
CONSTRUCTION AND MATERIALS SPECIFICATIONS MANUAL

REVISION # 6 – June 2017

NOTICE OF REVISION

Email Contact Information:

The City will only send notification of Manual revisions by email. If you would like to receive notifications of future revisions, send your email address to claudio.leon@hamilton.ca

Access to Hamilton Standards:

Each Manual holder is responsible for determining implementation dates and directions for use of these revisions. It is recommended that you retain superseded versions of specifications for future reference.

All specifications and drawings are available free of charge online at the City of Hamilton website at:

<https://www.hamilton.ca/develop-property/policies-guidelines/construction-and-material-specifications>

Here you will find the latest versions of the published standards, archives of the previously published standards and Revision Information Sheets for currently published standards.

Hard-copy paper versions of the standards are available for a fee at our office located at:

Public Works Department – Reception
77 James Street North, Suite 320
Hamilton, Ontario, L8K 6E9
Call 905 546-2424, Ext. 4170.

Method of payment: Cash or company cheque payable to the City of Hamilton. Personal cheques must be certified.

Revisions to the Construction and Materials Specifications Manual:

Superseded / Cancelled (Remove)		Revised / New (Insert)		Comments
Document	Dated	Document	Dated	
Construction and Material Specification Manual Index	April 2014	Construction and Material Specification Manual Index	June 2017	Updated
Form 300, General Construction Requirements	June 2006	Form 300, General Construction Requirements	June 2017	Updated
Form 400, Specification for the Installation of Watermains	April 2014	Form 400, Specification for the Installation of Watermains	June 2017	Form 400 and Appendix 400-A updated
Form 500, Specification for Sewer Pipe Materials and CCTV Inspection	April 2014	Form 500, Specification for Sewer Pipe Materials and CCTV Inspection	June 2017	Updated
Form 600, Specification for Granular Fill Materials	June 2006	Form 600, Specification for Granular Fill Materials	June 2017	Updated
Form 700, Specification for Portland Cement Concrete	June 2013	Form 700, Specification for Portland Cement Concrete	June 2017	Updated
Form 900, Specification for Standard Compaction Requirements	June 2006	Form 900, Specification for Standard Compaction Requirements	June 2017	Updated
Form 1000, Amendments to Ontario Provincial Standards	January 2011	Form 1000, Amendments to Ontario Provincial Standards	June 2017	Updated
-----	-----	Approved Products List Table of Contents	June 2017	Added
Approved Products List Section 1 - Watermains	May 2016	Approved Products List Section 1 - Watermains	June 2017	Updated
Approved Products List Section 2 - Sewers	May 2016	Approved Products List Section 2 – Sewers	June 2017	Updated
Approved Products List Section 3 Street Lighting	May 2016	Approved Products List Section 3 Street Lighting	June 2017	Updated
Approved Products List Section 4 Traffic Signals	May 2016	Approved Products List Section 4 Traffic Signals	June 2017	Updated
-----	-----	Approved Products List Section 5 Parks Construction	June 2017	Added

Superseded / Cancelled (Remove)		Revised / New (Insert)		Comments
Document	Dated	Document	Dated	
Standard Road Drawing Index	April 2012	Standard Road Drawing Index	June 2017	Updated
Note: All Standard RD Drawings, including those not revised, have been provided in single side format for ease of updating your binders.				
RD-102	November 2005	RD-102.01	June 2017	Revised
-----	-----	RD-102.02	June 2017	Added
RD-106	January 2011	RD-106	June 2017	Revised
RD-107	November 2005	RD-107	June 2017	Revised
RD-108	November 2005	RD-108	June 2017	Revised
RD-109	November 2005	RD-109	June 2017	Revised
RD-110.01	November 2005	RD-110.01	June 2017	Revised
RD-110.02	November 2005	RD-110.02	June 2017	Revised
RD-111	November 2005	RD-111	June 2017	Revised
RD-113.05	November 2005	RD-113.05	June 2017	Revised
RD-114	November 2005	RD-114	June 2017	Revised
RD-115	November 2005	RD-115	June 2017	Revised
RD-116.04	November 2005	RD-116.04	June 2017	Revised
RD-117	November 2005	RD-117	June 2017	Revised
RD-118	November 2005	RD-118	June 2017	Revised
RD-120	November 2005	RD-120	June 2017	Revised
RD-123.01	November 2005	RD-123.01	June 2017	Revised
RD-123.02	November 2005	RD-123.02	June 2017	Revised
RD-125.02	November 2005	RD-125.02	June 2017	Revised
-----	-----	RD-127	June 2017	Added
DT:0111-01	March 2011	DT:0111-01 (Size 24" x 36")	September 2015	Revised
DT:0111-02	December 2010	DT:0111-02 (Size 24" x 36")	September 2015	Revised

Superseded / Cancelled (Remove)		Revised / New (Insert)		Comments
Document	Dated	Document	Dated	
-----	-----	DT:0119-01 (Size 18" x 24")	January 2017	Added
Standard Watermain Drawing Index	June 2013	Standard Watermain Drawing Index	June 2017	Updated
WM-201.01	November 2005	WM-201.01	June 2017	Revised
WM-201.02	November 2005	WM-201.02	June 2017	Revised
-----	-----	WM-201.03	June 2017	Added
WM-202	November 2005	WM-202	June 2017	Revised
WM-209	November 2005	WM-209	June 2017	Updated

Revision Summaries:

These summaries are for information purposes and will highlight major or substantial changes only. Each revision and specification should be reviewed in its entirety.

Construction and Materials Specification Manual Index:

- References and specification dates updated.

Summary of Changes to Form 300 – General Construction Requirements:

- Section 300.03 – Shop Drawings – Submittals and Review – Revised.
- Section 300.05 – Pre-construction Photography – Revised.
- Section 300.06.05 – Field Office – Points g) and h) revised as follows:
 - g) A designated location for the storage of photocopies of all locates obtained by the Contractor for the project.*
 - h) A printer / scanner complete with a supply of paper and toner.*
- Section 300.06.05 – Field Office – Revised to add the following:
 - Silent portable generators will be permitted when absolutely necessary.*
- Section 300.06 – Accident and First Aid – Renumbered to Section 300.07. All Subsequent Sections renumbered.
- Former Section 300.10.01, now Section 300.11.01 – Use of Hydrants – Revised to add the following:
 - All persons operating a hydrant shall have sufficient knowledge on hydrant operation and water distribution systems. Guidelines for Obtaining Water from City Hydrants have been*

provided in Appendix A. All persons operating a hydrant must follow these guidelines and must complete the Hydrant Use Log Sheet provided each time a hydrant is used.

- Former Section 300.24.01, now Section 300.25.01 – Dust Control – Revised to add the following:
Concrete cutting shall be done using wet saws or by methods that minimize concrete dust emissions.
- Former Section 300.36, now Section 300.37 – Short Term Pavement Markings – Rewritten.
- Former Section 300.37, now Section 300.38 – First paragraph revised as follows:
The Contractor shall calculate all proposed road, curb and sidewalk grades and elevations and shall submit them to the Project Manager for review, prior to construction.
- Form 300 - Appendix A - GUIDELINES FOR OBTAINING WATER FROM CITY HYDRANTS FOR AUTHORIZED CONTRACTORS AND CITY STAFF – Added.

Summary of Changes to Form 400 - Specification for the Installation of Watermains:

- Specification and standards references updated.
- Section 400.04 – Approved Watermain Materials - Revised to allow Steel Pipe for special projects only as per the Contract Documents.
- Section 400.05.01 – Revised to add the following:
*All watermain joints and fittings within areas of engineered fill shall be restrained. Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.
All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.*
- Section 400.05.02 – Revised to add the following:
All watermain joints and fittings within areas of engineered fill shall be restrained.
- Section 400.06 – Revised to add the following:
*All watermain joints and fittings within areas of engineered fill shall be restrained.

Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.*
- Section 400.07.01 – Revised to add the following:
*All watermain joints and fittings within areas of engineered fill shall be restrained. Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.
All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.*

- Section 400.07.02 – Revised to add the following:
All watermain joints and fittings within areas of engineered fill shall be restrained.
- Changes to Appendix 400-A:
 - 1.2 Definitions - updated.
 - 2.5 Disinfection of Watermain – Chlorine concentrations and contact times for new watermains revised.
 - 3.1 Revised to include Tapping of Watermains.
 - 5. Watermain Breaks – Revised - Watermain breaks shall be treated in accordance with the MOECC – Watermain Disinfection Procedure, Section 3. Watermain Disinfection Procedures for Emergency Repairs.
 - 6. Relining of Watermains – Added

Summary of Changes to Form 500 - Specification for Sewer Pipe Materials and CCTV Inspection:

- Specification and standards references updated.
- Section 500.04 – CCTV Sewer Inspection – Revised.
- 500.03.04, Table 500-1 - Approved Sewer Pipe Materials table – Revised

Summary of Changes to Form 600 - Specification for Granular Fill Materials:

- Specification and standards references updated.

Summary of Changes to Form 700 - Specification for Portland Cement Concrete:

- Specification and standards references updated.
- Section 700.08 – Finishing Concrete Sidewalks – Revised to add the following:
*Sidewalks control joints shall be saw-cut at 1.5m centres unless otherwise noted.
All edges shall be finished with an edging tool having a 13mm radius.*

Summary of Changes to Form 900 – Summary of Standard Compaction Requirements:

- Specification and standards references updated.

Summary of Changes to Form 1000 – Amendments to Ontario Provincial Standards:

- Specification and standards references updated.

Summary of Revisions to the Approved Watermain Products List – Section 1:

- Specification and standards references updated.
- Couplings listed separately for In-Chamber and Direct Buried applications.
- New approved products added:
 - Advanced Corrosion Solutions – ACS PetroGuard (primer, mastic and tape).
 - Ductile Iron Pipe - Canada Pipe – TR Flex.
 - PVC Pipe – Diamond Plastics Corp. (DPC) – 100mm to 200mm, and 300mm.
 - Butterfly valves – Henry Pratt Company – Models 2FII (450mm and 500mm) and Triton XR-70 (600mm and larger).

Summary of Revisions to the Approved Sewer Products List – Section 2:

- New approved products added:
 - Catch basin frame and cover OPSD 400.100 – Govind Steel (GS)
 - Maintenance hole frame and cover OPSD 401.010 – Govind Steel

Approved Street Lighting Products List Section 3:

- LED Cobra-head Luminaires – All wattages – Products Revised.

Approved Traffic Signals Products List Section 4:

- Grounding Rods – Erico Part Number Revised.

Approved Parks Construction Products List Section 5:

- New Section 5 – Approved Parks Construction Products - Added.

CONSTRUCTION AND MATERIAL SPECIFICATIONS MANUAL INDEX

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	<u>General Conditions</u>
January 2011	Form 200 - General Conditions
June 2017	Form 300 - General Construction Requirements
	<u>Standard Specifications</u>
June 2017	Form 400 - Specification for the Installation of Watermains
June 2017	Form 500 - Specification for Sewer Pipe Materials and CCTV Inspection
June 2017	Form 600- Specification for Granular Fill Materials
June 2017	Form 700 - Specification for Portland Cement Concrete
June 2013	Form 800 - Specification for Hot Mix Asphalt
June 2017	Form 900 - Specification for Standard Compaction Requirements
June 2017	Form 1000 - Amendments to Ontario Provincial Standards
	<u>Approved Products</u>
June 2017	Approved Products List
	<u>Standard Drawings</u>
June 2017	RD Standard Road Drawings
June 2017	WM Standard Watermain Drawings
January 2011	SEW Standard Sewer Drawings
June 2006	PK Standard Park Drawings

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.01 DEFINITIONS

The following definitions shall apply:

- (i) **"Existing Road Grade"** - means the centre-line elevation of the existing road and/or allowance.
- (ii) **"Proposed Road Grade"** - means the centre-line elevation of the road Work proposed under this Contract.
- (iii) **"Future Road Grade"** - means the centre-line elevation of a future road beyond the scope of this Contract.
- (iv) **"Private Drain"** - means that part of the drainage system that connects the yard sewer to the main sewer and is situated within the limits (road allowance) of the highway.
- (v) **"Yard Sewer"** - means that part of the drainage system from a point 1 metre from the face of a facility on a parcel of land to the private drain or any other place of disposal. Also includes that part of a drainage system between a catch basin and storm water private drain.
- (vi) **"Lateral", "drain"** - shall mean any part of drainage system situated within the limits (road allowance) of the highway, other than the main sewer. (e.g. catch basin drain)

.02 MATERIALS AND APPLIANCES

Unless otherwise specified, the Contractor shall at their expense, provide all materials, labour, water, tools, equipment, light, and power necessary for the execution of the Work.

.02.01 Ordering Responsibility

It shall be the sole responsibility of the Contractor to ascertain (and follow up until delivered), that all material or equipment, whether directly under their or under their Sub-Contractor's jurisdiction, which is not available from stock" (check same), but which requires longer manufacturing or delivery time, is ordered immediately after award of the Contract, and that all Shop Drawings which must be prepared before fabrication and all samples requested to be submitted for the City's selection, be so prepared or submitted by the responsible Sub-Contractors right away.

It is stressed that no deviations from Specifications or acceptance of substitutes, which may be proposed by the Contractor in order to compensate for tardiness in ordering or failure to expedite deliveries, or acceptance of Work for which Shop Drawings had not been submitted and reviewed by the City, shall be permitted.

Immediately upon the receipt of shipment(s), all Contractors and Sub-Contractors shall thoroughly check all shipments for correctness and completeness in order to avoid discovering the incorrectness or incompleteness of shipment(s) when installation of the same is due.

.02.02 Approved Products and Materials Lists

All products and materials that are supplied by the Contractor shall be listed on the appropriate Approved Products Lists, issued by the City. Where a product or material needed to complete the Works is not specified in the Contract Documents and is not on the current Approved Product List, the Contractor shall verify its use with the City prior to the start of any Works.

The City shall reserve the right to not allow a product that is listed on the Approved Products and Materials List, if for any reason, its use in a given application is deemed to be inappropriate.

.03 SHOP DRAWINGS – Submittals and Review

After the award of the Contract, prior to ordering the delivery of equipment to be supplied and in sufficient time to permit the satisfactory progress of the Work, the Contractor shall submit to the Project Manager for review, additional drawings or prints in triplicate of such equipment, together with other information in such detail as may be necessary to permit the Project Manager to become informed of the design of the equipment which the Contractor proposes to use.

Shop drawings and schedules shall be furnished by the Contractor for review and comments showing all piping components, fittings and appurtenances.

The Contractor shall make changes to the shop drawings as may be found necessary upon review by the Project Manager to make the same conform to the Specifications. Tabulated lists shall be provided by the Contractor of minor items of equipment for which drawings are not required. These lists shall show the name of the manufacturer, the catalogue type number, leading dimensions and other pertinent data.

Upon review and no further comments, shop drawings, lists and specifications shall become a part of the Contract and the materials and equipment furnished and installed shall conform with the final revision of shop drawings. Final shop drawings, lists and specifications shall not in any way release the Contractor from its responsibility for the proper fulfilment, by any equipment or material, of the requirements of the Contract, and of the purpose for which the said equipment and materials are installed, nor from its liability to replace the equipment and/or materials should they prove defective or fail to meet specified requirements.

.04 INFORMATION TO BE SUBMITTED AT PRE-CONSTRUCTION MEETING

The Contractor shall make available to the City the following information at the Pre-Construction Meeting.

- a) Proposed Work schedule and cash flow schedule
- b) Where blasting is anticipated, the name of the independent inspection company, together with the pre-construction survey report.

- c) The addresses of all dump sites to be used to deposit materials together with letters of permission from the property owners involved.
- d) Executed agreements and/or letters of permission for dumping will also be required from any municipalities involved, and where applicable, conservation and/or other authorities having jurisdiction.
- e) The names and addresses of manufacturers and/or suppliers of all materials required in the Contract, including but not limited to the following: pipe, concrete, precast manholes, chambers, catch basins, asphalt, granular materials together with its sources and castings (when applicable).
- f) Copy of the Contractor's company health and safety policy and program.
- g) Notice of Project from Ministry of Labour.
- h) Contractor's 24-hour hotline phone number
- i) Impact on parking, access, garbage pickup and the anticipated disruption of services – water, sewer, postal delivery, schools.
- j) Methods of bulkheading and/or weir construction in downstream sewer manhole(s) to prevent siltation to existing downstream sewer system.
- k) The hourly rates of Contractor's staff ie. foreman, labourers, operators, pipe layers and the percent of corresponding burdens.
- l) All types of equipment and their hourly and daily rates.

When, in the opinion of the Project Manager, the Contractor does not provide the required information in time for the pre-construction meeting, the Project Manager reserves the right to delay the start of construction and to immediately commence to charge Working days against the Contractor.

.05 PRE-CONSTRUCTION PHOTOGRAPHY

The Contractor shall provide the City with one set of pre-construction photographs (colour prints or digital files) prior to commencement of construction of the project.

The photographs shall be 3 1/2 x 5 inch (min.) colour prints, legibly marked on the back, showing location, house no. etc.

Digital photograph shall be in colour. File names shall indicate the building's municipal address.

Photograph prints shall be labelled showing location, house no. etc. in a manner not to obstruct the images.

A minimum of 2 photographs per typical residential property or the number required to show both sides of driveways, all vegetation, utilities, ditches, culverts, hydrants etc. A series of photographs may be required to show long frontage properties

(max. spacing of 20m), extra photographs of particular items such as culvert crossings, damaged buildings, etc. All photographs shall be overlapping and continuous. Photographs shall show general condition of pavement, curbs, walks, shoulders, ditches (as applicable). A series of all intersecting streets shall be supplied as well.

All photographs shall be of 35mm quality and clarity. The Contractor must have negatives available up to the end of the projects maintenance period. There will be no specific payment item for providing these photographs. Where a digital camera is used, the City will accept a CD with all the required photos.

All photographs shall be taken and provided to the City no later than 1 (one) week prior to the start of construction.

.06 WORK SITE LIMITS

All aspects of this entire item shall be at the Contractor's expense.

The site which may be occupied by the Contractor during the prosecution of this Contract will be limited to the areas shown on the drawings as the public road allowances. No plant, equipment, materials or temporary buildings shall be stored or erected and no roads shall be constructed by the Contractor outside the designated areas except as required by the Contract with the prior written permission of the Project Manager.

The Contractor shall be entirely responsible for providing and properly maintaining adequate temporary access roads to, and detour roads around, the designated areas.

If private lands are to be traversed or otherwise occupied by the Contractor, they shall complete all necessary legal arrangements with the owners for rights over access to and from, or occupancy of the private lands, or any combination thereof, and submit to the Project Manager acceptable proof that these legal arrangements have been completed prior to entering upon such lands. Upon completion of the Contract, the Contractor shall file with the City a release and indemnification absolving the City from all obligations with respect to damages claimed and incurred as a consequence of using said private lands.

On all lands to be used by the Contractor for any reason, the Contractor shall strip all topsoil and vegetation from areas to be disturbed and stock-pile this on the site for future restoration of the site. The Contractor shall be responsible for its own access. That portion of the site that will be used by the Contractor for the purposes of vehicular traffic, material storage purposes and temporary shelter, shall be properly drained and provided with a granular working pad that shall be kept free from mud and debris at all times.

The Contractor shall clearly define all limits of easements in order to confine operations to such areas.

Prior to entering the easements with any materials and/or equipment, the Contractor shall verify all survey markers along the limits of the easements. Upon such

verification it shall be the Contractor's responsibility to install and maintain for the duration of the Contract, steel posts spaced at maximum intervals of 15.24m (50') continuously strung with brightly coloured plastic tape or such other method of marking as may be approved by the Project Manager.

The Contractor should note that the above requirement will be strictly enforced and that indiscriminate damaging of adjacent properties will not be tolerated.

Should the Contractor be found not confining its operations strictly to easement lands or designated areas, the Project Manager reserves the right to stop Work on the project until such time as the Contractor has supplied and temporarily installed snow fences along the limits of the easements and completely restored all damaged areas to the satisfaction of the Project Manager, all at the Contractor's own expense.

.06.01 Postal Services

Along the route of the Work, where mail boxes must be removed to facilitate construction, the Contractor shall temporarily relocate such mail boxes and posts to a safe location and shall make other arrangements suitable to the residents and Canada Post to facilitate uninterrupted postal delivery. All costs entailed shall be the responsibility of the Contractor.

.06.02 Temporary Access

The Contractor shall provide temporary roads, street approaches, walks, ramps, stairs and other means of access to the Site as required or ordered by the Project Manager or other authorized City representatives.

.06.03 Sanitary Convenience and Shelter

The Contractor shall provide, and properly maintain, in a clean condition, suitable and convenient privy or water closet accommodation for all workers employed on the Work such that it shall not be a source of inconveniences, complaint, or nuisance to the public or the residents in the vicinity of the Works.

The Contractor shall provide, at its own expense, an adequate, comfortable shelter, accessible during the noon hour and inclement weather, to all Workers employed on the Work, and its location shall be approved by the Project Manager.

Such sanitary conveniences shall meet all current applicable regulations and shall be otherwise satisfactory to the Project Manager.

.06.04 Contractor's Identification Signs

Signs, bearing the Contractor's name and 24 hour emergency phone number shall be supplied and installed by the Contractor on barricades, flashers or steady light stands at each end of all barricaded sections of the Work. Signs shall be constructed of weather-resistant materials with lettering a minimum of 75mm in height, of contrasting colour with its background, clearly legible and neat in appearance.

All Contractor identification signs shall be positioned to be clearly visible to traffic at all times, repositioned as required and maintained by the Contractor for the duration of the Contract.

The Contractor is to supply a 24 hour phone number (hotline) available to the public and City at any time. This number is to be shown on the Contractor's identification signs as indicated above.

.06.05 Field Office

The Contractor shall provide and maintain in good condition for the exclusive use of the Project Manager, Inspector and assistants, one (1) insulated, weather- proof construction field office, having a floor space of not less than 12 sq. metres. The office's location on, or in the immediate vicinity of the project shall be determined by the Project Manager, and shall be constructed so that it can be moved to another site (if required) and shall be in operation within one week of commencement of the Contract.

The site office shall be of a standard equal to that usual in the trade for such construction and shall comply with the following requirements:

The site office shall be constructed and equipped as per current Occupational Health and Safety requirements and shall not be limited to the following:

- a) All entrances are to be equipped with steel security doors and exterior type locks
- b) All windows are to be equipped with heavy gauge steel bars or cages to prohibit entrance from outside
- c) All windows are to be capable of being opened to the outside to allow natural ventilation of the office
- d) A supply of fresh cold and hot drinking water
- e) A fire extinguisher mounted next to all entrances
- f) First Aid kit, including a portable eye wash kit
- g) A designated location for the storage of photocopies of all locates obtained by the Contractor for the project.
- h) A printer / scanner complete with a supply of paper and toner.
- i) An internet connection shall be provided for the use for the Project Manager and Inspector.
- j) The site office shall be cleaned weekly to the satisfaction of the Project Manager and Inspector.

- k) The Contractor shall service, maintain and carry insurance on the site office and contents and provide evidence of insurance to the Project Manager before Work commences.

The office shall be provided with sufficient natural and electrical light, shall be adequately heated to maintain a minimum temperature of 20°C, and shall be adequately air-conditioned to maintain a maximum temperature of 24°C depending upon outside temperature conditions.

The office shall be equipped with a sloped plan table, two (2) chairs and a bench. The office shall be equipped with a minimum of one (1) electrical outlet.

Silent portable generators will be permitted when absolutely necessary with the approval of the Project Manager.

The Contractor shall make available to the Public Works Staff such ablution and sanitary facilities as provided for its own forces.

There will be no specific payment item for providing this office, including the cost of erecting it, relocating it if necessary, furnishing it, supplying it with heat/air-conditioning (as required), light and printer/scanner, and eventually removing it at the termination of the Contract. Upon removal of field office, the site shall be cleaned up and restored to original condition.

The Contractor shall note the above requirements will be strictly enforced and that a field office is required on all construction projects unless deemed not required by the Project Manager.

.07

ACCIDENT AND FIRST AID

The Contractor shall provide, at the site, such equipment and medical facilities as are necessary to furnish first aid to anyone who may be injured in connection with the Work.

The Contractor must promptly report, in writing, to the Project Manager, all accidents arising out of, or in connection with the performance of the Work, whether on, or adjacent to the site, which caused death, personal injury, or property damage, giving full details and statements of witnesses. In addition, in case of death, serious injuries or damages, the accident shall be reported immediately by telephone, to the Project Manager. If any claim is made by anyone against the Contractor or any Sub-Contractor, on account of any accident, the Contractor shall promptly report the facts in writing to the Project Manager, giving full details of the claim.

.08

SAFETY MEASURES

The Contractor shall, at all times, comply with all safety by-laws, Municipal by-laws and Safety Acts of the Province of Ontario, Government of Canada and any staff instructions issued by the Project Manager, or through any Inspector appointed or so recognized by the City.

All aspects of the Work under any Contract must meet all requirements of the

Occupational Health Safety Act including Regulations for Construction Projects, as amended.

The Contractor shall file a "Notice of Project with the Ministry of Labour as required under the Occupational Health Safety Act.

.08.01 Special Protection

The Contractor shall take reasonable and required measures, including those required by authorities having jurisdiction, to protect the public and those employed on the Works from bodily harm and to protect adjacent public and private property and City property from damage. Without limiting the generality of any other provision in this Contract, the Contractor shall:

- a) Provide and keep available in the Construction Office, safety helmets for authorized visitors to the site.
- b) Protect excavation, trenches and building from damage by rainwater, ground water, backing up of drains or sewers and other water, frost and other weather conditions. Provide sheeting, piling, shoring, pumps, equipment, temporary drainage and enclosures if any as required. Provide necessary pumps, including spare pumps, for keeping the project free of water throughout the duration of the project.
- c) Provide fences, hoarding, guard rails, barriers, night lights and pavement protection as required for protection of the public and of public and private property and constructed in accordance with and as required by law and authorities having jurisdiction. Erect sturdy railings around shafts, stairwells and the like to protect Workmen, supervisory personnel and the public from injury.
- d) Provide and maintain guard lights at barricades, railings, obstructions in roads or sidewalks.
- e) Properly secure the Job Site at night, on Saturdays and Sundays, on statutory holidays and other times when the Work is not in progress.

The Contractor shall make full restitution of such harm and damage resulting from failure to take adequate protective measures, and shall make good any damage to the Work from whatever cause.

.09 MATERIAL SAFETY DATA SHEETS

M.S.D.S. data sheets must be supplied and be readily available on the job site at all times and be issued to City staff if so requested.

.10 TRANSPORTING MATERIALS ON STREETS

The Contractor shall, if so directed by the Project Manager, provide tight trucks, approved by the Project Manager, to haul soft or wet material over the streets, in order to prevent litter on the street. In all cases where any materials are dropped from the trucks of the Contractor, the Contractor shall clean up the same as often as directed and also keep all roads and sidewalks clean and free from dirt and mud.

If the Contractor refuses or neglects to clean up said litter when ordered to do so by the Project Manager, the City shall do the necessary cleaning up, and the costs of same shall be deducted from monies due to the Contractor.

.11 TEMPORARY SUPPLY OF WATER, POWER, AND OPERATION OF CITY HYDRANTS

.11.01 Use of Hydrants

The City of Hamilton will allow Contractors to use existing fire hydrants as a source of water for construction Works. Where a Contractor requires the use of a hydrant, they shall obtain and complete a "Water Hydrant Use Agreement" from the Water Distribution Division and shall be bound by the rules and be responsible for all costs associated by the permit and the use of the hydrant.

The Contractor shall call 905 546-4426 to obtain the permit.

All persons operating a hydrant shall have sufficient knowledge on hydrant operation and water distribution systems. Guidelines for Obtaining Water from City Hydrants have been provided in Appendix A. All persons operating a hydrant must follow these guidelines and must complete the Hydrant Use Log Sheet provided each time a hydrant is used.

For those Contracts where the use of a hydrant is permitted, flushing of watermains shall be conducted during regular Working hours whenever possible. Prior to any flushing operation, the Contractor shall notify the Water Maintenance Section at 905 546-4426 to ensure that the after hours desk is aware of flushing operations. Hydrants shall have a hose connected directing water to the gutter and catch basins. An approved backflow preventer shall be used to prevent back siphon. No free flowing hydrants will be permitted.

All materials and arrangements of valves and piping required to provide temporary use by the Contractor shall be in accordance with the Project Manager's requirements to prevent freezing and contamination of service and watermain. All arrangements and costs for the above shall be paid by the Contractor.

The Contractor shall see that no waste of water is permitted and that water shall not be left running when not in use.

The Contractor shall take all necessary measures and precautions to prevent any icy conditions of the roadways developing as a result of use of water from the above service.

Any repairs to service or watermains made necessary as a consequence of damage

due to the Contractor's operations, shall be made by the City's forces at the Contractor's expense.

.11.02 Power and Water Supply

The Contractor shall make all necessary arrangements and be responsible for all costs to provide themselves with an adequate supply of power to operate its equipment and to provide for lighting, etc. They shall bear all costs entailed.

The Contractor may arrange with the City, Public Works Department for a water service or services, to be installed at the Contractor's expense, from an existing watermain near the site or sites of its Work operations.

When the Contractor's need of temporary services (power and water) terminates, they shall make proper arrangements for their discontinuance.

.12 DRAINAGE AND DEWATERING

Ditches, culverts and gutters shall be kept open at all times. Any flow of water shall not be directed across or over pavements except through pipes or properly constructed troughs. The Contractor shall keep all portions of their Work properly and efficiently drained during construction and until completion. They will be held responsible for all damages until completion. They will be held responsible for all damage which may be caused by, or result from water backing up or flowing over, through, from or along any part of the Work, or which any of its operations may cause to flow elsewhere.

All trenches and other excavations shall be kept free of water at all times. The Contractor shall employ adequate means to remove the water in a manner that will prevent loss of soil and maintain the stability of the excavation.

The Contractor shall provide for the disposal of such water in a manner that will not be a danger to the public health, private property or to any portion of the Work completed or under construction either by them or any other Contractor, nor cause an impediment to the use of the streets by the public, and provide sediment control as required.

Drainage of the trench or other excavations through newly laid storm sewer pipe will be allowed only with the express permission of the Project Manager.

When drainage is directed to existing catch basins, the catch basins must be regularly inspected, and, cleaned of debris and sediment by the Contractor.

The Contractor shall not hold the City or other Contractors liable for leakage encountered by them in its Work from existing sewers, watermains, or drains, or from other sewers or drains under construction.

