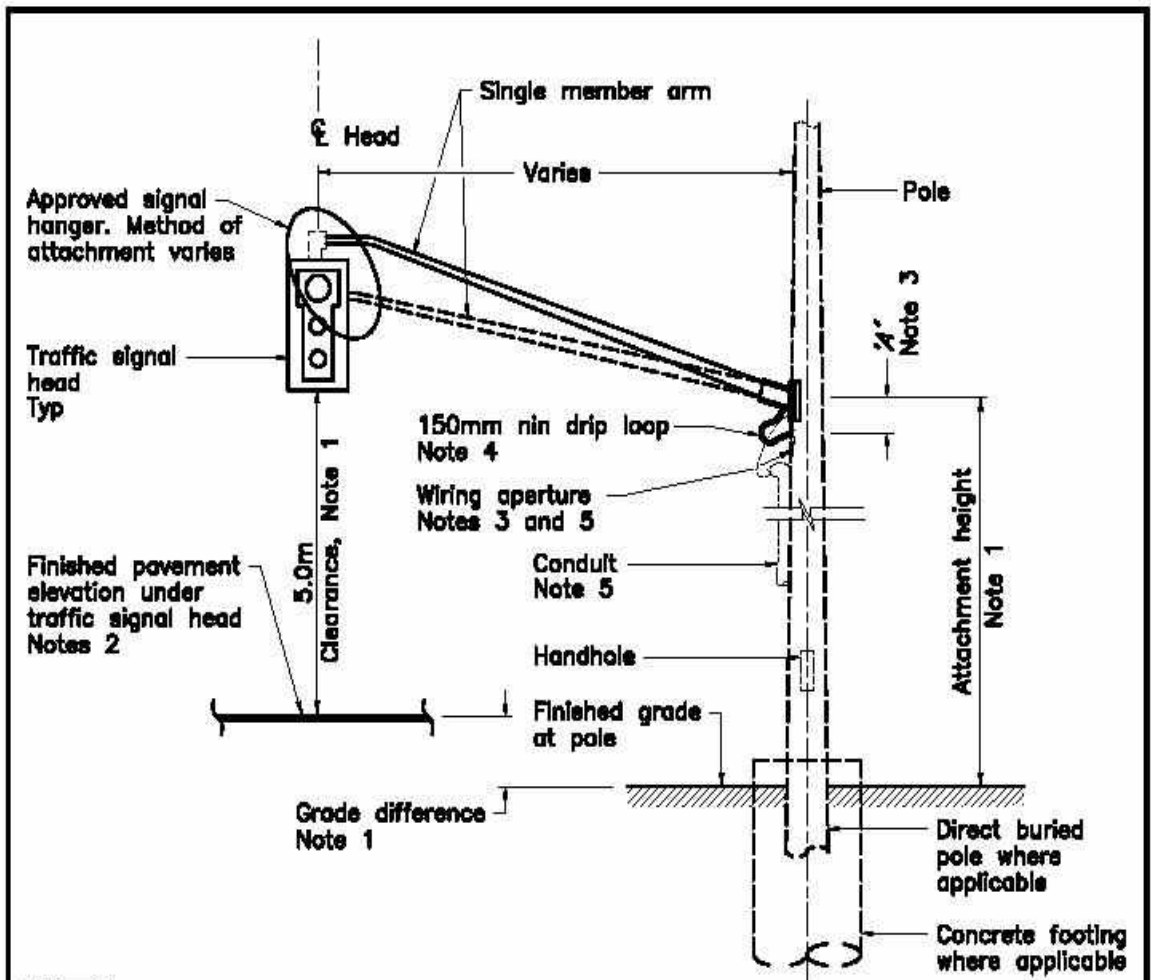


**BRACKET BASE PLATE**

**NOTES:**

- A For mounting details, see OPSD 2250.01.
- B All dimensions are in millimetres unless otherwise shown.

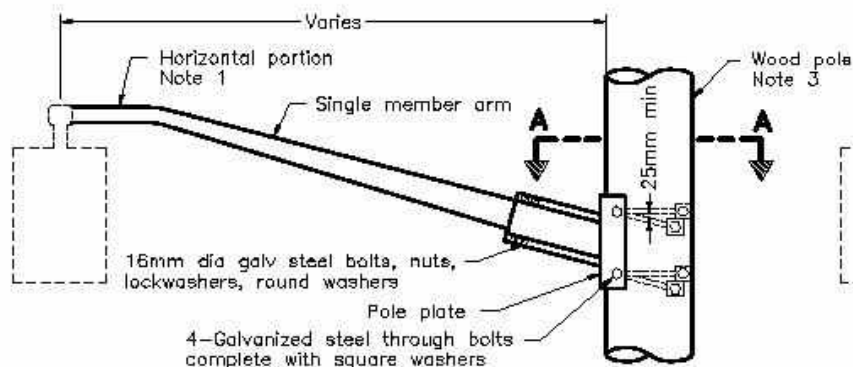
ONTARIO PROVINCIAL STANDARD DRAWING	April 2007	Rev 4	
<b>1.8m AND 2.4m ALUMINUM TAPERED ELLIPTICAL BRACKET</b>	-----		
<b>OPSD 2420.01</b>			



**NOTES:**

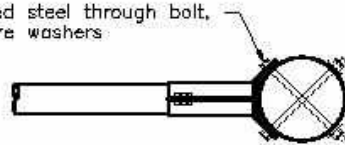
- 1 Where a grade difference exists, the attachment height shall be adjusted so that the 5.0m signal head clearance is obtained.
  - 2 Where the traffic signal head is not over the travelled portion of the pavement clearance shall be set using the elevation of the finished pavement at the edge of pavement directly in line with the arm.
  - 3 Wiring aperture to be field drilled at a dimension 'A' equal to the pole diameter at the point of arm attachment or 25mm below overlapping sectional steel joints. The aperture to be 25mm dia, de-burred, protected with zinc rich paint and fitted with a 20mm ID rubber grommet.
  - 4 Drip loops to be 450mm max. Loops between 300mm and 450mm in length to be banded to pole with 16mm stainless steel strapping.
  - 5 For external conduit system on wood or concrete poles refer to OPSD-2552.01 or OPSD-2554.01.
- A For orientation and location poles, arms and traffic signal heads refer to layout drawings.
- B For arm attachment details refer to OPSD-2500.02. For traffic signal head wiring details refer to OPSD-2528.01.
- C All dimensions are in millimetres or metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	1993 12 15	Rev 1	
<b>SINGLE MEMBER ARM AND SIGNAL HEAD</b>	Date _____		
<b>OPSD - 2501.01</b>			



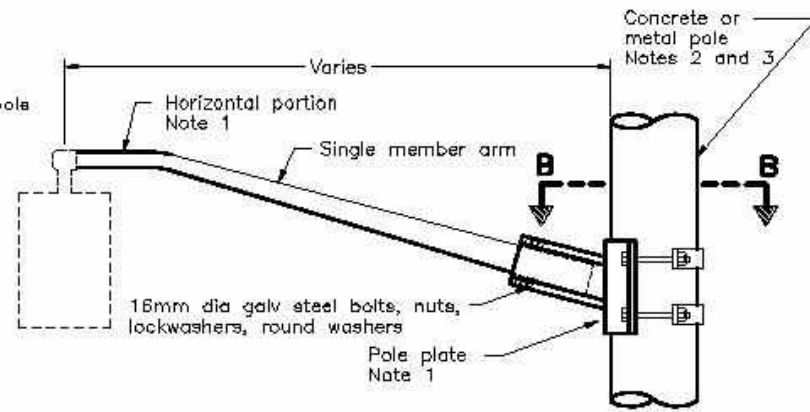
**GENERAL ARRANGEMENT**

16mm dia galvanized steel through bolt, complete with square washers



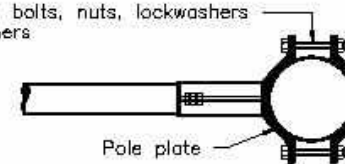
**SECTION A-A**

**ATTACHMENT TYPE 2, THROUGH BOLTS**  
Note 3



**GENERAL ARRANGEMENT**

16mm dia steel bolts, nuts, lockwashers and round washers



**SECTION B-B**

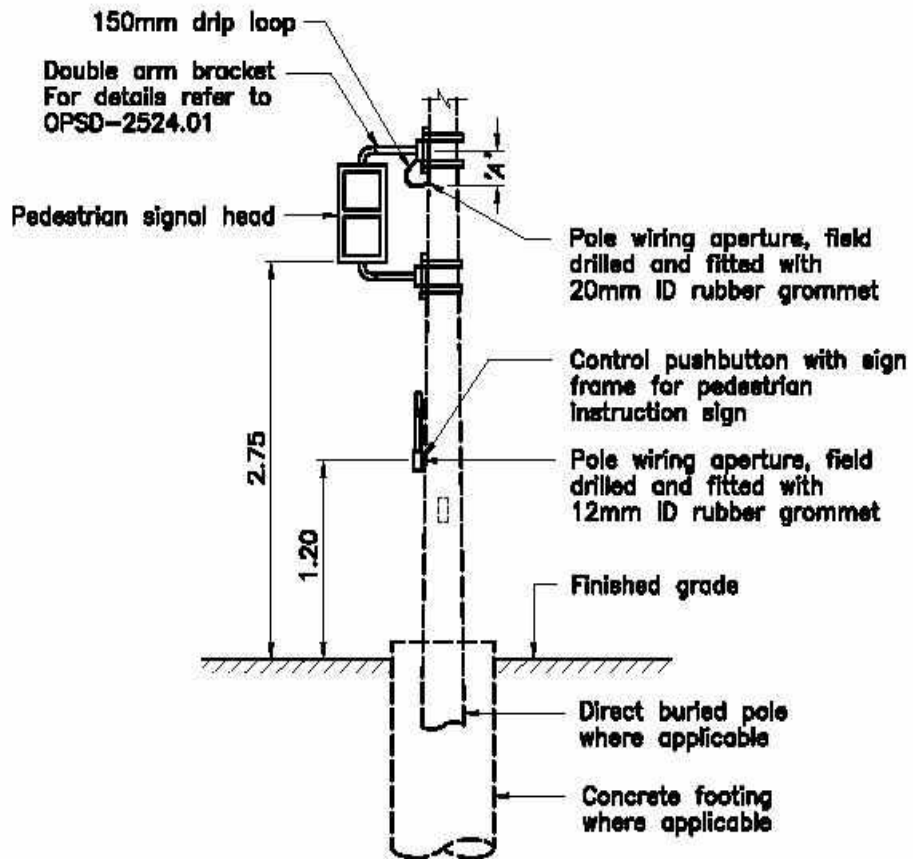
**ATTACHMENT TYPE 1, 'U' CLAMPS**  
Note 2

**NOTES:**

- 1 Pole plate bolts to be adjusted so that horizontal portion of arm is level.
- 2 Attachment type 1 shall be used for all metal poles and for all concrete poles less than 250mm diameter at the point of attachment. For all concrete poles greater than 250mm diameter at the point of attachment refer to construction detail drawings.
- 3 Attachment type 2 shall be used for all wood poles.
- A For pole attachment locations refer to OPSD-2501.01.

- B For brackets of 1.2 to 5.5m length using type 2 attachment, use 16mm through bolts with 50x50mm square washers.
- C For brackets 6.1 and 6.7m length using type 2 attachment, use 20mm through bolts with 75x75mm square washers.
- D All dimensions are in millimetres or metres unless otherwise shown.

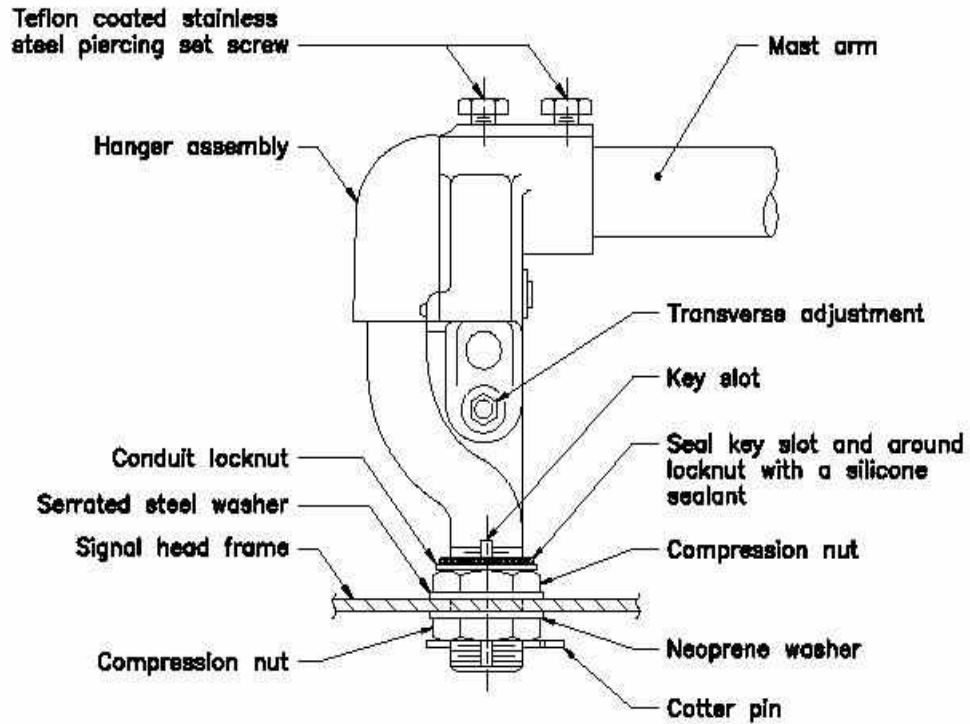
ONTARIO PROVINCIAL STANDARD DRAWING		Date	1985 04 15	Rev	
<b>ALUMINUM SINGLE MEMBER ARM ATTACHMENT DETAILS</b>		Date _____			
		<b>OPSD - 2501.02</b>			



**NOTES:**


- A Dimension 'A' to be equal to the pole diameter at the point of attachment.
- B For orientation of signal head, pedestrian pushbutton and instruction sign, refer to traffic signal layout.
- C All dimensions are in millimetres or metres unless otherwise shown.