.13 NOISE**.13.01 Acceptable Noise Levels**

The noise levels of construction equipment operating in built-up areas shall not exceed the values stated in the City of Hamilton's Noise By-Law to control noise.

The use of chainsaws and other types of power-saw on the site shall be limited to hours of the day when noise from this source will produce no complaints from the residents living in the vicinity.

.14 OVERTIME WORK

In general, Night, Sunday and Holiday Work requiring the presence of a Project Manager or Inspector, will not be permitted, except in case of an emergency, and then only to such an extent as deemed advisable and with the written permission of the Project Manager. It may be necessary or expedient in the judgment of the Project Manager to do Work at these times or after regular Working hours. When requested in writing by the Project Manager to perform such Work, the Contractor shall be entitled to additional payment as per Form 200.06. This additional payment shall be limited to include the overtime (plus 15%) of hourly paid labourers and the use of extra necessary equipment. The Contractor shall submit vouchers showing the hours worked and the type of additional equipment used.

.15 PRESERVATION OF SURVEY MONUMENTS

The location of existing survey monuments (eg. concrete monuments, stone monuments, iron bars, etc.) which have been established to indicate right-of-way, subdivisions and other surveyed limits of the ground surface, shall be ascertained by the Contractor prior to its entry onto the site, or sites, of the Work. The Contractor shall mark all concrete monuments, iron bars, etc., with a 50mm by 50mm by 1.2m marker which has been dipped in red paint for the upper 100mm.

During the course of the Work, when it is absolutely necessary to remove existing survey monuments, the Contractor shall arrange and pay for the establishment of proper reference points of the original markers by an Ontario Land Surveyor (OLS) before their removal. The Contractor shall provide the name and contact information of the Ontario Land Surveyor to the City for approval.

Reference points shall be clear of the Work and shall be marked in the manner specified in the foregoing paragraph. The Contractor shall arrange to replace any removed survey monuments in their original locations after completion of the Work, by the same Ontario Land Surveyor used to establish the reference points. Where the City is not satisfied with the survey services provided, it reserves the right to complete the works using an Ontario Land Surveyor and deduct any costs incurred from monies owing to the Contractor.

.16 SHORING EXISTING STRUCTURES

The Contractor shall at its own cost and expense, shore up or otherwise support or protect, any buildings, bridges, walls, fences, pavements, or other structures which may show defects or which, in the opinion of the Project Manager or the Contractor, may be liable to injury or to be endangered during the Work, and in the case of injury, damage or disturbance to any such structure during construction, herein contracted for, whether directly or indirectly by and because of the construction of said sewer and watermain, or of any extra Work entering into this Contract, the Contractor shall, at its own expense and costs, proceed to restore, repair, rebuild or otherwise make good, the damage, injury, or the disturbance noted, and put the said buildings, fences, walls or other structures, in a condition the same as or equal to that existing previous to its beginning the Work.

.17 ENVIRONMENTAL CONSIDERATION**.17.01 Equipment Fuelling and Maintenance**

Equipment fuelling and maintenance shall be done in such a manner that no fuel or oil can gain access to surface water or ground water. This Work shall therefore not be done in or near any drainage ditch or watercourse.

.17.02 Cleaning Equipment and Construction Debris Disposal

The cleaning of equipment machinery in ditches or watercourses shall not be permitted. All construction and equipment debris must be contained and disposed of in locations approved by the Project Manager. Construction equipment shall be cleaned prior to entering public roadways, but not in areas where the debris can gain access to storm sewers, watercourses or ditches. Should such cleaning be impractical, the Contractor shall see to it that all trucks either its own or those rented, shall drive on the roadway shoulders only, until all mud and debris has been removed from the wheels. Contaminated shoulders and pavements shall be cleaned and protected from generating air-borne dust.

.17.03 Exhaust Emissions

Exhaust emissions shall be minimized through efficient machine maintenance. The Project Manager may require evidence that regular maintenance is carried out. Should any equipment show visible signs of exhaust emission problems, the Project Manager may require same-day service, or removal of the equipment from the Work site.

.17.04 Soil Erosion Control

This item shall be read in conjunction with the Hamilton Conservation Authority - Erosion & Sediment Control guideline for Hamilton Harbour Watershed.

Erosion of soil shall be prevented. Stabilization of disturbed areas shall be completed as soon as practical after completion of each section of Work. In areas not prone to surface erosion, stabilization may be delayed until more practical units of Work has accumulated. No areas or Work should remain uncompleted, however,

at the approach of the unsuitable weather season. Where soil erosion is expected to occur, vegetation strips shall be maintained between the disturbed areas and adjacent sensitive areas and watercourses. Provision shall be made to intercept site drainage at short distance intervals into settling ponds or permeable ground cover, to minimize sediment discharge. Snow fencing shall be placed between any Working areas and adjacent to sensitive areas and watercourses where endangered by construction machinery operations.

.18 PRESERVATION OF EXISTING STRUCTURES AND PLANTINGS

The Contractor will be required to remove, without extra remuneration, all boulders, stones, rocks, stumps, roots, trees, walls or other obstructions found upon the line of Work, and to fill up all unauthorized openings. All such filling shall be made using approved materials. The Contractor shall provide proper protection to prevent the fill from spreading on private property. Privately owned fences, hedges, trees, shrubs, walls, etc., encroaching on the line of the Work will normally be removed by the owner. In the event that such removal has not been carried out, the Contractor will be required to carefully remove the encroaching object and place safely on the owner's property (or remove from site if so authorized). No extra payment will be made for Work of this nature.

The Contractor will not be required to re-erect or replace any items removed under this paragraph.

Inconvenience to all owners whose properties abut on the proposed Works, shall be kept to a minimum by the Contractor, wherever and whenever it is in its power to do so. Doing this will tend to foster harmonious relations with the affected parties during the period of construction.

Lawns, or other landscaped areas, damaged or otherwise disturbed in the course of the Work, shall have a minimum of 100mm of approved topsoil. Topsoil shall be that of previously removed from the site and stockpiled, or approved imported material at the Contractor's expense.

When lawns have been cut or otherwise damaged, the Contractor shall, in addition to topsoiling, replace all sod. The sod shall be No. 1 Nursery Sod of a quality equal to or better than that which existed before commencing Work. The Contractor shall be responsible for maintaining and watering sod until such time as it is thoroughly established to the satisfaction of the Project Manager.

The Contractor will be required to remove all rubbish and material from boulevards and lawns adjoining the Work and restore same to as good and clean a condition as existed before commencement of the Work.

.19 TREES ENCOUNTERED DURING CONSTRUCTION

.19.01 Tree Removal

Under no circumstances shall the Contractor remove trees or tree limbs without prior permission to do so by the Project Manager. Trees subject to damage shall be fully protected by the Contractor to the satisfaction of the Project Manager.

The purpose of these specifications is to preserve and prevent damage to existing trees during construction projects.

- a) Excavating within two metres of the vicinity of the base of any tree must be done by hand digging. Construction shall be done in such a way as to ensure the roots will not be damaged.
- b) During construction any item which may cause soil compaction or damage to the tree will not be permitted within the dripline of any tree. Excavation soil, equipment, supplies or debris must not be piled even temporarily over the roots.
- c) Any roots contacted or exposed during excavation will be root pruned. Make a clean square cut (flush) three inches back from the damage with a saw.
- d) Any limbs damaged/broken during construction will be trimmed with a square cut (flush) three inches back from the damage with a saw.
- e) No change of grade will be permitted within the dripline of any tree. If a major grade change is required a retaining wall or tree well will be built in order to maintain the original grade around a city tree. No foundations or retaining walls will be constructed where severing of major roots will occur.
- f) Backfilling will consist of good topsoil free from debris, bricks, lumber, nails, steel stake, etc.
- g) When installing underground connections within the dripline of a municipal or City of Hamilton tree, proper auguring techniques as specified by the Arborist shall be used.

.20 UTILITIES

.20.01 Co-ordination With Other Contractors and Utilities

The Contractor shall co-operate and co-ordinate with all other Contractors and/or utility companies that may have Work to complete adjacent to or within the limits of the Contract. The Contractor shall permit access to the Work site by these other Contractors/Utilities when required.

The Project Manager reserves the right to alter the methods of operations in the Contract to avoid interference with other Work.

.20.02 Verify Locations and Elevations of Utilities

The Contractor shall verify the elevations and locations of all utilities in the vicinity of its proposed trenches. Excavation of all such utilities shall be carried out far enough ahead of its pipe laying crews to permit deflection of the proposed installation if required without requiring additional fittings.

Where utilities are found to conflict with the proposed installations as shown on the Contract Drawings, the Contractor shall immediately notify the Project Manager.

.20.03 "Ontario One Call"

Contractors shall use "Ontario One Call", telephone number 1-800-400-2255 utility locating service. Some utilities have not subscribed to "Ontario One Call" and it is the responsibility of the Contractor to ensure all field locates have been ordered from the pertinent authorities and are available prior to any construction.

.20.04 Protection of Existing Plant, and Utilities, Overhead and Underground

It shall be the Contractor's responsibility to contact all pertinent owners of plant and utilities and to verify the location of all underground plants in the vicinity of its trenches and Work. All such plant and utilities endangered by the Contractor's Work shall be adequately supported and protected from damage by the Contractor, at its own expense, to the satisfaction of the Project Manager and the plant or utility owner involved. See Ontario One Call Form 300.20.03.

The Contractor shall restore all plant and utility, underground and above ground, disturbed or damaged by construction to the satisfaction of the Project Manager and the local authorities having jurisdiction over the same. All restoration is to be done at the Contractor's expense.

.20.05 Procedures for Excavating Near Utilities

(Applies to all Utilities except Bell Canada)

It is a requirement for all Contractors to ascertain the location of any utilities that they may come in contact with during the course of its construction activities.

.20.05.01 Notification

The first requirement is that the Contractor must contact the Utility (note Call Ontario One Call service) and request a locate of plant in the area of the Construction. When a field locate has been given and that locate indicates that a potential conflict with the proposed construction exists, the following procedures will be used:

.20.05.02 Initial Exposure

After a locate has been provided, the Contractor will not use *mechanical equipment within one metre of any such locate without first digging a test hole to determine the plant's depth.

* The term "mechanical equipment" refers to backhoes, graders, heavy earth moving equipment, augers and other earth piercing equipment. Jackhammers and concrete saws are not considered to be "mechanical equipment".

The normal procedure for digging this hole, or test holes, would be to stop the mechanical equipment 1.0m away from the locate mark and have a labourer dig laterally in towards the Utility at various depths until the plant is found. If this is not possible due to the location and direction of construction activity in relationship to the located plant, then a test hole should be dug off to the side of the roadway,

entirely by hand, to determine the depth of the plant at that location. After this initial test hole is dug by hand, then mechanical equipment may be used to dig further test holes as close as 0.3m to the plant. Regardless of the location of the preliminary test holes, it is necessary that one test hole be located in the centre of the proposed trench or excavation directly over the Utility.

In any case, the last 0.3m must be excavated by hand. Whenever mechanical equipment is used closer than 1.0m to the Utility, a labourer must be used in conjunction with the mechanical equipment to probe and hand dig for the plant in the excavation. Whenever physically possible, the mechanical equipment shall be operated parallel to rather than perpendicular to the direction of the plant when excavation is within 1.0m of the Utility.

If it is not possible to dig the test hole off to the side of the roadway, then the test hole will be dug over the utility in the roadway with mechanical equipment, subject to the following conditions:

A concrete saw or jackhammers are only permitted to break the concrete. A backhoe may be used to remove these cut pieces of concrete. Excavation below the concrete is to be done by hand.

If another layer of concrete is encountered, the Utility and Project Manager should be consulted with, as the layer could be a concrete encased duct.

If there are other layers of concrete, or similar hard materials (not to include frozen ground), a backhoe may be used to excavate and remove this concrete providing that it does not excavate in more than 150mm swaths, and that a labourer is used to probe for the plant, by hand, between each swath. Once the initial test hole is completed, further test holes must be dug at sufficient short horizontal intervals as determined by the Contractor to ensure that possible variances, such as altered plant depths, are recognized. Mechanical equipment may be used with the labourer to dig these further test holes, provide that mechanical equipment is not used closer than 0.3m to the plant.

.20.05.03 Continuous Exposure

Once the plant has been located by the various test holes, then the Contractor must expose the plant along its length which is in conflict with the proposed construction. Mechanical equipment must not be used closer than 0.3m and the last 0.3m must be dug by hand. What is meant by exposing here is to uncover the top of the plant along its length of conflict.

It is of importance here that exposing the plant is not necessary when the test holes have determined that the proposed construction will maintain a 0.3m buffer of undisturbed soil between the mechanical equipment and the plant.

Once the plant is physically exposed, digging with mechanical equipment is allowed up to 150mm of plant, the last 150mm must be hand dug.

.20.05.04 Damages

If during the exposure procedure any damage is caused to sheath integrity for telecommunication, power cables or external damage to pipeline coatings, the appropriate utility shall be notified in order for repairs to be made.

.20.05.05 Breakout Existing Road At Existing Bell Structures

To facilitate road excavation required around any existing Bell structure which is clay pipe or conduit without concrete encasement, the Contractor must conform to the following minimum requirements:

1. Structure must be uncovered using the Bell approved procedures with the exception that mechanical excavation may be used within 0.3m alongside the structure once it has been exposed.
2. Manual excavation is required to expose the top of the structure. Saw cutters and jackhammers should not be used over the structure.
3. There can be NO heavy equipment or trucks working on top of the structure or crossing the structure once it has been exposed - i.e. the road surface has been removed from the top of the support of the existing soil beside the structure has been removed.
4. The structure cannot be undermined at any location without complete bridging in place. The bridging must be installed with a support at either end on original soil. The support area at each end must equal 30% of the intended open span under the structure.
5. The structure must not rest directly on any hard material after construction - i.e. watermains, sewer pipes, concrete, unshrinkable fill, etc. There must be a minimum of 150mm of properly compacted sand cushion between the bottom of the structure and any installation under the structure.
6. Compaction equipment must not run over the structure at any time, nor can such equipment be used within 0.5m alongside the structure.
7. Where the structure has been exposed and is adjacent to an excavated area, shoring may be required, at Bell Canada's discretion, to prevent collapse.
8. All costs associated with protective measures noted above or identified later (including during construction) will be borne by the Contractor.
9. Adherence to these requirements or any to be determined later does not absolve any party from normal responsibility for loss due to damages.
10. Bell Canada's on site Inspector must be informed of the location of any excavation activities taking place within 1.0 m of the structure 24 hours in advance.

11. Any damage, incidental or otherwise, must be reported to the Bell Inspector, or in its absence, to Bell Canada repair at 611.

To facilitate both road excavation and traffic requirements the haulage trucks must be loaded on the hardtop behind the backhoe, i.e. no "third lane" loading.

.20.06 Notification of Existing Utilities

Should any utility or structure, within the limits of this Contract and interfering with the laying of the sewer or watermain, be unexpectedly encountered, the Contractor shall immediately notify the Project Manager in writing, giving the location and conditions. The point may be passed over until satisfactory arrangements are made without any claim for damage, or extra compensation arising from the delay, the Contractor being allowed an extension of time as provided.

.20.07 Sub-Surface and Other Site Conditions

The information shown on the Contract Drawings regarding sub-surface and other site conditions is, at best, a guide to assist in the determination of conditions that will probably be encountered when excavating. The City assumes no responsibility for the accuracy of this information, and the Contractor shall have no claim against the City due to it encountering conditions other than those indicated on the Contract Drawings.

It is expected that Contractors shall make, at their own expense, such tests, inspections, and other on-site investigations as they consider necessary to satisfy themselves as to the nature of the conditions to be met with and the quantities of the various kinds of Work to be done.

However, should the Contractor encounter, in the course of construction, conditions more difficult than those anticipated on the basis of its investigations, they shall have no claim against the City on this account.

.21 CONNECTING TO EXISTING PLANT

As part of its construction procedure the Contractor shall, prior to construction, verify the positions and elevations, by excavating if necessary, of all existing watermains, sewers and manholes that are required to connect to. All such verifications shall be carried out far enough ahead of its pipe installation operations to permit approved adjustments to alignment and/or grade of the proposed Works. All costs entailed shall be included by the Tenderer in the prices bid for the items involved.

All costs involved to remove, re-install or correct its Work in any way, due to the Contractor's negligence in carrying out the above investigations shall be borne by the Contractor.

.21.01 Maintain Flow

The Contractor shall supply all labour and materials to maintain flow in all existing sewers, private drains, watermains, and water services involved in this Contract. Any existing services cut shall be permanently repaired by the Contractor at no cost

to the City and all materials will be supplied by the Contractor to the satisfaction of the Project Manager.

.21.02 Connection to Existing Watermain

A reduced pressure zone backflow preventer is required on all temporary supply lines used for filling and flushing of all water lines. Only approved backflow preventer valves are permitted.

The Contractor shall test, swab, and chlorinate the new systems, to the satisfaction of the Project Manager, in accordance with Form 400, Appendix 'A' – Procedure for the Disinfection, Testing and Connection of Watermains, prior to connection to existing watermains.

The Contractor shall supply and install all temporary caps or plugs, pipe closure, oversized, and adapter pieces as required in order to connect to existing watermains.

All costs arising from these requirements shall be included in the respective unit prices.

.22 COLD WEATHER WORK

The Project Manager may permit Work to be done when the air temperature is below freezing, in which case the Contractor shall, at its own cost and expense, furnish sufficient temporary protection and take all necessary precautions to protect the Work so as to prevent damage.

The Contractor shall protect all water pipe from freezing, but the City Project Manager reserves the right to do this Work and charge cost of same to the Contractor.

In the event of stoppage of the flow through any watermain or water service due to frost, or in the event of any watermain or water service is damaged due to the Contractor's operations, while they are on the Worksite or after leaving, due to trench settlement or other cause, the Contractor shall thaw the frozen watermain or water service, or repair the damaged watermain or water service at their own expense. If the Contractor does not properly and promptly thaw or repair the frozen or damaged watermain or water service, the Project Manager may arrange to thaw, repair or replace the same and the associated cost to do so will be deducted from any sum or sums due, or to become due to the Contractor.

.23 EXCAVATED MATERIALS

Where applicable, this section will be superseded, in its entirety, by the Special Provisions contained within the Contract Documents.

The Contractor shall strip all topsoil from those areas which will suffer disturbance in the course of performing the required Work. This topsoil shall be neatly stockpiled near the site, as directed by the Project Manager, and shall be disposed of later as directed. The cost of this Work shall be borne by the Contractor.

All surface or excavated materials which in the opinion of the Project Manager, are suitable for reuse in future surfacing, repaving, backfilling, or otherwise, shall be properly stored in such suitable places as directed by the Project Manager.

.23.01 Disposal of Surplus or Unsuitable Materials From All Operations For Which Excavation is Required

Material excavated in carrying out the Work of the various tender items included in this Contract which is unsuitable for, or which is surplus to the requirements for backfill or embankment construction, shall be disposed off site at locations arranged for by the Contractor at its own expense. The disposal/site location shall be submitted to the Project Manager and the Governing Conservation Authority for review and approval, before any material is permitted to leave the site. Conservation Authority approval shall be solely based on the area in which it has jurisdiction and does not relieve the Contractor from compliance with any other applicable law.

See also Form 300.04 - "Information to be submitted at Preconstruction Meeting".

.24 WORK ON AND UNDER RAILWAY COMPANY RIGHTS-OF-WAY

It shall be the sole responsibility of the Contractor to contact and arrange with the appropriate officials for such access routes as they may require across Railway property.

The Contractor shall immediately advise the Chief Engineer or Representative of the Railway Company, in writing, at least forty-eight (48) hours in advance of any Work being performed on or near Railway property in order that a Railway Inspector can be made available.

Flagmen, Inspectors or other staff as required and provided by the Railway Company will be at the expense of the Contractor and all other mandatory requirements of the Railway Company with respect to Work performed or under the Railway right-of-way, shall be complied with by the Contractor at its expense.

The Contractor shall be responsible for all damage and injury to the facilities of the Railway Company resulting from its construction operations and other Work attendant thereon. In the event of settlement, or injury to, these facilities as a consequence of inadequate, insufficient or otherwise unsuccessful method or means of support employed in its construction operations, then the Railway Company may proceed to regrade and realign such tracks, and restore facilities to the condition similar to that existing to commencement of Work on the Contract, at the Contractor's expense.

.25 TIDINESS

The Contractor shall at all times, keep its Work sites free from accumulation of waste materials and rubbish due to their employees or the Work.

Cleaning up, to the satisfaction of the Project Manager, shall be a mandatory condition to the final acceptance of the Work.

.25.01 Dust Control

The Contractor will supply and apply calcium chloride to areas along the route of the Contract at intervals as required to effectively control dust created by the Contractor's construction operations. This is a provisional item and will only be required when, in the opinion of the Project Manager, such control is necessary.

Quantities shown in the Schedule of Quantities and Prices are an approximate estimate only and payment will be made on the unit price stated for the actual amount.

Concrete cutting shall be done using wet saws or by methods that minimize concrete dust emissions.

.25.02 Progress Clean-up Restoration and Public Relations

To maintain good public relations the Contractor shall, during construction, attend to the following:

- a) All trenches to be backfilled on progressive basis each day (no more than 12m (40 feet) open at any time).
- b) All disturbed areas to be graded after backfill to maintain drainage on a progressive basis.
- c) All excess material to be removed as the job progresses.
- d) Restoration shall be completed as soon as possible.

The Contractor shall respond to the direction of the Project Manager regarding the above or any other complaints in a positive manner and within 48 hours. If the Contractor does not co-operate, the Project Manager reserves the right to have the Work done by others, and to charge the costs to the Contractor.

In addition to the above, if the Contractor continues to ignore proper clean-up, restoration and/or attending to Public Relations the Project Manager reserves the right and may deduct 15% of any monies due to the Contractor on progress payments.

.26 MATERIALS TO BE SALVAGED

Where the City has indicated that materials are to be salvaged, the Contractor will arrange for the delivery of such items to the appropriate City Yard as directed by the

Contract Documents and/or the Project Manager.

All cost associated with the collection, delivery and unloading of the materials to be salvaged shall be deemed to be included in the prices provided.

.27 CONSTRUCTION EQUIPMENT

All equipment, including plant and machinery, to be used for the required construction shall be furnished by the Contractor at its own expense. Equipment to be used shall be subject to the Project Manager's approval, but approval, or failure to approve, of the equipment, on the part of the Project Manager, shall not relieve the Contractor of responsibility for proper performance of the Contract, or from its liability thereunder.

.28 STOPPAGE OF WORK

If the Work, or any part thereof is suspended or left uncompleted by the Contractor, for what is in the opinion of the Project Manager, an unreasonable length of time, the Contractor shall in the instance of a trench or other excavation, and when so directed by the Project Manager, refill such trench or excavation or part thereof, and temporarily repave over the same at its own expense. If the Contractor refuses, neglects or fails to completely refill such trench and temporarily repave over the same within 48 hours, after the receipt of a notice in writing to do so, the City may refill and temporarily repair the pavement over the trench, at the Contractor's expense.

.29 SHEATHING AND SHORING

The Contractor shall furnish at its own expense, place and maintain such sheathing, shoring and bracing, and at such locations and elevations as are necessary, or as may be directed to support and protect the excavation and to prevent any movement which could in any way disturb or weaken the supporting materials, adjacent pavements, property, buildings or other Works.

"Close Sheathing" is defined as vertically placed sheathing in which the edge of the adjacent individual members comprising it are in full contact with each other throughout the entire length of the sheathing place, so as to prevent adjacent soil from entering the trench either below or through such sheathing.

.30 TUNNELLING, BORING AND JACKING OF PIPES

.30.01 General

Pipe tunnel details may be shown on the Plans, or alternatively tunnels may be constructed at the Contractor's option in place of trench excavation. In the latter case for a continuous tunnel greater than 6 metres in length, the Contractor shall submit its proposed plan of tunnel operation to the Project Manager for approval. This request for approval shall include drawings showing the following details.

- (a) The tunnel shaft bracing and dimensions
- (b) Tunnel supports

- (c) Method of back packing tunnel supports
- (d) Bracing to prevent pipe shifting and floating

.30.02 Jacking Operations

Where shown on the drawings or where the Contractor elects to jack pipe in place of tunnelling, or deep trench excavations, the Contractor shall submit details of the jacking pit bracing, jacking head and method, for approval by the Project Manager.

The leading section of conduit shall be equipped with a jacking head securely anchored thereto to prevent any wobble or variation in alignment during the chamber operation. Excavation shall be performed entirely within the jacking head and no excavation in advance thereof shall be permitted. Every effort shall be made to avoid any loss of earth outside the jacking head.

Excavated material shall be removed from the conduit as excavation progresses and no accumulation of such material within the conduit will be permitted. The Contractor shall excavate, maintain and restore all required jacking and receiving pits that may be necessary to complete the Work. Once the jacking operation has commenced, it shall be continued uninterrupted, until the conduit has been jacked between its specified termination points.

Upon completion of the jacking operation, all voids around the outside of the conduit shall be filled by grouting. Grouting equipment and approved material shall be on the site before jacking operations are started in order that grouting around the jacked conduit may be started immediately after the jacking operation is finished.

.31 RESTORATION

The Contractor shall repave and/or restore all surfaces, cut or otherwise damaged in the course of the Work, to a condition at least equivalent to that existing prior to the commencement of the Work.

The schedules provide for payment of the major items required to restore areas cut or damaged by construction. It is however a Contract requirement that all areas and items disturbed by construction be completely restored to original conditions by the Contractor. Items include but are not necessarily limited to the following:

The reconstruction of ditches to original conditions;

The reconstruction of fences, signs, guiderails, barricades, etc., removed to facilitate construction;

The restoration of all areas of roadways, roadway shoulders, driveways, private walks, grassed areas, etc. cut or damaged by construction;

The replacement of all culverts cut or damaged by construction with new 2.0mm wall thickness, galvanized corrugated, steel culverts as per OPSS.MUNI 421 and OPSS 1801, of the same diam. and length as existing. The culverts shall be installed to the same elevations and grades as existing in a minimum of 150mm granular "A" encasement.

The seed supplied shall contain not less than 35% Marion or Kentucky Blue Grass by weight and shall be uniformly spread at a rate of not less than 1.81 kg. per 93 sq. metres (4 lbs. per 1,000 sq. ft.) and thoroughly raked into the top soil.

All fences, signs, posts, etc. removed to facilitate construction shall be reinstated by the Contractor in the same locations as existing prior to construction.

For purposes of this Contract, the Tenderer shall include all costs of restoration as specified, in its prices bid for the various items in the schedule of quantities and prices to which restoration pertains.

.31.01 Repaving Roads

When the Contractor closes an excavation in a paved street they shall, repave the area of the Work in accordance with the City's Standard Specifications and Standard Drawings, RD-100.01 and RD-100.02, for the type of roadway pavement required to be restored.

.31.02 Repairs to Curbs, Sidewalks and Roads

The Contractor shall replace all curbs, sidewalks and roads as soon as possible but consistent with its operations, in the area and according to the requirements concerning concrete Work during the appropriate season. All restoration of curbs, sidewalks and roads shall conform to City of Hamilton Public Works Department Standard Specifications.

If so directed by the Project Manager, the Contractor shall make temporary repairs to curbs, sidewalks and roads immediately, as specified and shall maintain the Work until permanent repairs can be made.

.31.03 Temporary Closing of Excavation

If the Contractor elects to stop its operations at an excavation with the intention of returning to it at a later date, more than four (4) weeks removed, they shall close the excavation in a manner safe for traffic to be restored to normal.

Notice, 10 days in advance, shall be given if the Contractor intends to temporarily close an excavation. With this notice, he shall submit details of its proposed temporary surface, making the site safe for traffic.

The Contractor shall not temporarily close an excavation before receiving the approval of the Project Manager.

.31.04 Grading and Excavation Behind the Sidewalks and Curbs (All Sections)

- a) All grading, excavation and/or filled areas to be sodded shall be included in the prices for sodding per square metre.
- b) All grading and excavation for driveway repairs shall be included in the unit prices stated for driveway repairs.

- c) All grading and excavation for private concrete repairs shall be included in the prices per square metre for private Work repairs.

.31.05 Saw Cutting of Pavement

Prior to excavation in areas not subject to reconstruction, the Contractor shall saw cut existing pavements back to a minimum of 300mm beyond trench edges. Cuts shall be to depths sufficient to allow removal of pavements, and base without damaging adjacent surfaces.

.31.06 Cutting, Fitting and Patching

The Contractor shall co-ordinate the Work of all cutting, fitting and patching necessary to make the various parts of the Work come together properly. The Contractor shall also co-ordinate the cutting, fitting and patching as required to connect the Work on this Contract with that of any separate Contractor.

.32 TRAFFIC CONTROL DURING CONSTRUCTION

.32.01 Provision for Traffic, Construction and Maintenance of Detours and Roadways

The Contractor shall at all times carry on the Work in a manner that will create the least interference with traffic consistent with the faithful performance of the Work. The Contractor shall not close the road or provide any detour except with the approval of the Project Manager, in writing. The Contractor, at its own expense, shall at all times provide for the safe passage and control of traffic by supplying, placing, maintaining, changing, and removing such barricades, signs, lights, and traffic controllers as are required for the proper notification and protection of the public approaching or passing through any part of the Contract area and all devices so used shall be in accordance with the Ministry of Transportation of Ontario, Traffic Control Manual and the Ontario Traffic Manual Book 7 - Temporary Conditions and all aspects of the Work shall conform to Occupational Health and Safety Act as amended.

Where, with the approval of the Project Manager, the road is closed and the traffic is diverted to any other public roads, the Contractor shall, at its own expense supply and erect barricades, lights and such other protection as may reasonably be required by the Project Manager at all points where traffic might enter on that portion of the road so closed to traffic. The Contractor, when required by the Project Manager, shall supply traffic control personnel, to protect the barricades and direct traffic at each end of the portion or portions of the highway closed to traffic.

The City will erect signs and lights and maintain such approved detours over other public roads which may be used during the said closure of the road.

The Contractor will not be required to maintain any existing public road within the limits of the Work of the Contract until such time as they have commenced operations on the said road. Once the Contractor has commenced operations, they shall maintain at all times, the existing road or any roadside detour unless otherwise specifically provided.

The Contractor shall at its own expense and prior to the acceptance of the Work, rectify to the satisfaction of the Project Manager, any defacement of the road allowance due to the construction and maintenance of detours.

If, at any time, the Contractor fails to provide for the safe passage and control of traffic on any existing road or detour for which, under these General Conditions he is responsible, and if the Contractor fails to correct forthwith such an unsatisfactory condition upon being so directed in writing, the Project Manager may immediately correct the unsatisfactory condition and take such other action as they deem necessary for the safe passage and control of traffic. The City may deduct from any monies due or to become due to the Contractor, on any account, any cost or expense incurred by the City under this paragraph.

Failure to act on the part of the Project Manager under this subsection shall not relieve the Contractor from its responsibilities under this Contract.

The Contractor shall co-ordinate the removal and reinstallation of any existing parking meters, Traffic Control Signals or Street Signing with the City of Hamilton Traffic Department.

The Contractor shall restore all parking meters or traffic control signs, or signals damaged by construction to the satisfaction of the Project Manager and the City of Hamilton Traffic Department. All restoration is to be done at the Contractor's expense.

A Traffic Co-ordination Meeting shall be arranged, where required, at least 2 weeks in advance of the start of construction.

Wherever roadway plates are required they must be saw cut in, flush with the road surface, and be skid resistant.

The Contractor shall provide Traffic Protection Plans, as required, to meet all requirements of the Ministry of Labour and the Occupational Health and Safety Act.

The Contractor will be required to strictly adhere to all requirements for barricading, lighting, and traffic control as specified by the City of Hamilton, and the Ministry of Transportation, Ontario Traffic Manual, Book 7 - Temporary Conditions.

Wherever possible, the Contractor shall avoid working on arterial roadways with high traffic volumes during peak traffic periods. In general the peak traffic periods shall be considered to be 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. on weekdays. Any exceptions to this requirement shall be at the discretion of the Project Manager. The Contractor shall have no basis for increased working time due to this requirement.

Where there is no item in the Schedule of Quantities and Prices for traffic control, all costs for the above shall be deemed to be included and no separate payment will be made.

.32.02 Hamilton Street Railway (HSR) and School Bus Services

Wherever possible, HSR and school bus traffic shall be maintained at all times, including the provision for suitable, clean areas for bus stops. At temporary bus stops, a flat platform shall be constructed of granular "A" material for pedestrian use. In addition, a safe walkway must be maintained between the temporary bus stop and any adjacent sidewalk.

Prior to closing any roadway, the Contactor shall ensure that all school bus operators using that route are notified well in advance.

The Contractor shall contact and notify the City and the HSR at 528-4200, Ext. 1810, at least one week prior to:

- a) Closing or restricting lanes on any local streets or arterial roads with HSR routes. The Contractor will notify the HSR two weeks prior to closing any arterial roads in this Contract so bus traffic can be maintained and to give sufficient time for the HSR to notify its customers. All bus movements must be approved by the HSR and/or authorities having jurisdiction over school bus traffic.
- b) Working in areas of existing bus shelters to co-ordinate their removal and/or identify and maintain any underground electrical conduit
- c) The removal and/or relocations of any bus stops during construction
- d) The pouring of concrete or laying asphalt for any landing pad or shelter pad, in order to ensure they are properly located and any inserts for the bus stops are supplied

.32.03 Traffic Control – Police Services

The Contractor shall be responsible for arranging for and full payment of all costs for the use of Hamilton Police Services or other Police forces having jurisdiction where:

- a) The use of Police Officers is required for the safe passage of traffic through construction detours and/or traffic signals
- (b) In the opinion of the Project Manager, construction operations require the use of Police Officers as a safety precaution

.33 UTILITY FRAME AND COVER RAMPING/BARRICADING

The Contractor shall note if a street is opened to traffic prior to completion of construction the Contractor shall:

- a) Temporarily ramp all utility frames and covers with hot mix asphalt.
- b) Temporarily barricade all utility frames and covers where necessary.

.34 DAMAGE BY VEHICLES AND OTHER EQUIPMENT

If at any time, in the opinion of the Project Manager, damage is being done or is likely to be done to any highway or any improvement thereon, other than such portions as are part of the Work, by the Contractor's vehicles or other equipment whether licensed or unlicensed, the Contractor shall, on the direction of the Project Manager and at the Contractor's own expense make changes in or substitutions for such vehicles or other equipment or shall alter loading or shall in some other manner remove the cause of such damage to the satisfaction of the Project Manager, except that where such a change, substitution, alteration or removal is made in circumstances that could not have been foreseen by the Contractor at the time of tendering and in respect of a vehicle hauling a load within its licensed capacity, it shall be at the expense of the City.

.35 EXCESS LOADING OF MOTOR VEHICLES

Where a vehicle is hauling material for use in the Work under this Contract, in whole or in part upon a public highway and where motor vehicles registration is required for such vehicles, the Contractor shall not cause or permit such vehicles to be loaded beyond the capacity for which it is licensed whether such vehicle is registered in the name of the Contractor or otherwise, except upon those areas within the limits of the Contract as designated in the special provisions.

The Contractor shall bear the onus of weighing disputed loads. Notwithstanding any other provision of this Contract, where a vehicle is hauling material which is being measured for payment by weight, over any portion of highway on which overloading is not permitted by this Contract, no payment shall be made by the City to the Contractor for any part of the load carried in said vehicle that exceeds the licensed capacity of the vehicle.

.36 BLASTING AND USE OF EXPLOSIVES

.36.01 Blasting Provisions

Should the Contractor, in its excavating, find it expedient to use explosives, they shall observe and be governed by the applicable provisions of the regulations in accordance with Form 300.08.

In reference to statutory and other regulations, it is to be understood that each reference is to the latest version, and that all amendments made before or during the performance of the Work are equally binding.

In addition to Form 200.03.21, the following shall apply:

Where blasting is anticipated the Contractor must hire an independent Inspection Company, at its own expense, to conduct a pre-construction inspection of the properties within 100 metres of the construction area which must be completed prior to carrying out any blasting operations.

This will include all structures considered to be of potential risk, including, but not limited to buildings, driveways, sidewalks, swimming pools, patios, etc.

The pre-construction survey report shall include as a minimum the following information and shall be made available to the City at the pre-construction meeting:

- 1) Type of structure, including type of construction, and the date if possible, when built.
- 2) Any differential settlements: visible cracks in walls, floors and ceilings shall be identified and described, including a diagram, if applicable, room by room.
- 3) Any other apparent structural or cosmetic damage or defect must also be noted.
- 4) The report shall use positive dimensions whenever practical to do so, instead of general terms, e.g. "sagging 1 to 2 inches" as opposed to "sagging badly".
- 5) Clear quality photographs, as deemed necessary for proper recording of significant concerns.

The standard inspection procedure will include the provision of an explanatory letter to the building owner with a formal request for permission to carry out an inspection.

In the event that free access cannot be gained to any property, or after three (3) attempts being made, or through refusal by the owner or tenant, it shall be considered a complete inspection. If after three calls, the occupant cannot be contacted, the exterior of the building will be inspected if accessible.

The Contractor shall provide, at the pre-construction meeting, at no expense, a copy of the pre-construction survey report to the Project Manager. The survey report shall indicate the address of each of the properties inspected, the refusals received, and an evaluation of any evident or potential hazards that exist.

The Contractor shall employ, at its own expense, the services of a Specialist experienced in seismic investigations to determine and control the permissible intensity of vibrations which will result from blasting operations. Investigations shall be carried out by the Contractor and the Specialist before any rock excavation is started in order to determine the maximum explosive charges that can be used at different locations throughout the area of rock excavation. The Contractor shall submit a report to the Project Manager outlining the results of the investigations and tests made, and detailing the control required during blasting, throughout the area of rock excavation.

Further seismic readings shall be taken by the Specialist during blasting operations. Such readings shall be on a continuous basis and shall be taken where buildings and structures are located within 60 metres (200 ft.) of the blast area.

Within the area of the above, building and structures, the monitoring equipment shall be placed to obtain representative readings. As construction proceeds, the monitoring equipment shall be repositioned on an on-going basis.

In addition to the above, vibrations generated shall not exceed a vibrational peak particle velocity of 50mm (2 inches) per second when monitored at the nearest building or structure.

If the monitoring station is not at the nearest structure, then the allowable particle velocity shall be reduced in accordance with the increased distance from the blast and shall be determined by the blasting specialist.

Additional monitoring and readings shall be obtained in other sensitive areas where the pre-blast survey indicates the need.

The Contractor and Specialist shall visit the Owners of properties and buildings where test and/or investigations are required and shall describe blasting and seismic investigations to them and obtain their permission to carry out the necessary investigations and notify them of the blasting schedule. In addition, all property owners within 300m of the blast area shall be provided with the blasting schedule. In addition all property owners having had their property surveyed shall be provided with a card, stating that a copy of the pre-blast survey, of their property will be provided upon written request.

The Specialist will be an advisor to the Contractor and the acceptance of his/her reports and recommendations by the Project Manager will, in no way relieve the Contractor of any responsibility for damage or injury by blasting.

.36.02 Tunneling

Where blasting methods are employed in tunneling operations all conditions and requirements as stated herein shall be met and adhered to by the Contractor.

The blasting specialist shall be present and monitor the first ten (10) blasts detonated at the tunnel heading as a trial section. If it is found that the maximum allowable particle velocity has not been exceeded at any time during the test section, the City will allow the Contractor to continue its operation employing seismic recorders only.

The recorders shall be supplied and installed by the blasting Specialist, repositioned on an on-going basis as Work progresses and shall be checked for accurate operation at intervals not to exceed three (3) Working days.

Should the Contractor elect to alter its blasting methods they shall immediately notify the Specialist and the City and have another trial section of ten (10) blasts recorded in the presence of the Specialist at the Contractor's own expense.

If at any time during construction, the recordings indicate that the maximum allowable particle velocity has been exceeded, the Project Manager will require the blasting Specialist to be present at each and every further detonation or until such time as the Project Manager is satisfied that all requirements are being adhered to, all at the Contractor's own expense.

All costs incurred by the Contractor in the employment of the Specialist in seismic

investigations shall be deemed to be included in the items in the Contract under which any rock excavation is required.

.36.03 Blasting Mats

Where blasting methods are employed by the Contractor in the vicinity of buildings, structures or other properties subject to damage by flying material, the Contractor shall supply and place blasting mats or use such other methods as may be approved by the Project Manager to prevent damage by air borne materials.

.37 SHORT TERM PAVEMENT MARKINGS

All short term and temporary pavement markings shall be installed in accordance with the Contract Documents, OPSS 710 and the Ontario Traffic Manual unless otherwise noted.

In general, short term pavement markings refer to any marking that is required to provide delineation and positive guidance to road users until permanent pavement markings can be installed. Short term pavement markings are typically used where the road surface has been altered in such a manner as to obscure existing pavement markings however the road and general lane arrangement is unaffected (i.e. road resurfacing where a milled surface will be left for an extended period of time before final paving or where there is a time lag between final paving and the application of permanent pavement markings).

In general, temporary pavement markings refer to any marking that is required to provide delineation and positive guidance to road users through work zones where the general lane arrangement of the road is altered to facilitate construction (i.e. lane shifts, lane reductions, lane narrowing etc.)

Under no circumstances shall short term or temporary pavement markings conflict with any permanent pavement marking. Furthermore, only Temporary Preformed Plastic Pavement Marking Tape shall be used on road surfaces that are not being reconstructed or resurfaced unless otherwise specified in the contract documents or agreed to by the parties.

For short term pavement markings involving directional dividing line and lane lines, Table 1 of OPSS 710 is amended as follows.

TABLE 1: SHORT TERM PAVEMENT MARKINGS

Type of Roadway	Min. Line Length	Max. Gap Length	Max. Duration*
All roads, Speed Limit < 90 km/h	0.3 m	6.0 m	15
All roads, Speed Limit ≥ 90 km/h	0.3 m	9.0 m	15
* Maximum number of Working Days before permanent markings must be placed.			

.38 PROPOSED ROAD, CURB AND SIDEWALK GRADES AND ELEVATIONS

The Contractor shall calculate all proposed road, curb and sidewalk grades and elevations and shall submit them to the Project Manager for review, prior to construction.

The proposed grades for road, curb and sidewalk construction shall be determined using the following design criteria:

1. All gutter grades shall be 0.75% minimum slope to catch basins.
2. Radii to be improved where possible, up to 9 metres maximum where there is sufficient property. Contractor to verify property lines for improvements, with the City prior to construction.
3. All driveway repairs to have a minimum slope of 2% toward the road.
4. All apron approaches shall not exceed a maximum slope of 8% toward the road.
5. At all arterial cross streets, road cross fall shall be 1%.
6. At all local cross streets, road cross fall shall be 2%.
7. Sidewalk cross fall shall be 2%.
8. Boulevard cross fall shall be 4%.
9. All variations from specified criteria shall be approved by the Project Manager.

.39 METHOD OF PAYMENT FOR EXTRA WORKS BY FORCE ACCOUNT

For the purpose of this section,

"Work" means the Extra Work approved by the Project Manager pursuant to Form 200.02.06, which is to be paid for on a time and material basis.

"cost of labour" means the amount of wages and payroll burden paid or incurred directly by the Contractor for or in respect of the labour forces and for or in respect of supervision by foreman actively and necessarily engaged on the Work. Costs will be based on the recorded time and hourly rates of pay for such labour and supervision, but shall not include any payment or costs incurred for general supervision, administration or management or any wages, or payroll burden for which the Contractor is compensated by any payment made by the City for equipment.

"payroll burden" means the payment in respect of Worker's compensation, vacation pay, employment insurance, public liability and property damage insurance, sickness and accident insurance, pension fund, and shall include any

costs or expense of food, lodging and incidental expenses such as the Project Manager may approve when such costs are assumed by the Contractor as a condition of employment of those directly and actively engaged in the extra Work.

"cost of material" means the cost of materials by the Contractor for the extra Work as shown by itemized invoices and the cost of material from the Contractor's stock used on the Work valued at current prices.

Subject to such exceptions as the Project Manager may permit in writing, the Work performed by the Contractor under this section shall be subject to all the terms, conditions, specifications and provisions of this Contract.

Daily Work records prepared by the Project Manager or Inspector reporting the labour and equipment employed and the material used on the Work shall be reconciled with and signed each day by the Contractor's representative.

The City shall pay the Contractor for labour on the Work, at the rate of 135% on the first \$3,000.00 of the cost of labour, and at the rate of 120% on the cost of labour in excess of \$3,000.00.

The City shall pay the Contractor for material used in the Work, 120% at the rate of the cost of material, up to \$3,000.00 and at the rate of 115% over \$3,000.00 excluding the costs of materials for which compensation is included in the rental rates for construction equipment. Material originally supplied and used by the Contractor in the Work, and subsequently salvaged by the Contractor in reusable condition shall be accepted by the Contractor and 50% of the costs of such material shall be deducted from the amount payable to the Contractor.

Where the Contractor arranges for Work on a Time and Material Basis, or a part of it, to be performed by Sub-Contractors on a Time and Material Basis and has received approval prior to the commencement of the Work, in accordance with the requirements of OPSS.MUNI 100 subsection GC3.09, Sub-Contracting by the Contractor, the Owner will pay the cost of Work on a Time and Material Basis by the Sub-Contractor calculated as if the Contractor had done the Work on a Time and Material Basis, plus a mark-up calculated on the following basis:

- (a) 20% on the first \$3,000; plus
- (b) 15% on the amount from \$3,000 to \$10,000; plus
- (c) 5% on the amount in excess of \$10,000.

No further mark-up will be applied regardless of the extent to which the Work is assigned or sublet to others. If Work is assigned or sublet to an associate, as defined by the Securities Act, no mark-up whatsoever will be applied.

Equipment owned by the Contractor used in the Work shall be paid for in accordance with the Ministry of Transportation, Ontario "Schedule of Rental Rates for Construction Equipment, Including Model and Specification Reference", as set out in the OPSS 127, hereinafter called the "127 Rate". Each period of time during which the equipment is actively and of necessity engaged in performing the Work,

and the first two hours of each immediately following period during which the equipment is not so engaged but the Work is otherwise proceeding, shall be considered Working time for which the City shall pay the Contractor the "127 Rate". Equipment owned by the Contractor that is not covered by the "127 Rate", shall be paid at a negotiated price.

The City will pay the Contractor for the Working Time of all equipment other than Rented Equipment and Operated Rented Equipment used on the Work on a Time and Material basis at the "127 Rates" with cost adjustments as follows:

- (a) Cost \$10,000 or less - no adjustments
- (b) Cost greater than \$10,000 but not exceeding \$20,000 - payment \$10,000 plus 90% of the portion in excess of \$10,000; and
- (c) Cost greater than \$20,000 - \$19,000 plus 80% of the portion in excess of \$20,000.

The City will pay the Contractor for the Working Time of Rented Equipment used on the Work on a Time and Material Basis at 110% of the invoice price approved by the Project Manager up to a maximum of 110% of the "127 Rate". This constraint will be waived when the Project Manager approves the invoice price prior to the use of the Rented Equipment.

The City will pay the Contractor for the Working Time of Operated Rented Equipment use on the Work on a Time and Material Basis at 110% of the Operated Rented Equipment invoice price approved by the Project Manager prior to the use of the equipment on the Work on a Time and Material Basis.

Any period of time, or part thereof, which is not herein considered Working time, and during which the equipment owned by the Contractor is required to remain on the site of Work, shall be considered standby time. The wages, salary and payroll burden of the operator or operating crew who cannot be otherwise employed during standby time shall be included in the cost of labour. In addition the City shall pay one-third of the "127 Rate" for that portion of standby time which together with the Working Time does not exceed 10 hours in any one day.

When equipment owned by the Contractor is being transported by float within the limits of the Contract to or from the site of the Work, payment shall be made by the City only in respect of the float. When equipment owned by the Contractor is being moved under its own power, it shall be deemed to be working. The Project Manager shall negotiate payment for transporting such equipment from sources outside the limits of the Contract.

"Rental Equipment" means equipment that is rented or leased for the special purpose of Work on a Time and Material Basis from a person, firm or corporation that is not as associate or affiliate of the lessee as defined by the Securities Act, and is approved by the Project Manager.

Notwithstanding any other provision of this Section, no payment shall be made to the Contractor for or in respect of hand tools or equipment that are tools of the trade.

Except where there is agreement in writing to the contrary, the compensation as herein provided shall be accepted by the Contractor as compensation in full for all costs and expenses arising out of the Work including all costs of general supervision, administration and management time spent on the Work and no other payment or allowance shall be made in respect of such Work.

The Contractor shall submit to the City a separate invoice in triplicate for the Work within thirty days of the completion of the Work. Each invoice shall include the number and covering dates of the Work, and shall itemize separately labour, materials and equipment, and submitted with the invoice shall be receipted invoices for materials, rented equipment, and other charges incurred by the Contractor on the Work.

**APPENDIX A - GUIDELINES FOR OBTAINING WATER FROM CITY HYDRANTS FOR
AUTHORIZED CONTRACTORS AND CITY STAFF.**

1. General

- a. This document provides procedural guidelines to Contractors and City Staff authorized to operate City Hydrants for the purpose of obtaining water.
- b. Water obtained from City hydrants shall be solely used for the operations related to City of Hamilton business. The City may require that water usage is metered.
- c. Any person operating a hydrant shall have sufficient knowledge on hydrant operation and water distribution systems.
- d. Only hydrants included in the approved hydrant list should be used. The List is updated yearly and can be obtained from Engineering Services, Asset management Section, Subsurface Group.
- e. All persons operating a hydrant must maintain a Hydrant Use Log Form by entering the required information each time a hydrant is used. Completed forms are to be submitted to the City Inspector weekly.
- f. A hydrant pump must be used to pump out water each time a hydrant is used if the water in the hydrant body does not drain properly, especially during the months of November, December, January, February and March. Hydrant pump shall be disinfected with 1% Sodium Hypochlorite spray before use. This will occur regardless of the outside temperature. The City inspector will perform periodic spot checks utilizing a camera to ensure that pumping has been successful and no ice has built up that could possibly limit hydrant operation. In the event an issue is discovered, the inspector shall be notified immediately. The Inspector shall call CSR's to schedule a WDO to inspect the hydrant.
- g. In the case where prolonged use of a fire hydrant is required, Inspector is to call "hydrant out of service" with the CSR's for the communication with Fire Department and update in Hansen system. Inspector is to call "hydrant back in service" with CSR's when operations are completed.

2. Hydrant Operation - Normal Operation

- a. Verify direction of operation by visual observation of arrow on top of hydrant and/or the presence of black painted "L" on body.
- b. Only City of Hamilton approved hydrant wrenches are to be used in the operation of a fire hydrant.
- c. Remove cap of port to be used while ensuring that remaining port caps are tightly secured. If front port is to be used, install appropriate adaptor as required.
- d. All hydrants are to be operated in the fully open position with a hydrant adaptor / backflow preventer installed for control. The hydrant adaptor shall be disinfected with 1% Sodium Hypochlorite spray before each use.

- e. Open all hydrants slowly. Initially flow the hydrant just enough to remove branch water and then open a minimum of three to four turns to ensure the main valve drains are fully open. Proceed to open hydrant to full open position. If flow must be regulated, a 2 ½" gate valve must be used.
- f. Close hydrant slowly. Once the flow has stopped, turn the operating nut ½ a turn in the open direction to take the strain off the operating parts of the hydrant while ensuring that the hydrant is fully off.
- g. Verify that the hydrant is draining following closure by looking in the open port to see if the water level is dropping. If the hydrant does not drain or does not shut off completely, notify the City inspector immediately.
- h. In the event that the hydrant body does not drain, pumping out the water with a hydrant pump shall be used. Hydrant pump shall be disinfected with 1% Sodium Hypochlorite spray before each use.
- i. Replace cap of port used slightly to ensure air has been released and tighten.
- j. Replace hydrant marker flag if one was present.

3. Connection / Disconnection of Hydrant Adaptor

- a. Before installing the hydrant adaptor, the hydrant adaptor shall be disinfected with 1% Sodium Hypochlorite spray.
- b. After disconnection of hydrant adaptor, the hydrant should be inspected for proper operation and sufficient drainage of hydrant body.



Guidelines for Obtaining Non-Potable Water from City Hydrants Authorized Contractors & City Staff Only City of Hamilton - Hydrant Use Log Form

1	Date (MM/DD/YY)	Time ON	Time OFF	Hydrant ID	Address
		AM PM	AM PM		
	Operator's Name (First, Last)		Operator's Signature		Review
		X			Hydrant Draining? YES NO - Had to be Pumped Hydrant Operation? GOOD ISSUES - Inspector Notified Adaptor Disinfected before use? YES

2	Date (MM/DD/YY)	Time ON	Time OFF	Hydrant ID	Address
		AM PM	AM PM		
	Operator's Name (First, Last)		Operator's Signature		Review
		X			Hydrant Draining? YES NO - Had to be Pumped Hydrant Operation? GOOD ISSUES - Inspector Notified Adaptor Disinfected before use? YES

3	Date (MM/DD/YY)	Time ON	Time OFF	Hydrant ID	Address
		AM PM	AM PM		
	Operator's Name (First, Last)		Operator's Signature		Review
		X			Hydrant Draining? YES NO - Had to be Pumped Hydrant Operation? GOOD ISSUES - Inspector Notified Adaptor Disinfected before use? YES

4	Date (MM/DD/YY)	Time ON	Time OFF	Hydrant ID	Address
		AM PM	AM PM		
	Operator's Name (First, Last)		Operator's Signature		Review
		X			Hydrant Draining? YES NO - Had to be Pumped Hydrant Operation? GOOD ISSUES - Inspector Notified Adaptor Disinfected before use? YES

5	Date (MM/DD/YY)	Time ON	Time OFF	Hydrant ID	Address
		AM PM	AM PM		
	Operator's Name (First, Last)		Operator's Signature		Review
		X			Hydrant Draining? YES NO - Had to be Pumped Hydrant Operation? GOOD ISSUES - Inspector Notified Adaptor Disinfected before use? YES

6	Date (MM/DD/YY)	Time ON	Time OFF	Hydrant ID	Address
		AM PM	AM PM		
	Operator's Name (First, Last)		Operator's Signature		Review
		X			Hydrant Draining? YES NO - Had to be Pumped Hydrant Operation? GOOD ISSUES - Inspector Notified Adaptor Disinfected before use? YES

7	Date (MM/DD/YY)	Time ON	Time OFF	Hydrant ID	Address
		AM PM	AM PM		
	Operator's Name (First, Last)		Operator's Signature		Review
		X			Hydrant Draining? YES NO - Had to be Pumped Hydrant Operation? GOOD ISSUES - Inspector Notified Adaptor Disinfected before use? YES

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APPENDICES

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.01 SCOPE**.01.01 General**

This Specification covers the requirements for the installation of ductile iron, polyvinyl chloride, concrete and steel watermains. All watermains and water services shall be supplied and installed in accordance with OPSS.MUNI 441 – Construction Specification for Watermain Installation in Open Cut, as amended by this specification.

.01.02 Work Included

The Contractor shall, unless specified otherwise, furnish all equipment, tools and labour necessary to do the Work required under this Contract and unload, haul and distribute all pipe, fittings, valves, hydrants and accessories. The Contractor shall also remove the pavement as stipulated; excavate the trenches and pits to the required dimensions; excavate the bell holes; construct and maintain all bridges for traffic control; sheet, brace and support the adjoining ground structure where necessary; handle all drainage or ground water; provide barricades, guards and warning lights; lay and test the pipe, fittings, valves, hydrants and accessories; backfill and consolidate trenches and pits; restore roadway surface, unless otherwise stipulated; remove and dispose of surplus excavated materials as directed; clean the site of the Work; and maintain the street or other surface over trenches as specified.

.02 RESPONSIBILITY FOR MATERIAL**.02.01 Material Furnished by the Contractor**

Unless otherwise noted in the Contract Documents, the Contractor shall supply all materials required to complete the Works. This will include but not be limited to:

- a) The proposed watermain pipe(s) complete with all valves, connections, fittings, special appurtenances, thrust blocks, anchor blocks, tee's, bends, sleeves, and all lowerings in accordance with the elevations and grades shown on the Contract Drawings.
- b) Water for testing and disinfection shall be supplied by the Contractor from a location corresponding to the appropriate Drinking Water System. Hydrant usage will require the necessary permit and meterage charges. The Contractor shall be responsible for the transportation of this water from source of supply to point of use.
- c) The Contractor shall be responsible for all material furnished by them and shall replace all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labour required for the replacement of installed material discovered defective prior to the final acceptance of the Work.
- d) In addition to Form 200.04.06, all materials supplied by the Contractor shall be in accordance with the applicable current Approved Products List or Contract specification. Any material used that is not approved or not appropriate shall be

removed and replaced by the Contractor at no cost to the City.

.02.02 Material Furnished by the City

Where the Contract Documents or Drawings indicate that the City will supply materials, the Contractor shall pick-up the required materials at the designated location and haul such materials to the site as required.

The Contractor's responsibility for material furnished by the City shall begin F.O.B. at the point of delivery to the Contractor. Materials already on the site shall become the Contractor's responsibility on the day of the execution of the Contract. The Contractor shall examine all material furnished by the City at the time and place of delivery to and shall reject all defective material.

.02.03 Safe Storage

The Contractor shall be responsible for the safe storage of material supplied by or to them and accepted by them and intended for the Work, until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

.02.04 Replacement of Damaged Material

Any material furnished by the City that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor.

.02.05 Disposition of Defective Material

Prior to acceptance of responsibility for safe storage by the Contractor under Form 400.02.03, any material furnished by the City found to be defective shall be set aside and removed from the site or the Work by the City. All defective materials furnished by the Contractor shall be promptly removed by from the site.

.03 HANDLING OF MATERIAL

.03.01 Loading and Unloading

All pipe fittings, pipe, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

.03.02 Transporting, Unloading, Storing and Handling Pipe

All pipe up to and including 600mm shall be delivered to the site with end covers and tamper evident seals in accordance with OPSS.MUNI 441.07.07.

.04 APPROVED WATERMAIN MATERIALS

All watermain pipe, fittings and other materials shall be as listed on the Approved Products List, as amended. Materials shall meet the current version of the applicable standards, including but not limited to CSA, ASTM, ANSI/AWWA, NSF Standard 61 and OPSS.

Acceptable pipe materials are ductile iron, polyvinyl chloride and concrete pressure pipe. Steel Pipe is acceptable in project specific applications only.

OPSS.MUNI 441.05.02	Ductile Iron Pipe – acceptable. Refer to Form 400.05.
OPSS.MUNI 441.05.03	Concrete Pressure Pipe – acceptable. Refer to Form 400.06.
OPSS.MUNI 441.05.04	Polyvinyl Chloride Pipe – acceptable. Refer to Form 400.07.
OPSS.MUNI 441.05.04.03	Molecularly Oriented Polyvinyl Chloride Pipe (PVCO) – acceptable. Refer to Form 400.07.01.
OPSS.MUNI 441.05.05	Polyethylene Pipe - not acceptable.
OPSS.MUNI 441.05.06	Steel Pipe – acceptable for special projects only per the Contract Documents.
OPSS.MUNI 441.05.07	Copper Pipe – acceptable. Refer to Form 400.23.
OPSS.MUNI 441.05.08	Composite Pipe - not acceptable.

.05 DUCTILE IRON PIPE WATERMAIN

All watermain materials shall be in accordance with AWWA C104, C105, C110, OPSS.MUNI 441, this specification and be selected from the Approved Products List, latest version.

.05.01 Ductile Iron Pipe Watermain – 100mm, 150mm, 200mm and 300mm

Ductile iron pipe shall be Pressure Class 350, cement lined, Tyton joint, for 300mm and smaller pipe as per OPSS.MUNI 441.05.02 with cement lined fittings.

All pipe and mechanical joints of pipe shall be protected by Polyethylene Encasement in accordance with this specification and the manufacturer's recommendation. Field cut pipe shall be kept to a minimum.

Anchor blocks and joint restraint shall be used at all fittings. Anchor blocks shall be constructed in accordance with the Contract Drawings and standard watermain drawings. Joint restraint shall be selected from the Approved Products List and

installed in accordance with the following:

All fittings and valves shall be restrained for a minimum of 18m in each direction.

All fittings at dead ends shall be restrained for a minimum of 18m.

All watermain joints and fittings within areas of engineered fill shall be restrained.

Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.

All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

All proposed or replacement water services, 100mm or larger, shall be constructed using a pipe material that is the same as the watermain material.

.05.01.01 Polyethylene Encasement of Ductile Iron Watermain

Polyethylene encasement shall be in accordance with ANSI/AWWA C105/A21.5 and the following:

- (i) Material to be Low Density, polyethylene film having a nominal thickness of 8 mil (.008 inch) in accordance with ANSI/AWWA C105/A21.5, Section 4.1.2.3
- (ii) Installation Method "A" only to be used. (Poly-Tube with overlap - No sheets)
- (iii) Direct service connection tapping through triple polyethylene adhesive tape & the polyethylene film is to be used for all service taps.
- (iv) Junctions between wrapped & existing unwrapped pipe - polyethylene wrap is to cover the adjacent pipe for a distance of at least 0.9m. Secure the end with sufficient circumferential turns of tape.
- (v) Attached service lines of dissimilar metals shall be wrapped with polyethylene or suitable dielectric tape for a minimum clear distance of 0.9m away from the ductile iron pipe.