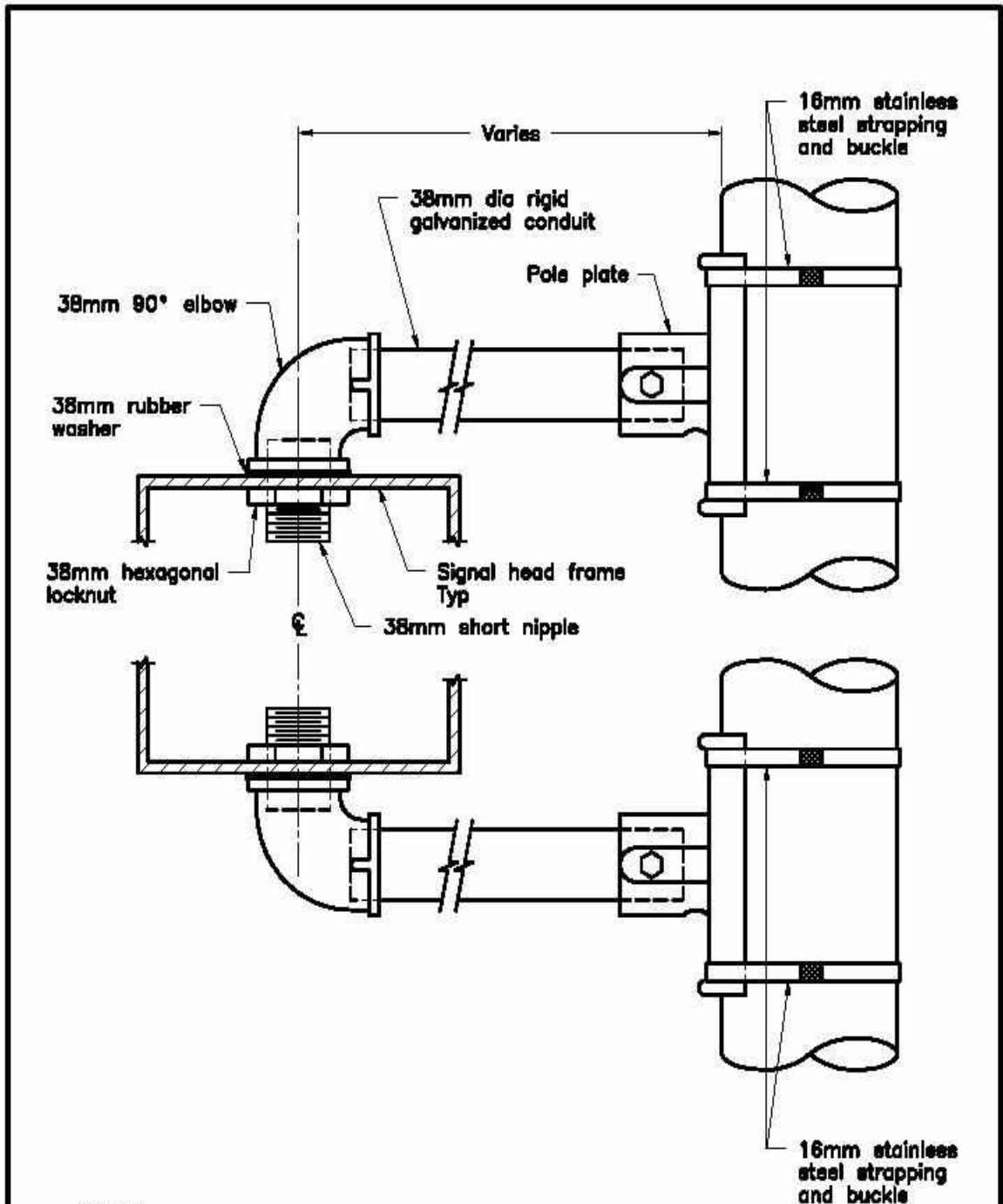
ONTARIO PROVINCIAL STANDARD DRAWING	Date	1985 04 15	Rev
<b>TRAFFIC SIGNAL</b> PEDESTRIAN HEAD AND PUSHBUTTON MOUNTED ON POLE	Date _____		
<b>OPSD - 2505.01</b>			



**NOTE:**

A This OPSD to be read in conjunction with OPSD 2501.01 and 2501.02.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2007	Rev 0	
<p style="text-align: center;"><b>TRAFFIC SIGNAL</b> CUSHION HANGER</p>	<p style="text-align: center;">----- -----</p>		
	<b>OPSD 2522.010</b>		



**NOTE:**

A All dimensions are in millimetres or metres unless otherwise shown.

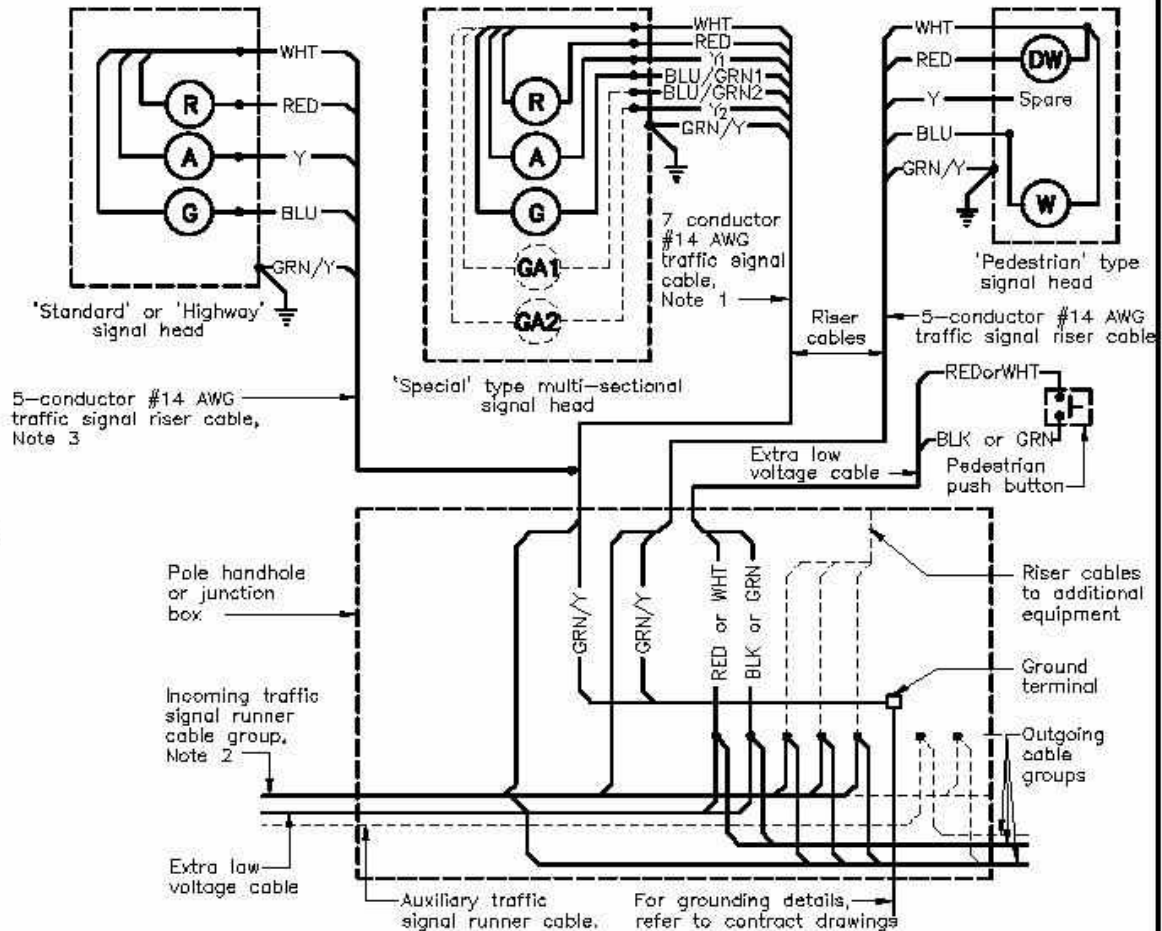
<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Date	1985 04 15	Rev	
	Date _____			
<b>TRAFFIC SIGNAL DOUBLE ARM BRACKET</b>		<b>OPSD - 2524.01</b>		

**NOTES:**

- 1 7 conductor riser cable to be installed to all 'Special' multi-sectional signal heads.
- 2 Riser cable connection to be made to the designated conductor in the cable group as indicated in the contract drawings, together with connection to the outgoing conductor.
- 3 5-conductor riser cable to be installed to all 'Standard' or 'Highway' signal heads.
- A For traffic signal cable groups, abbreviations and colour coding, refer to contract drawings.
- B Details shown are typical only. For multiple equipment installations on the same pole, maintain riser cable type and colour coding and connect to the designated conductors shown on the contract drawings.
- C Green conductors 'with yellow tracer' used as ground shall be tagged 'Ground' in the pole handhole or junction box.

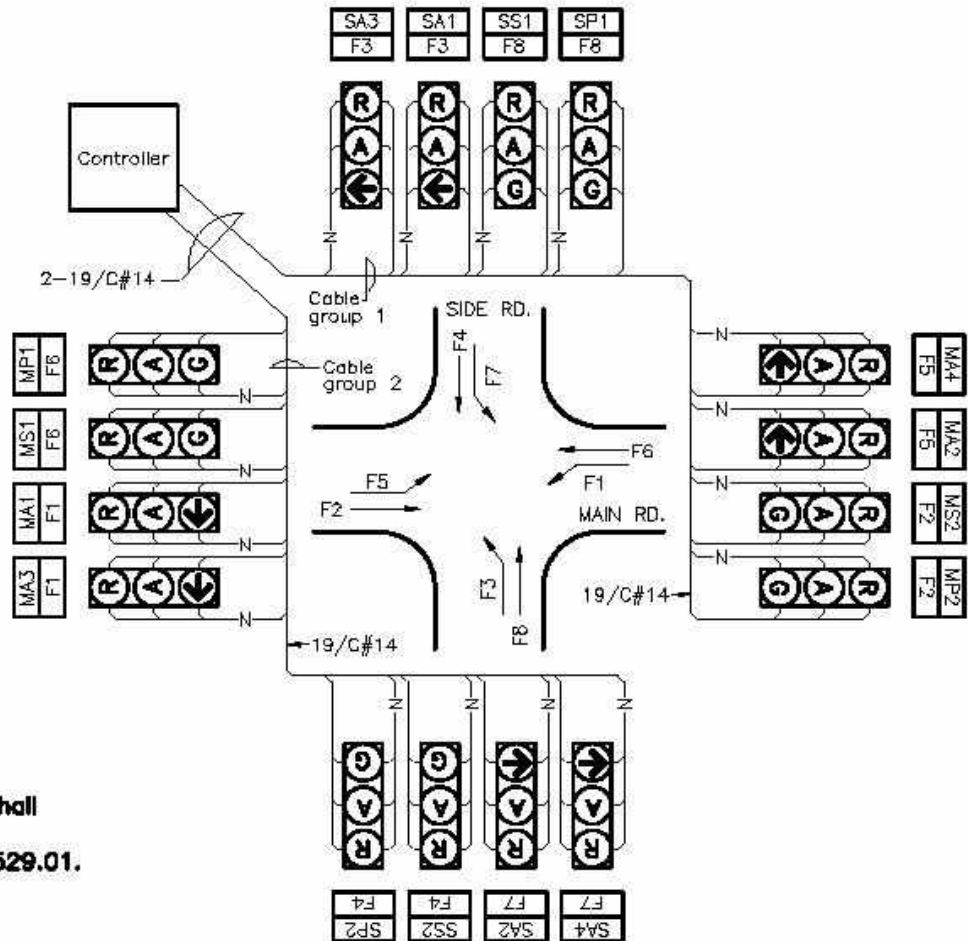
**CABLE COLOUR ABBREVIATIONS**  
Colour,/Marker or Colour/Marker

ABBREVIATION	DESCRIPTION
BLU/GRN 1	Blue with 'green one' marker
BLU/GRN 2	Blue with 'green two' marker
Y <sub>1</sub>	Yellow with marker - Y <sub>1</sub>
Y <sub>2</sub>	Yellow with marker - Y <sub>2</sub>
RED	Red
BLU	Blue
GRN/Y	Green with yellow tracer
BLK	Black
WHT	White
GRN	Green



<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Date   1991 10 30   Rev   1
<b>TRAFFIC SIGNAL EQUIPMENT POLE WIRING DIAGRAM</b>	Date _____
<b>OPSD - 2528.01</b>	

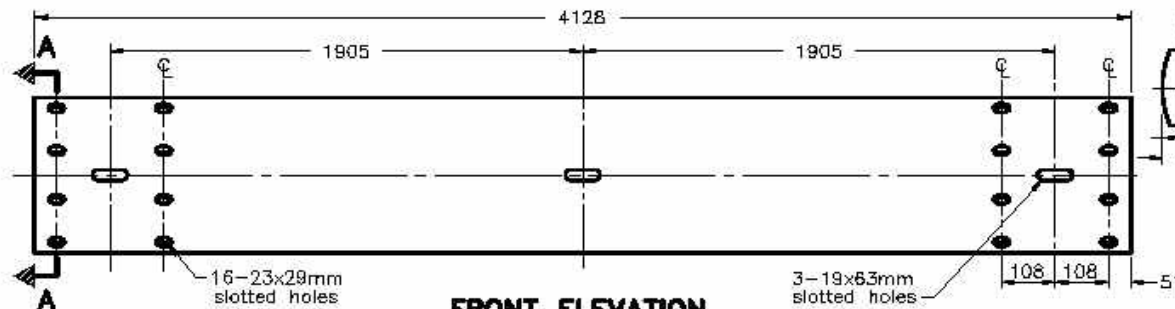
Cond #	Colour/Mark	Cable Group 1	Cable Group 2
1	White/White One	Main Rd. Neutral	Main Rd. Neutral
2	White/White Two	Side Rd. Neutral	Side Rd. Neutral
3	Black	Spare	Spare
4	Orange	Spare	Spare
5	Red/Red One	Main Rd. Red-F2	Main Rd. Red-F6
6	Red/Red Two	Main Rd. LT.Red-F5	Main Rd. LT.Red-F1
7	Red/Red Three	Side Rd. Red-F8	Side Rd. Red-F4
8	Red/Red Four	Side Rd. LT.Red-F3	Side Rd. LT.Red-F7
9	Red/Red Five	Spare	Spare
10	Yellow/Amber One	Main Rd. Amb-F2	Main Rd. Amb-F6
11	Yellow/Amber Two	Main Rd. LT.Amb-F5	Main Rd. LT.Amb-F1
12	Yellow/Amber Three	Side Rd. Amb-F8	Side Rd. Amb-F4
13	Yellow/Amber Four	Side Rd. LT.Amb-F3	Side Rd. LT.Amb-F7
14	Yellow/Amber Five	Spare	Spare
15	Blue/Green One	Main Rd. Green-F2	Main Rd. Green-F6
16	Blue/Green Two	Main Rd. LT.Gr-F5	Main Rd. LT.Gr-F1
17	Blue/Green Three	Side Rd. Green-F8	Side Rd. Green-F4
18	Blue/Green Four	Side Rd. LT.Gr-F3	Side Rd. LT.Gr-F7
19	Blue/Green Five	Spare	Spare



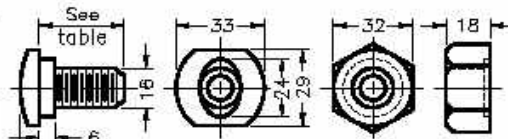
**NOTES:**

- A Connections shown are general and typical and shall be adjusted to suit intersection layout.
- B For Legend and pedestrian facilities see OPSD-2529.01.
- C The system shown requires ducts all around the intersection.

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b>	Date	1991 10 30	Rev	
<b>SIGNAL WIRING</b>	Date _____			
USING 19/C CABLE TAPPED, 2 TO 8 PHASE	<b>OPSD - 2529.07</b>			

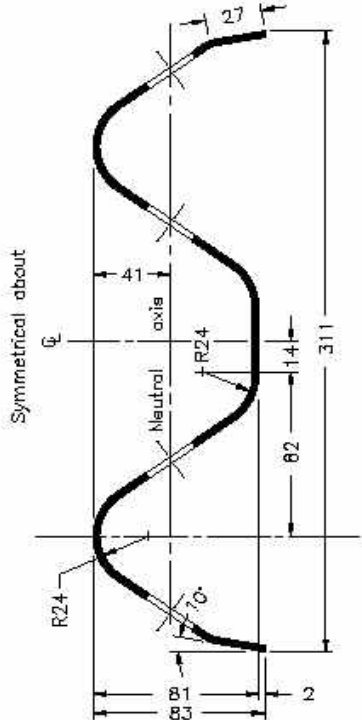


**FRONT ELEVATION**

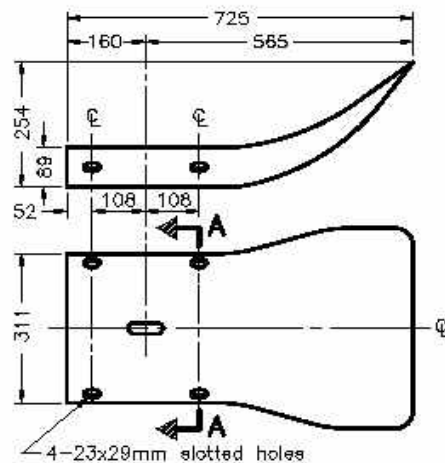


**SPLICE BOLT AND NUT**

SPLICE BOLT LENGTH	
Location	Length mm
At posts	32
At structure anchor	38

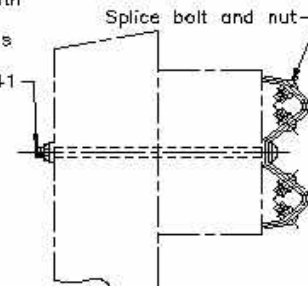


**ENLARGED SECTION A-A**  
Note 1



**TERMINAL SECTION**


Fast bolt and nut with washer as directed on assembly drawings OPSD-912.130, 912.140, and 912.141



**ARRANGEMENT AT POST**  
Wood Post Shown

**NOTES:**

- 1 Thickness of rail to be 2.5mm.
- A All dimensions subject to manufacturing tolerances unless otherwise indicated.
- B All dimensions are in millimetres unless otherwise shown.

<b>ONTARIO PROVINCIAL STANDARD DRAWING</b> <b>GUIDE RAIL SYSTEM, STEEL BEAM</b> <b>RAIL</b> <b>COMPONENT</b>	Nov 2002 _____ _____ <b>OPSD - 912.101</b>	Rev 1 _____ _____ 
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**SECTION VI**  
**STANDARD SUBDIVISION AGREEMENT**  
**& LETTER OF CREDIT**

**THIS SUBDIVISION AGREEMENT** is made in quadruplicate this \_\_\_\_ day of \_\_\_\_\_, 2008, A.D.

**BETWEEN:** \_\_\_\_\_

hereinafter called the "Owner"

**OF THE FIRST PART**

**AND: THE CORPORATION OF THE CITY OF CORNWALL**

hereinafter called the "City"

**OF THE SECOND PART**

**WHEREAS** the Owner is the Owner of the lands described in the Schedule "A" of this Agreement and proposed to subdivide and register a Plan of Subdivision for :

---

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(description of lands)

**AND WHEREAS** the City has recommended to the Minister that the Owner shall be required to construct and install certain public services hereinafter referred, to serve such Plan, which work shall be done by Private Contractor at the expense of the Owner, and to undertake to make such financial arrangements with the City for the installation and construction of the said services before requiring the approval of the said Plan by the Minister;

**AND WHEREAS** the Owner is required by the City to grant certain lands referred to herein for drainage purposes or other municipal purposes;

**AND WHEREAS** the City has approved this subdivision subject to the execution of this Agreement in relation to the planning and development of the lands contained in Schedule "A";

**AND WHEREAS** the Owner purports to be the Owner of the said lands and has applied to the Minister of Municipal Affairs for approval of a Plan of Subdivision and such approval has been granted, subject to the execution of this Agreement;

**AND WHEREAS** the City has entered into a Service Extension Agreement with the owner of the subject lands, \_\_\_\_\_, which agreement is dated the \_\_\_\_ day of \_\_\_\_\_, 200\_ for the watermain, storm and sanitary sewer extensions of mains as well as for the granular roadway structure of the south end of \_\_\_\_\_ on Part of Lot \_\_\_\_\_, Concession (south end of \_\_\_\_\_ Subdivision Phase \_\_\_\_\_) for the construction of a model home for the proposed future subdivision development);

**NOW THEREFORE THIS INDENTURE WITNESSETH** that, in consideration of the sum of One Dollar (\$1.00) of lawful money of Canada and other good and valuable consideration, now paid by the City to the Owner (the receipt whereof is hereby acknowledged), and in consideration of the mutual covenants hereinafter expressed, the parties hereto covenant and agree with the other as follows:-

In this Agreement:

1. **DEFINITIONS**

- |  |  |
|--|--|
| "Consultant"                                     | includes the Civil Engineering Consultant engaged by the Owner to design the facilities and/or supervise the construction.                             |
| "Engineer"                                       | means the Manager of Engineering Services appointed by the Council of the City of Cornwall.  |
| "Maintain"                                       | includes repair and/or replace.  |
| "Plan" or "Plan of Subdivision" or "Subdivision" | means the proposed Plan of Subdivision submitted by the Owner for approval and includes the lands described in Schedule "A" and shown in Schedule "J". |
| "Works"  | includes those services and other works listed in Schedule "B" of this Agreement.  |

2. **INDEX AND SCHEDULES**

This Agreement includes the following clauses:-

1. Definitions
2. Index and Schedules
3. Agreement Registered Against Lots
4. Subdivision Approval
5. Time Limitation of Agreement
6. Responsibility of Construction and Costs
7. Financing
8. Financial Requirements
9. Save Harmless
10. Liability Insurance
11. Payment of Taxes
12. Local Improvement Charges
13. City Administration Fee
14. City Expenditures Borne by Owner
15. Monies Held Back by Owner
16. Easements and Land Dedications
17. 300mm Reserves
18. Agreements with Utilities
19. Engineering by Professional Engineer
20. Design Information
21. Specifications
22. Drainage Report
23. Existing Drains Within Subdivision
24. Sanitary Sewer
25. Storm Sewer
26. Rear Yard Catchbasins
27. Watermains & Maintenance
28. Opening of Valves, Etc.
29. House Services

30. Roads and Maintenance
31. Street Lighting
32. Estimate of Cost
33. Signs
34. Testing
35. City Rights Re: Construction, Inspection, and Stop Work
36. Prosecution of Work
37. Emergency Repairs
38. Actions Not Deemed Acceptance
39. Lot Grading and Grade Control Plan
40. Interim Grading of Open Lots
41. Maintenance of Lot Drainage
42. Design Changes
43. Building Permits
44. Occupancy
45. Boulevard Tree Planting
46. Lots Unsuitable for Building Purposes
47. Fill, Debris, Etc.
48. Construction Lien Act
49. Statutory Declaration
50. O.L.S. Certificates
51. Guaranteed Maintenance Period
52. Engineer's Recommendation of Final Acceptance
53. Assumption by City
54. Special Provisions
55. Location Notices to be Served

The following Schedules shall be attached to and form part of this Agreement:-

- |     |  |
|-----|--|
| "A" | Description of Lands to which this Agreement applies |
| "B" | Works to be Provided by Owner                        |
| "C" | Estimated Cost of the Works                          |
| "D" | Financial Requirements                               |

"E"	Subdivision Charges
"F"	Easements and Land Dedications
"G"	Design Criteria and Specifications for: <ul style="list-style-type: none"> <li>- Roads, Curb and Gutters, Signs and Sidewalks</li> <li>- Storm Sewers</li> <li>- Sanitary Sewers</li> <li>- Watermains</li> <li>- Street Lighting</li> <li>- Ancillary</li> </ul>
"H"	Phasing of Construction
"I"	List of Engineering Consultant(s)
"J"	Approved Draft Plan of Subdivision
"K"	Plan of Subdivision
"L"	Approved Set of Engineering Drawings
"M"	Agreement between Owner and Cable TV Company
"N"	Agreement between Owner and Electric Company
"O"	Agreement between Owner and Gas Company
"P"	Agreement between Owner and Telephone Company
"Q"	Drainage Report
"R"	Agreement between Owner and Canadian National Railway Company
"S"	Requirements for Maintenance of Facilities
"T"	Lot Grading Agreement

3. **AGREEMENT REGISTERED AGAINST LOTS**

The Owner hereby agrees that this Agreement may be registered against the lots contained in the Plan of Subdivision at the expense of the Owner.

4. **SUBDIVISION APPROVAL**

The Owner covenants and agrees that it will not subdivide any block on the Plan without the execution of a supplementary Subdivision Agreement.

5. **TIME LIMITATION OF AGREEMENT**

In the event that the proposed Plan of Subdivision has not been registered within three (3) years from the date of this Agreement, the City may, at its option, on one (1) month's notice to the Owner, declare this Agreement to be null and void.

6. **RESPONSIBILITY OF CONSTRUCTION AND COSTS**

The Owner covenants and agrees to construct and install all of the works more particularly set out in Schedule "B" annexed hereto. The said works shall be constructed and completed at the expense of the Owner in a good and workmanlike manner under the supervision of the Engineer and Consultant.

7. **FINANCING**

The Owner covenants to comply with all other financial requirements provided herein and as set out in Schedule "D".

8. **FINANCIAL REQUIREMENTS**

The Owner shall file with the City an Irrevocable Letter of Credit from a Chartered Bank with drawing rights for not less than one (1) year from date of issue and in the amount of not less than one hundred (100%) percent of the "Total X" of Schedule "D" attached, this being the total of the Consultant's approved estimate of quantities and prices, by item, for the construction of all underground facilities plus the estimated cost of site inspection associated with these works and the project administration by the Consultant, which approved estimate shall be dated not more than three (3) months prior to the date of the Letter of Credit, plus the City Administration Fee of two (2%) percent of the total estimated cost of constructing the facilities, plus the underground installation costs of utility companies.

From time to time during the construction of underground facilities, the Consultant shall prepare a Progress Certificate indicating the total amount of work completed as of the date of the Progress Certificate. Upon certification of the Progress Certificate by the Engineer, the City may reduce the balance of the Letter of Credit by the "Total Balance Due" (this being the difference between the "Total Work Performed to Date" and the "Total Paid to Date") less ten (10%) percent of the "Total Work Performed to Date". At no time will the Letter of Credit be reduced to below the value of the "Total Y" of Schedule "D".

Upon satisfactory completion of the works and the issuing of the letter of preliminary acceptance of the facilities, the holdback will be reduced to five (5%) percent plus the value of uncompleted works (if any). The five (5%) percent holdback will be released upon expiry of the Guaranteed Maintenance Period.

9. **SAVE HARMLESS**

The Owner hereby covenants and agrees to indemnify and save harmless the City from all actions, causes of action, suits, claims, or demands whatsoever which arise directly or by reason of development of the Plan of Subdivision herein and the construction and maintenance of the Works until such Works have received final acceptance from the City.