.05.02 Ductile Iron Pipe Watermain – 400mm and Larger

All ductile iron watermain shall be designed in accordance with the Trunk Watermain Design and Construction Parameters given in Form 400.08.

Pipe shall be Class 52, ductile iron cement lined, with Tyton and/or restrained Joints as per OPSS.MUNI 441.05.02, with cement lined fittings. All pipe and mechanical joints of pipe shall be protected with Polyethylene Encasement in accordance with this specification and the manufacturer's recommendation. Field cut pipe shall be kept to a minimum.

Anchor blocks and joint restraint shall be used at all fittings in accordance with the City's standard drawings and Contract Documents.

Restrained Mechanical Joint for ductile iron pipe will be required at all fittings and for suitable length as recommended by the Supplier. Restraint shall be selected from the Approved Products List and shall be installed in strict accordance with the manufacturer's specifications and recommendations. Joints alone shall be capable of withstanding thrust up to 150psi test pressure.

All watermain joints and fittings within areas of engineered fill shall be restrained.

The maximum permissible joint deflection shall be less than or equal to 50% of the values recommended by the manufacturer.

Polyethylene encasement shall be in accordance with ANSI/AWWA C105/A21.5 and as described in subsection .05.01.01.

Closure pipe shall consist of Restrained Mechanical Joint Fittings and Solid Sleeve.

All dead ends on watermain shall be closed with cast iron plugs/caps or bulkheads that are adequately restrained for pressure testing and provided with a 50mm corporation main stop.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

.05.02.01 Submissions

The Contractor shall supply 2 copies of the following information to the Project Manager prior to installing any pipe:

- a) Letter confirming that the proposed pipe material, fittings and restraint are designed to operate as a complete system that meets all specified watermain design and operating parameters.
- b) Pipe layout drawings and schedules showing the location and type of all pipe, fittings, restrained lengths, valves, method of restraint, location and size of all anchor blocks;
- c) Drawings showing the proposed location of all valve chambers, including detailed dimensions and a listing of all internal components.
- d) Where the City has provided a standard valve chamber drawing (WM series) or Contract Drawing stamped by a Professional Engineer, the Contractor shall construct all valve chambers in accordance with the drawing provided. Any variations to the approved drawing will require a revised stamped valve chamber drawing submission by the Contractor.
- e) All submissions shall be stamped by an Engineer licensed by Professional Engineers Ontario (PEO) to practice in the Province of Ontario.

.06 CONCRETE PRESSURE PIPE WATERMAIN (500mm and Larger)

All concrete watermain shall be in accordance with AWWA C301 and/or C303, OPSS.MUNI 441, this specification and be selected from the Approved Products List, latest version. Non-cylinder pipe is not permitted.

400mm concrete pressure pipe will only be permitted for short repair sections or where specifically approved for use by the City. All concrete watermain shall be designed in accordance with the Trunk Watermain Design and Construction Parameters given in Form 400.08.

Restrained Joint Concrete Pressure Pipe will be required at all fittings and for suitable length as recommended by the manufacturer. Joints alone shall be capable of withstanding thrust up to 150psi test pressure. Joint restraint shall be in accordance with the manufacturer's recommendations. Welded joints will not be permitted.

All watermain joints and fittings within areas of engineered fill shall be restrained.

Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.

Anchor blocks and joint restraint shall be used at all fittings in accordance with the City's standard drawings and Contract Documents.

Tracer wire shall be installed on concrete pressure pipe shall be light coloured, plastic coated and strapped to the pipe at 6m intervals and in accordance with Form 400.11.

Closure pipe shall consist of two lengths of pipe with a dresser coupling. The lengths of pipe shall be made to lengths measured in the pipe trench by the Contractor.

The maximum permissible joint deflection shall be less than or equal to 50% of the values recommended by the manufacturer.

.06.01 Submissions

The Contractor shall supply 2 copies of the following information to the Project Manager prior to installing any pipe:

- a) Letter confirming that the proposed pipe material, fittings and restraint are designed to operate as a complete system that meets all specified watermain design and operating parameters.
- b) Pipe layout drawings and schedules showing the location and type of all pipe, fittings, restrained lengths, valves, method of restraint, location and size of all anchor blocks;
- c) Drawings showing the proposed location of all valve chambers, including detailed dimensions and a listing of all internal components.

- d) Where the City has provided a standard valve chamber drawing (WM series) or Contract Drawing stamped by a Professional Engineer, the Contractor shall construct all valve chambers in accordance with the drawing provided. Any variations to the approved drawing will require a revised stamped valve chamber drawing submission by the Contractor.
- e) All submissions shall be stamped by an Engineer licensed by Professional Engineers Ontario (PEO) to practice in the Province of Ontario.

.07 POLYVINYL CHLORIDE (PVC) PIPE WATERMAIN

All PVC watermain shall be in accordance with OPSS.MUNI 441, AWWA C605, C900, C907, C909, this specification and be selected from the Approved Products List, latest version.

.07.01 Polyvinyl Chloride (PVC) Pipe – 100mm, 150mm, 200mm and 300mm

Pipe shall be in accordance with OPSS.MUNI 441.05.04, and the following:

OPSS.MUNI 441.05.04 Polyvinyl Chloride Plastic Pipe Products

PVC pipe in sizes 100mm, 150mm, 200mm and 300mm shall have cast iron outside diameters (CIOD) in all sizes. Pipe shall be joined by means of integral elastomeric-gasket joints conforming to ASTM D3139. Acceptable PVC materials are as follows:

- a) Polyvinyl chloride pipe (PVC) Class 235, DR18 conforming to AWWA C900 and CSA B137.3;
- b) Molecularly oriented polyvinyl chloride (PVCO), Pressure Class 235 (PC235) conforming to AWWA C909.

Fittings for 100mm, 150mm and 200mm PVC pipe shall be injection molded PVC conforming to AWWA C907. Fittings for 300mm shall be manufactured from segments of AWWA C900 PVC pipe, bonded together and over-wrapped with fibreglass-reinforced polyester to meet the requirements of CSA B137.3.

Where metal fittings are used on PVC mains, protective coatings (primer, mastic and tape) and cathodic protection must be installed to the satisfaction of the Project Manager.

Anchor blocks and joint restraint shall be used at all fittings. Anchor blocks shall be constructed in accordance with the Contract Drawings and standard watermain drawings (WM series). Joint restraint shall be selected from the Approved Products List and installed in accordance with the following:

All fittings and valves shall be restrained for a minimum of 18m in each direction.

All fittings at dead ends shall be restrained for a minimum of 18m.

All watermain joints and fittings within areas of engineered fill shall be restrained.

Joint restraints shall be installed in strict accordance with the manufacturer's specifications and recommendations.

All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

.07.01.01 Service Connection Fittings and Appurtenances – PVC Pipe

OPSS.MUNI 441.05.12 Service Connection Fittings and Appurtenances

Add the following:

Service connections to 100mm, 150mm and 200mm PVC mains shall be made by using PVC molded tapped couplings, conforming to AWWA C907 and CSA B137.2, or using service saddles selected from the Approved Products List.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

All proposed or replacement water services, 100mm or larger, shall be constructed using a pipe material that is the same as the watermain material.

.07.02 Polyvinyl Chloride (PVC) Pipe – 400mm to 750mm

All PVC watermain 400mm to 750mm shall be designed in accordance with the Trunk Watermain Design and Construction Parameters given in Form 400.08.

OPSS.MUNI 441.05.04 Polyvinyl Chloride Pipe

Revised as follows:

PVC pipe in sizes 400mm to 750mm shall conform to AWWA C900 and shall be designed according to AWWA Manual M23: PVC Pipe-Design and Installation, 2nd Edition. All 400mm pipe shall be DR18. Joints alone shall be capable of withstanding thrust up to 150psi test pressure.

Fittings for 400mm through 750mm PVC pipe shall be manufactured from segments of AWWA C900 PVC pipe, bonded together and over-wrapped with fibreglass-reinforced polyester to meet the requirements of CSA B137.3.

Where metal fittings are used on PVC mains, protective coatings (primer, mastic and tape) and cathodic protection must be installed to the satisfaction of the Project Manager.

Joint restraint will be required at all fittings and for suitable lengths as recommended by the manufacturer. Joint restraint shall be selected from the Approved Products List and installed in strict accordance with the manufacturer's recommendations.

Anchor blocks and joint restraint shall be used at all fittings in accordance with the City's standard drawings and Contract Documents.

All watermain joints and fittings within areas of engineered fill shall be restrained.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

.07.02.01 Submissions

The Contractor shall supply 2 copies of the following information to the Project Manager prior to installing any pipe:

- a) Letter confirming that the proposed pipe material, fittings and restraint are designed to operate as a complete system that meets all specified watermain design and operating parameters.
- b) Pipe layout drawings and schedules showing the location and type of all pipe, fittings, restrained lengths, valves, method of restraint, location and size of all anchor blocks;
- c) Drawings showing the proposed location of all valve chambers, including detailed dimensions and a listing of all internal components.
- d) Where the City has provided a standard valve chamber drawing (WM series) or Contract Drawing stamped by a Professional Engineer, the Contractor shall construct all valve chambers in accordance with the drawing provided. Any variations to the approved drawing will require a revised stamped valve chamber drawing submission by the Contractor.
- e) All submissions shall be stamped by an Engineer licensed by Professional Engineers Ontario (PEO) to practice in the Province of Ontario.

.07.03 Installation of Pipes

OPSS.MUNI 441.07.14 Installation of Pipe

Add the following:

Excavation and Preparation of Trench shall be completed in accordance with the manufacturers recommendations and AWWA C605.

.07.04 Jointing Polyvinyl Chloride (PVC) Pressure Pipe

OPSS.MUNI 441.07.15.04 Polyvinyl Chloride Pressure Pipe – PVC and PVCO

Add the following:

PVC pipe shall be laid in accordance with AWWA C605. Pipe deflection shall be in accordance with subsection .07.05 Changes in Line and Grade.

Bell and Spigot Joints

The pipe shall be jointed in accordance with AWWA C605 and the manufacturer's specifications. If elastomeric gaskets are supplied separately, they shall be inserted into the groove of the bell end of the pipe.

Lubricant for gaskets shall conform to pipe manufacturers recommendations and shall be NSF-61 approved. Clean the gasket, the bell, the groove area and the spigot area with a clean rag to remove any dirt or foreign material before assembling. Insert the gasket into the groove and seal it firmly. Apply lubricant, as provided by the manufacturer, to the beveled spigot end. Push the lubricated end past the gasket into the bell until the reference mark is even with the bell.

.07.05 Changes in Line and Grade

OPSS.MUNI 441.07.17 Change in Line and Grade

Add the following:

All pipe joint deflections shall be less than or equal to 50% of the values recommended by the manufacturer. No deflection of the pipe barrel for changes in line or grade are permitted.

.07.06 Polyvinyl Chloride (PVC) Pipe - Cathodic Protection

The following are minimum requirements. Specific soil conditions may require changes to the cathodic protection system. The installation and placement of anodes and tracer wires shall be in accordance with OPSD 1109.011 and the following:

Cathodic protection shall be provided for all tracer wires on PVC watermain pipes. One (1) 5.4kg zinc anode will be provided for every 1000m tracer wire.

One (1) 5.4kg zinc anode is to be installed on all copper service connections, by means of a service ground clamp, coated with T.C. Mastic or wrapped with "Scotchfill" electrical putty or approved equal. The anode is to be placed at least 1.0m away from the water service and as deep as the service and within 1.0m of the curb stop.

One (1) 10.8kg zinc anode is to be installed on each hydrant. If PVC pipe is used between the hydrant tee and the hydrant boot, two (2) 10.8 kg zinc anodes shall be used.

One (1) 5.4kg zinc anode is to be installed on every line valve, and every metallic fitting connected to a PVC watermain. Fittings include bends, tees, crosses, sleeves, reducers, plugs, caps and couplings.

One (1) 14.5kg magnesium anode is to be connected to the first length of an existing metallic watermain pipe when connected to a new PVC watermain.

All sacrificial zinc anodes shall conform to ASTM B-418 Type II and shall be made of high grade electrolytic zinc, 99.99 % pure. Magnesium anodes shall

conform to ASTM B-107-Type M1.

For all anodes connected to new pipe, fittings or to existing metallic water mains, a Cadwelder and CA-15 or equivalent cartridge shall be used. All thermite weld connections to be coated with T.C. Mastic (Tapecoat of Canada), Roybond 747 Primer and Royston "Handy Cap" or approved equal.

Contractors are advised that there is no specific pay item for Cathodic Protection; all costs shall be included in all other appropriate items.

.08 TRUNK WATERMAIN DESIGN AND OPERATING PARAMETERS – 400mm AND LARGER

All trunk water mains shall be in accordance with the following requirements:

The pipe manufacturer shall calculate the joint restraint required based on the trench width, cover over the pipe, bedding and pressures indicated in this specification and on the Contract Drawings.

Water mains, fittings and restraint shall be designed and constructed for operation under the following parameters:

Design / Field Test Pressure	Working Pressure	Surge Pressure (Additional)	Additional External Loads
150psi	100psi	100psi	Hwy. H-20 S16

- a) The factor of safety for pipe and fitting restraint shall be 2 times the design / field test pressure (300psi).
- b) Pipe joints alone shall be capable of withstanding 150psi test pressure.
- c) Trench Type 5 shall be used.
- d) Proposed joint restraint shall be able to accommodate all operating, test and surge pressures independent of anchor blocks.
- e) Anchor blocks will be required in addition to joint restraint.
- f) All restrained joints shall be installed in strict accordance with the manufacturer's specifications and recommendations and shall include appropriate corrosion protection.
- g) Depth of bury shall be a maximum of 1.6m to top of pipe or less. Where drawings or documents indicate depth of bury less than 1.6m to top of pipe, that value will be used.

.09 VALVE CHAMBERS**.09.01 Chambers**

Valve chambers shall be in accordance with OPSS 402, OPSS 1351, City standards and Contract Drawings. Chambers shall be capable of withstanding the required thrust forces and be selected from the Approved Products List.

Pre-cast chambers shall be supplied from a plant listed as Prequalified under the Plant Prequalification Program by the Ontario Concrete Pipe Association.

.09.02 Valve Chamber Piping

Chamber piping materials shall be ductile iron or concrete pressure pipe in accordance with the following:

.09.03 Ductile Iron

Ductile Iron Pipe shall be a minimum of Class 54, conform to AWWA C151 and be cement lined as per AWWA C104.

.09.04 Concrete Pressure Pipe

Prestressed Concrete Cylinder Pipe shall conform to AWWA C301.

.09.05 Chamber Fittings

Ductile Iron Fittings shall conform to AWWA C110.

Prestressed Concrete Cylinder Pipe shall conform to AWWA C301.

.09.06 Bolts

All nuts, bolts and washers shall be stainless steel. Bolt size, type and diameter shall be in accordance to AWWA C207. Bolt length shall be sufficient to accommodate flanges, gaskets and insulators. Protective coatings (primer, mastic and tape) shall be applied to all nuts and bolts inside chambers.

.09.07 Design

All pipe and fittings shall be designed to the values given in the Trunk Watermain Design and Operating Parameters – 400mm and Larger, subsection 400.08.

.09.08 Submissions

The following shall be in addition to the trunk watermain requirements outlined in Form 400, Sections .05.02.01, .06.01 or .07.02.01. The following information shall be submitted prior to ordering or installing any chamber components:

- a) Shop drawings, specifications and data sheets for all pipe specials;
- b) Valve type, catalogue data, actuator type (with input and output torque ratings), principal dimensions, schedule of parts and materials and expected

time of delivery;

- c) Layout drawings showing all chamber pipe and internal components. Itemized listing of chamber components including model names, numbers and all dimensions.

.10 VALVES

OPSS.MUNI 441.05.09 Valves

All valves shall be selected from the Approved Products List or as specified in the Contract Documents.

OPSS.MUNI 441.05.09.01 General

Revised as follows:

Valve types shall be in accordance with the following:

- a) All gate and butterfly valves installed within the boundaries of the former City of Hamilton are to be open right (clockwise), with the City's 25mm standard operating nut WM-203.04.
- b) All gate and butterfly valves in the remainder of the new City are to open left (counter clock-wise), with the City's 50mm operating nut.

The remainder of the new City of Hamilton shall be defined as the former municipalities of Ancaster, Dundas, Flamborough, Glanbrook and Stoney Creek.

- c) Track and roller option required for horizontal position valves.
- d) Bell end valves not acceptable.
- e) Fasteners including nuts, bolts and bolt studs shall be stainless steel.

.10.01 Gate Valves

OPSS.MUNI 441.05.09.03 Gate Valves

Add the following:

Valves 75mm to 400mm shall be ductile iron gate valves.

.10.02 Butterfly Valves

OPSS.MUNI 441.05.09.04 Butterfly Valves

Add the following:

- a) Valves greater than 400mm shall be butterfly valves selected from the Approved Products List.

- b) Torque ratings shall be as specified by the City. Contractor shall supply detailed actuator information upon request.
- c) Butterfly valves shall be installed so that the valve seat adjustment faces the spool piece side.

.10.03 Air Release and Vacuum Valves

OPSS.MUNI 441.05.09.05 Air Release and Air/Vacuum Valve

Revised as follows:

Air release and air/vacuum valves shall be double acting type selected from the Approved Products List.

.11 TRACER WIRE AND CONDUCTIVITY TESTING

.11.01 Tracer Wire

Tracer wire shall be installed on all new installations of polyvinyl chloride and concrete pressure pipe including mains, branches and services. The wire shall be positioned along the top of the pipe and fastened at 6 metre intervals. Tracer wire shall be as listed on the Approved Products List.

The wire is to be installed between each valve and/or the end of the new watermain. Joints in the wire between valves shall be avoided. At each valve and hydrant secondary valve, the tracer wire loop shall be brought up the outside of the valve box and inserted into the tracer wire opening in the upper section. Insertion point shall be clear of the lid and use a protective grommet. Tracer wire shall be secured to the outside of the valve box near the top prior to backfilling. The tracer wire shall also be connected to the cathodic protection system as required.

Splices in tracer wire shall be done using a splice kit approved for use in direct bury underground use.

.11.02 Conductivity testing

The Contractor will be required to conduct all tracer wire conductivity testing to ensure that the tracer wire is installed correctly and intact. Testing shall be conducted by authorized personnel using approved testing equipment and shall be supervised by the Contract Inspector or Project Manager. No payments for watermain works shall be processed until tracer wire testing is completed and accepted by the City. All costs for conductivity tests shall be included in the watermain item. If the tracer wire is not electrically continuous from valve to valve, the Contractor shall, at their expense, replace or repair the wire as required.

.12 TEMPORARY WATER SERVICE BY-PASS FOR CONSUMERS

Where called for or where needed, the Contractor shall provide, maintain and remove by-pass piping in accordance with OPSS 493, Appendix A attached to this specification and the following requirements.

12.01 Submissions

In order to evaluate the impact on the water network as a whole and the ability of the by-pass pipe to provide the volumes and flows required, the Contractor shall provide the proposed by-pass system layout proposal to the Project Manager for review and written approval. The Contractor shall not commence the installation of any by-pass materials in the absence of such written approval.

The Contractor will be required to revise the by-pass system and construction staging per the conditions provided in the written approval and shall provide revised drawings.

The Contractor shall have no basis for increased working time due to these requirements, revisions and/or conditions and all associated costs will be deemed to be included in the unit prices bid.

The Contractor shall supply 3 prints of the by-pass proposal a minimum of 3 weeks in advance of installation. Drawings of the system(s) being proposed shall be 1:500 metric scale (hard copy and PDF format) will be submitted to the Project Manager for approval. The Contractor shall provide By-pass Piping Submissions, for all phases of the bypass installation, in accordance with Form 400 and the following requirements.

- a) construction staging
- b) pipe sizes, manufacturer and material
- c) by-pass connection points/details
- d) back flow preventer size, location and manufacturer
- e) temporary hydrants connection points
- f) water services connection points
- g) horizontal location of the by-pass pipe in the road allowance
- h) locations and the materials used to ramp over the by-pass pipe
- i) locations where by-pass pipe is to be buried and the associated temporary restoration.

.12.02 General Description

Temporary by-pass pipe, where required, shall be laid above ground to supply water to consumers connected to a pipeline while that pipeline is out of service. An approved back-flow preventer shall be used by the Contractor whenever connecting to a hydrant.

Temporary by-pass shall include hoses and the necessary outlet/fittings to each house service connection. The Contractor shall maintain the temporary water lines in safe operating condition at all times. The Contractor shall be required to

mound over the by-pass wherever it crosses a street, driveway, or sidewalk, in order to prevent injury to vehicular and pedestrian traffic. Lights and barricades shall be furnished and maintained by the Contractor when required by the Project Manager. When a replaced section of watermain is restored to service, the Contractor shall remove any corresponding temporary pipe and house service connection and shall leave the street, sidewalk and adjacent property in a neat and orderly condition.

.12.03 By-Pass Pipe and Materials

The size, pipe, hose and other materials furnished by the Contractor for the temporary service pipe and connections to house services/branches, shall be approved by the Project Manager and be fully adequate to withstand the indicated pressures and all other conditions of use. The pipe and fittings shall provide adequate water tightness and be disinfected prior to being put into service.

.12.04 Service of Water to Feed By-Pass

The Contractor shall furnish all above and below ground connections required to provide the necessary pressurized water to feed the temporary by-pass line. All connections shall be at reasonably close and convenient locations and hydrants will be used whenever available.

.12.05 Temporary Connection to Customer

The Contractor shall make all shut-offs of consumers services and the final connections from the by-pass pipe to the consumer using flexible hose. Special connections requiring excavation, cutting or tapping shall be made by the Contractor. The Contractor shall notify the customer concerning this operation in advance. When the pipeline has been replaced, the Contractor shall clean the service by back-flushing with air or water. Once the pipeline is returned to service, the Contractor shall restore the consumer to service and disconnect the hose from the consumer connection. Where admittance to the customer's premises is denied or impossible, by virtue of absence, the connection cannot be cleared, it may be necessary to excavate and clear the service at the main. This shall be paid for on a unit price basis stated in the Form of Tender - Schedule of Quantities and Prices.

Where 100mm diameter Temporary Connections to the Consumers are called for, the length of the 100mm diameter piping required will be paid at the unit price for 100mm diameter Temporary By-Pass Piping. Cutting-in or tapping shall be provided by the Contractor and is included in the price bid.

All temporary service connection materials shall conform to the NSF 61 Standard. All hose used for individual property connections shall be minimum 20mm I.D., designed for a working pressure of 860kPa and be free from defects in materials and workmanship.

The pipe, hose and all other materials supplied by the Contractor for temporary servicing shall be approved by the Project Manager. Materials shall be fully adequate to withstand the pressures and other conditions of use and shall be of

material which does not impart any taste or odour to the water in accordance with NSF 61 Standard. The pipe and fittings shall provide adequate water tightness and care shall be exercised throughout the installation of any temporary pipe and service fittings to avoid the possible pollution of any City main/property services or the contamination of the temporary service pipe. Flushing of the private service connections and chlorination of the by-pass line prior to their use will be required. The temporary service connection shall be valved near the point of connection to the by-pass and also to the private plumbing system so that, except for the final connection, the by-pass line and private services may be chlorinated.

During freezing, stormy or inclement weather, no Work shall be done except that which is directed by the Project Manager. No by-pass service pipe or property service connections shall be installed during freezing or inclement weather and pipes already in use shall be removed or drained and services restored when directed by the Project Manager. Removal and re-installation of such pipes or services shall be done at the Contractor's expense.

Each home shall have its own temporary water service connection to the by-pass pipe and a connection to the private plumbing via a wye at an outside tap. The branching of wyes from a single spigot shall not be permitted; nor will connecting homes in series. An approved hose connection vacuum breaker (HCVB) shall be supplied on the open end of all wyes.

It shall be the responsibility of the Contractor to ensure an adequate water supply at all times. During the construction process, the Contractor is responsible for restoring a customer's water supply within two hours of notification from the Project Manager.

.12.06 Disinfection of Temporary Service Connections

Temporary service connections shall be chlorinated at the commencement of the Contract Works. Disconnection and relocation of service connections from one site to another within the Contract Works will not be subject to re-chlorination, unless otherwise directed by the Project Manager.

Where temporary service connections are disinfected in conjunction with the temporary by-pass watermain no physical connections to hose bibs will be permitted until after successful disinfection.

Where temporary by-pass service connections are disinfected offsite in a controlled environment, one set of samples shall be collected from every 350m of service hose connected in a series. One set of samples shall also be taken from the source and at each end of any hose group connected in series, regardless of the total length. Where temporary by-pass service connections are disinfected in conjunction with the temporary by-pass water main additional samples must be taken at the end of any two (2) temporary by-pass service connections for every 350m of temporary by-pass watermain disinfection.

.13 EXCAVATION AND PREPARATION OF TRENCH

.13.01 General

The trench shall be excavated only so far in advance of pipe laying as permitted. Removals shall be in accordance with Form 300 – General Construction Requirements.

.13.02 Alignment and Grade

Refer to OPSS.MUNI 441.07.14, 441.07.17, Form 200.02.05, 200.02.06 and 200.03.18.

.13.03 Excavation to Grade

Refer to OPSS.MUNI 441.07.08 and 441.07.14.

.13.04 Excavation in Poor Soil

Where the bottom of the trench at the required pipe grade is found to be unstable or to include material which, in the opinion of the Project Manager, should be removed, the Contractor shall excavate and remove such unsuitable material. Poor soil may consist of ashes, cinders, all types of refuse, organic or inorganic material.

Material shall be removed to the width and depth required to provide adequate support to the pipe and allow proper installation. The Contractor shall be allowed extra compensation for this work provided for in Form 200.

Where the bottom of the trench at subgrade is found to consist of material which, in the opinion of the Project Manager, cannot be removed and replaced with an approved material and thoroughly compacted in place to support the pipe properly, the Contractor shall construct a foundation for the pipe. Pipe foundation shall consist of piling, timbers, concrete or other materials. All plans for pipe foundation shall be approved by the Project Manager. Extra compensation will be allowed for such additional work as per Form 200.

.13.05 Excavation in Rock

Where excavation is made in rock or boulders, the trench shall be excavated to the width and depths that are required to provide for the granular bedding shown on plans.

In areas where the proposed watermain trench bottom varies from rock to earth, the Contractor shall taper the bottom of the earth trench over a two (2) metre length and supply, place and compact Granular "A" in this section to minimize any differential settlement between the two (2) bedding conditions.

.13.06 Preparation of Trench Bottom

The bottom of the trench at pipe grade shall be finished to within 9mm of a straight line between pipe joints or batter boards and all tolerances shall be above the specified grade. It will only be permissible to disturb the finished surface over a

distance of 450mm near the middle of each pipe for the withdrawal of slings or other lifting tackle.

.13.07 Preparation of Trench Bottom Below Grade

Where the trench has been excavated below pipe grade the Contractor shall place Granular "A" in 150mm layers to the required grade. Each layer shall be compacted by approved vibratory tampers to obtain 95% of the Standard Proctor Maximum Dry Density. The surface of the compacted granular material shall be finished to provide a continuous uniform support for the pipe at grade to the accuracy specified in subsection .13.06.

Unless otherwise specified, when the trench bottom has been excavated below the required pipe grade, the preparation of the trench bottom to pipe grade will be at the Contractor's expense. When the trench bottom is excavated below the pipe grade at the direction of the Project Manager, the preparation of the bottom of the trench to pipe grade will be allowed as extra compensation as provided for in Form 200.

.13.08 Care of Surface and Excavated Material for Reuse

Refer to Form 300.22.

.13.09 Piling Excavated Material

All excavated material shall be piled in a manner that will not endanger the Work and that will avoid obstructing sidewalks and driveways. Hydrants, valves, utilities and drainage courses shall be left unobstructed and accessible until the Work is completed.

.13.10 Interruption of Service, Shutting Down or Charging of Mains

OPSS.MUNI 441.07.21 Shutting Down or Charging Mains

Revised by the following:

No valves or other controls on the existing system shall be operated for any purpose by the Contractor. Only City employees will operate such valves, hydrants, blow-offs and curb stops. Refer to Form 300.20 Connecting to Existing Plant and Appendix A.

.14 BEDDING AND BACKFILL OF WATERMAINS

.14.01 General

OPSS 401.07.10, 441.07.13 and 441.07.14 are revised by the following:

Bedding and backfill shall be conducted in accordance with the depths and widths specified on the standard drawings and/or on the Contract Drawings. No type of slag including steel slag, blast furnace slag or nickel slag will be permitted for bedding or backfilling of watermains or water service trenches. All granular bedding and cover materials shall meet the requirements of Form 600.

.14.02 Bedding

Bedding shall be Granular material conforming to Form 600, placed in accordance with WM-200.01 and 200.02. Granular material shall extend to a minimum of 300mm above the top of pipe. Bedding materials shall conform to Form 600 and shall be compacted in accordance with Form 900. Bedding shall be shaped and compacted adequately to support pipe barrel and bells as required.

No type of slag including steel slag, blast furnace slag or nickel slag will be permitted for bedding of water mains.

.14.03 Backfill

Unless otherwise specified on the Contract Drawings or documents, trenches may be backfilled with select, approved native excavated earth materials from trenches. Where these materials are unavailable or deemed to be unsuitable, granular backfill will be used. Where granular backfill materials are used, they shall conform to Form 600 and shall be compacted in accordance with Form 900.

No type of slag including steel slag, blast furnace slag or nickel slag will be permitted for backfilling of watermain trenches.

The use of unshrinkable fill shall be employed where normal means cannot produce the required compaction of the material.

.14.04 Summary of Bedding and Backfill Materials

Bedding and backfill of water mains shall be in accordance with the following:

.14.04.01 Ductile Iron and Polyvinyl Chloride (PVC) Pipe Watermain

Bedding and cover - Granular "A"

Backfill - Select approved excavated native materials or Granular "A" or "B"

.14.04.02 Concrete Pressure Pipe Watermain

Bedding and cover - Granular "A" or "B"

Backfill - Select approved excavated native materials or Granular "A" or "B"

.14.04.03 Water Services

Bedding and cover – Granular "D" (crushed stone)

Backfill: approved excavated native materials or Granular "A" or "B"

.14.04.04 Hydrants

Bedding and cover - 19mm washed crushed stone

Backfill approved excavated native materials or Granular "A" or "B"

.15 LAYING

.15.01 Laying Pipe

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a suitable watertight plug. Before filling main with water in freezing weather, exposed pipe and fittings shall be covered with straw, or other approved means shall be taken in order to prevent freezing.

Refer to also OPSS.MUNI 441.07.14 and 441.07.15.

.15.02 Cutting Iron Pipe

Refer to OPSS.MUNI 441.07.16 Cutting of Pipe and the following:

The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe and in accordance with the manufacturer's recommendations.

The flame cutting of pipe by means of an oxyacetylene torch shall not be allowed nor shall the cutting of pipe with hammer and chisel be allowed.

.16 JOINTING MECHANICAL-JOINT PIPE

.16.01 Assembling Joints

Refer to OPSS.MUNI 441.07.15.

.16.02 Bolting of Joint

Refer to OPSS.MUNI 441.07.15 and all nuts shall be tightened with a suitable torque-limiting wrench. The torque for various sizes of bolts shall be as follows:

SIZE mm	RANGE OF TORQUE N-m
16	55-80
19	80-120
25	95-135
32	120-160

Nuts spaced 180° apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

.16.03 Permissible Deflection in Mechanical-Joint Pipe

Refer to Table 4.1 in Form 1000 – Amendments to Ontario Provincial Standards Volume 1, Division 4 - Drainage and Tunnels.

.17 JOINTING STEEL CYLINDER REINFORCED CONCRETE PIPE

Refer to OPSS.MUNI 441.07.15 Jointing

.18 JOINTING TYTON-JOINT PIPE

.18.01 Cleaning and Assembling Joint

Refer to OPSS.MUNI 441.07.15 Jointing

.18.02 Preparation of Spigot on Site

Where spigots require preparation on site, the outside of the spigot shall be filed to produce an angle of approximately 30°.

.18.03 Electrical Conductors

"Lockwedges" or strap-type electrical connections supplied by the pipe manufacturer shall be provided at each joint to ensure electrical conductivity. A minimum of two wedges per joint shall be installed in accordance with the manufacturer's directions.

Strap-type electrical connections shall be connected at each joint in accordance with manufacturer's directions.

The wedges shall be installed only after the pipe has been laid to proper line and grade and shall be preferably located at 180° apart.

.18.04 Permissible Deflection in Tyton-Joint Pipe

Refer to Table 4.2 in Form 1000 – Amendments to Ontario Provincial Standards Volume 1, Division 4 - Drainage, Watermains and Utility

.18.05 Jointing Flange Pipe

Unless otherwise specified, the Contractor shall furnish all bolts, studs, nuts and gaskets required to completely connect up all flanged pipe, fittings, flanges and other appurtenances attached to the pipe.

All bolts and nuts shall have American Standard threads of the Coarse Thread Series, and shall conform to ASA B18.2. For sizes 28mm diameter and below, they shall be of the conventional type and the material shall conform to ASTM A-307 (Grade B). Materials for bolts and studs 31mm diameter and above shall conform to ASTM A-193 (Grade B-7) or to ASTM A-325 (S.A.E. Grade 5). Nuts shall conform to ASTM A-194 Grade 2H. Bolts shall have hexagonal heads and shall be held with hexagonal semi-finished nuts. The length of any bolt shall be such that it will not project beyond the nut more than 13mm or less than 6mm, and no bolt shall be less than the diameter of the hole in which it fits by more than 3mm.

Gaskets shall be red rubber full faced 3mm thick in accordance with dimensions given in the latest edition of ASA B16.21 for Non Metallic Gaskets for Pipe Flanges.

.19 SETTING VALVES AND FITTINGS**.19.01 Valve Boxes**

Valve boxes shall be used for secondary valves at hydrants and where indicated on the watermain plans and profiles. Valve boxes shall be centred and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed. Refer to Standard Drawing WM-202. Installed valve boxes over gate valves shall be staked and the marking on the stake shall read "Gate Valve".

.19.02 Drainage of Mains

Drainage branches, blowoffs, air vents and appurtenances shall be provided with gate valves. Drainage branches or blowoffs shall not be connected to any sewer, submerged in any stream or be installed in any other manner that will permit back siphon into the distribution system.

.19.03 Dead Ends

All dead ends on new mains shall be closed with cast iron plugs or caps and provided with a 19mm corporation main stop.

.20 HYDRANTS

Hydrants supplied shall be in accordance with OPSS.MUNI 441.05.10, as amended by City standards and must be selected from the Approved Products List. Hydrants shall be installed in accordance with OPSS.MUNI 441.07.19, as amended and the following:

The Contractor shall supply and install the standard 3-way hydrants complete with secondary valves. Hydrant extensions and connections to the proposed watermains shall be in accordance with drawing WM-203.01 and WM-203.02, in the locations shown on the Contract Drawings. All hydrant extensions shall be done from the bottom, at the boot. No extension from the top will be permitted.

All proposed or replacement hydrant lead pipe material (DI or PVC) shall match the proposed watermain pipe material. Fittings at the watermain can be either DI or PVC.

The Contractor shall paint all parts of the hydrant above ground "Red", including caps and bonnets, using Exterior Gloss Alkyd type CGSB 1-GP-59 paint. Storz nozzles shall be painted gloss black.

The Contractor shall apply a minimum 2mm thickness in addition to the factory supplies primer and finish coat as required by Annual Supplies Specifications. The surface to be painted shall be clean, dry and free of grease.

For bedding and backfill requirements refer to Form 400.14.

.21 BACKFLOW PREVENTERS

OPSS.MUNI 441.05.11 Double Check Valve Backflow Preventers

All backflow preventers used on hydrants shall be supplied by the City in accordance with Appendix A, Section 2.1.

Where Contract Documents require the Contractor to supply a backflow preventer, the type shall be in accordance with City of Hamilton By-Law 10-103 and CSA B64-11.

.22 ANCHORAGE

.22.01 Anchorage for Fittings

All fittings shall be anchored according to the method shown on the standard drawings or as otherwise directed. The concrete shall be placed such that the joints will be accessible for repairs.

.22.02 Metal Harness

Metal harness of tie rods or clamps of adequate strength to prevent movement may be used instead of concrete backing, or if directed. Steel rods or clamps shall be galvanized or otherwise rustproof treated, or shall be painted as shown or directed.

.23 WATER SERVICES

Water services shall be installed in accordance with AWWA C800, OPSS.MUNI 441 and be selected from the Approved Products List.

.23.01 Services – 19mm to 50mm Diameter

Refer to OPSS.MUNI 441.07.15.07 Service Connection Pipe and the following:

Water service pipe shall be Type "K" soft copper and include the connection at the main and a curb stop with rod.

19mm and 25mm water services shall be installed in accordance with WM-207.01.

50mm water services shall be installed in accordance with OPSD 1104.02.

Connections to ductile iron watermain pipe shall be in accordance with Form 400.05.

Connections to PVC watermain pipe shall use a service saddle and be in accordance with Form 400.07.

Service connections to 100mm, 150mm and 200mm PVC mains shall be made by using PVC molded tapped couplings, conforming to AWWA C907 and CSA B137.2.

Where a water service is connected to a 50mm copper watermain loop, the connection shall be in accordance with WM-205.01 or WM-205.02.

Insulation of water services, where required, shall be in accordance with WM-207.03.

.23.02 Services - 100mm Diameter and Larger

Service connections shall be in accordance with OPSS.MUNI 441.07.15.07 Service Connection Pipe and the following:

Services shall be installed in accordance with WM-207.04 and WM-207.05, include the connection at the main, a reducer where required, a gate valve and valve box at property line.

Service pipe shall be either ductile iron or polyvinyl chloride in accordance with Form 400.05 or 400.07 and shall be constructed using the same pipe material as the proposed watermain.

The connection of any proposed watermain or water service with a diameter equal to that of the existing watermain shall only be made using a manufactured "Tee".

All fittings on all water services 100mm or greater shall be restrained from the main to the service valve at the property line.

.23.03 Curb Boxes

Curb boxes are to be located in accordance with standard watermain drawing WM-207.01 and WM-207.02 or as otherwise directed.

The Contractor shall indicate the positions of all water services installed in the following manner:

At each curb box location, a 1.83m, 50mm x 100mm wooden stake shall be planted and shall have a 1 metre bury. Stakes shall be painted white, and each shall bear, on its broad side, above ground, the words "WATER SERVICE", painted in black.

The Contractor shall be responsible for the preservation of all marker stakes. Where stakes are damaged or displaced in any way, the Contractor shall arrange to have the stakes replaced and accurately positioned, at their own expense.

.23.04 Trench for Water Service

The Contractor shall excavate and backfill the service trench from the watermain to the street line to a minimum depth of 1.6m below the proposed road grade whichever is the lower elevation unless otherwise directed.

.23.05 Laying Water Service Pipe

The Contractor shall lay the service pipe and install fittings to the street line. Soldered joints will not be permitted.

The service shall be bedded in accordance with Standard Drawing No. WM-200.01

and WM-200.02.

If laid over a sewer service or in a rock trench, the pipe shall be laid on a minimum of 150mm of tamped earth or sand. Service corporation fittings shall be installed into the watermain under pressure.

Valves in service pipe lines shall be properly braced before any pressure test is conducted.

Backfill for water service trenches shall be as specified for the watermain trench.

Service pipe at street line shall be temporarily plugged to prevent entrance of foreign material.

.23.06 Leaks in Services

All leaks that may develop in service lines laid by the Contractor within two years after date of completion of Contract shall be immediately repaired by the Contractor when notified by the Project Manager. Emergency repairs will be made by the City at the Contractor's expense.

.24 CONCRETE AND MORTAR

.24.01 Materials

Refer to OPSS.MUNI 441.05.13, 441.07.23 and OPSS Division 9. Concrete shall be Type HS High Sulfate Resistant in accordance with OPSS 1301 and Form 700.

.24.02 Proportioning and Mixing Mortars

Refer to OPSS.MUNI 441.05.14 and OPSS Division 9.

.24.03 Jointing Old and New Work

All joints between different sections of concrete masonry shall be made in an approved manner after the adjoining surfaces are cleaned, washed, roughened and coated with a neat cement grout, at locations approved of by the Project Manager, suitable provisions being made for the bonding of said joints.

.24.04 Placing in Water

No concrete shall be laid in water, except by permission of the Project Manager, nor shall water be allowed to rise and flow over newly placed concrete for a period of 24 hours.

.24.05 Forms

Forms shall be of such strength and rigidity and so supported that they will not deflect objectionably under the weight of pressure of the wet concrete.

They shall be properly braced and tied together so as to maintain position and shape, and prevent leakage of mortar.

Forms shall be so constructed that the finished concrete will conform to the shapes, lines, grades and dimensions indicated on the plans.

The face adjacent to the exposed concrete face shall consist of dressed lumber, smooth and clean.

.24.06 Form Removal

Shoring and forms shall not be removed before the time determined by the Project Manager.

.24.07 Curing of Concrete

After concrete has sufficiently set, its exposed surfaces shall be kept continuously moist for a period of at least seven (7) days.

Effective means shall be provided for maintaining the temperature of the concrete at not less than 10° C for at least 72 hours after placing. The temperature shall then be reduced at a maximum rate of 5.6° C per day until that of the surrounding atmosphere has been reached.

No concrete shall be deposited on ground that is frozen or which contains frozen materials.

Hydrostatic testing shall not be carried out until concrete anchor or thrust blocks have a minimum of 5 days curing time.

.24.08 Finish

Special care shall be used to secure smooth, uniform finish to the exposed surface of concrete. After form removal, concrete surfaces shall be immediately rubbed smooth to a uniform, satisfactory finish, and all surfaces subject to wear shall be faced with facing mixture where shown on the plans.

.24.09 Defects

Should any voids or other defects be discovered in any part of the Work when the forms are taken down, or at any other time, the defective Work shall be removed and the space refilled with a suitable concrete mortar in a proper manner at the expense of the Contractor.

.24.10 Reinforcing Steel

The ties for reinforcing shall not show on the exposed face of the concrete. All steel for reinforced concrete shall be supplied by the Contractor.

.25 DISINFECTION, TESTING AND CONNECTION OF WATERMAINS

OPSS MUNI. 441.07.25 - Flushing and Disinfecting Watermains

Revised as follows:

All connections, flushing, hydrostatic testing, swabbing, and bacteriological testing procedures shall be in accordance with Appendix 400-A and the Ministry of the Environment and Climate Change (MOECC) Watermain Disinfection Procedure.

APPENDIX A PROCEDURE FOR THE DISINFECTION, TESTING AND CONNECTION OF WATERMANS

1.0 INTRODUCTION

1.1 Scope: Watermain Installation and Testing Procedures

This procedure covers the cleaning, disinfection, hydrostatic testing and sampling of watermains. Unless specified otherwise this procedure applies to all new watermains, above ground by-pass watermains and relined watermains.

1.2 Definitions

Appurtenance means an appurtenance within the meaning of O. Reg. 170/03.

Category 1 Classification are watermain breaks with no evident or suspected contamination.

Category 2 Classification are watermain breaks with evident or suspected contamination.

Contaminant means foreign matter that is not intended to enter a watermain.

Contamination means the introduction of a Contaminant into a watermain.

Contractor means the person, partnership or Corporation undertaking the Work as identified in the agreement.

CHEL means the City of Hamilton Environmental Laboratory.

CSR means City of Hamilton Customer Service Representative.

CS&CO means City of Hamilton Customer Service and Community Outreach section.

Disinfectants means calcium or sodium hypochlorite that meets or exceeds ANSI/AWWA B300 or liquid chlorine that meets or exceeds ANSI/AWWA B301.

Flushing means post repair valve operation to restore secondary disinfection and discharge suspended materials by flowing water through the repaired section of watermain and out of the system. This definition does not include recharging the watermain or a requirement to achieve scouring velocity within the watermain.

Inspector means the City of Hamilton, Public Works, Engineering Services Contract Inspector or the City of Hamilton, Planning and Economic Development, Growth Management Inspections/Development Construction Coordinator who hold a minimum MOECC, O.Reg. 128/04 Water Operator Distribution Licence.

LIMS means the City of Hamilton Environmental Laboratory work order database.

LWO Number means the City of Hamilton Environmental Lab Work Order Number.

MOECC means Ministry of the Environment and Climate Change

Neutralizing Agent means Sodium Thiosulfate that meets or exceeds Appendix C of ANSI/AWWA Standard C651.

Project Manager means the City of Hamilton, Public Works, Engineering Services Project Manager or the City of Hamilton, Planning and Economic Development, Growth Management Project Manager.

SDWA means the Safe Drinking Water Act of Ontario.

Service Pipe means a service pipe within the meaning of O. Reg. 170/03.

Specialist means a company specializing in regulated water systems or a company approved by the Project Manager, whose personnel hold a minimum MOECC, O.Reg. 128/04 Water Operator Distribution Licence.

NSF 61 means the National Sanitation Foundation, Standard 61.

1.3 References

These procedures are based on and shall be used in conjunction with, the following:

- Ontario Provincial Specifications (OPS),
- American Waterworks Association Standards (ANSI/AWWA C651 – Disinfecting Water Mains and Appendices A and B),
- Safe Drinking Water Act of Ontario
- Ministry of the Environment and Climate Change (MOECC) – Watermain Disinfection Procedure
- The City of Hamilton Design Criteria
- The Canadian Standard Association - CAN/CSA-B64.10
- Hamilton Water procedure PW-WW-P-013-007 entitled DWQMS Water Quality Testing for New Watermain Connections.

1.4 General Requirements for Watermain Installation

The Contractor shall keep pipes clean and dry and take precautions to protect the interiors of pipes, fittings and valves against contamination. End caps shall be installed when Work is not in progress and removed only when connecting the next pipe or appurtenance or continuing Work. Pipes shall not be laid directly in water. Existing watermains, which are dead ended during construction, shall have a minimum 25mm bleeder installed at the dead end. New watermains which are temporarily dead ended shall have a minimum 50mm blow off installed with a temporary cap if there is no hydrant downstream of the last water service on the watermain.

1.5 Connection and Testing Procedures Plan and Meeting

The Contractor shall provide a plan to the Project Manager and Inspector detailing the connection locations, swabbing locations, hydrostatic testing, chlorination and dechlorination methods, disposal of water and final connection methods prior to the commencement of such works. If the project is being constructed in phases, this plan shall detail each of these items for each phase.

A pre-watermain connection and testing meeting shall be held by the Project Manager prior to any commissioning procedures.

1.6 Forms

The following forms are attached to this document:

- a) Watermain Commissioning Form – Swabbing and Hydrostatic Testing Record
- b) Watermain Commissioning Form – Disinfection and Chlorine Residual Sample Record

1.7 Supervision, Testing and Records

The Inspector shall witness all cleaning, swabbing, hydrostatic testing, disinfection and conduct sample collection. The Specialist carrying out the cleaning and disinfection shall take and record measurements in conjunction with the Inspector on the appropriate Watermain Commissioning Form.

1.8 Valve Operation

City of Hamilton Water Distribution staff must perform the operation of all existing valves inclusive of hydrant secondary valves. In the event of an emergency, the Inspector may operate or direct the Contractor to operate valves.

The opening and closing of any valve should be coordinated with the Inspector. All known affected residences or businesses shall be notified 48 hours prior to a planned disruption of water service.

2. WATERMAIN TESTING PROCEDURE

This document is to be read in conjunction with the forms attached to the end of this document. These procedures are to be used in conjunction with the Ontario Provincial Standard Specifications (OPSS), the American Waterworks Association Standards (AWWA) and the Safe Drinking Water Act of Ontario (SDWA), including the MOECC - Watermain Disinfection Procedure.

All required low-end chlorine residual tests shall be performed by the Specialist and confirmed by the Inspector utilizing an electronic tester such as a Hach Pocket Colourimeter or equivalent.

All Works associated with swabbing, pressure and leakage testing, chlorination, dechlorination and sterilization of the watermain are to be performed by a company specializing in this type of work or a company approved by the Project Manager and witnessed by the Inspector. The Inspector in charge of monitoring shall take and record measurements as per the Commissioning Forms attached herein.

Temporary by-pass piping shall meet all procedures and requirements of new watermain with the exception of hydrostatic pressure testing. A visual check shall be performed at line pressure on a temporary by-pass to ensure that it is leak free.

2.1 Temporary Connection and Backflow Preventer

The temporary connection is to be used for all water supplies to maintain continuous supply of water unless otherwise noted. The size of the temporary connection shall be 50mm diameter for watermains up to and including 200mm diameter and 100mm diameter for watermains 250mm diameter to 400mm diameter, inclusive. All materials for the temporary connections are to conform to the City of Hamilton Approved Products List. Watermains larger than 400mm in diameter shall be as per design standards.

For Public Works projects, the hydrant adapter (backflow preventer and meter) shall be a reduced pressure principle type and shall be supplied by the City of Hamilton upon receipt of request from the Project Manager.

For Planning and Economic Development projects, the hydrant adapter (backflow preventer and meter) shall be supplied by the City of Hamilton upon request from the Inspector on behalf of the Contractor.

The adapter shall be installed on a prescribed hydrant and charged by a City of Hamilton Water Distribution Operator. Hydrant(s) utilized as the source water for temporary by pass will be determined by the Project Manager in consultation with City of Hamilton Water Distribution staff.

The existing distribution system and backflow preventer shall be physically disconnected from the test section during all hydrostatic testing.

2.2 Charging of Watermains

The watermain is to be recharged via a temporary connection equipped with an approved backflow preventer.

2.3 Swabbing

The isolated section of watermain shall be charged or pressurized prior to the commencement of swabbing. The swabs shall be numbered and carefully controlled by the Specialist to ensure that all swabs that are introduced into the watermain are retrieved and accounted for. The Inspector shall record the number of swabs inserted and retrieved. All swabs must be inspected prior to insertion and immediately after they exit the watermain to ensure that they have remained intact and that pieces of the foam do not remain inside the watermain. New swabs shall be used for this procedure and under no circumstances will used swabs be allowed.

All watermain pipes must be swabbed with a minimum of THREE swabs plus a minimum of one swab shall be passed through each hydrant lead, large diameter water service, stub or blow-off. Additional swabs shall be used as directed by the Project Manager or Inspector should discharge water not run clear within ten seconds of the swab exiting the discharge point. No additional payment shall be made for subsequent swabbing.

Swabs shall be forced through the watermain using potable water at a minimum velocity of 0.6m to 1m per second. The Project Manager must approve all methods of disposal of the discharged water. The Contractor shall take all necessary precautions to minimize soil erosion and shall reinstate any affected areas upon completion.

The swabs must be new open cell polyurethane foam, having a density of 1.5 pounds per cubic foot (24 kilograms per cubic metre) and are to be a minimum of 50mm larger than the nominal

pipe diameter with a length at least one and a half times its diameter. Watermains 300mm or smaller may be swabbed through hydrants with the approval of the Project Manager. Procedures for swabbing watermains larger than 300mm must also be approved by the Project Manager.

2.4 Hydrostatic Testing

Leakage tests shall be carried out on the test section of watermain after swabbing operations have been successfully completed. The Contractor shall ensure that no air pockets are present in the test section of watermain. The existing distribution systems and the backflow preventer shall be physically disconnected from the test section during all hydrostatic testing. The test section shall be capped and the main filled with potable water under a pressure of 1035 kPa. After any visible leaks are stopped, leakage shall then be measured by a calibrated meter with readings taken at fifteen minute intervals for a period of two hours and recorded on the Watermain Commissioning form. The allowable leakage shall not exceed 0.128 litres per mm of pipe diameter per km of pipe for the 2 hour period. If the leakage exceeds this figure, the Contractor shall locate and repair all leaks and the test section shall be retested until a satisfactory result is obtained.

The watermain is to be tested in sections, where a section is a length of watermain between two valves or a valve and a dead end. Should the Contractor wish to test more than one section at a time, the Project Manager/ Inspector will calculate the allowable leakage for all sections within the tested portion and the smallest calculated leakage will become the allowable for the entire tested portion.

2.5 Disinfection of Watermains

The main shall be completely filled to remove air pockets and flushed to remove any particulates. After flushing is completed, the main shall be filled with potable water.

The chlorine solution shall be thoroughly mixed prior to pumping it into the system. Chlorine solution shall be injected into the system using the continuous feed method through the access point on the temporary connection. The chlorine solution shall be applied so that the initial chlorine concentration is a minimum of 50mg/L throughout the system and does not exceed 100mg/L.

The chlorine solution shall flow through each hydrant and blow-off. The high chlorine residual is to be measured and recorded by the Specialist at each sample location in conjunction with the Inspector.

The high chlorine concentration shall be left in the isolated system for a minimum of 24 hours. After the required contact time, the chlorine residual shall be measured and recorded at each sample location by the Specialist in conjunction with the Inspector. Flow required to take the chlorine residuals shall be provided through the temporary connection.

The maximum allowable decrease in chlorine concentration after 24 hours is 40% of the initial chlorine concentration, to a maximum decrease of 50 mg/L.

Table 1: Chlorine Concentrations and Contact Times for New Watermains			
Disinfection Method	Minimum Contact Time	Initial Chlorine Concentration	Maximum Allowable Decrease in Chlorine Concentration
Continuous Feed	24 hours	Minimum 50mg/L not to exceed 100mg/L	40% of the Initial Chlorine Concentration (to a Maximum of 50mg/L)

The following examples are provided to demonstrate the proper use of Table 1:

Example 1

When using the continuous feed method of chlorination with an initial chlorine concentration of 50mg/L, the maximum allowable decrease in chlorine concentration is 40% of 50mg/L, or 20mg/L. Therefore, at least 30mg/L of chlorine must be present after 24 hours.

Example 2

When using the continuous feed method of chlorination with an initial chlorine concentration of 150mg/L, the maximum allowable decrease in chlorine concentration is 50mg/L, because 40% of 150mg/L is greater than the maximum allowable decrease of 50mg/L. Therefore, at least 100mg/L of chlorine must be present after 24 hours. However, the initial chlorine concentration should not exceed 100mg/L.

If the chlorine residual meets the above Table 1 criteria after 24 hours, the chlorine is ready to be discharged. In the event that the chlorine residual is less than the allowable levels after 24 hours, the chlorine in the system is to be discharged and the system is to be re-chlorinated. The Inspector has the authority to require further swabbing if the residual is less than the allowable levels after 24 hours. Once this has been achieved, the watermain shall be flushed and sampled for chlorine residual levels.

Minimum acceptable levels are 40% of the initial chlorine concentration to a maximum decrease of 50mg/L.

2.6 Removal/Disposal of Super Chlorinated Water

The Contractor shall dechlorinate the discharge water to protect receiving streams and other bodies of water, via catch basins or other points of entry, as per the MOECC regulations and ANSI/AWWA C651 as amended. If in near proximity to the sewer treatment plant, the plant is to be notified and must approve receiving the water. The Contractor shall be required to supply all labour, equipment and materials to dechlorinate the water including, but not limited to, de-chlorination mats, diffusers and dechlorination chemicals. There shall be no separate payment for dechlorination.

2.7 Bacteriological Sampling

Bacteriological sampling shall be done in accordance with ANSI/AWWA C651, the MOECC - Watermain Disinfection Procedure – Section 1.1.2, and the following:

Before the watermain, or temporary above ground by-pass system can be approved for connection to the existing water distribution system, two (2) consecutive rounds of water samples, taken 24 hours apart, shall pass the appropriate chlorine residual (within the

respective drinking water system – Woodward, Fifty Road and communal wells) and bacteriological testing requirements as per the City of Hamilton Laboratory testing procedures. Prior to chlorine residual and bacteriological testing, all other testing and disinfection shall be completed and any super chlorinated water removed from all portions of the watermain system under consideration including hydrant leads, stubs, branches, services, etc.

The Inspector shall field test for residual chlorine at each testing point of the new watermain to be no less than 0.25mg/L and to be no greater than 3.0mg/L. The Inspector will then take the bacteriological sample at each sample location and deliver it to the City of Hamilton Environmental Laboratory. The watermain test section shall be immediately shut down and must not be disturbed or flushed for the period between this sample round and the next bacteriological sample round 24 hours later. The watermain must remain continually pressurized through the approved backflow preventer from the start of the bacteriological testing until the connection to the existing system is undertaken.

Samples shall be taken from the end of every dead end and from every 360 metres or less of new watermain pipe. No hose or hydrant shall be used in the collection of bacteriological samples.

2.8 Sample Results

Once the new watermain is installed and pressure tested, the proper numbers of water samples are to be collected by the Inspector. The Inspector shall drop off sample bottles at CHEL along with the completed chain of custody form(s).

Lab staff will process and log in the bottle(s). Each chain of custody form will be assigned an LWO Number. In addition to the LWO, each sample bottle will be assigned a unique record number. Samples delivered after 3:30pm on working days will be set up the same day but may not be logged in until the next day. Samples delivered after 4:00pm on working days may not be set up for analysis or logged in until the next day.

Lab staff, using the LIMS database, will generate an email that will be sent to the Inspector. The email will contain the LWO and record numbers that can then be used by the Inspector when calling in to the lab.

Special arrangements can be made to bring sample bottles to the lab on a weekend. Inspectors are to call CHEL on the Friday and provide the sample location, account number and the project/permit number (if applicable). In this case, CHEL will pre-log the samples into LIMS.

Inspectors can call the CHEL after 24 hours and 48 hours to determine the status of water quality testing with the understanding that these results are provisional until they have gone through the data approval process. The new watermain cannot be put into service until the final approved lab report from the CHEL has been obtained.

After the 48-hour testing period, data is entered into the LIMS database which will go through a data approval process. CHEL will create a PDF file of the final approved lab report for each LWO and save the file at the following locations:

- a) For CS&CO staff, the PDF file is saved at N:\Environmental Laboratory Reports\CSCO_WmRech

- b) For Planning and Economic Development, Growth Management, the PDF file is saved at N:\Environmental Laboratory Reports\Development Engineering
- c) For Public Works, Engineering Services, the PDF file is saved at N:\Environmental Laboratory Reports\Construction.

The files will be named as follows:

PRIVATE-ROADS_XXXXXX_ - ##### _YYYY-MM-DD HH-MM-SS Final Report.pdf

where:

XXXXXX represents the permit No. / Contract No., if supplied.

represents the LWO Number.

YYYY-MM-DD is the date that the PDF was created.

HH-MM-SS is the time that the PDF was created.

The pdf file of the final approved lab report is also emailed to the Inspector.

If changes are required to the staff permissions for the files above, the Lab Services Project Manager must be contacted at Ext. 1145.

Inspectors shall also contact a CSR 24 hours and/or 48 hours ahead of the proposed watermain shutdown, depending on the project, to facilitate the connection of the new watermain to the source watermain and inform the CSR of the following information: name of the Inspector, Contract No. or development site, where/when to meet WDO, duration of shutdown and LWO number.

The CSR will create a Service Request containing the information listed above. The CSR will also attach by OLE the corresponding LWO PDF file from the network drive N: \ environmental laboratory reports\CSCO_WmRech . The CSR will then create the Service Request for a WDO to connect the new watermain to the existing water distribution system.

If sample results are successful, the system will be put into service. A single failed bacteriological parameter will constitute a failure of the entire sampling round. If sample results do not meet requirements, the failed section must be flushed or re-disinfected as directed by the Project Manager/Inspector and re-sampled at the sample locations. Sampling will continue until two (2) consecutive sets of water samples, taken 24 hours apart, pass both the appropriate chlorine residual and bacteriological requirements as per the City of Hamilton Laboratory testing procedures.

3. CONNECTION TO EXISTING WATER DISTRIBUTION SYSTEM

Connections to the existing water distribution system shall be done in accordance with ANSI/AWWA C651 and the following:

Once the bacteriological tests have passed, the connection to the existing watermain shall be performed.

A sump, minimum 300mm depth, shall be excavated in the trench bottom and be filled with clear stone to provide a location to collect and pump water.

Watermains shall be cut back to remove any temporary taps. The Contractor shall disinfect the connection watermain pipe as outlined in section 3.1 and shall dewater the watermain and trench in a controlled manner as to not allow backflow of water into the watermain.

If trench water, dirt, or debris has entered the watermain during the final connection, the watermain shall be aggressively flushed and additional bacteriological samples shall be taken as directed by the Inspector. If contamination is evident or suspected, the procedures defined under Section 3 of the MOECC - Watermain Disinfection Procedure for Category 2 watermain breaks shall apply.