10. **LIABILITY INSURANCE**

The Owner shall take out and keep in force until the date of final acceptance of the entire work by the Engineer, a comprehensive policy of public liability and property damage insurance acceptable to the Engineer providing insurance coverage in respect to any one accident to the limit of at least \$2,000,000, exclusive of interest and cost, against loss or damage resulting from bodily injury to or death of one or more persons and loss of or damage to property and such policy shall name the City as an additional insured thereunder and shall protect the City against all claims for all damage or injury including death to any person or persons and for damage to any property of the City of any other public or private property resulting from or arising out of any act or omission on the part of the Owner or any of his servants or agents during the execution of the construction, and the Owner shall forward with the executed Subdivision Agreement a certified copy of the policy or certificate thereof, as the City may direct. The policy shall not have any exclusion for blasting.

11. **PAYMENT OF TAXES**

(a) That the Owner agrees to pay all arrears of taxes outstanding against the property herein described before the approval of the said Plan is required.

(b) That the Owner further undertakes and agrees to pay all taxes levied, or to be levied, on the said lands on the basis of and in accordance with assessment and collector's roll entries appearing from time to time.

12. **LOCAL IMPROVEMENT CHARGES**

The Owner hereby agrees to pay all frontage charges with respect to existing local improvements assessed against the property on the said Plan of Subdivision which will become non-assessable when the said Plan is approved. Such payment is to be made in full by the Owner before approval is given to the engineering drawings.

13. **CITY ADMINISTRATION FEE**

The Owner agrees to pay in cash to the City, prior to the commencement of construction of the underground facilities, two (2%) percent of the total estimated cost of constructing the facilities as required herein as full payment for processing of plans and engineering supervision including, without limiting the generality of the foregoing, examination of proposals, plans and specifications, checking of designs and general supervision of the Consultant and construction.

14. **CITY EXPENDITURES BORNE BY OWNER**

The Owner agrees to pay to the City charges for all engineering and legal services at the standard professional engineering

and legal rates only if the City is forced to become actively involved in the subdivision as a direct result of a default on the part of the Owner.

The Owner shall pay all City of Cornwall accounts within thirty (30) days of their receipt. Failure to pay will constitute default under the terms of the Letter of Credit.

15. **MONIES HELD BACK BY OWNER**

The Owner agrees that it will hold back in its payment to any contractors who may construct the Works, such sums as provided in accordance with the Construction Lien Act and will otherwise indemnify the City against any claims, actions, or demands for liens or otherwise in connection with the Works, and all costs in connection therewith and on demand of the Engineer will forthwith take such steps to immediately discharge all liens upon the Works.

16. **EASEMENTS AND LAND DEDICATIONS**

At no cost to the City, the Owner will grant to the City easements and land required for municipal drainage and other purposes in accordance with Schedule "F" annexed hereto.

Lands to be conveyed for park purposes shall be graded and drained in accordance with the "Park Improvement Plan" showing cadastral, topographic, grading, tree planting, and shall be serviced with a water lateral to the street line, topsoiled, seeded and fenced to the satisfaction of the City's Manager of Parks and Recreation, such work to be completed within one year of registration of the Plan of Subdivision or within such other period as the Manager of Parks and Recreation may determine, plus seven thousand, five hundred (\$7,500.00) dollars per hectare to an upset limit of twenty thousand (\$20,000.00) dollars for park equipment. For the purposes of park equipment, the twenty thousand (\$20,000.00) dollars is, in general, an upset limit regardless of the number of phases. For developments of more than forty (40) hectares, the twenty thousand (\$20,000.00) dollars may not be considered as the upset limit. The City shall endeavour to purchase and install the above park equipment within two (2) years of final acceptance of the Subdivision.

The Owner, instead of the conveyance of land for parkland purposes, shall pay to the City a sum of money equal to five (5%) percent of the value of the lands within the proposed Plan of Subdivision, plus one hundred (100%) percent of this sum for improvements, plus seven thousand, five hundred (\$7,500.00) dollars per hectare to an upset limit of twenty thousand (\$20,000.00) dollars for park equipment, regardless of the number of phases, if so requested by the City and authorized by the Minister of Municipal Affairs. The City may require an appraisal of the lands at the time of development to determine the value of the lands.

Lands set aside for school purposes, as shown in Schedule "F" by Block Lands, shall be reserved for such purpose for a minimum of two (2) years from the date of registration of the Plan.

17. **300mm RESERVES**

The Owner agrees to convey to the City all 300mm reserves as indicated on the approved Draft Plan of Subdivision and listed in Schedule "F" attached hereto. The Owner shall provide the deed in respect to these upon registration of the Subdivision Agreement.

18. **AGREEMENTS WITH UTILITIES**

The Owner shall produce agreements with the respective utilities to bury all cable TV, electric, gas and telephone lines beneath ground level, unless deemed impossible or impractical by the local topography, at no cost to the City. The said agreements shall be attached hereto as Schedules "M", "N", "O" and "P" respectively.

19. **ENGINEERING BY PROFESSIONAL ENGINEER**

At the expense of the Owner, all Works shall be designed and installations supervised by a Consultant registered in the Province of Ontario. The said Consultant shall design and carry out general supervision and resident supervision of the Works. All designs drawn shall carry the signature and seal of the Professional Engineer who is responsible for the engineering designs. The Consultant, acceptable to both the Owner and the City, shall be specified in Schedule "I" attached to this Agreement. The Engineer must be notified in writing of any changes to this Schedule.

The services of the Consultant must include the following:-

- Preparation of the drainage report (Schedule "Q");
- Design of facilities specified in Schedule "B";

- Preparation of Engineering Drawings;
- Preparation of approval submissions to M.O.E.;
- Call Tenders;
- Contract and construction supervision and administration;
- Full time inspection of construction works;
- All testing and supervision of TV inspections;
- Certification of facilities (see Clauses 24, 25, 26, 27, 29, 30 and 31);
- Organization of acceptance inspection, including preparation of letter recommending acceptance (see Clause 52);
- Supervision of correction of deficiencies;
- Preparation and submission of "As-Constructed" drawings, clean/reproducible hard copies and digital AutoCAD copies on computer disks.

20. **DESIGN INFORMATION**

The Owner, at its expense, shall submit for the approval of the Engineer all plans, specifications, calculations, contours, and other information pertaining to the Works.

21. **SPECIFICATIONS**

All of the Works shall be installed in accordance with this Agreement, as well as any schedules attached hereto, and in accordance with the specifications approved by the Engineer and outlined in Schedule "G".

22. **DRAINAGE REPORT**

Attached hereto as Schedule "Q" shall be a drainage report prepared by the Consultant which sets out generally all matters which may require consideration with respect to drainage in the drainage area of which the subdivision forms part.

23. **EXISTING DRAINS WITHIN SUBDIVISION**

The Owner agrees not to permit the continued existence of open drains or open water courses within the subdivision without the written approval of the Engineer. Design of storm drain systems shall have reference to the Drainage Report under Clause 22 of this Agreement.

24. **SANITARY SEWER**

The Owner agrees to construct a sanitary sewer system, including house connections (coloured white) from the sewers to the lot line to service the lands in the subdivision according to the design and specifications set forth in Schedule "G" to this Agreement. Upon completion of the sewer mains and lateral construction to the lot lines, all sanitary sewer mains shall be inspected by CCTV camera and trenches tested for compaction at the Owner's expense under the direction of the Consultant.

Upon rectification of deficiencies to the Engineer's satisfaction and upon completion of any additional inspection or testing requested by the Engineer and upon receipt by the Engineer of a letter from the Consultant certifying that the sewers have been constructed in accordance with the approved plans and specifications and that acceptance of the facilities is recommended by the Consultant, the City will issue a preliminary letter of acceptance to the Owner for the purpose of the issuing of building permits. Maintenance of the sanitary sewer mains is the responsibility of the Owner until a letter of final acceptance is received from the City. Maintenance of sewer laterals is not the responsibility of the City at any time.

25. **STORM SEWER**

The Owner agrees to construct a storm sewer system including house connections (coloured green) from the sewers to the street line and rear yard catchbasins, to service the land in the subdivision and adjacent road allowances and in accordance with the design and specifications set out in Schedule "G" of this Agreement. The said sewers shall be constructed to an outlet according to designs approved by the Engineer in accordance with good engineering practice. Upon completion of the sewer mains and lateral construction to the lot lines, and the construction of rear yard or ditch inlet catchbasin laterals, all storm sewer mains shall be inspected by CCTV camera and trenches tested for compaction at the Owner's expense, under the direction of the Consultant, or by in-pipe inspection for sewers greater than 900mm in diameter, by the City and Consultant. Upon rectification of deficiencies to the Engineer's satisfaction and upon completion of any additional inspection or testing requested by the Engineer and upon receipt by the Engineer of a letter from the Consultant verifying that the sewers have been constructed in accordance with the approved plans and specifications and that acceptance of the facilities is recommended by the Consultant, the City will issue a preliminary letter of acceptance to the Owner for the purpose of the issuing of building permits. Maintenance of the storm sewer mains is the responsibility of the Owner until a letter of final acceptance is received from the City. Maintenance of sewer laterals is not the responsibility of the

City at any time.

26. **REAR YARD CATCHBASINS**

The Owner agrees to construct catchbasins as shown on the Grading Control Plan required under Clause 39 of this Agreement or as required to correct drainage deficiencies apparent after construction is completed.

27. **WATERMANS AND MAINTENANCE**

The Owner hereby agrees to construct a watermain system, including house connections to the lot lines and fire hydrants to service the lands in the subdivision, according to the design and specifications set forth in Schedule "G" of this Agreement.

Upon completion of the watermain construction, the mains shall be tested in accordance with City specifications, at the Owner's expense, under the direction of the Consultant. Upon completion of the watermain with proper trench compaction, passing of the pressure test and upon subsequent chlorination and flushing of the lines and upon receipt by the Engineer of a letter from the Consultant enclosing the pressure test results, trench compaction results and certifying that the watermains and appurtenances have been constructed in accordance with the approved plans and specifications and that the acceptance of the facilities is recommended by the Consultant, the City will issue a preliminary letter of acceptance to the Owner for the purpose of the issuing of building permits. Maintenance of the watermains and appurtenances is the responsibility of the Owner until a letter of final acceptance is received from the City. Maintenance of the water service laterals on the property side of the shutoff located at the lot line is not the responsibility of the City at any time.

The routine winter maintenance of hydrants (draining and protection against freezing) will be undertaken by the City's Waterworks Department after the hydrants have been tested and charged with water. Any other work associated with raising, lowering, or leaking hydrants or appurtenances remains the responsibility of the Owner until the final acceptance. The foregoing does not limit or reduce the responsibility of the Owner or any builder to obtain the necessary permit for the use of fire hydrants in the subdivision once the system has been tested and charged with water and put in service the City.

28. **OPENING OF VALVES, ETC.**

Only the City's Waterworks Department shall open or close any valve in the existing street mains or interfere with them in any manner. No hydrants, either inside or outside the boundary of the subdivision, may be used by the Owner or any builder for water needed during construction without first acquiring a Hydrant Use Permit.

29. **HOUSE SERVICES**

All portions of water and sewer connections from water and sewer mains to the limit of the road allowance shall be installed according to the specifications set forth in Schedule "G" to this Agreement. With the sanitary sewer laterals coloured white and storm sewer laterals coloured green, any connections which will involve the tunnelling or cutting of the travelled portion of any road shall be made before constructing the granular base course of the roads.

30. **ROADS AND MAINTENANCE**

All roads in the subdivision shall be constructed to the satisfaction of the Engineer in accordance with the specifications and in the manner set out in Schedule "G" of this Agreement. The design and contract documents shall ensure that the road will be constructed to a standard sufficient to avoid later upgrading at the City's expense in order to qualify for the Ministry of Transportation and Communications maintenance subsidy requirements at the time of construction.

The Owner shall maintain, on a year-round basis, all roads within the limits of the subdivision until a letter of final acceptance of the roads is received from the City. Maintenance of the roads shall be to a standard acceptable to the City's Department of Infrastructure & Municipal Works (Division of Municipal Services) and shall be at the Owner's expense except where homes are occupied.

31. **STREET LIGHTING**

A street lighting design drawing must be included with the Engineering Drawings. This drawing must be signed, dated and stamped by a qualified Professional Engineer as do all the other Engineering Drawings. The street lighting design must be consistent with the Guide for the Design of Roadway Lighting from the Transportation Association of Canada (TAC) - Geometric Design Manual for Canadian Roads, Ontario Provincial Standard Drawings Section 4 - Electrical Works, Design Manual for Highway Illumination (MTO), the Ontario Electrical Safety Code (OESC) and must use the materials specified by City Traffic/Transportation Section. The street

lighting design must be reviewed by the Engineering Department prior to its finalization.

The street lighting shall be installed by a competent and qualified contractor, as defined by and in accordance with the O.E.S.C.

- The Owner shall have the installation supervised by the Engineering Consultant.
- The Contractor shall obtain permits for all work requiring hydro inspections and shall file applications for inspection with the Electrical Safety Authority as necessitated by the progress of the work.
- The Contractor shall correct all defects in his workmanship and electrical equipment that is not approved by the Electrical Safety Authority. This work shall be done within such time and in such a manner as indicated by notices of deficiency from the Electrical Safety Authority.
- Upon completion of all work and receipt of a letter from the Consultant recommending the acceptance of the street lighting installation, the Contractor shall obtain a final certificate of approval or connection authorization from the Electrical Safety Authority and shall furnish one copy of the connection authorization to the Owner.

32. **ESTIMATES OF COST**

Estimates of cost to supply and install all facilities included in Schedule "B", with the exception of:-

- underground hydro, telephone lines, cable TV and natural gas

shall be prepared by the Consultant and submitted to the Engineer for approval. Estimates shall show each item, description of item, estimated quantity, and unit price. Unit prices for each item shall be those currently in use for engineering report estimates prepared by the City's Department of Engineering Services at the time the Consultant's estimate is prepared.