3.1 Connections and Tapping of Watermains

The new pipe, fittings and valves required for the connection shall be spray-disinfected and swabbed with a minimum 1% to maximum 12% solution of sodium hypochlorite immediately prior to being installed. The existing watermain being connected to shall also be cleaned in the immediate area of the connection and spray-disinfected with the same solution.

Where existing watermains are tapped, the drill/cutting/tapping bits and all surfaces of mainstops, service saddles, tapping sleeves and valves which will come into contact with drinking water shall likewise be cleaned and disinfected.

The Contractor shall make every possible effort to ensure that the final connection is no more than one pipe length.

4. WATER SERVICES

Service connections shall be tapped and connected under pressure. All connections shall be inspected to ensure they are drip tight prior to backfilling. The pipe shall be left exposed until directed by the Inspector, after which backfilling shall be completed.

All new water service pipe 38mm in diameter up to but not including 100mm diameter, as well as all sizes of temporary by-pass service hose, shall be disinfected. The chlorine solution shall be applied so that the chlorine concentration is a minimum of 50mg/L and does not exceed 100mg/L. Pre-disinfected pipe shall be sealed immediately following disinfection until immediately prior to connection.

All new services shall be thoroughly flushed prior to connecting to the existing service. Required drill / cutting / tapping bits, and all surfaces of mainstops, service saddles, tapping sleeves and valves which will come into contact with the drinking water shall be cleaned and spray-disinfected with a minimum 1% to maximum 12% solution of sodium hypochlorite immediately prior to the connection.

If any of the disinfected surfaces come into contact with the soil and/or water in the excavation prior to use, the cleaning and disinfection procedure shall be repeated.

Services 100mm in diameter and larger shall be considered mainline and shall meet all mainline procedures and testing requirements of Section 2.5 Disinfection of Watermains, and MOECC - Watermain Disinfection Procedure - 1.1 New Watermains.

All by-pass services hoses to be used will be of potable water grade and shall meet the requirements of NSF 61 Standard. Service hoses shall be capped on both ends with brass caps until installed. Service hoses shall not be installed on by-pass piping until the day of the change over from the distribution watermain to the above ground by-pass watermain.

5. WATERMAIN BREAKS

Watermain breaks shall be treated in accordance with the MOECC – Watermain Disinfection Procedure, Section 3. Watermain Disinfection Procedures for Emergency Repairs.

6. RELINING OF WATERMAINS

Relining of existing watermains shall be treated in accordance with the MOECC – Watermain Disinfection Procedure, Section 1.2 Relining of Watermains, and Section 2.5 of this document.

WATERMAIN COMMISSIONING FORM
Swabbing and Hydrostatic Testing Record

CONTRACT/SITE NAME:

DATE:	LOCATION:
TIME:	
PERFORMED BY:	WITNESSED BY:
No. SWABS INSERTED:	No. OF SWABS RETRIEVED:

DATE	WATERMAIN SECTION, LENGTHS AND DIAMETERS	TIME	LEAKAGE (litres)

0.128 L/mm of pipe diameter per kilometre of pipe for the 2 hour test period

PRESSURE TEST PASSED: YES NO

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.01 CONCRETE PIPE

.01.01 General

This specification covers the material requirements for circular concrete pipe to be used for the conveyance of storm water and sewage. All pipe materials shall meet the requirements of OPSS 1301, OPSS.MUNI 1820, this specification and be selected from the Approved Sewer Products List.

All pipe supplied shall be from a plant listed as Prequalified under the Plant Prequalification Program by the Ontario Concrete Pipe Association.

.01.02 Classes and Uses of Concrete Pipe

The classes of concrete pipe specified for various construction applications are outlined as follows:

- a) Reinforced Concrete Pipe:
ASTM Designation C-76, Class III, or CSA A257.2, 65-D
- b) Reinforced Concrete Pipe:
ASTM Designation C-76, Class IV, or CSA A257.2, 100-D
- c) Reinforced Concrete Pipe:
ASTM Designation C-76, Class V, or CSA A257.2, 140-D

Reinforced concrete pipe shall be used for the construction of storm sewers, manhole channels, and inlet chamber drains which require pipe with an internal diameter of 300mm and larger.

.01.03 Sulphate Resistant Portland Cement

Portland cement used in the manufacture of concrete pipe shall be Type HS High Sulphate Resistant and meet the requirements of OPSS 1301. The type of cementing materials used shall be marked on each pipe in accordance with OPSS 1301.07.02.

.01.04 Inspection and Testing

Pipe manufacturers shall provide the City all reasonable facilities to permit the City representative to verify that the pipe conforms to the City's specification.

The pipe manufacturer shall provide the required test specimens, labour and testing equipment required to satisfy the City that the proposed pipe materials meets the specification.

The costs of all testing shall be at the expense of the pipe supplier and/or manufacturer.

.02 CLAY PIPE

.02.01 General

This specification covers the material requirements for circular clay pipe to be used for the conveyance of storm water, sewage, and industrial waste.

.02.02 Classes and Uses of Clay Pipe

Extra strength clay pipe shall be used for the construction of the following installations:

- a) Storm sewers, sanitary sewers and manhole channels up to and including pipe with an internal diameter of 600mm.
- b) Inlet chamber drains up to and including pipe with an internal diameter of 600mm, and inlet chamber drain risers up to and including pipe with an internal diameter of 250mm.
- c) Private sanitary drains and private sanitary drain risers for pipe with an internal diameter up to and including 250mm.
- d) Catch basin drains, catch basin drain risers, and manhole drop pipes for pipe up to and including an internal diameter of 250mm.

.02.03 Inspection and Testing

Pipe manufacturers shall provide the City all reasonable facilities to permit the City's representative to verify that the pipe conforms to the City's specification. The pipe manufacturer shall provide the required test specimens, labour, and testing equipment and machines to meet the quality assurance conditions of the City.

The costs of all testing shall be at the expense of the pipe supplier and/or manufacturer.

.03 PVC PIPE

.03.01 General

This specification covers the material requirements for circular PVC pipe to be used for the conveyance of storm water and sewage. All pipe materials shall meet the requirements of OPSS 1841, this specification and be selected from the Approved Sewer Products List, latest edition.

.03.02 Classes and Uses of PVC Pipe

The Standard Dimension Ratio (SDR) is the ratio of the average pipe diameter to the minimum wall thickness. The specified SDR values for main sewers and private drain laterals are as follows:

- a) SDR 35 for main sewer installations with a pipe diameter of 200mm up to and including 600mm.
- b) SDR 28 for private drains and laterals.
- c) Profile or Ribbed pipe is not accepted.

.03.03 Inspection and Testing

Pipe manufacturers shall provide the City all reasonable facilities to permit the City's representative to verify that the pipe conforms to the City's specification. The pipe manufacturer shall provide the required test specimens, labour, and testing equipment and machines to meet the quality assurance conditions of the City.

The costs of all testing shall be at the expense of the pipe supplier and/or manufacturer.

.03.03.01 Pipe Stiffness

The pipe stiffness shall be determined at 5 % deflection according to ASTM D2412. The minimum pipe stiffness requirements for SDR values of 35 and 28 shall be 50 and 100 respectively.

.03.03.02 Internal Hydrostatic Pressure

A typical joint assembly shall be subjected to an internal pressure of 74 kPa for 10 minutes without leakage.

.03.03.03 Internal Vacuum

A typical joint assembly shall be subjected to an internal vacuum of 74 kPa for 10 minutes without leakage.

.04 CCTV SEWER INSPECTION

.04.01 CCTV Reports and Submittals

The Contractor shall submit the following once all inspections are complete:

- a) A printed inspection report, including an index for each inspection, and detailed records for every inspection performed
- b) A PDF version of the printed report
- c) Electronic media generated during inspection arranged and identified in a manner that facilitates referencing to each inspection record
- d) A database as specified in Form 500.04.04 Data Format

The Contractor is required to keep a record of all inspection material for the duration of the maintenance period, or a minimum of 3 years from the date of inspection.

.04.02 Inspection Related Instructions

The Contractor will be held responsible for damage to street surfaces, curbs, gutters, existing utilities, etc. that result from their negligence during any inspection.

The Contractor shall repair, at their cost, any damage resulting there from, which shall be subject to approval, by the City.

The Contractor will be required to inspect all sewers without disturbing the existing condition of the sewer. Should the Contractor decide to use a stringing method to inspect the sewer, the stringing lines shall not be left in the sewer for more than five days or without consent of the Project Manager.

All obstructions, cracks, irregularities must be fully inspected and documented. The Contractor must inform the City's representative immediately of any obstruction encountered, locations of hazardous atmosphere, or sewers that are in immediate danger of structural failure while the inspection is still in progress. Where possible, the survey shall be reversed so that the extent of the blockage can be assessed.

The Contractor, under the supervision of the Project Manager, or their representative, may install plugs in the sewers to prevent the flow of sewage during inspection for a period of no longer than 10 minutes. The plugs must then be removed for a minimum of 10 minutes after which time they may be installed again for the period stated above. Plugs shall only be installed when and for the time period directed by the Project Manager where the existing flow hinders a proper inspection.

.04.03 Occupational Health and Safety – Confined Space Entry

The Contractor shall ensure that all aspects of the required work are, at all times, in full and complete compliance with the Occupational Health and Safety Act, as amended.

The Contractor shall provide approved equipment and training to personnel who enter confined spaces as may be required on this project. The procedures the Contractor follows for Confined Space Entry must meet or exceed the requirements outlined by the Occupational Health and Safety Act.

.04.04 Data Format

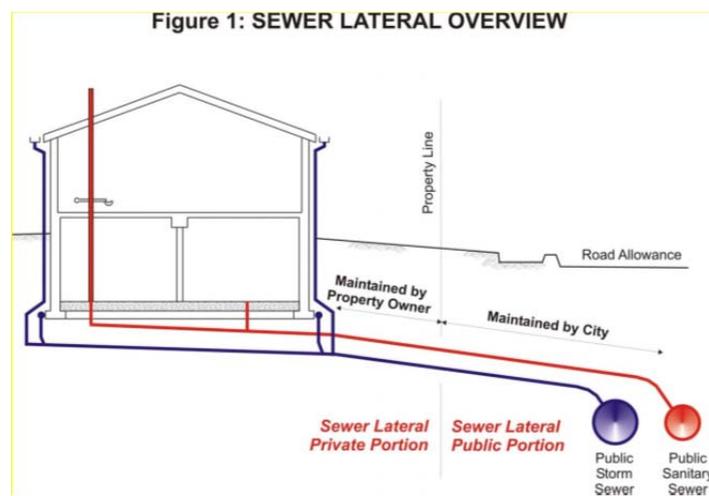
Data structure shall be as specified in the latest NASSCO standard for mainline, manhole, or lateral inspection.

Database file shall be in Microsoft Access format.

Key fields issued by the City to identify inspection records and assets shall be used during inspection and be included in the database inspection records.

.04.05 Lateral Inspection and Asset Inventory

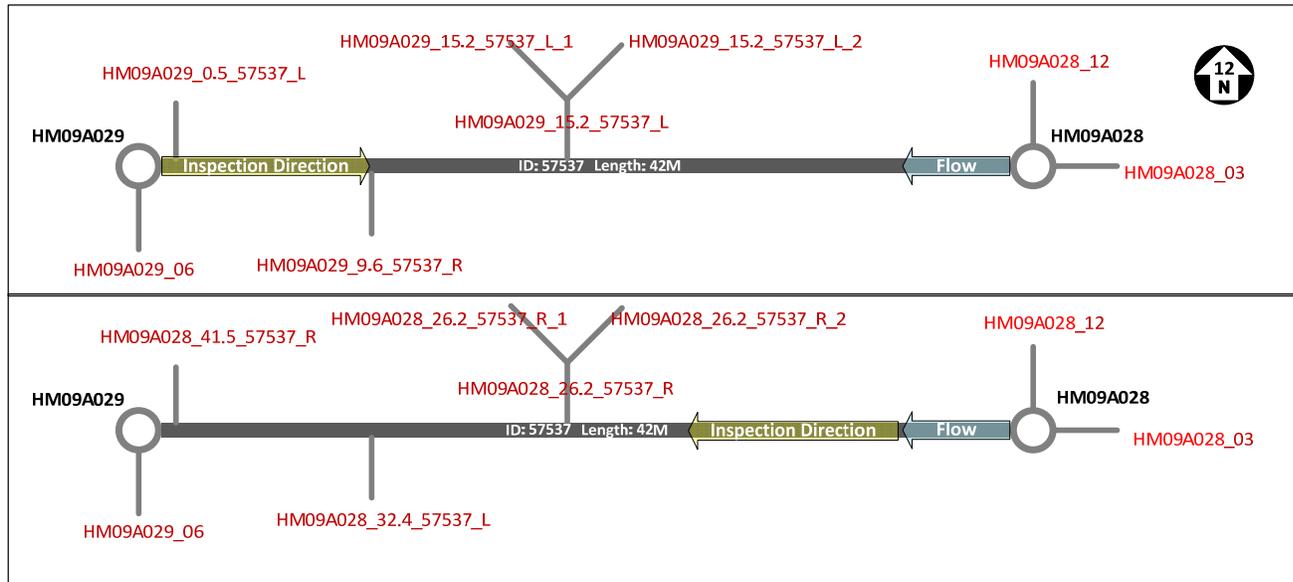
A Sewer Lateral-Private Portion refers to the drain pipe extending from a building on private property to the Sewer Lateral-Public Portion. The Sewer Lateral-Private Portion may be used to convey either storm water, sanitary sewage, or a combination of the two. Figure 1 outlines the location of the Sewer Lateral-Private Portion.



Unless otherwise specified, Contractors shall inspect laterals from the mainline sewer only and up to property line (public portion).

Where sewer lateral inventory is not available, Contractors will be required to generate lateral inventory based on conditions observed during inspection in relation to the existing mainline sewer inventory. Figure 2 outlines the methodology for lateral ID creation.

Figure 2: Sewer Lateral Inspection – Lateral ID Creation



ID Components - Mainline Laterals (PACP Lateral_Segment_Reference field)
Starting Manhole ID_Chainage_Mainline ID_Direction of Lateral

Start Manhole ID: The Hansen Manhole ID (MH_ID*)
Chainage: Length in m to one decimal point from start manhole to lateral connection
Mainline ID: The Hansen Mainline ID (COMPKEY*)
Direction of Lateral: L – Left, R – Right

*City of Hamilton GIS layer field name reference

ID Components - Manhole Laterals
Manhole ID_Clock Position

Manhole ID: The Hansen Manhole ID
Clock Position: North is 12o'clock

.01 GENERAL

Unless amended herein, granular material physical properties, and testing procedures to evaluate granular material quality shall conform to the requirements of OPSS 1001.

.02 GRANULAR 'A' BASE COURSE AND GRANULAR 'B' SUBBASE

.02.01 Physical Properties

Granular 'A'

Physical properties shall conform to OPSS.MUNI 1010.05.02, and Table 1.

100 % Reclaimed Concrete Material (RCM) and up to 30% by mass Reclaimed Asphalt Pavement (RAP) shall be accepted in Granular 'A' base course materials.

Granular 'B' – Type II

Physical properties shall conform to OPSS.MUNI 1010.05.03.03 and Table 1.

.02.02 Gradation Properties

Gradation properties for Granular 'A' and 'B' shall conform to OPSS.MUNI 1010, Table 2.

Granular 'B' for sub base shall meet the gradation requirement for Type II.

.03 GRANULAR PIPE BEDDING

.03.01 Physical Properties

Physical properties shall conform to Table 600-1. Slag (blast furnace and steel slag) shall not be used for pipe bedding of watermains or water services.

.03.02 Gradation Properties

Gradation properties shall conform to the requirements of Granular material in OPSS.MUNI 1010, Table 2. Granular D shall conform to the gradation requirements in Table 600-2.

.04 GRANULAR TRENCH BACKFILL

.04.01 Excavated Native Materials

Trenches may be backfilled with select, approved excavated native materials, or as specified in the Contract Documents. Where granular trench material is required refer to Form 600.04.02 and 600.04.03.

.04.02 Physical Properties

Physical properties shall conform to Table 600-1. Crushed bedrock, or crushed blast furnace slag are acceptable for granular trench backfill. Use of slag is not permitted for backfill of watermains or water services.

.04.03 Gradation Properties

Gradation properties shall conform to the requirements of Granular B, Type I material in OPSS.MUNI 1010, Table 2, with the additional requirement that 100 % of the aggregate, by mass, shall pass the 100mm sieve size.

TABLE 600-1

PHYSICAL TESTS	GRANULAR TRENCH BACKFILL	GRANULAR PIPE BEDDING	MTO LAB TEST NUMBER
Los Angeles Abrasion, Loss in Maximum Allowable Percent	N/A	N/A	LS 603
Petrographic Number, Maximum Allowable	250	250	LS 609
Plasticity Index	0	0	LS 704
Percentage of Crushed Particles, by mass Minimum	N/A	N/A	LS 607
Maximum Allowable Percentage of Asphalt Coated Particles in Coarse Aggregate	30	30	LS 621

**TABLE 600-2
GRADATION REQUIREMENTS FOR GRANULAR D**

SIEVE SIZE	PERCENTAGE PASSING BY MASS
106 mm	-
53 mm	-
26.5 mm	-
22.4 mm	-
16 mm	-
13.2 mm	-
9.5 mm	100
4.75 mm	50-100
1.18 mm	20-55
300 μ m	10-30
150 μ m	-
75 μ m	0-12
53 μ m	-

.05 BLAST FURNACE SLAG

The use of blast furnace slag shall be in accordance with Table 600-3.

APPROVED USES OF BLAST FURNACE SLAG TABLE 600-3		APPLICATIONS			
		APPLIED TO LAND SURFACE	APPLIED BELOW LAND SURFACE	PLACED IN WATER	ENCAPSULATED USES
GRANULAR BASE (Granular A) Under Asphalt/Concrete Pavement	Urban Road Cross- Section		APPROVED		
	Rural Road Cross- Section with Ditches		NOT APPROVED		
GRANULAR SUBBASE (Granular B) Under Asphalt/Concrete Pavement	Urban Road Cross- Section		APPROVED		
	Rural Road Cross- Section with Ditches		NOT APPROVED		
SUBGRADE STABILIZATION			USE SUBJECT TO RISK ASSESSMENT OF DRAINAGE FEATURES		
GRANULAR SHOULDER MATERIAL Rural Road Section with Ditches		NOT APPROVED	NOT APPROVED		
LIGHT-WEIGHT EMBANKMENT/BERM FILL		USE SUBJECT TO RISK ASSESSMENT OF DRAINAGE FEATURES	USE SUBJECT TO RISK ASSESSMENT OF DRAINAGE FEATURES		
WATERMAIN TRENCH BACKFILL			NOT APPROVED		
SEWER TRENCH BACKFILL			NOT APPROVED		
PIPE BEDDING/COVER MATERIAL			NOT APPROVED		
CLEAR STONE BEDDING AROUND PERFORATED SUBDRAIN PIPE			NOT APPROVED		
HOT MIX ASPHALT AGGREGATE		APPROVED			APPROVED IN ASPHALT
GABION AGGREGATE FOR RETAINING WALLS		NOT APPROVED			
LIGHT WEIGHT CONCRETE AGGREGATE					APPROVED IN CONCRETE

.01 GENERAL

This specification covers mixed Portland cement concrete to be used for the construction of sidewalks, pavements, structures, appurtenances, sewers and water mains. Concrete shall be in accordance with OPSS.MUNI 1350 and the following:

.02 AGGREGATES

Concrete aggregates shall conform to OPSS 1001 and OPSS.MUNI 1002. Coarse aggregate shall have a nominal maximum size of 19mm, with corresponding gradation requirements as given in OPSS.MUNI 1002, Tables 3 and 4.

.03 COMPRESSIVE STRENGTH CLASS

The class of concrete specified for the various construction applications is outlined in Table 700-1.

.04 CHEMICAL ADMIXTURES

Chemical admixtures shall conform to the requirements of OPSS.MUNI 1303.

.05 HYDRAULIC CEMENTING MATERIALS

Hydraulic cementing materials shall conform to the requirements of OPSS 1301. Unless otherwise specified in the contract. Type GU general use Portland cement shall be used for all above grade concrete.

All below grade concrete shall be resistant to a "very severe" sulphate environment as defined CAN/CSA-A23.1, latest edition. This concrete mix shall incorporate Type HS high sulphate resistant cement, or slag cement and normal Portland cement in the proportions required to achieve a sulphate resistant concrete. The potential sulphate resistance of the slag and cement blend shall be determined by ASTM specification C 1012.

Type HS cement shall be used in all concrete for the construction of pre-cast and cast in place sections of manholes, valve chambers, thrust blocks and concrete pipe.

.06 CONCRETE CURING

Curing of concrete surfaces shall be undertaken by using one of three alternatives:

- 1) White waterproof paper, white opaque polyethylene film, or white burlap-polyethylene sheeting which conforms to OPSS 1305
- 2) Burlap as specified in OPSS 1306
- 3) White or green pigmented membrane curing compound as specified in OPSS 1315

.07 PLACEMENT BY SLIPFORM

The concrete slump for slipform placement shall be generally in accordance with OPSS.MUNI 1350. The mix slump, however, must be compatible with the type of placement equipment in order to eliminate honeycombing.

.08 FINISHING CONCRETE SIDEWALKS

Sidewalks control joints shall be saw-cut at 1.5m centres unless otherwise noted.

All edges shall be finished with an edging tool having a 13mm radius.

The concrete shall be struck off and floated to a true surface. Care shall be taken not to bring to the surface an excess of water and fine sand by overfinishing.

When required by the Project Manager or Inspector, the Contractor will be required to furnish wooden templates cut to the exact form and slope of the alleyway or sidewalk, for use by the inspector.

The top surface of the concrete shall be screeded to true grade and cross section using a straight edge and an oscillating motion.

The screeded surface shall be floated using a hardwood float so that the entire surface is tight and compact. Cement or sand shall not be added to the surface. Any surface imperfections shall be removed and replaced before the concrete has set. Patching shall not be done unless authorized by the Project Manager.

A coarse textured broom finish shall be applied on all exposed Concrete sidewalk unless otherwise directed by the Project Manager. The presence of footprints or other marks in the completed sidewalk shall require the removal and replacement of the complete bay of sidewalk. Separation of unacceptable from acceptable sidewalk shall be by sawcutting.

Table 700-1
Minimum Compressive Strength of Concrete

COMPRESSIVE STRENGTH CLASS OF CONCRETE	APPLICATION OR LOCATION OF CONCRETE
32 MPa	sidewalks, curbs, road base, manholes, valve chambers, catch basins and pole bases
15 MPa	concrete pipe bedding
as specified in the contract	structural concrete for bridges and culverts

.01 SUMMARY OF STANDARD COMPACTION REQUIREMENTS

MATERIAL	LOCATION / USE	MINIMUM SPECIFIED COMPACTION	SPECIFICATION REFERENCE
Hot Mix Asphalt	Pavement Structures on Roads and Paved Parking Areas	97 % MARSHALL DENSITY	OPSS 310
Granular "A" Base Course	Road, Curb, Sidewalk and Bikepath Construction	100 % SPMDD	OPSS.MUNI 501
Granular "B" Sub-Base	Road Construction	100 % SPMDD	OPSS.MUNI 501
Granular Backfill Form 600	Trench Backfill for Sewers, Watermains, Utilities, Catch Basins, Manholes, Valve Chambers	95 % SPMDD	OPSS.MUNI 401 OPSS.MUNI 402
Earth, Soils and/or Native Materials	Trench Backfill for Sewers, Watermains, Utilities, Catch Basins, Manholes, Valve Chambers	95 % SPMDD	OPSS.MUNI 401 OPSS.MUNI 402
	Embankment Fill and Subgrade Material for Pavements, Sidewalks and Bikepaths	95 % SPMDD	OPSS.MUNI 501
	General Fill for Landscaped Areas	90 % SPMDD	See contract documents
Granular Backfill around Structures	Fill next to Footings, Bridge Abutments and behind Retaining Walls	100 % SPMDD	OPSS.MUNI 401
Granular Bedding	Pipe Bedding for Watermains and Sewers	95 % SPMDD	FORM 600 OPSS.MUNI 441

- Notes:** [1] Unless otherwise directed, compaction will be assessed using a nuclear density gauge, as per ASTM D2922 and D3017.
- [2] SPMDD refers to **Standard Proctor Maximum Dry Density** as determined by MTO laboratory test method LS-706.

.02 COMPACTON METHODS

All contract references to % compaction or maximum compacted densities by whatever method specified, shall be interpreted as being "The maximum dry density as determined by current City procedures".

Current City procedures shall mean the method described in the current Standards:

D.698-70 Moisture - Density Relations of Soils Using 5.5 lb. Hammer and 12 in. Drop

D.2922-71 Determining the Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D.2950-71T Density of Bituminous Concrete in Place by Nuclear Methods.

As an expedient the City may determine the (degree of compaction) maximum dry density by "the constant dry weight methods", as set out in D.H.O. Research Report No. 141, together with such variations of the above methods as the City may from time to time introduce.

Any such deviation between current City procedures and methods formerly specified or any modifications to current City procedures which may be introduced shall be for the purpose of increasing the reliability of the test results and speed in field testing and will result in no increase in the compactive effort required.

All backfill materials shall be placed in layers not exceeding 300mm (12") in depth and compacted to a minimum of 95% Standard Proctor Maximum Dry Density - see Standard Compaction Requirements in COH FORM 900.01 and Specifications for Materials and Testing.

These amendments apply to and are to be read in conjunction with the latest version of OPSS and OPSD. These specifications will be adopted in their entirety. Each Contract will have its specifications adapted to suit its design requirements as necessary.

VOLUME 1 GENERAL & CONSTRUCTION SPECIFICATIONS

Division 1 General Specifications – No amendments.

Division 3 Pavement (Flexible and Rigid)

OPSS 310 Construction Specification for Hot Mix Asphalt

310 Hot mix asphalt requirements shall comply with OPSS 310 except where superseded by Contract Special Provisions – refer to Contract Documents.

Division 4 Drainage, Watermains and Utility

OPSS 407 Construction Specification for New Maintenance Hole, Catch Basin, Ditch Inlet and Valve Chamber Installation

407.05.05 Precast concrete collars are permitted for temporary adjustments only. Rubber and HDPE adjustment units are not permitted. Frames are to be set in concrete.

407.07.16 All permanent adjustments are to be poured in place concrete.

407.07.19 New manholes - 1st step to be 450 mm (\pm 40 mm) from finished road grade, however existing rebuilds to be 450 mm (\pm 150 mm) from finished road grade.

407.07.21 To conform to City Specifications and/or Contract Documents.

407.07.22

407.07.23

OPSS 412 Construction Specification for Sewage Forcemain Installation in Open Cut

412.05 Acceptable materials shall be identified by the Contract Documents.

412.05.04 Polyvinyl chloride pressure pipe only permitted where specified in Contract Documents.

412.05.05 Polyethylene plastic pressure pipe only permitted where specified in Contract Documents.

412.05.06 Steel pipe is acceptable in Special Projects only as per the Contract Documents.

412.05.07 Valve type to be selected from the Approved Products List or as specified in the contract documents. Valve operators - conform to City Standard and operating torque specifications.

412.05.07.04 Knife Gate Valves acceptable where specified in the Contract Documents.

412.05.07.05 Air and Vacuum valves - conform to City Specifications, double acting kinetic valves only selected from Approved Sewer Products List.

412.07.10 Pipe bedding and backfill to conform to City Specifications, OPS not acceptable.

412.07.14.01 Superseded by the following:

Wherever it is required to deflect mechanical - joint pipe, the maximum amount of deflection in a joint in any direction, shall not exceed the limits shown on Tables 4.1 and 4.2.

TABLE 4.1
PERMISSIBLE DEFLECTION IN MECHANICAL-JOINT PIPE

NOMINAL PIPE SIZE (mm)	MAXIMUM PERMISSIBLE BEND ANGLE PER JOINT (Degrees)	MAXIMUM PERMISSIBLE DEFLECTION PER METRE OF PIPE (mm)
100	5	87
150	4	70
200	3	52
250	3	52
300	3	52
350	2	35
400	2	35

Permissible Deflection in Tyton-Joint Pipe

Wherever it is required to deflect Tyton-Joint pipe, the maximum amount of deflection in a joint in any direction, shall not exceed the limits shown on the following table:

TABLE 4.2
PERMISSIBLE DEFLECTION IN TYTON-JOINT PIPE

NOMINAL PIPE SIZE (mm)	MAXIMUM PERMISSIBLE BEND ANGLE PER JOINT (Degrees)	MAXIMUM PERMISSIBLE DEFLECTION PER 5.49m LENGTH OF PIPE (mm)	MINIMUM PERMISSIBLE RADIUS OF CURVE (m)
100	3	290	103
150	3	290	103
200	3	290	103
250	3	290	103
300	3	290	103
350	2.5	240	125
400	2.5	240	125

412.07.14.03 412.07.14.04	PVC & PE pipe deflections to be 1/2 of manufacturer's recommendations.
412.07.17	Hydrostatic Testing
412.07.17.01	All flushing, cleaning, swabbing and hydrostatic Leakage testing shall be in accordance with Form 400, Appendix A and Contract Documents.
OPSS 416	Construction Specification for Pipeline and Utility Installation by Jacking and Boring
416.07.05	Pipe Installation as per design requirements. Space between pipe and wall to be filled with slurry, sand or grout, as specified in Contract Documents. Hardwood skids to be steel strapped prior to jacking.
416.07.07	Cathodic protection shall be provided on the casing pipe where specified in the Contract Documents.
Division 5	Miscellaneous – No amendments.
Division 6	Electrical - This entire section will be adapted to suit Contract requirements.
OPSS 603 and OPSS 616	Construction Specification for the Installation of Ducts Construction Specification for Footings and Pads for Electrical Equipment Specification acceptable, shall be superseded by City of Hamilton Traffic Department Drawing No. DT:0111-01 and Contract Documents where applicable.
Division 7	Traffic Safety – No amendments.
Division 8	Environmental and Landscape
OPSS 801	Construction Specification for the Protection of Trees
801	Acceptable with amendments by City of Hamilton Tree By-Law and Contract Documents.
Division 9	Structural - No amendments.
VOLUME 2	MATERIAL SPECIFICATIONS For revisions to OPSS Materials Specifications, refer to the Contract Documents and the following: Form 600 - Specification for Granular Fill Materials Form 700 - Specification for Portland Cement Concrete Form 800 – Specification for Hot Mix Asphalt Form 900 – Specification for Standard Compaction Requirements

VOLUME 3	DRAWINGS FOR ROADS, BARRIERS, DRAINAGE, SANITARY SEWERS, WATERMANS AND STRUCTURES (OPSD)
Division 100	Abbreviations Abbreviations and legends will be a combination of OPSS, OPSD and City Specifications used and denoted as required.
Division 200	Grading Delete OPSD 201.010, 201.020, 207.010, 207.020, 207.030, 209.020 and 216.020.
Division 300	Side Entrances Delete expansion joint material in OPSD 310.010, 310.020-and 310.050 except as directed by the City. OPSD 310.030 - Refer to RD-124, Sheets 1 - 3 OPSD 310.040 – Refer to RD102.02
Division 400	Frames and Grates Frames and Grates shall be as listed in the applicable Approved Product List(s) or Contract Documents.
Division 500	Paving 509.010 shall be read in conjunction with RD-100.01 and RD-100.02
Division 600	Curbs and Gutters Curbs and gutter shall be as specified in Contract Documents.
Division 700	Catch Basins and Manholes OPSD 701.010, 701.011, 701.012, 701.013, 701.014, 705.015, 705.010 and 705.020 are all acceptable with a goss trap (SEW-304) Delete OPSD 708.01
Division 800	Culverts and Drains Delete: all 802 series and 805.02, 806.02, 806.04, 806.06, 807.03, 807.04 and 807.05
Division 900	Fencing, Guide Rails All acceptable.
Division 1000	Sanitary Sewers, Manholes and Catch Basins OPSD 1003.010 permitted OPSD 1003.020, 1003.030, 1003.031, and 1006.010 not permitted.
Division 1100	Watermains OPSD 1104.02 and 1109.011 permitted Remaining 1100 drawings are superceded by Hamilton Standard Watermain Drawings (WM Series).