Estimates of the cost to the Owner to supply and install underground hydro, telephone, cable TV lines, street lighting and gas mains shall be provided in writing by the utility concerned.

Schedule "C" of this Agreement shall be based on approved estimates which have been prepared within the three (3) months prior to the date of the Letter of Credit. If an approved estimate is dated earlier than three (3) months, it shall not be used as the basis for the computation of the amount of the Letter of Credit and a revised estimate shall be re-submitted by the Consultant to the Engineer for approval.

33. **SIGNS**

The Owner shall pay for, and the City shall supply and erect, street and traffic signs in accordance with the standard design of the City at locations specified by the City's Traffic Engineer. The Owner agrees to prepare a list of proposed street names and submit the same to the Engineer for approval prior to registration of the lots.

A sign advertising subdivision lot sales will temporarily be permitted upon review of proposed design and location. The City reserves the right to require the removal of said signs within thirty (30) days written notice.

34. **TESTING**

The Engineer may have any qualitative or quantitative tests made of any materials which have been or are proposed to be used in the construction of any of the Works required by this Agreement, or may require soil tests to be carried out and the cost of such tests shall be paid by the Owner within thirty (30) days of the account being rendered by the City, provided that nothing herein shall relieve the Owner of its responsibility to carry out any tests required by good engineering practice. A qualified testing laboratory acceptable to both Owner and the City shall be employed for these Works.

35. **CITY RIGHTS RE: CONSTRUCTION, INSPECTION, AND STOP WORK**

The Engineer shall have the right at all times to inspect the installation of the Works. If at any time the Engineer is of the opinion that the installation of the Works is not being carried out in accordance with the approved plans and specifications or in accordance with good engineering practice, he may stop all or any part of the Works under construction until it has been placed in satisfactory condition. The Engineer shall have the right to reconsider the approval given to the Consultant specified in Schedule "I".

36. **PROSECUTION OF WORK**

If, in the opinion of the Engineer, the Owner is not prosecuting or causing to be prosecuted the work required in connection with this Agreement within the specified time, or so that it may be completed within the specified time, or is improperly performing the work, or should the Owner neglect or abandon any of the work before its completion, or unreasonably delay the same so that conditions of this Agreement are being violated, or carelessly executed, or in bad faith, or should the Owner neglect or fail to renew or again perform such work as may be rejected by the Engineer as being or having become defective or unsuitable, or should the Owner fail to carry out any maintenance required under this Agreement, or should the Owner, in any manner, in the opinion of the Engineer, make default in the performance of any of the terms of this Agreement, if such notification be without effect for seven (7) clear days after such notice, then in that case, the Engineer shall thereupon have full authority and power immediately to purchase such materials, tools and machinery and to employ such workmen as, in his opinion, shall be required for the proper completion of the said work at the cost and expense to the Owner.

The cost of such work shall be calculated by the Engineer whose decision shall be final. Additional to the direct cost of such work shall be a charge of eighteen (18%) percent of the direct cost as contribution to overhead, and twenty (20%) percent of the direct cost as an inconvenience and dislocation fee, both payable to the City by the Owner.

37. **EMERGENCY REPAIRS**

The City may enter the said lands at any time or from time to time for the purpose of making emergency repairs to any of the said Works. Such entry and repair shall not be deemed an acceptance of any of the said Works by the City nor an assumption by the City of any liability in connection therewith nor a release from the Owner of any of its obligations under this Agreement. The cost of such work shall be payable to the City by the Owner in accordance with the provision for payment in Clause 36.

38. **ACTIONS NOT DEEMED ACCEPTANCE**

The Owner agrees that the Works referred to herein may be used by the City for the purpose for which such Works are designed, and that such use shall not be deemed an acceptance of the Works by the City, nor shall such use in any way relieve the Owner of its obligations with respect to the construction and maintenance of such Works.

39. **LOT GRADING AND GRADE CONTROL PLAN**

As part of the submission of the engineering drawings for the approval of the Engineer, the Owner shall provide a Grade Control Plan containing the following information:-

- (a) The existing and final elevations at all lot corners;
- (b) The existing and final elevations at the centreline of each road at a spacing of 25 metres or less and at all street intersections;
- (c) The finished ground elevation at the building line;
- (d) The finished elevation of all critical points, such as catchbasins, beyond the street line;
- (e) Arrows indicating direction of flow of all surface water;
- (f) The location and details of all swales;
- (g) The location and details of all surface water outlets.

It is agreed between the parties hereto that the Grade Control Plan may be amended from time to time by the Owner with the prior written approval of the Engineer and such approval shall not be withheld except for sound engineering reasons.

The Owner shall be responsible for registering on the title of all lots affected the amended Grade Control Plan. The Owner shall be responsible for the rough grading of the lands such that the material excavated for the foundation of the building shall be equal to the material required to complete the lot grading in accordance with the approved Lot Grading Plan. All lot corners and swales shall be graded from 0 to 300mm below the finished grade to comply with "Rough Lot Grading" requirements. All lots shall be shaped or contoured as necessary to provide positive drainage.

The Owner agrees to submit a "Rough Lot Grading" Certificate prepared by the Consulting Engineer or Ontario Land Surveyor that certifies that the rough lot grading complies prior to the issuance of building permits. The Owner further agrees to establish (c) above, (Ground elevation at foundation wall), consistent with the Grade Control Plan prior to foundation excavation. In all cases, the Owner will maintain, at its own expense, sufficient interim drainage and outlets to provide adequate drainage until pavement has been constructed and accepted by the City. This will include the installation and removal of culverts when required by the Engineer.

40. **INTERIM GRADING OF OPEN LOTS**

Reinstatement of affected boulevards abutting already developed lots and proposed City Blocks of land must be undertaken by the Owner with 100 mm layer of topsoil and sod to final grades.

The Owner undertakes and agrees that, prior to seeking final acceptance of roads, all abutting lots and open lands upon which construction has not been commenced will be filled and graded as necessary to provide positive drainage at the Owner's expense. Where rights to the said lots have been sold or otherwise transferred, the Owner covenants and agrees to enforce these provisions by way of a condition in the agreement of sale or transfer.

41. **MAINTENANCE OF LOT DRAINAGE**

The Owner agrees to register Schedule "T" of this Agreement against the title of all properties within the Subdivision.

42. **DESIGN CHANGES**

The engineering drawings which have been submitted for approval by the City and which have been approved and form part of this Agreement as Schedule "L" show the designation of each lot for development. The Owner hereby agrees that no rearrangement of designation on the Plan(s) shown in Schedule "L" attached hereto shall be permitted without the written approval of the Engineer, in addition to any other legal consents which may be required. The Engineer shall require a written statement from the Consultant of the effects of such a change on the design capacities of the underground facilities. The Consultant shall advise the Engineer in writing as to which lots have been pre-serviced with water and sewer at the time of the request for re-designation.

43. **BUILDING PERMITS**

Building permits may be issued subject to other requirements of the Building Permit Office to construct on lots within the subdivision when:

- 1) the City has issued a letter indicating preliminary acceptance of storm and sanitary sewers and water mains;
- 2) the Plan of Subdivision, easements and land dedications have been registered and the Registered Plan certified;
- 3) funding has been provided, as outlined in Clause 8 of this Agreement, for the completion of the Works described under Schedule "B" and "L";
- 4) the rough grading is complete and certified, as per Clause 39.

44. **OCCUPANCY**

Where a building has been constructed on any lot in the subdivision, the Owner shall not convey such lot or allow such building to be occupied until the base course of asphalt is in place to the satisfaction of the Engineer.

45. **BOULEVARD TREE PLANTING**

The Owner agrees to plant trees in the boulevard following the final grading of the lot and boulevard in accordance with City standards. These plantings may occur once a year during the tree's dormancy period and the availability of acceptable nursery stock, men, materials and machinery.

46. **LOTS UNSUITABLE FOR BUILDING PURPOSES**

The Owner agrees that the lots and blocks listed in Schedule "R" hereto and indicated on the attached Draft Plan of Subdivision are unsuitable for building purposes and that no application will be made for a building permit for the erection of any structure on the said lots or blocks until suitable drainage is provided and a written clearance is obtained from the Engineer. The Owner consents to register a caution or notice against said lands as described in Schedule "R".

47. **FILL, DEBRIS, ETC.**

The Owner covenants and agrees that it will not dump nor permit to be dumped any fill or debris on, nor will it remove or

permit to be removed any fill from any public lands without the written consent of the Engineer.

48. **CONSTRUCTION LIEN ACT**

The filing of any lien under the Construction Lien Act S.O. 1983, Chapter 6, and any amendments thereto against the City or the Owner and the City shall constitute default under this Agreement on the part of the Owner. Upon such default, the City may be entitled to draw upon the Irrevocable Letter of Credit, after thirty (30) days from the filing of the lien, the amount or amounts required for payment into court of holdbacks plus costs under the Construction Lien Act, unless the lien has been discharged or vacated.

49. **STATUTORY DECLARATION**

Before applying for final acceptance of any of the Works or any part thereof, the Owner shall supply the City with a Statutory Declaration that all accounts for work and materials have been paid except normal guarantee holdbacks, and that there are no claims or liens or otherwise in connection with such work done or materials supplied for on behalf of the Owner.

50. **O.L.S. CERTIFICATE**

The Owner undertakes and agrees that he will file with the Engineer, not earlier than thirty (30) days before the acceptance of the roads by the City, a certificate signed by a registered Ontario Land Surveyor, to the effect that such Surveyor has found or replaced all standard iron bars or monuments within 150mm of the finished grade, as shown on the registered Plan of Subdivision, and the City shall not be obliged to accept such roads as being completed in accordance with this Agreement until such certificate has been filed.

51. **GUARANTEED MAINTENANCE PERIOD**

This period shall commence on the date following the satisfactory completion of the "Substantial Completion Inspection" for all underground mains and services, roads, curbs, sidewalks, boulevards, catchbasins, manholes, gate valves and boxes, standpipes, curb stops, corporation stops, fire hydrants, storm water management facilities, and all other surface works.

The Owner guarantees that the said work shall remain for a minimum period of twelve (12) months from the dates of commencement as outlined above, in such condition as will meet with the approval of the Engineer, and that he, upon being required by the Engineer, will make good in a permanent manner, satisfactory to the Engineer, any imperfections or damages caused by whomsoever. The decision of the Engineer is to be final as to the nature and cause of such imperfections and the necessity for remedying the same. Should the Owner fail to comply with the directions of the Engineer, the latter may perform the necessary work after giving the Owner a twenty-four (24) hour written notice, and the cost thereof will be collected by the City from the Owner, as outlined in Clause 35.

52. **ENGINEER'S RECOMMENDATION OF FINAL ACCEPTANCE**

Upon completion of the Guaranteed Maintenance Period and rectification of the deficiencies found, the Engineer may consider a request by the Owner to have the facilities, as outlined in Schedule "B" attached, accepted by the City, provided the Engineer has received the CCTV sewer inspection report and photographs (as per City standards), inspection reports, test results, declarations, certificates, fees, deeds, easements, reserves and a set of hard copies servicing drawings amended "as-constructed" as well as digital copies of same by the Consultant at the Owner's expense. When the Engineer is satisfied that the Works set out in this Agreement or any part thereof and any other Works which may have been required have been executed in accordance with this Agreement and has also been satisfied that all City accounts have been paid and maintenance requirements met, he will forthwith present a report to City Council stating that the work or any part thereof has been completed satisfactorily and the roads are in the required condition for them to be assumed by the City. The City shall forthwith enact the necessary bylaw accepting the Works or any part thereof.

53. **ASSUMPTION BY THE CITY**

Upon the said Bylaw being passed, the ownership of the Works, within the dedicated road allowance and easements as applicable, shall vest on the city at no cost to the City. The Owner shall have no claim or rights thereto other than those accruing to it as Owner of the land abutting on streets on which the Works were installed.

54. **SPECIAL PROVISIONS**

The following special provisions are agreed to by the Owner:-

55. **LOCATION NOTICES TO BE SERVED**

Any notices required to be given hereunder may be given by registered mail and addressed to the other party at its principal place of business and shall be effective as of the date of deposit thereof in the Post Office.

The principle place of business of the agreeing parties is as follows:-

**CITY** Corporation of the City of Cornwall  
P.O. Box 877  
CORNWALL, Ontario  
K6H 5T9

Attention: City Clerk

**OWNER**

Attention: \_\_\_\_\_, President

**AND IT IS DECLARED AND AGREED UPON THAT** this Agreement and the covenants, provisoes, conditions, and schedules herein contained shall enure for the benefit of and be binding upon the respective heirs, executors, administrators, successors, and assigns of each of the parties hereto.

**IN WITNESS WHEREOF** the Owner has hereunto set his hand and seal, and the City has hereunto affixed its corporate seal by the hands of its proper officers in that behalf duly authorized.

**SIGNED, SEALED, AND DELIVERED** \*  
\*  
**in the presence of** \*  
\*



## **SCHEDULE "A"**

The following is a legal description of the lands to which this Agreement applies:

In the City of Cornwall, in the County of Stormont and being composed of:

LOTS:

BLOCKS:

Inclusive, according to Registered Plan \_\_\_\_\_.

## **SCHEDULE "B"**

The following facilities will be provided by the Owner to the specifications contained in the attached Schedules:

- Sanitary sewers and appurtenances, including house laterals to the lot line.
- Storm sewers and appurtenances, including catchbasin and house laterals to the lot line.
- Watermains and appurtenances, including fire hydrants and house services to the lot line.
- Roads, including hot mix, hot laid asphalt paving on granular road base, complete with concrete curbs and gutters.
- Underground hydro, telephone and cable TV lines, and natural gas.
- Rough lot grading.
- Street name and traffic signs.
- Sidewalks and walkways.
- Fencing.
- Street lighting.