VOLUME 4	DRAWINGS FOR ELECTRICAL WORK
	All specifications and drawings for electrical works shall be in accordance with the Contract Documents.
VOLUME 5	Not applicable.
VOLUME 6	Not applicable.
VOLUME 7	MUNICIPAL-ORIENTED OPS GENERAL CONDITIONS OF CONTRACT AND GENERAL & CONSTRUCTION SPECIFICATIONS
OPSS.MUNI 100	OPS General Conditions of Contract Not applicable, refer to Contract Documents.
Division 2	General Grading
OPSS.MUNI 206	Construction Specification for Grading
206.07.01.07	Grading tolerances to "match existing line and grade", or as specified in the contract documents.
206.09	"Measurement For Payment" shall not apply. Excavation and/or break out limits shall be as defined by the Measurement For Payment Drawings RD-119.01 to RD-119.04 inclusive or as specified in the Contract Documents.
Division 4	Drainage, Watermains and Utility
OPSS.MUNI 401	Construction Specification for Trenching Backfilling and Compacting
401.07.13	Superseded by Form 300.22.01 and Contract Documents
OPSS.MUNI 403	Construction Specification for Rock Excavation for Pipelines, Utilities and Associated Structures in Open Cut
403.07.02	Superseded by City Blasting and Use of Explosives Form 300.35
OPSS.MUNI 410	Construction Specification for Pipe Sewer Installation in Open Cut
	Acceptable, payments for dual sewer will be used when applicable.
OPSS.MUNI 441	Construction Specification for Watermain Installation in Open Cut
	For all amendments to OPSS 441, refer to Form 400 - Specification for the Installation of Watermains and Appendix A.
VOLUME 8	MUNICIPAL-ORIENTED MATERIAL SPECIFICATIONS
OPSS.MUNI 1101	Material Specification for Performance Graded Asphalt Cement As modified by Form 800 and Contract Documents.

**OPSS.MUNI 1151 Material Specification for Superpave and Stone Mastic Asphalt
Mixtures**

As modified by Form 800 and Contract Documents.



Hamilton

APPROVED PRODUCT LIST

JUNE 2017

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Section 2	Approved Sewer Products List
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Section 4	Approved Traffic Signals Products List
Section 5	Approved Parks Construction Products List



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Backflow Preventers		Watts	009 (16mm to 50mm)
			LF909 (75mm to 200mm)
Backwater Valve		Bibby-Ste-Croix	69060
Corrosion Protection	Zinc Anodes: 5.4 Kg and 10.5 Kg ASTM B-418, Type 2		
	Magnesium Anodes: 14.5 Kg - B-107, ASTM 843, Type M1 OPSS.MUNI 442		
	Protective coatings for metal fittings	Advanced Corrosion Solutions Inc.	ACS PetroGuard (primer, mastic and tape)
		Bren Technologies	Petro Coating Systems (PCS) (primer, mastic and tape)
		Denso North America	Denso Wrap (primer, mastic and tape)
		PetroWrap	PetroWrap (primer, mastic and tape)
Trenton	No. 1 Wax Tape (primer, mastic and tape)		
Polyethylene encasement for ductile iron watermain pipe and fittings			
ANSI/AWWA C105 A21.5 - 8 mil low density Poly- Tube with overlap			
Couplings	Water Service Couplings 19mm to 50mm AWWA C800, NSF 61(Annex G) compression fit copper to copper connections	Cambridge Brass	118NL
		Ford Meter Box Co.	C44-Q-NL
		Mueller	H-15403N
	Water Service Couplings 19mm to 50mm AWWA C800, NSF 61(Annex G) copper to lead or alloy connection	Ford Meter Box Co.	Q14-NL, Q24-NL, Q34-NL with internal stop



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Couplings Cont'd...	Direct Buried Watermain Pipe Couplings AWWA C219-06 epoxy coated with stainless steel straps, nuts and bolts	Ford Meter Box Co.	FC1 and FC2A 100mm to 300mm DI and PVC
			FC2W-xx-SH 100mm to 400mm DI and PVC
		Robar Industries	1506 (4 or 5 bolt model) 100mm to 400mm DI and PVC
		Krausz Industries	Hymax Model No. 2000 100mm to 300mm DI and PVC
		Viking Johnson	MaxiFit (100mm to 1200mm)
	In-Chamber Watermain Pipe Couplings AWWA C219-06 epoxy coated with stainless steel straps, nuts and bolts	Straub Tadco	Straub-Flex, non-restrained up to 1200mm (modified for Hamilton)
Victaulic		Vic 31 400mm DI only	
Curb Stops	19mm to 50mm AWWA C800 NSF 61(Annex G) compression ends ball type, non-draining.	Cambridge Brass	202NL
		Ford Meter Box Co.	B44-Q-NL
		Mueller	300 B-25209N
Fittings	Ductile Iron Up to 300mm Pressure Class 350, cement lined, AWWA C104, C110 / A21.10, C153/A2.53, OPSS.MUNI 441, NSF 61	Bibby-Ste-Croix	
		Sigma	
		Star Pipe Products	
		Tyler/Union	DM, DFF and XM
	Ductile Iron 400mm and larger Class 52, cement lined restrained mechanical joint AWWA C104, C110 / A21.10, OPSS.MUNI 441.05.02	Bibby-Ste-Croix	
		Sigma	
		Star Pipe Products	
		Tyler/Union	DM, DFF and XM
	PVC 100mm, 150mm, 200mm, injection molded AWWA C907, B137.3 OPSS.MUNI 441	Ipex	Blue Brute
		Royal	Royal



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Fittings Cont'd...	PVC 300mm to 750mm CSA B137.3 shall use AWWA C900 pipe, bonded and over-wrapped with fiberglass-reinforced polyester	Ipex	Blue Brute, Big Brute
		Royal	Royal
Hydrants	3 way hydrants AWWA C502 CAN / ULC S-520 2-63.5 mm side ports, CSA standard thread, stainless steel nuts, bolts and studs 100mm "STORZ" pumper connection 25mm hydrant operating nut open left (counter clockwise) Extensions permitted at boot only	American AVK	Style 2780
		Clow Canada	Brigadier Series M -67
		Mueller	Darling B-50-B
Insulation	Extruded Polystyrene	Dow	Styrofoam Highload 100
		Owens Corning	Foamular 1000 (Pink)
Joint Restraint	Ductile Iron Pipe	Ebaa Iron	Mega-Lug Series 1100 Black epoxy coated wedges and nuts (100mm to 1200mm)
			Tru-Dual Series 1500TD (100mm to 300mm)
		Ford Meter Box Co.	Uni-Flange Series 1390 (100mm to 300mm)
		Smith-Blair	Cam-Lock Series 111 - epoxy coated wedges and nuts (100mm to 600 mm)
			Bell-Lock 115 and 165 (100mm to 300mm)
		Sigma	One-Lok - SLDE (100mm to 600mm)
		Star Pipe Products	Stargrip Series 3000 and 3100 (100mm to 1200mm)
Tyler/Union	TUFGrip TLD (black)		



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
<p>Joint Restraint Con'd...</p>	<p>Polyvinyl Chloride Pipe (PVC) AWWA C900 ASTM F1674</p>	Ebaa Iron	Tru-Dual Series 1500TD (100mm to 300mm)
		Ford Meter Box Co.	Uni-Flange Series 1390 (100mm to 300mm)
		Sigma	PV-Lok - SLC (100mm to 600mm)
		Star Pipe Products	Stargrip Series 4000 Top breakaway nut same size as the T-bolt (100mm to 750mm)
			Stargrip Series 4000G2 (100mm to 300mm)
			1000C - pipe to MJ or Push-On Fittings (100mm to 300mm); 1100C – Bell Joints (100mm to 300mm); 1200C – pipe to PVC Pressure Fittings with DI pipe OD (100mm to 300mm)
		1000G2C – pipe to MJ push-on fittings (100mm to 300mm); 1100G2C – Bell Joints (100mm to 300mm); 1200G2C – pipe to PVC pressure fittings with DI pipe OD AWWA C907 (100mm to 300mm).	
		9000C – pipe to MJ push-on fittings (100mm to 300mm); 9100C – Bell Joints (100mm to 300mm); 9200C – pipe to PVC pressure fittings with DI pipe OD AWWA C907 (100mm to 300mm).	
		Smith-Blair	Bell-Lock 115 (100mm to 300mm)
			Cam-Lock Series 120 (100mm to 600 mm)
Tyler/Union	TUFGrip TLP (red).		



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Joint Restraint Con'd...	Molecularly Oriented Polyvinyl Chloride (PVCO) AWWA C909	Sigma	PV-LOK: PWM - PVCO to MJ fitting PVPF - PVCO to PVC fitting PWP - PVCO bell and spigot.
		Star Pipe Products	Stargrip Series 4000 (100mm to 300mm)
			Stargrip Series 4000G2 (100mm to 300mm)
			9000C – pipe to MJ push-on fittings (100mm to 300mm); 9100C – Bell Joints (100mm to 300mm); 9200C – pipe to PVC pressure fittings with DI pipe OD AWWA C907 (100mm to 300mm).
			1000G2C – pipe to MJ push-on fittings (100mm to 300mm); 1100G2C – Bell Joints (100mm to 300mm); 1200G2C – pipe to PVC pressure fittings with DI pipe OD AWWA C907 (100mm to 300mm).
	Tyler/Union	TUFGrip TLP (red) - pipe to MJ fittings (100mm to 300mm)	
Main Stops (Corporations)	19mm to 50mm AWWA C800 NSF 61(Annex G) compression end, ball Type non-draining	Cambridge Brass	301NL - A3H3, A4H4, A6H6, A7H7
		Ford Meter Box Co.	FB1000 Series, Q Type
		Mueller	300 B-25008N
Pipe	Concrete Pressure Pipe 500mm and larger AWWA C300, C301, C302 and C303, OPSS.MUNI 441 Plant pre-qualified by ACPPA	Forterra	
		Decast Ltd.	
	Ductile Iron Pipe 100mm to 200mm & 300mm Pressure Class 350, AWWA C104 / A21.4, C150 / A21.50, C151 / A21.51 OPSS.MUNI 441	Canada Pipe Company <i>(Includes polyethylene encasement of pipe and fittings AWWA C105 / A21.5)</i>	Tyton Joint Pipe TR Flex Joint Pipe



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Pipe Cont'd...	Ductile Iron Pipe, Thickness Class 52 AWWA C104 / A21.4, C150 / A21.50, C151 / A21.51 OPSS.MUNI 441	Canada Pipe Company	Tyton Joint Pipe 400mm to 1050mm
		<i>(Includes polyethylene encasement of pipe and fittings AWWA C105 / A21.5)</i>	TR Flex Joint Pipe 400mm to 900mm
	Ductile Iron Pipe 1200mm Pressure Class 350 AWWA C104 / A21.4, C150 / A21.50, C151 / A21.51 OPSS.MUNI 441	Canada Pipe Company	Tyton Joint Pipe
		<i>(Includes polyethylene encasement of pipe and fittings AWWA C105 / A21.5)</i>	
	Polyvinyl Chloride (PVC) 100mm to 200mm & 300mm AWWA C900 - DR18 OPSS.MUNI 441	Diamond Plastics Corp. (DPC)	AWWA C900
		Ipex	Blue Brute
		National Pipe and Plastics	AWWA C900
		Royal	Royal
	Molecularly Oriented Polyvinyl Chloride (PVCO) 100mm to 200mm & 300mm AWWA C909-PC235, OPSS.MUNI 441	Ipex	Bionax
	Polyvinyl Chloride (PVC) 400mm AWWA C900 – DR18 OPSS.MUNI 441	Ipex	Big Brute, Centurion
		Royal	Royal
	Polyvinyl Chloride (PVC) 500mm to 750mm AWWA C900, OPSS.MUNI 441	Ipex	Big Brute, Centurion
Royal		Royal	
Water Service Pipe 19mm to 50mm AWWA C800, OPSS.MUNI 441, ASTM B88, Type K Soft Copper	Great Lakes Copper Canada Ltd.		



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Repair Clamps	clamps to be supplied with conductivity strip	Robar Industries	5616, 5626, 5636
		Ford Meter Box Co.	Style FS1, FS2 and FS3
Service Boxes	Slide adjustment type Stainless steel rods brass cotter pin	Mueller	H-10300 Series
		Clow Canada	"D" Series
Service Saddles	DI, PVC Pipe Outlet size: 19mm to 50mm	Cambridge Brass	403 and 812 Series
		Ford Meter Box Co.	FS202
		Robar Industries	2506 DS, 2616
		Smith-Blair	317
	Concrete Pressure Pipe Outlet size: 19mm to 50mm	Ayotte Enterprises	A-900 with A-571 thermoplastic coating (400 mm only)
Tapping Sleeves	Outlet size: 100mm to 400mm Protective coating shall be applied to all steel sleeves.	Ayotte Enterprises	A-600 with A-571 thermoplastic coating, stainless steel nuts and bolts - concrete pipe only
		JCM Industries	JCM 415 epoxy coated with stainless steel nuts and bolts, concrete pipe only
		Smith-Blair (Steel)	#622 epoxy coated (up to 750mm) Ductile Iron and PVC pipe
		Robar Industries (Steel)	6808 and 6906 epoxy coated (100mm to 500mm) Ductile Iron, C900 PVC only
		Romac (Steel)	FTS420 epoxy coated Ductile Iron pipe
Tracer Wire	Solid 12 gauge copper		TWU75 or RWU90XLPE



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Valves	<p>Butterfly Valve 450mm and Larger</p> <p>AWWA C504, Class 150B manual actuator - traveling nut type with external position indicator nuts, bolts, and bolt studs to be stainless steel</p> <p>Former City of Hamilton: 25mm operating nut, open right (clockwise)</p> <p>Former Municipalities: 50mm operating nut, open left (counter clockwise)</p>	Clow Canada	M & H 504 (450mm to 500mm) M & H AWWA Large Diameter (600mm and larger) Valve seat adjustment to face spool piece side
		Mueller	Lineseal
		Henry Pratt Company	2FII (450mm and 500mm)
			Triton XR-70 (Flanged ends) 600mm and larger
	<p>Gate Valve* Resilient Wedge 100mm to 300mm</p> <p>AWWA C509, C515 nuts, bolts, and bolt studs to be stainless steel, bronze pin top adjustment not permitted</p> <p>Former City of Hamilton: 25mm operating nut, open right (clockwise)</p> <p>Former Municipalities: 50mm operating nut, open left (counter clockwise)</p> <p>*includes hydrant secondary valves</p>	Clow Canada	F-6100, F-6102, F-6106
		Mueller	A2360-6, A2360-19, A2360-23
		American AVK Co.	Series 65



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Valves Cont'd...	Gate Valve Resilient Wedge 400mm AWWA C509, C515 nuts, bolts, and bolt studs to be stainless steel Former City of Hamilton: 25mm operating nut, open right (clockwise) Former Municipalities: 50mm operating nut, open left (counter clockwise)	Clow Canada	F-6102
		Mueller	A2361-6
	Combination Air Release and Vacuum Breaker Valves AWWA C512 with surge protection	A.R.I Flow Control Accessories	D-060 C HF NS
		Vent-O-Mat	Water RBX Series
	Tapping Valves 100mm to 300 mm AWWA C509	Clow	F-6106
		Mueller	A2360-19
	Tapping Valves 400mm to 600mm AWWA C509	Clow Canada	F-6106BG
		Mueller	A-2361-19
Valve Boxes	Sliding Type with 6mm pre-drilled tracer wire hole and grommet in upper section	Bibby-Ste-Croix	VB1000 Series
Valve Chambers	OPSS 407, 1351 Plant must be pre-qualified by the Ontario Concrete Pipe Association	Anchor	
		Co-Pipe	
		Con Cast	
		Decast Ltd.	
		Forterra	
		M-Con	
		Wilkinson	



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Valve Chamber Frame and Cover	OPSS 1850 OPSD 402.011 WM 212.03	Bibby-Ste-Croix	
		EJ (McCoy)	
		Mueller	
		R.B. Agarwalla	
	750mm cover OPSS 1850 10 - 25mm vent holes "WATER" cast into cover 4 lifting keyways	EJ (McCoy)	Frame 1220Z1, Product No. 00122016 Cover 1220B, Product No. 00122028
Water Meter Reader Enclosure		Hoffman Nema 4x, fiberglass	Includes internal mounting plate



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Catch Basins	CSA A257.4 Form 700 OPSS 407, 1351 Supplied from a plant prequalified by the OCPA	Co-Pipe	
		Con Cast	
		Forterra	
		M-Con	
		Decast Ltd.	
		Wilkinson	
Catch Basin Frames & Covers	OPSD 400.100 ASTM A48 OPSS 1850	Bibby-Ste-Croix	
		Domcast	
		EJ (McCoy)	"All in one" cover
		Govind Steel	GS
		Labco	
		Mueller	
		Prosperity Exim P.	MF
R.B. Agarwalla			
Couplings	CSA B182.2 CSA B182.4 OPSS 1841	Fernco Connectors	
		Kwik Connectors	
		Mission Rubber Co.	
		Pipe Conx	
		Preper-PLS Tech	
Culvert Pipe	Corrugated Steel (CSP) Riveted or Spiral CSA G401 galvanized or aluminized (Type 2) OPSS 1801 and 1841 up to 1000mm - 1.6 Gauge over 1000mm - 2.0 Gauge	Armtec	Hel-Cor, Ultra Flo
		Atlantic Industries	
		Canada Culvert	Steelcor
	HDPE and PVC OPSS 1840, ASTM F 894	Armtec	Big "O", Boss 2000
		ADS	ADS N12
Goss Traps	SEW-304	EJ (McCoy)	
		CB Trap	
Maintenance Holes	CSA A257.4-M92 Form 700 OPSS 1351 1200mm to 3000mm Supplied from a plant prequalified by the OCPA	Coldstream	
		Co-Pipe	
		Con Cast	
		Forterra	
		M-Con	
		Decast Ltd.	
		Wilkinson	



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.	
Maintenance Hole Frames & Covers	OPSD 401.010 Type A and B ASTM A48	Bibby-Ste-Croix		
		Domcast		
		EJ (McCoy)		
		Govind Steel	GS	
		Mueller		
		Prosperity Exim P.	LM	
		R.B. Agarwalla		
Sewer Pipe	Vitrified Clay Pipe 150mm to 600mm CSA A60.1M-1976 Form 500	Logan	T-Tap (without flanges)	
		Concrete Pipe - Reinforced 300mm or greater CSA A257.2 65-D, 100-D, 140-D Form 500 and 700 OPSS 1820 Supplied from a plant prequalified by the OCPA	Co-Pipe	
			Con Cast Pipe	
	Forterra		Concrete Bell (mortared in)	
	M-Con			
	Decast Ltd.			
	Polyvinyl Chloride Pipe (PVC) Smooth Wall 150mm – SDR 28 200mm to 600mm – SDR 35 CSA B182.2 Form 500 OPSS 1841	Ipex	Ring-Tite Enviro-Tite	
		Next Polymers	NEXT Duraloc	
		Royal	Royal	
	Saddles / Connections	CSA B182.2 CSA B182.4 100mm to 300mm	ADS Canada	Inserta – Tee Saddle Tee (2 straps) Saddle Wye (2 straps) Wing Adapter Universal Sewer Saddle 22 ½° to 45° bends
Ferenco 100mm and 150mm			EZ Tap	
Specialty Products 2000 Inc. (150mm)			Core Bell Adaptor	
Valves	Combination Air / Vacuum Breaker AWWA C512	A.R.I	D-020 (stainless steel)	



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
High Pressure Sodium Lamps – all wattages, medium and mogul base	Non-cycling, TCLP compliant including lead-free brass base. 30,000+ hours life, universal operating position. Meet ANSI specification corresponding to wattage.	General Electric	Ecolux NC
		Osram Sylvania	Lumalux Plus/Eco
		Philips	Ceramalux ALTO Non-Cycling
Metal Halide Lamps – all wattages, medium and mogul base	Inclusive of probe start, pulse start and ceramic metal halide. Operating position designation as per luminaire requirements. Meet ANSI specification corresponding to wattage.	General Electric	Multi-Vapor
		Osram Sylvania	Metalarc
		Philips	Metal Halide (standard)
Metal Halide Lamps – 200W	200W pulse start lamps	Venture	Uni-Form
Photocell – Standard life, twist-lock type	Standard Life Photoelectric controller with NEMA rated locking type blades. OPSS 2485 Note: Use only permitted for maintenance/replacement. Prohibited for use with LED luminaires.	Fisher-Pierce	FP-N7700 Series Instant Response
		DTL	DSS Series
		Precision	
Photocell – Long life, twist-lock type	Long Life Photoelectric controller with NEMA rated locking type blades. OPSS 2485	DLL Elite	DTL 127
		Fisher-Pierce	TRS Series
		SELC	8483 Range
Photocell – Standard life, button type	Photoelectric controller – button/micro CSA C239	Fisher-Pierce	B Series
		DTL	DBE Series



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Cobra-head Luminaires – drop glass, all wattages	Prismatic drop glass high pressure sodium and metal halide 'cobra-head' luminaires Integral twist-lock photocell socket CSA C22.2 No. 9.0-96 CSA C653-08, OPSS 2432 Note: Use only permitted for maintenance/replacement.	Cooper Lighting	OVZ Series
		American Electric Lighting	115 Series
		General Electric	M-250R2 Series
LED Cobra-head Luminaires – all wattages	Light Emitting Diode (LED) 'cobra-head' luminaires, conforming to specifications established in RFPQ C11-59-12	General Electric	EVOLVE
Cobra-head Luminaire – sag/flat glass, all wattages	Sag glass/flat glass (cut-off) high pressure sodium and metal halide 'cobra-head' luminaire. Integral twist-lock photocell socket CSA C22.2 No. 9.0-96 CSA C653-08 OPSS 2432 Note: Use only permitted for maintenance/replacement.	Cooper Lighting	OVF Series
		American Electric Lighting	115 Series
		General Electric	M-250R2 Series
Decorative Luminaire – Carriage Style, all wattages	Decorative carriage (4-sided lantern) high pressure sodium luminaire. Integral twist-lock photocell socket CSA 22.2 No. 9.0-96 CSA C653-08	King Luminaire	K601 Empress Series
		Cooper Lighting	Springdale Series
		Cyclone	Elencia Series
		American Electric Lighting	Georgian Style Series



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Decorative Luminaire – Tear Drop Style, all wattages	Decorative tear-drop (lantern) high pressure sodium luminaire. Integral twist-lock photocell socket CSA 22.2 No. 9.0-96 CSA C653-08	King Luminaire	K211 Manchester Series
		Holophane	Memphis Series
		Philips Lumec	Renaissance Series
Decorative Luminaire – Acorn Style, all wattages	Decorative post-top (lantern) high pressure sodium luminaire. Integral twist-lock photocell socket CSA 22.2 No. 9.0-96 CSA C653-08	King Luminaire	K118 Washington Series
		Cooper Lighting	ARN Acorn Series
Power Supply Pedestal Feeder Wiring	Single conductor, stranded copper wire 90 degree Celsius, 600V rated Type RWU90-XLPE #2 AWG (minimum) CSA C22.2 No.38	Anixter Canada	6CN Series (or equal)
		General Cable	
		Southwire	
Pole-to-pole and Branch Feeder Wiring	Single conductor, stranded copper wire 90 degree Celsius, 600V rated Type RWU90-XLPE #6 AWG (minimum) CSA C22.2 No.38	Anixter Canada	6CN Series (or equal)
		General Cable	
		Southwire	
In-pole/In-arm (internal) Wiring	Single conductor, solid copper wire 90 degree Celsius, 600V rated Type TWU #12 AWG (minimum) CSA C22.2 No.75	Anixter Canada	6CA Series (or equal)
		General Cable	
		Southwire	



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Electrical Conduit and Fittings	Type II rigid polyvinyl chloride (PVC) 50mm (minimum) CSA C22.2 No.211.2-06	Ipex	Scepter
		Royal	Rigicon
Concrete Pole – Standard Duty, all lengths	Direct buried, spun concrete pole– street lighting use. Class B (minimum) CSA A14-M1979 CSA C22.2 No. 206-M OPSS 2421 OPSD 2225.01	Stresscrete Group	
		Utility Structures Inc. (USI)	
Concrete Pole – Heavy Duty, all lengths	Direct buried, spun concrete pole – combined use (street lighting & traffic signals). Class D (minimum) CSA A14-M1979 CSA C22.2 No. 206-M OPSS 2421 OPSD 2225.01	Stresscrete Group	
		Utility Structures Inc. (USI)	
Concrete Pole – Decorative Octagonal, all lengths	Direct buried, spun concrete pole – street lighting use. Class B (minimum) Octagonal decorative tapered profile, midnight black etched finish CSA A14-M1979 CSA C22.2 No.206-M OPSS 2421 OPSD 2225.01	Stresscrete Group	
		Utility Structures Inc. (USI)	
Concrete Pole – Decorative Post/Top Mount, all lengths	Direct buried, spun concrete pole – street lighting use. Decorative, including profiled decorative base, midnight black etched finish – post top luminaire mounting. CSA A14-M1979 CSA22.2 No.206-M OPSS 2421 OPSD 2225.01	Stresscrete Group	Sheridan Collection Series



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Street Light Luminaire Bracket Arm - Standard, all projection lengths	Aluminum tapered sidemount elliptical bracket arms. OPSS 2428 OPSD 2250.01 OPSD 2420.01	Aluminous Lighting Products	
		Stresscrete Group	
		Dynapole	
Street Light Luminaire Bracket Arm – Decorative, all projection lengths	Decorative metal 'Victorian' scroll arm – side mount configuration – midnight black painted finish	Stresscrete Group	17x Series
Pole Identification Tag	Aluminum Engraved modular number/letter insert type pole ID tags. 25mm letter/numbers, black text on white or natural aluminum background. Vertical orientation, affixed with aluminum banding	Almetek	E-Z Tag V400-TH-A
		Electromark	
Power Supply Pedestal	Complete pedestal assembly consisting of the following: - 100A rated meter socket c/w blank/shorting meter socket insert - 120/240V, 100A panelboard c/w 60A-2P main breaker, 6x40A-1P branch breakers and provision for up to 12 breakers - All equipment contained within a weather proof, tamper proof, dark green in colour metal ground/pad mounted enclosure - Enclosure door and internal panelboard door shall have provision for pad-locking CSA or ESA Approved	Pedestal Solutions Inc.	HSLM271-6-40
		Keltour Controls Inc.	