## SCHEDULE "C"

The following is an estimate of the direct construction cost of the Works required to service the area defined by Schedule "A":

<u>ITEM #</u>	<u>DESCRIPTION</u>	<u>QUANTITY</u>	<u>UNIT</u>	<u>UNIT PRICE</u>	<u>\$</u>
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## SCHEDULE "D"

The total cost of the underground construction detailed in Schedule "C" is estimated as follows:

Direct Construction Cost (Underground)	\$
City Administration Charge (2 %)	\$
Supervision by Consultant and Testing	\$
Underground Hydro Design & Installation	\$
Contingency (5%)	\$
Other: Bell	\$
Cable	\$
Gas	\$
Street Lighting Design & Installation	\$
	_____
<b>TOTAL X</b>	<b>\$</b>
	_____

The total cost to complete the construction of surface facilities as detailed in Schedule "C" is estimated as follows:

Direct Construction Cost (Surface)	\$
City Administration Charge (2 %)	\$
Supervision by Consultant and Testing	\$
Tree Planting ( __ lots x \$     /tree)                      \$	
Street and Traffic Signs ( __ signs x \$     /sign)	\$
Contingency (5%)	\$
Other: Parkland Dedication	\$
Playground Equipment charge	\$
	_____
_____ <b>TOTAL Y</b>	<b>\$</b>
	_____

## **SCHEDULE "E"**

### **SUBDIVISION CHARGES**

At the time an application is made for a Building Permit for any lot covered by this Agreement, the Owner shall pay to the City the following subdivision charge(s) as a lot levy to provide a fund through which the City, at its sole discretion, may undertake improvements to existing facilities made necessary by area development:

1.     \$ \_\_\_\_\_ per foot of lot frontage.

## **SCHEDULE "F"**

The following is a list of Easements and Land Dedications:

### **Easements in Favour of the City:**

- 
- 
- 

The owner agrees to obtain an easement in favour of the Corporation of the City of Cornwall over the above identified lands, the alignment/area being a drainage easement. The easement shall have the specified width and shall enable the City to enter upon the lands to maintain, repair, replace or excavate municipal storm sewer and /or appurtenances.

### **Easements in Favour of Others:**

example: Permanent and perpetual easement in gross over, under along and upon the whole of the lands subject to development in favor of C.N. Railway Company for the purpose of discharging, emitting and releasing noise, vibration and other sounds of every nature and kind ("Operational Emissions") at any time during the day or night arising from, out of or in connection with any existing and future railway facilities.

### **300 mm Reserves:**

### **Parkland Dedications:**

\_\_\_\_\_

### **Land Set Aside for School Propose:**\_\_\_\_\_

\_\_\_\_\_

### **Others:**\_\_\_\_\_

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## **SCHEDULE "G"**

### **DESIGN CRITERIA AND SPECIFICATIONS**

1. **Roads, Curb and Gutters, Signs and Sidewalks:**

City of Cornwall Manual of Design Criteria and Specifications for Subdivisions and Design Standards Part III, the Ontario Provincial Standard Specifications, and Approved Drawings.

2. **Storm Sewers:**

City of Cornwall Manual of Design Criteria and Specifications for Subdivisions and Design Standards--Part IV. Also, City of Cornwall Construction Specifications for Watermains and Sewers, the approved Ontario Provincial Standard Drawings, and approved drawings.

3. **Sanitary Sewers:**

City of Cornwall Manual of Design Criteria and Specifications for Subdivisions and Design Standards--Part V. Also, City of Cornwall Construction Specifications for Watermains and Sewers, the approved Ontario Provincial Standard Drawings, and approved drawings.

4. **Watermains:**

City of Cornwall Manual of Design Criteria and Specifications for Subdivisions and Design Standards--Part VI. Also, City of Cornwall Construction Specifications for Watermains and Sewers, the approved Ontario Provincial Standard Drawings, and approved drawings.

5. **Street Lighting:**

Consistent with the Guide for the Design of Roadway Lighting from the Transportation Association of Canada (TAC) - Geometric Design Manual for Canadian Roads, Ontario Provincial Standard Drawings Section 4 - Electrical Works, Design Manual for Highway Illumination (MTO), the Ontario Electrical Safety Code (OESC) and must use the materials specified by City Traffic/Transportation Section, and approved drawings. The work must also be approved by the Electrical Safety Authority.

6. **Ancillary:**

Items not covered by above specifications or standards will be constructed according to the latest approved Ontario Provincial Specifications or Standard Drawings.

# SCHEDULE "H"

## PHASING OF CONSTRUCTION

---

The Owner agrees to install the municipal infrastructure, and associated facilities and servicing detailed under Schedules "B" and "P" of this agreement in general accordance with the following construction timelines:

<u>STAGE #</u>	<u>FACILITY*</u>	<u>STREET</u>	<u>FROM</u>	<u>TO</u>	<u>START</u>	<u>COMPLETION</u>
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Notes: Concrete curbs must not be depressed for proposed driveways but rather must continue full height unless an explicit design drawing is generated for all proposed future driveway entrance locations.

Temporary asphalt ramping at the edge of concrete gutter/edge of pavement must be placed in the Fall by the Developer's Contractors in order to protect the curb/gutter from snow ploughs and reduce the bump/straight edge formed temporarily at driveways.

\*"FACILITY" implies either Underground or Surface

## **SCHEDULE "I"**

### **ENGINEERING CONSULTANT(S)**

The following Consultant(s) will be engaged by the Owner to provide the professional engineering services for the subdivision on the lands described under Schedule "A":

Phone:  
Facsimile:

## **SCHEDULE "J"**

This Agreement is based on the Draft Plan approved by the Manager of Planning/Housing Services on behalf of City Council for this development, being a drawing prepared by: \_\_\_\_\_, dated \_\_\_\_\_, which may be viewed during regular office hours at the offices of the Ontario Land Surveyor, \_\_\_\_\_, the City of Cornwall Municipal Offices of the City Clerk, at 360 Pitt Street, or the Department of Engineering Services, at 1225 Ontario Street.

This drawing forms part and parcel of this Schedule and the attached Agreement.

## **SCHEDULE "K"**

Being a drawing prepared by the office of \_\_\_\_\_,  
dated \_\_\_\_\_, being a Plan of Subdivision for Part of Lots and \_\_\_\_\_, Concession \_\_\_\_\_,  
City of Cornwall, County of Stormont, to be submitted to City Administration for approval and to  
the Mayor and Clerk for their signature prior to registration, may be viewed during regular office hours  
at the offices of the Land Surveyor, \_\_\_\_\_, \_\_\_\_\_, the City of Cornwall  
Municipal Offices of the City Clerk, at 360 Pitt Street, or the Department of Engineering Services, at  
1225 Ontario Street.

This drawing forms part and parcel of this Schedule and the attached Agreement.

# **SCHEDULE "L"**

## **DESIGN AND CONSTRUCTION DRAWINGS**

The following design and construction drawings, prepared by \_\_\_\_\_  
\_\_\_\_\_ where stamped and approved by the City of Cornwall, Department of  
Infrastructure & Municipal Works, and dated \_\_\_\_\_, or latest revision, form part  
and parcel of this Schedule and Agreement.

**TITLE**

**DRAWING NUMBER**

## SCHEDULE "R"

## **SCHEDULE "S"**

### **MAINTENANCE OF FACILITIES**

The standards which are required to be met with regard to the maintenance of all facilities are those currently being applied by the Department of Infrastructure & Municipal Works. Advice in this respect can be obtained from the Division Manager of Municipal Works.

## **SCHEDULE "T"**

These restrictions shall run with and be binding upon the lands: The Grantees, in respect to the herein described lands, shall maintain proper grades and levels thereon in accordance with the approved lot drainage patterns as represented by the latest approved revision and/or approved red-line modifications of Lot Grading Plan, that is, Drawing Number \_\_\_ of Schedule "L" to the Subdivision Agreement for this area of which the lands are a part, prepared by \_\_\_\_\_ in order to ensure that no back yard, side yard, or front yard accumulation of storm water occurs on the land or neighbouring lands.

In the event that the Grantees do not maintain the proper grades and levels herein referred to, or in the event that they impede any drained system or pattern on the herein described lands or neighbouring lands, they shall be responsible for the curing of any problems resulting thereto and costs arising out of same.

## **SCHEDULE "Q"**

### **Drainage Report**

## LETTER OF CREDIT

NAME OF BANK: \_\_\_\_\_

DATE ISSUED: \_\_\_\_\_

LETTER OF CREDIT NO.: \_\_\_\_\_

AMOUNT: \_\_\_\_\_

Issued subject to the Uniform Customs and Practices for Documentary Credits being ICC Publication UCP 500.

TO: THE MUNICIPAL CORPORATION OF THE CITY OF CORNWALL

ADDRESS: P.O. BOX 877, CORNWALL, ONTARIO, K6H 5R9

WE HEREBY AUTHORIZE you to draw on the

\_\_\_\_\_  
(Name of Bank)

for the account of \_\_\_\_\_  
(Name of Customer)

up to an aggregate amount of \_\_\_\_\_  
dollars (\$ \_\_\_\_\_) available on demand.

PURSUANT TO the request of our customer: \_\_\_\_\_

\_\_\_\_\_, we the \_\_\_\_\_  
(Name of Bank)

hereby establish and give you an Irrevocable Letter of Credit in your favour in the above amount which may be drawing on by you at any time and from time to time, upon written demand for payment made upon us by you which demand we shall honour without enquiring whether you have the right as between yourself and the said customer to make such demand, and without recognizing any claim of our said customer, or objection by it to payment by us.

DEMAND shall be by way of a Letter signed by the Clerk of the Municipality under the corporate seal attached to which shall be the original Letter of Credit. Presentation shall be made to the bank at:

\_\_\_\_\_  
(Name and address of Bank)

THE LETTER OF CREDIT we understand relates to those Municipal services and financial obligations set out in an Agreement between the customer and the Municipality and referred to as \_\_\_\_\_

\_\_\_\_\_  
(Lot Description and Name of Project)

THE AMOUNT of this Letter of Credit may be reduced from time to time as advised by notice in writing to the undersigned by a representative of the Corporation of the City of Cornwall.

THIS LETTER OF CREDIT will continue in force for a period of one year, but shall be subject to the condition hereinafter set forth.

IT IS A CONDITION of this Letter of Credit that it shall be deemed to be automatically extended without amendment from year to year from the present or any future expiration date hereof, unless at least thirty (30) days prior to the present or any future expiration date, we notify you in writing by registered mail that we elect not to consider this Letter of Credit to be renewable for any additional period.

DATED at \_\_\_\_\_, Ontario this the \_\_\_\_\_ day of \_\_\_\_\_, 1995.

COUNTERSIGNED BY:

(NAME OF BANK)  
Per:

\_\_\_\_\_

## SECTION VII

### CONSTRUCTION STANDARDS

#### VII.1 Construction Inspection of Subdivisions

The Developer will provide the services of a qualified Consulting Engineer to supervise the installation of municipal services. The Consultant is responsible to ensure a quality product is constructed to O.P.S.S. standards, City of Cornwall standards, as well as all Provincial and/or Federal regulations.

The following are guidelines and limitations necessary to achieve this goal. These are only guidelines and they should be used as such.

##### .1 Public Relations

Even though most of the work is on the Developer's property, public involvement will exist. The Consultant's representative will be available, courteous and provide accurate answers to the general public or adjacent property owners' questions or concerns

##### .2 Role of the Inspector

There must be an inspector on site at all times when work is being done, without exception.

The inspector is the day-to-day link between the Owner, the Consulting Engineer, the Contractor and the City. The main duty of the inspector is to protect the interests of the City and the Owner, however in carrying out that duty, he/she must be fair to the Contractor. The inspector must be firm in his insistence that the Contractor construct the works properly and in accordance with the contract.

##### .3 As-built Records

The following items should be recorded on the as-built records:

- existing ground (if different than on the drawings);
- structure and utilities encountered;
- location, elevation, grade, and sizes of installed pipe and appurtenances;
- locations, length, sizes, and surface ties for laterals, tees, bends, and stubs (surface ties to be referenced to permanent structures);
- elevation of rock surfaces encountered;
- unusual ground conditions;
- support and sheeting left in place, anchor blocks, etc.

All the above measurements should be made at the actual time of construction, particularly if the item is to be buried, and plotted daily whenever possible.

As-built records shall be documented and marked "As Built" on all construction drawings. A complete set of construction/design Mylar drawings and AutoCAD diskettes or on other digital form will be provided by the Developer.

.4 Traffic Control

Although traffic control may not be a problem within the development of a subdivision, at times of tie-in outside the confines of that development, traffic control will be necessary. If this is the case, any disruption of traffic of any nature within City street allowances must be dealt with according to Provincial regulations, and shall be approved by the City of Cornwall Traffic Section.

**VII.2 TESTING REQUIREMENTS FOR SUBDIVISIONS**

The Developer is responsible for all testing requirements to be undertaken by a qualified Geotechnical Engineer. The following are requirements to achieve acceptable results and must be viewed by the Consultant to be the minimum required, with field decisions being made based on the conditions encountered at the time work is being done.

.1 Gradation Tests

Minimum of one test for each of the granulars used. More tests should be done if the material visibly changes during construction or if the job is large enough to warrant additional tests.

.2 Proctor Tests

Minimum of one test for each type of material that is being compacted. More tests if the job is large or if there are variances in the appearance of the materials.

.3 Compaction Tests

<b>Bedding:</b>	Random two to three times a week, providing that tests are consistently above the specification of 95%.
<b>Trenches Under Roadway:</b>	Random daily until the desired sequence to achieve 95%+ readings is found, then monitor that sequence and test randomly one to three times a week if the operation is achieving the desired result of 95%+.
<b>Subgrades :</b>	All subgrades must be checked and approved prior to any granular base being placed. Testing on subgrade will depend on conditions of soil and weather. Generally, tests should be done at 10 meter intervals randomly over the roadway.
<b>Granular Course:</b>	Maximum lift thickness to be checked should be limited to 300mm and each lift must be checked and approved prior to additional lifts being placed. Generally, tests should be done at 10 meter intervals randomly over the roadway. In the case of Granular "A" placed and not paved immediately, then testing just prior to paving must be retested and approved. Testing should be done at ± 10 meter intervals on all curb and gutter subgrades. Sidewalk testing is to be done randomly at the rate of two tests per load of concrete.

.4 Asphalt Testing

The following are guidelines for testing of asphalt pavements within subdivisions in the City of Cornwall:

<b>ASPHALT MIX TEMPERATURE SPECIFICATION</b>		
<b>Asphalt Type</b>	<b>Min. Temp. °C</b>	<b>Max. Temp °C (On Site)</b>
HL-3, HL-4 & HL-8	135° (275°F)	160° (320°F)

.5 Material Testing

Minimum of one extraction, gradation, and Marshall tests for each type of asphalt being placed. Each day, additional tests as required if the material does not meet specifications.

.6 Extraction Tests

Random samples should be picked up as paving is being done to ensure there is a representative sample for the area paved. Random compaction tests should be done at 10 meter intervals over the paved surface.

.7 Concrete Testing

The following tests are required for concrete work within subdivisions in the City of Cornwall:

<b>Air Test:</b>	Each load of concrete must be tested for air entrainment.	
<b>Slump Test:</b>	Each load of concrete must be tested for slump.	
<b>Concrete Cylinder (Set of 3):</b>	Cylinders must be taken at least once per day for small pours of less than four loads, or every fourth load if it is a large pour. It is at the discretion of the Inspector if additional cylinders are required due to concrete that appears to be abnormal.	
<b>Hot Weather Concrete:</b>	Hot weather exists when the air temperature is above 27°C. It is also considered to exist when the air temperature is likely to rise above 27°C within 24 hours. These temperatures refer to shade temperature.	
	<b><u>Type of Construction</u></b>	<b><u>Max. Temp. of Concrete</u></b>
	- Sidewalks, curb, slabs	35°C
	- Bridge decks, columns, (high strength concrete)	30°C

.8 Electrical Safety Authority Certificate

The Developer or Developer's contractor must obtain a final certificate of approval or connection authorization from the Electrical Safety Authority.

.9 Testing Reports

It is essential that the City be on the mailing list for all testing reports done on subdivisions so that the City has a record of the results for future use.

.10 Sewers and Watermains

Appendix "A" - Field Testing & Acceptance Procedures must be followed for sewer and watermain installations.

### **VII.3 GUIDELINES FOR THE REDUCTION OF LETTERS OF CREDIT**

The purpose of a Letter of Credit is to ensure that, in the event that the Developer is unable to proceed with the completion of the municipal services for a Subdivision, the City of Cornwall may draw on that Letter of Credit in order to complete the municipal services. It is the Contractor's responsibility, not the City's, to ensure that proper documentation and protection is in place for payment by the Developer of the completed work.

- .1 Prior to entering into a Subdivision Agreement, the Developer shall deposit with the City a Letter of Credit for 100% of the value of the underground work or surface work, whichever is greater, and any other related fees as outlined in Schedule "D" of the Subdivision Agreement.
- .2 Prior to qualifying for Building Permits, the Developer shall supply the City with a Letter of Credit for the value of the surface work and any other related fees, as outlined in Schedule "D" of the Subdivision Agreement.
- .3 Throughout the Subdivision Agreement and until Final Acceptance of this Subdivision, the City shall retain a 10% holdback of the total value of the underground and surface works combined. This 10% holdback shall only be eligible for release upon Final Acceptance of the Subdivision.
- .4 A request to the City for reduction of the Letter of Credit shall be accompanied by an estimate of the value of uncompleted work, any monies due to the City as outlined in the Subdivision Agreement, no more than once per month.
- .5 The City of Cornwall will not reduce the Letter of Credit for the underground work below the value of the surface work plus 10% of the value of the underground work.
- .6 The Letter of Credit will be reduced to NIL only after the Final Inspection and the Final Acceptance of the Subdivision has been completed.

### **VII.4 SUBDIVISION DAMAGE CONTROL**

The following are steps to be taken in damage control.

- .1 Before Building Permits are issued, preliminary acceptance of the subdivision by the Engineering Department must be completed. This will ensure that all deficiencies have been identified and corrected on all lots, and that all lots are pre-serviced.
- .2 The Right-of-Way Control Technologist does not carry out an inspection at the time the permit is issued, such that the Road Damage Permits and Boulevard Damage Permits are automatically issued where subdivisions have not received final acceptance.
- .3 The Developer is responsible for all damages of any nature caused until final acceptance of the subdivision. The Developer should oversee the Builder or Utility company to ensure that damage is not caused during the time between preliminary and final acceptance.
- .4 That, at the time of final acceptance of the subdivision, all deficiencies/damages have been corrected.
- .5 That, after final acceptance of the subdivision, the Builder/Owner is now directly responsible for any damages on the right-of-way related to their property, and the Right-of-Way Control Technologist would carry out an inspection prior to releasing any deposits from the permits.
- .6 That the balance of the unbuilt lots would be handled in the same format as any other infilling lot throughout the City.

## VII.5 SUBDIVISION CONSTRUCTION AND ACCEPTANCE

### .1 Pre-Construction Meeting

At a Pre-Construction Meeting, the following shall be reviewed:

- Construction Schedule (must be followed);
- Procedures for Preliminary Acceptance of the underground;
- Lot Grading requirements;
- Procedures for Reduction in Letters of Credit;
- Final Inspection/Acceptance;
- Copy of Liability Insurance.

### .2 Construction Schedule

The Consultant must provide a construction schedule showing all work to be done and in what sequence. This schedule will be reviewed and accepted. Any variance from it must be reviewed at Site Meetings and covered in writing. The intent of this schedule is to have work proceed at a satisfactory rate without delay. This Construction Schedule is a more detailed schedule than that provided in the Subdivision Agreement.

### .3 Acceptance of Subdivision

The acceptance of a Subdivision is divided into three parts:

- Preliminary Acceptance of Underground Municipal Services;
- Substantial Completion Inspection; and
- Final Acceptance.

#### a) Preliminary Acceptance of Underground Municipal Services

The Consultant must provide the City with a Letter of Recommendation for acceptance of the underground municipal services. In order for the City to accept the services, the following are the necessary requirements:

- ✓ all services must be installed;
- ✓ the surface iron must be within 300mm of the final grade and free from defects;
- ✓ the storm and sanitary sewers must have a camera inspection, including a report;
- ✓ all watermains must be cleaned, flushed, chlorinated and tested with results;
- ✓ Service Location Sheet CC-123 must be completed;
- ✓ street lighting system must be installed.

#### (b) Substantial Completion Inspection

Upon completion of the base lift of asphalt and all major works, and upon receipt of a Letter of Recommendation from the Consultant, the City representative will perform a Substantial Completion Inspection, thus initiating the One Year Maintenance Period.

(c) Final Acceptance

The Consultant must provide the City with a recommendation to accept the Subdivision, including the list of deficiencies existing at the final inspection and notice that they have all been rectified. When the City receives this notification in writing, the Consultant, Owner, Contractor, and City representatives will complete a Final Inspection together. If all work has been done to the satisfaction of this group and all conditions within the Agreement have been satisfied, then acceptance of the Subdivision can take place and a recommendation can be made that a bylaw be passed by City Council.

# A P P E N D I X " A "

## SECTION 4

### FIELD TESTING & ACCEPTANCE PROCEDURES

## SECTION 4 - FIELD TESTING & ACCEPTANCE

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### 4.1 SEWERS

#### 4.1.1 Visual Inspection

The sewers, manholes, and all related appurtenances shall be cleaned of all foreign material either by flushing, the use of cleaning buckets, by hand, or by a combination of all three, to the satisfaction of the Engineer.

The sewers shall be inspected by the Engineer for alignment and obstructions. The downstream end of the sewer should be backlighted with a powerful light. One should look downstream and see a minimum of  $\frac{3}{4}$  of the diameter when looking from manhole to manhole. All visible leaks shall be repaired immediately.

Ponding in gravity sewers shall not be allowed.

#### 4.1.2 Camera Inspection

All sewers shall be subject to a video inspection.

Recording equipment shall be provided in an enclosed vehicle suitable to record from the video camera the entire inspection VHS format color video tape, complete with data input for titles, manhole numbers, pipe conditions, and a continuous display of distance from the initial manhole location. The video tape shall be of quality that all minor defects (hairline cracks, etc.) are clearly visible and the color of the pipe inspected be true to actual conditions. Should the video tape not be of this quality, as determined by the Manager, the Contractor shall be required to reinspect the line to produce an acceptable quality video tape, at no additional cost. A monitor located on site shall provide a clear color picture of sufficient size and clarity to be easily readable by the Corporation's inspector, and it shall clearly define the details of the interior of the sewer. The colour CCD cameras used in the inspection shall be of a type capable of radial rotation of 360° and lateral rotation of 180°. The picture quality on the monitor shall provide a continuous 400 line resolution video picture. Linear measure through pipes from the center of manholes must be accurate to  $\pm 1\%$ . Recording equipment based on photographing the television monitor is not acceptable. More detailed information on equipment and data requirements can be obtained from the City Engineering office.

The report shall be reviewed by the Engineer and any deficiencies rectified prior to the start of any surface construction or restoration.

### 4.2 WATERMAINS

#### 4.2.1 Visual Inspection

The watermain and all related appurtenances shall be cleaned of all foreign material before installation to the satisfaction of the Engineer.

The valves must be thoroughly inspected for defects, damages, and proper operation before installation.

The watermain shall be inspected by the Engineer for alignment and obstructions during the installation of the pipe.

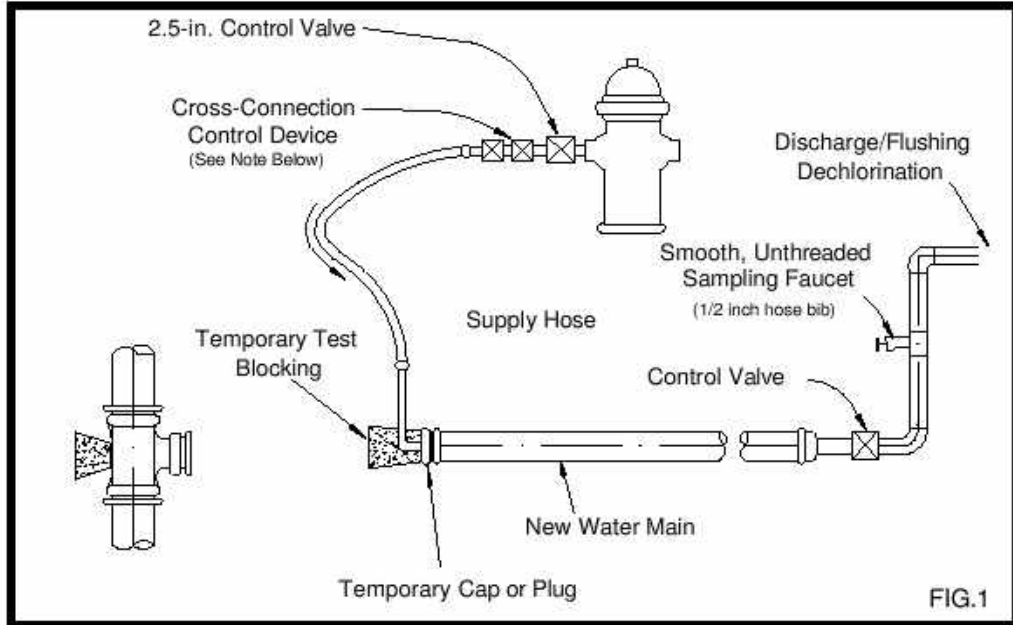
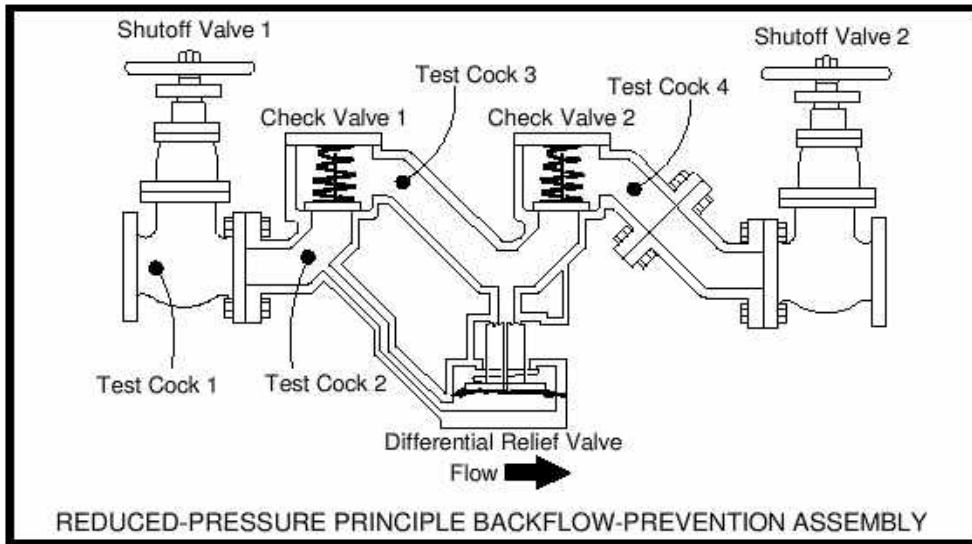


FIG.1

\*Clean potable-water hose only. Size and number of taps per Awwa C651-99 Table 3. This hose must be removed during the hydrostatic pressure test.

Note: Figure 1 applies to pipes with diameters 4 in. (100 mm) through 12 in. (300 mm). All larger sizes must be handled on a case-by-case basis.



REDUCED-PRESSURE PRINCIPLE BACKFLOW-PREVENTION ASSEMBLY

CROSS CONNECTION CONTROL DEVICE WITH HEADER  
to be supplied by Waterworks Department

Contact: Bill Dewit  
613-930-2787 ext. 2230  
to coordinate access.

<b>CITY OF CORNWALL</b> ENGINEERING DEPARTMENT <b>TEMPORARY</b> <b>FLUSHING / TESTING</b> <b>CONNECTION</b>	DRAWN BY: A.J.A.
	DATE: 04-03-27
	SCALE: N.T.S.
<b>CC-500</b>	

#### 4.2.2 Pressure and Leakage Test

The work of laying the pipe and all appurtenances shall be of such a character as to leave all pipe and connections watertight and able to withstand a static pressure of 1 MPa (150 psi).

Hydrostatic pressure test and leakage test must be performed on all watermains and appurtenances constructed. All valves shall be tested.

The Contractor must follow these procedures when testing the constructed watermain:

1. Contractor's Foreman or Superintendent must notify the Engineering Department and Waterworks Superintendent twenty-four (24) hours before the watermain is to be charged and later tested. Before the above is done, the Contractor must be certain that he has all the required test material, labour, and equipment. The Contractor must also make the required arrangement to obtain an approved water supply.
2. When temperature is 0°C or lower, the Contractor must construct a temporarily heated enclosure with a minimum dimension of 2.4 m square by 2.0 m high located at the point where pressure is to be introduced, and a 1.2 m square by 2.0 m high heated enclosure around hydrants and blow-offs to be used to remove air from the watermains and also to be used to flush the watermains.

This requirement must be fulfilled if temperature is at 0°C or is anticipated to decrease below 0°C during the test period.

In temperature 0°C or lower, the Contractor, at his cost, must take all precautions required to prevent watermains and appurtenances from freezing and will be totally responsible to undertake all necessary measures to repair or replace frozen watermains and appurtenances that are damaged.

3. Before filling the new watermains with clean uncontaminated water by using the existing water distribution system or from other approved source, the Contractor must:
  - (i) obtain approval from the Engineer on the section of watermains to be tested;
  - (ii) verify that all the required blow-offs have been installed at unlooped watermains, at other locations required to remove air from the watermain, and at the area where the test is to be performed.
4. The Contractor must obtain approval from the Waterworks Supervisor or Superintendent granting himself or his work crew permission to operate valves on the City's water distribution system.

Contractor cannot operate any existing water valves without the above permission.

5. The Contractor must fill the watermain to be tested by opening the valve that will feed the new watermains installed very slowly from the closed position. This will permit water to enter the watermains at a rate acceptable to the City Engineering Department and Waterworks Section.

OR

The Contractor must pump clean and uncontaminated water in the system to be tested, at an accepted rate to the City Engineering Department and Waterworks Section.

6. When filling the watermain, the Contractor must make certain that blow-offs and hydrants located at high points of the system to be tested are opened. These must remain opened until all air has been expelled from the sections of watermains to be tested and until the flushing of the main has been completed.

Flushing of the mains constructed must be done as soon as the watermain is filled and must be carried out for a minimum of twenty (20) minutes, or as specified by the Project Supervisor.

The watermains constructed must be flushed through hydrants and main-cocks (blow-offs) to produce a flushing velocity of not less than .76 m/second.

7. Once the Contractor has flushed the watermains to be tested for the required period and is certain that all the air has been removed from the system, the blow-offs and hydrants can be completely closed.

After the above procedure is followed, the valve feeding the system to be tested can also be completely closed and the hydrostatic and leakage test can begin.

8. The hydrostatic and leakage test to be carried out is a one test operation and the Contractor must complete all the previous procedures and proceed as follows:
  - (iii) install the required main-cock to perform the test;
  - (iv) install the complete hook-up to perform the test (i.e. the fittings from the main-cock to the pressure pump, from the pressure pump to the pressure gauge, and from the pressure pump to the supply barrel);
  - (v) install the approved test gauge;
  - (vi) apply the pressure to the watermains to be tested until the pressure reads 1 MPa (150 psi). This pressure is to be maintained for a period of two (2) hours (120 minutes).

When the Contractor is ready to perform the Official Watermain Hydrostatic and Pressure test, he must contact the Project Supervisor and inform him that he wishes the test to begin. At this time, if the Project Supervisor agrees that all procedures and requirements to perform the test have been fulfilled, he will then give the Contractor authorization to continue with the test.

When authorization is given to continue with the official test, the City's Inspector or Project Supervisor will record:

- (1) the initial time of the test;
- (2) the time and pressure reading before the pressure is re-applied, the procedure required to raise the pressure from the dropped value to the required pressure value of 1 MPa. This procedure must be carried out as often as required during the test period to maintain the pressure as specified above. The dropped value must not be lower than 930 kPa;
- (3) the water volume used in Section 2 to raise the pressure from the dropped value to 1 MPa.

All test data shall be recorded on the City of Cornwall Official Test Sheet. When the test is completed, the Project Supervisor shall determine the amount of leakage and compare it to the allowable leakage of 2.22 litres per day per mm of diameter per km of pipe.

$$A = T \times F \times D \times L$$

Where

- A = allowable leakage in liters
- F = a constant flow rate of 0.0925 liters per hour
- T = time period of test; i.e. 2 hours
- D = diameter of pipe in millimeters
- L = length of pipe being tested in kilometers

If the watermain has failed the leakage test, it is necessary to find the point or points where the excessive leakage is taking place. There are a few steps that can be taken to ensure that it is a pipe leak, and not a leak at a fitting. First, leave the line under normal pressure. The next day, repeat the test. If the leakage measured the next day is greater than before, the leak probably is in a pipe joint or a damaged pipe. If the leakage is the same, it is more probably in a valve or a service connection.

To determine which it is, take the following steps. Insert the key for the curbstops in each shutoff and listen at the top of the key. It may be possible to hear a leak since the key acts somewhat like a stethoscope. If a leak is heard, open the shutoff and close it again. If there is now no audible leak, test the section again. If no leaking curbstops are found, crack the main valves at the ends of the test section several times and close them again. This is to flush out any sand grains in the valve seats that may prevent the valves from closing completely causing slight leakages.

If it is found that the leakage does not occur at either of the above points, it is then necessary to try and find a leak through trial and error. Some sort of leak detector, such as a sensitive microphone with amplifier and earphones is necessary.

Any leaks in the line should be repaired and the line retested until the measured leakage is less than the allowable leakage.

The Contractor shall bear the expense of all labour, material, and equipment incurred in eliminating the leak or leaks, and the retesting until successful results are obtained.

9. On the completion of the hydrostatic and leakage test, the Contractor must immediately chlorinate the watermains tested.

The City of Cornwall will only accept the watermain section tested after the results of the hydrostatic and leakage test are acceptable; the chlorination test has been performed; the flushing of the watermain is completed; the Waterworks Section has checked all valves on the system; the hydrants have all been inspected; and a bacteriological test has been successfully completed.

When all the above have been met, the Engineering Department will confirm the acceptance in writing.

The cost for providing all necessary labour, material, and equipment required to carry out all the procedures set in this section to perform the required tests is to be included in the Unit Prices of the Tender Items. No extra payment will be made.

#### **4.2.3 Disinfection and Flushing**

In a public water distribution system, all newly laid watermains, temporary water systems, or existing watermains which have been repaired, must be disinfected before being placed into service, in accordance with **ANSI/AWWA C651-99** or latest revision. It is necessary to follow this practice in order to protect consumers against the possibility of infection which could result from ingestion of water contaminated by disease producing organisms.

In all likelihood, the newly constructed system will have sustained contamination during transit, storage of the components, and laying of the piping. Often the pipe must be laid in soggy trenches and possibly on occasions be in contact with wastewater or even sewage admitted into the trench through service cuts.

In general, the disinfection procedure consists of eight operations:

1. Inspecting all materials to be used to ensure the integrity of the materials.
2. Preventing contaminating materials from entering the watermain during storage, construction, or repair and noting potential contamination at the construction site.
3. Removing, by flushing or other means, those materials that may have entered the watermain.
4. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.
5. Protecting the existing distribution system from backflow caused by hydrostatic pressure test and disinfection procedures.
6. Documenting that an adequate level of chlorine contacted each pipe to provide disinfection.
7. Determining the bacteriological quality by laboratory test after disinfection.
8. Final connection of the approved new watermain to the active distribution system.

The cost of providing all necessary labour, material, and equipment required to carry out all the requirements of this section is to be included in the Unit Prices of the Tender items. No extra payment will be made.

## Preventing Contamination and Cleaning

Preventative measures must be taken to ensure no debris, mud, storm water, or other materials enter the pipe during storage or construction. These materials, if left in the system, will shield bacteria from contact with the chlorine solution, resulting in incomplete disinfection and possibly delivery of contaminated water to consumers. Flushing is no substitute for preventative measures. Certain contaminants, such as caked deposits, resist flushing at any feasible velocity.

In the event of failure to protect the main from dirt or contaminants, the system must be cleaned. If flushing is ineffective, mechanical means shall be used such as a hydraulically propelled foam pig in conjunction with the application of a 1% hypochlorite disinfecting solution. The pipe shall be cleaned in a manner to ensure all debris has been removed. Water used in cleaning must be potable water only.

## Disinfection

There are three acceptable methods of disinfecting newly constructed watermains: the tablet method, the continuous-feed method, and the slug method.

The continuous-feed method is suitable for general application, and because no tablets are required to be left in the pipe during construction and preliminary flushing can be done to remove light particulates from the main. This is the procedure recommended for typical installations and is described below.

The continuous-feed method consists of completely filling the main to remove all air pockets, flushing with potable water to remove particulates, and chlorinating the water in the main. Chlorination is done by introducing a solution to create an initial chlorine concentration of 25 mg/L (25ppm). After a minimum contact time of 24 hours in the main, there must be a free chlorine residual of not less than 10 mg/L (10ppm).

For preliminary flushing, the velocity in the main shall not be less than 0.75 m/s. The following table indicates the flow rates required for commonly used pipe:

Diameter (mm)	Flow to Produce 0.75 m/s (l/s)	Size of Taps			No of 64mm Hydrant Outlets
		25	38	50	
		No. of Taps in Pipe			
100	6.3	1	-	-	1
150	12.6	-	1	-	1
200	25.2	-	2	1	1
250	37.9	-	3	2	1
300	56.8	-	-	2	2
400	100.9	-	-	4	2

(Source: AWWA C651-99 Table 3)

Typically, chlorine solutions are available as calcium hypochlorite, a granular product having 65% available chlorine, or sodium hypochlorite, a liquid product having 10% to 15% available chlorine. They are prepared for feeding into the main as a one-percent solution (10,000 ppm). For calcium hypochlorite, a 1% solution requires 1 lb. (454 g.) in 30.0 liters of water. Appendix "A" provides a reference for comparison of measures of concentration. The quantity of one-percent solution required to produce 25 mg/L concentration in 30m of pipe is as follows:

Pipe Diameter (mm)	1% Chlorine Solution (l)
--------------------	--------------------------

100	0.6
150	1.4
200	2.5
150	3.9
300	5.4
400	9.8

(Source: AWWA C651-99 Table 4)

Chlorine solution shall be introduced into the main not more than 3 m. downstream from the beginning of the pipe. It may be applied to the watermain with a gasoline or electrically powered chemical-feed pump designed for feeding chlorine solutions. Feed lines shall be made of material capable of withstanding the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

Chlorine application shall not cease until the entire main is filled with a solution having a concentration of at least 25 mg/L. To ensure that this concentration is provided, chlorine concentrations can be measured using high-range test kits that are easy to use and satisfactory for the precision required. The chlorinated water shall be retained in the main for at least twenty-four (24) hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances.

If application of chlorine is carried out from one source, the Contractor must flush hydrants and blow-offs at various locations to the satisfaction of the Engineer to ensure that the chlorine has transferred into all parts of the constructed watermain.

Extreme care is to be exercised by the Contractor to ensure that the section of main being chlorinated is isolated from the existing water system. No valves shall be operated that could potentially permit escape of chlorine solution into the distribution system.

### **Final Flushing**

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/liter. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline.

The environment to which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the residual chlorine.

### **Bacteriological Tests**

After final flushing and before the watermain or temporary potable water system is placed in service, two consecutive sets of acceptable samples shall be taken at least twenty-four (24) hours apart. At least one set of samples shall be collected from every 350 m. of the new watermain, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality in accordance with *Standard Methods for the Examination of Water and Wastewater*. The Engineer or his representative must be present when the samples are collected.

The Contractor shall collect water samples in the presence of a City of Cornwall representative and send to an environmental laboratory accredited by the Standards Council of Canada for

microbiology testing of water. Samples for bacteriologic analysis shall be collected in sterile bottles provided by the accredited laboratory, and shall follow the sampling procedure directed by the laboratory. The sample bottles may contain sodium thiosulphate or other preservative to neutralize chlorine. This material must not be rinsed out of the bottles.

No hose or fire hydrant shall be used in collection of samples. A suggested sampling tap consists of a standard corporation cock installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly must be removed and retained for future use.

Water shall be tested for bacteriological contamination. The bacteriological analysis must prove results of zero total coliforms, zero fecal coliforms, and zero background colonies or organisms per 100 ml. The laboratory shall provide a written report confirming the analysis. The new watermain is not to be placed into operation until the results of these tests are known to be satisfactory, and the Contractor has submitted the laboratory results to the Engineer.

### **Repetition of Procedure**

If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. When the samples are satisfactory, the mains may be placed in service.