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Ground Rod Inspection Well	Polymer 254mm dia. Light duty inspection well/handwell ASTM C857 – A0.3 SCTE – Light Duty	Carson	L Series 910



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Electrical Conduit and Fittings	Polyvinyl Chloride (PVC) 25mm, 50mm and 75mm Bell end conduit NEMA TC-2 Schedule 80 CSA C22.2 No. 211.2-06 DT:0111-01 and DT:0111-02	Ipex	Scepter (type II), includes IPEX 100 conduit cement
	High Density Polyethylene (HDPE) - CSA B137.1-05, ASTM F2160 DT:0111-01 and DT:0111-02	Ipex Carlton	
Electrical Handholes	Polyvinyl Chloride (PVC) OPSD 2113.010 - Type III, rectangular	Ipex	
	Precast concrete with cast iron frame & cover OPSD 2112.02 (460mm dia.) ANSI/ASTM A48	HY-GRADE	
Detector Loop Lead-in Cable	# 14 AWG Overall shielded, twisted pair Polyethylene insulation PVC Jacket, 600 V	Belden	8720
Detector Loop Sealant	Non-shrinking Won't fracture at - 40 ° C	3M	Detector loop sealant 5000
		Chemque Canada	Q-Seal: 290S, 290W 295S, 295M
Detector Loop Splice Tape	Vinyl electrical tape OPSS 623 compliant CSA 22.2 No. 197 600 volts (- 18° C to 105° C)	3M	Scotch Super 88
Detector Loop Wire	Stranded copper wire #14 AWG, Black Type RWU-90 X-link 1000 V - 40° C OPSS 623 - CSA 22.2 No. 38	General Cable	Spec. # 5600
Grid Interconnecting Conductors	Solid, soft drawn, un-insulated Bare #2 AWG copper wire	Erico	Eritech
		Southwire	



PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Ground Electrode Conductor	Stranded copper wire RWU90-XLPE - insulated Green #3 AWG	Noramco	
		General Cable	
Ground Electrode Connectors	Compression connectors	Thomas & Betts	Blackburn E-Z-Ground
Ground Enhancement Material	< 20 ohm-cm resistivity MSDS sheet required DT:011-01 and DT:011-02	SAE Inc.	Conducrete DM100
		Erico	GEM25A
		Harger Lighting and Grounding	Ultrafill
Ground Rod Inspection Well	Polymer Concrete	Oldcastle Precast	Carson H-Series
Grounding Plates	254mm x 400mm x 6mm (10" x 16" x 1/4") galvanized steel CSA C22.2 No. 41-M or UL467 Min 0.2 sq. metre surface area DT:011-01 and DT:011-02	Thomas & Betts	Blackburn 1016TB
		Erico	Eritech EGGPC
		Hydel Enterprises	1016GPC
Grounding Rods	3.0m x 19mm (10' x 3/4 ") copper clad steel, pointed minimum 10 mils of copper CSA C22.2 No. 41-M or UL467 DT:011-01 and DT:011-02	Thomas & Betts	Blackburn 7510
		Erico	Eritech 613400
		Hydel Enterprises	3410CC
Junction Boxes for Detector Loop Splices	Fibre reinforced PVC OPSD 2300.010, Type No. P1-5 200mm x 200mm x 175mm Flanged with cover H-10 highway loading	Ipex	Scepter - H887



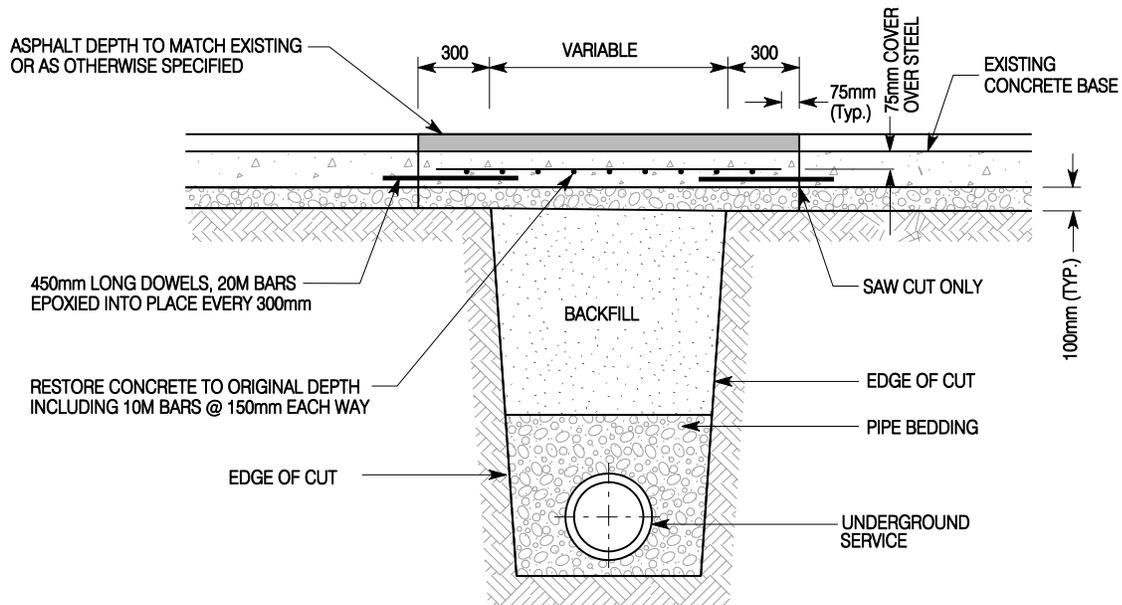
PRODUCT	SPECIFICATION	MANUFACTURER	DESCRIPTION / MODEL No.
Geotextile	Non-Woven PK-0210.01	Terrafix Geosynthetics	270R
Ice Rink Hut	Precast Concrete Structure with 4/12 pitch roof, size 1800x2400x3100mm.	Hy-Grade	Easi-set
Tree Guard	Plastic Forms 25cm high tree trunk wrap	Arborguard	
Tree Stake Tie	PK-1105.04	Treestrap	Vstrap, biodegradable cotton
		DeepRoot Canada Corp.	Arbor Tie - Trees <150mm Cal.: Arbor Tie Green (900lb. Break strength) - Trees ≥ 150mm Cal.: Arbour Tie White (2,500lb break strength)

DRAWING No.	DATE	DESCRIPTION
RD-100.01	November 2005	Road Restoration Over Utility Cuts –Sheet 1of 2
RD-100.02	November 2005	Road Restoration Over Utility Cuts - Sheet 2 of 2
RD-101	November 2005	100 mm Dia. Perforated Drain Pipe Detail
RD-102.01	June 2017	Wheelchair Ramp Locations Without Inegrated Accessibility Treatment
RD-102.02	June 2017	Control Joints at Side Inlet Catch Basin Frame and Cover and Utility Pole Isolation Boxout
RD-103	January 2011	Combined Concrete Walk and Curb and Independent Concrete Walk
RD-104	January 2011	Asphalt Sidewalk
RD-105	November 2005	Interlocking Paving Stone Sidewalk
RD-106	June 2017	Standard Approach
RD-107	June 2017	California Style Approach
RD-108	June 2017	Asphalt Driveway Approach
RD-109	June 2017	Concrete Apron Approach
RD-110.01	June 2017	Offset Curb & Gutter Detail at Single Catchbasin
RD-110.02	June 2017	Offset Curb & Gutter Detail at Double Catchbasin
RD-111	June 2017	Shoulder Paving for Manholes and Chambers in Shoulders
RD-112	November 2005	Concrete Alleyway
RD-113.01	November 2005	Typical Road Cross Section - Local Urban Residential (20.0 m Right-of-Way)
RD-113.02	November 2005	Typical Road Cross Section - Local Urban Residential (18.0 m Right-of-Way)
RD-113.03	November 2005	Typical Road Cross Section Local Urban Residential - Without Sidewalk For Cul De Sacs (18.0 m Right-of-Way)
RD-113.04	November 2005	Standard Road Section For Private Townhouses
RD-113.05	June 2017	Rural Cross Section
RD-114	June 2017	Unsignalized Industrial & Commercial Entrance - Urban Section
RD-115	June 2017	Hammerhead Turning Movement Diagram
RD-116.01	November 2005	Permanent Cul-De-Sac For Local Residential Streets – Symmetrical (18.0 m Right-of-Way)

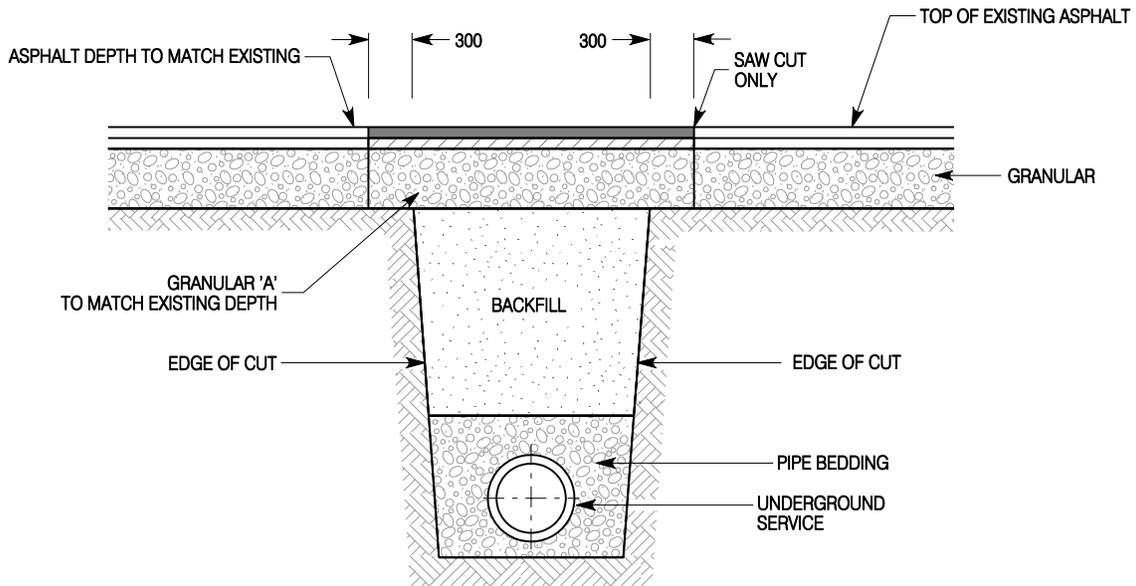
Note: 24" x 36" and 18" x 24" size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
RD-116.02	November 2005	Permanent Cul-De-Sac For Local Residential Streets – Offset Left (18.0 m Right-of-Way)
RD-116.03	November 2005	Cul-De-Sac For Industrial & Commercial Streets
RD-116.04	June 2017	Temporary Turning Circle (20.0 m R.O.W.)
RD-117	June 2017	Rural Residential Entrances
RD-118	June 2017	Rural Industrial & Commercial Entrances
RD-119.01	November 2005	Measurement for Payment Diagram – Road Reconstruction Only
RD-119.02	November 2005	Measurement for Payment Diagram – Road Reconstruction and Combined Walk and Curb Reconstruction
RD-119.03	January 2011	Measurement for Payment Diagram – Widening / Realignment /Narrowing
RD-119.04	November 2005	Measurement for Payment Diagram – Road and Independent Curb and Gutter Reconstruction
RD-120	June 2017	Typical Transit Shelter Pad for 1.2 m by 3.0 m Shelter
RD-121	November 2005	Rear Yard Swale Detail
RD-122	November 2005	Typical Toe of Excavation Swale & Berm Detail
RD-123.01	June 2017	Privacy Fence
RD-123.02	June 2017	Privacy Fence Details
RD-124	November 2005	Urban Braille Sidewalk – Typical Details (Size 24" x 36")
RD-125.01	November 2005	Heritage Poles and Details (Size 24" x 36")
RD-125.02	June 2017	Heritage Poles and Details (Size 24" x 36")
RD-126	November 2005	Irrigation – Typical Details (Size 24" x 36")
RD-127	June 2017	Typical Construction of Flagstone Wall on Slope
DT:0111-01	September 2015	Typical Installation of Underground Traffic Control Devices (Size 24" x 36")
DT:0111-02	September 2015	Typical Installation of Grounding and Bonding for Traffic Control Devices (Size 24" x 36")
DT:0119-01	January 2017	Standard Design for Speed Humps (Size 18" x 24")

Note: 24" x 36" and 18" x 24" size drawings are not bound in this document



CROSS SECTION THROUGH COMPOSITE PAVEMENT



CROSS SECTION THROUGH ASPHALT ON GRANULAR BASE PAVEMENT

City of Hamilton
Public Works Department

ROAD RESTORATION OVER UTILITY CUTS - Sht 1 of 2

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)

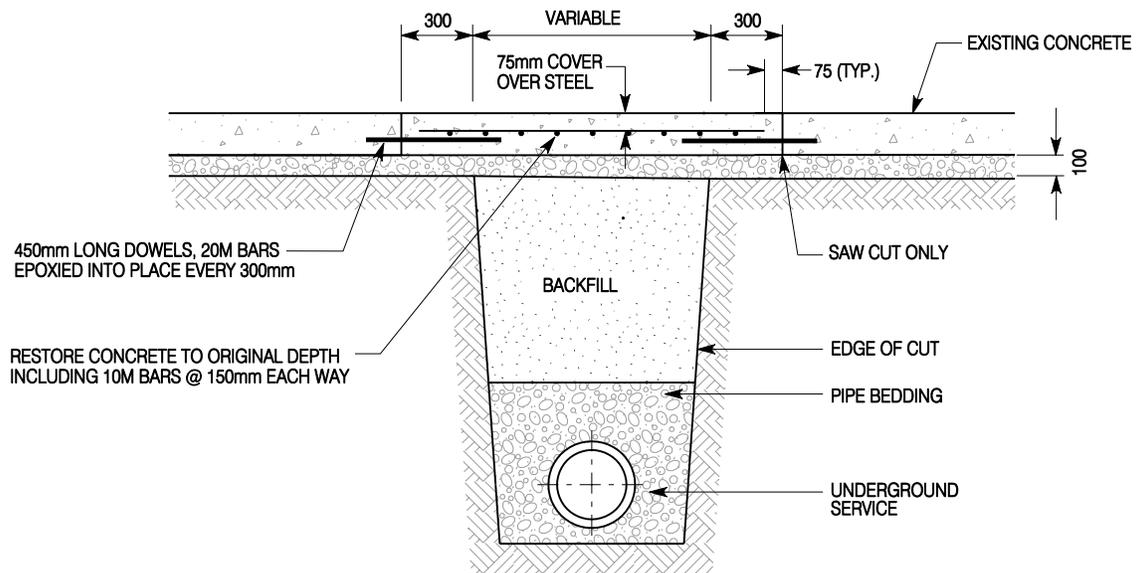
DATE
November 2005

REV No

FORMERLY: RHS-502

HAMILTON STD No

RD-100.01



CROSS SECTION THROUGH CONCRETE

City of Hamilton
Public Works Department

ROAD RESTORATION OVER UTILITY CUTS - Sht 2 of 2

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

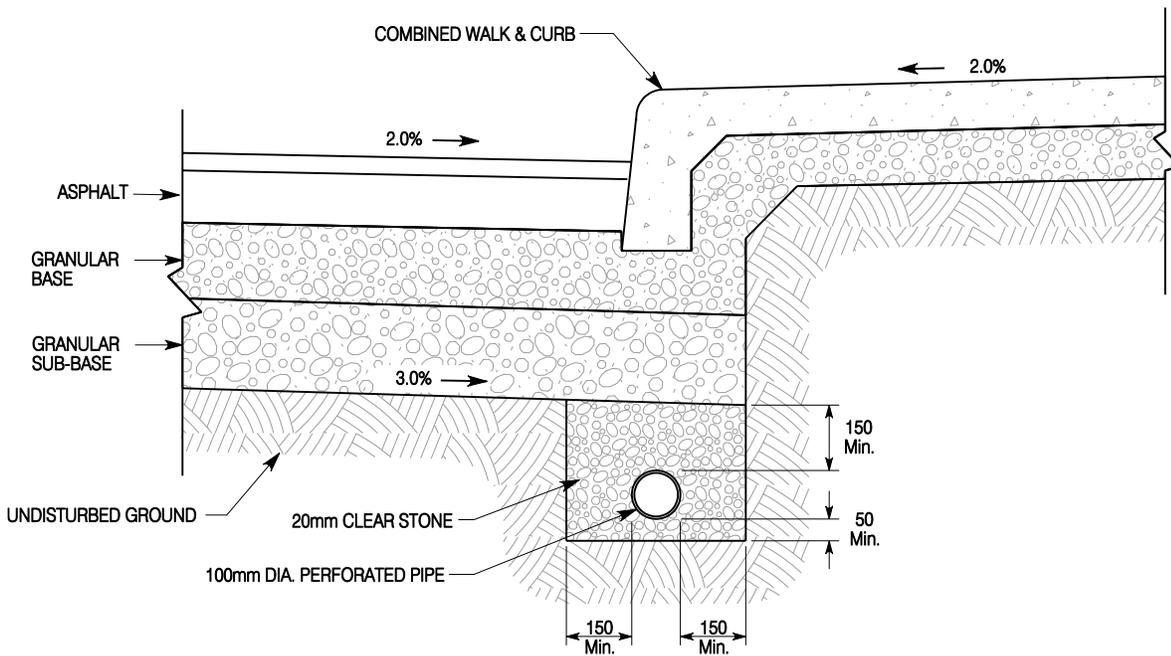
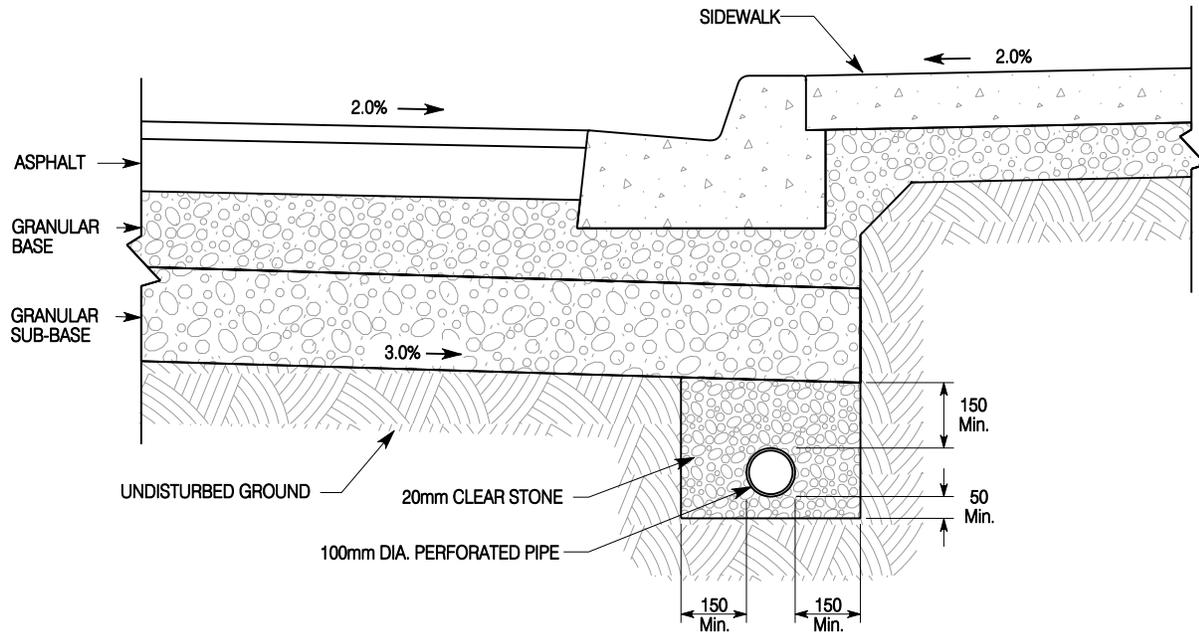
DATE
November 2005

REV No

FORMERLY: RHS-502

HAMILTON STD No

RD-100.02



City of Hamilton
Public Works Department

PERFORATED DRAIN PIPE

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

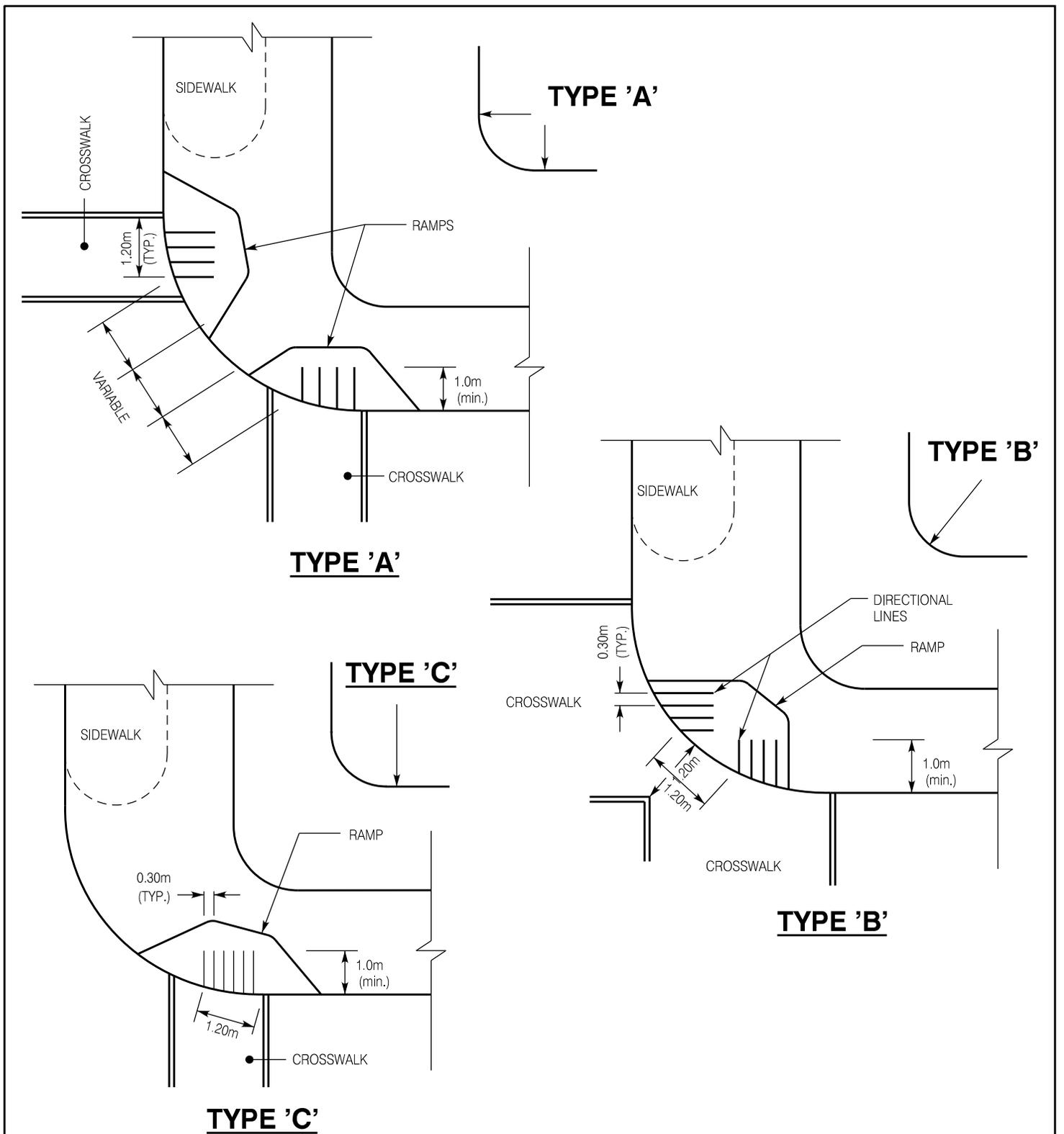
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REV No

FORMERLY:

HAMILTON STD No

RD-101



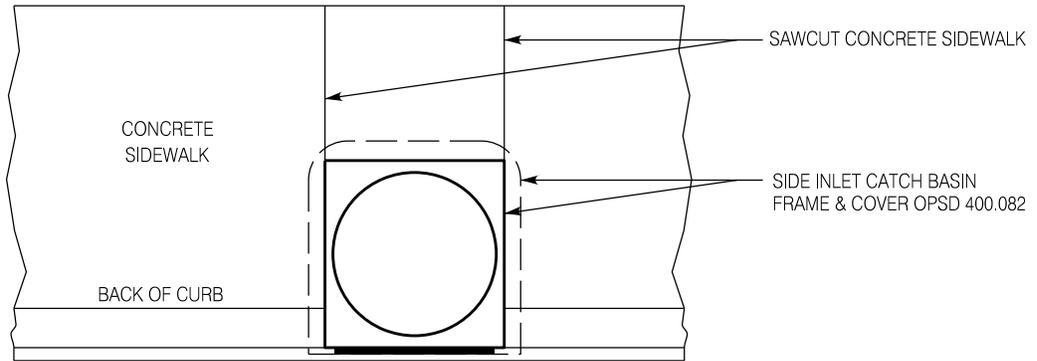
NOTES:

1. DIRECTIONAL LINES (MADE WITH EDGING TOOL HAVING A 15mm RADIUS) TO BE PARALLEL TO CROSSWALK OR PEDESTRIAN PATH
2. RAMP SLOPES 1:12 MAX. TO 1:20 MIN.
3. LOCATIONS OF WHEELCHAIR RAMPS SHOWN ON CONTRACT DRAWINGS

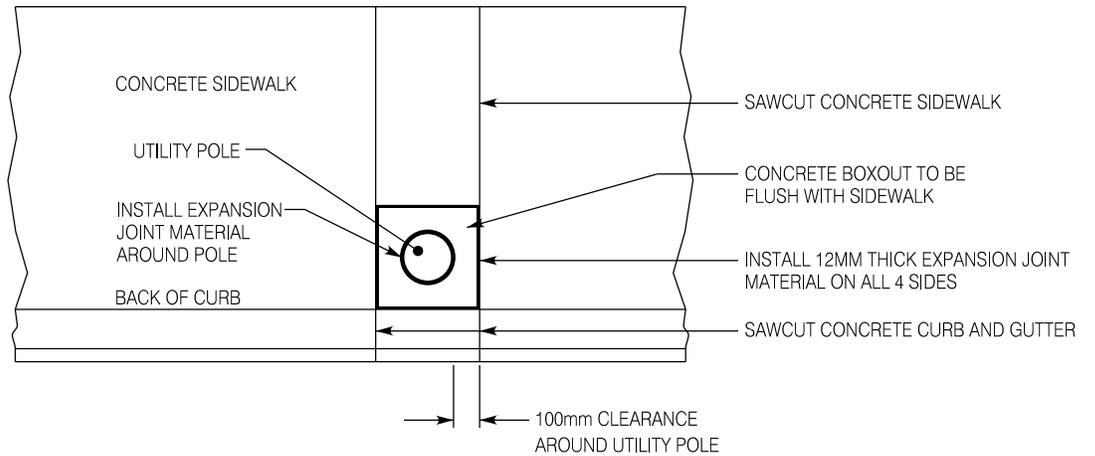
City of Hamilton
Public Works Department

**WHEELCHAIR RAMP LOCATIONS
WITHOUT INTEGRATED ACCESSIBILITY TREATMENT**

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE June 2017	REV No	FORMERLY: RHS-312, RD-102	HAMILTON STD No RD-102.01
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**CONTROL JOINTS
AT SIDE INLET CATCH BASIN
FRAME AND COVER**



UTILITY POLE ISOLATION BOXOUT

City of Hamilton
Public Works Department

**CONTROL JOINTS AT SIDE INLET CATCH BASIN FRAME AND COVER AND
UTILITY POLE ISOLATION BOXOUT**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

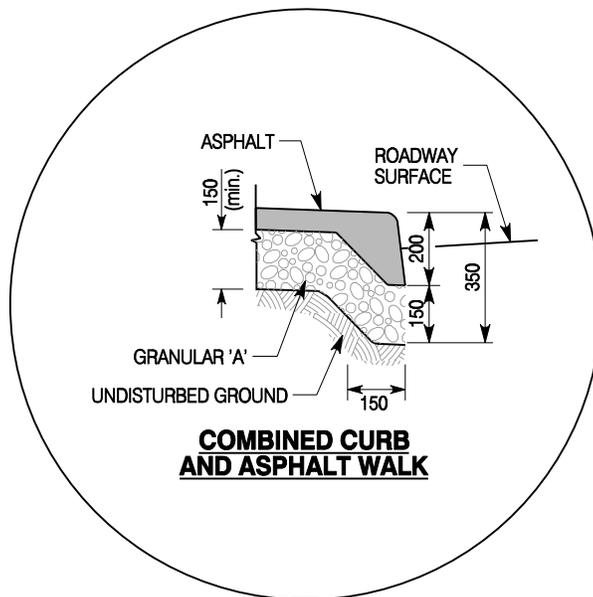
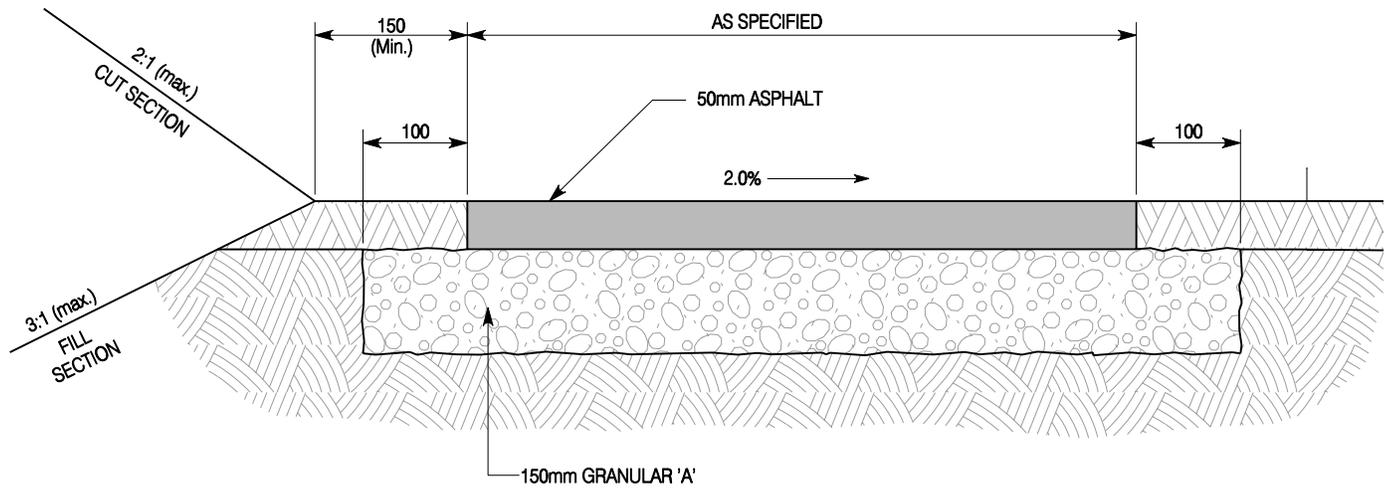
DATE
June 2017

REV No

FORMERLY:

HAMILTON STD No

RD-102.02



NOTES:

1. RESTORATION TO BE TOPSOIL AND SOD UNLESS OTHERWISE NOTED.
2. ALL EDGES TO BE HAND TAMPED WHERE REQUIRED.

City of Hamilton
Public Works Department

ASPHALT SIDEWALK

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

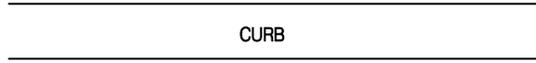
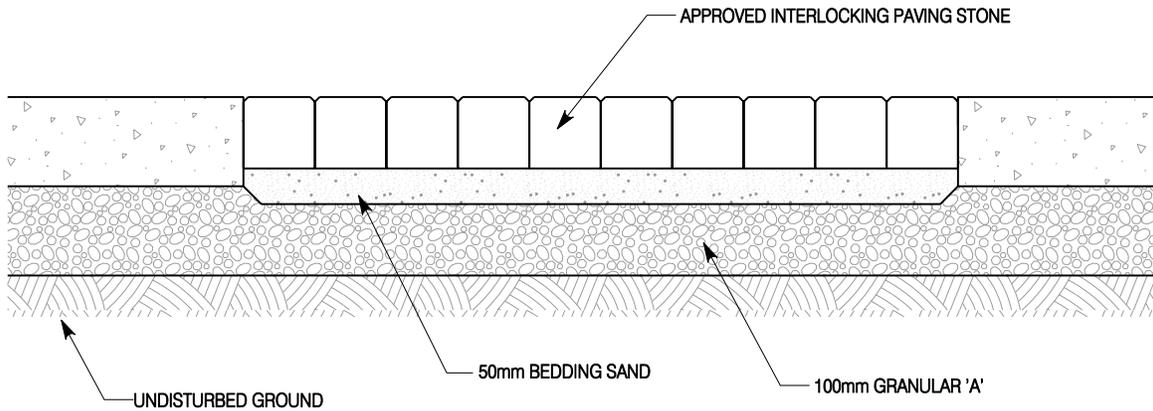
DATE
January 2011

REV No
1

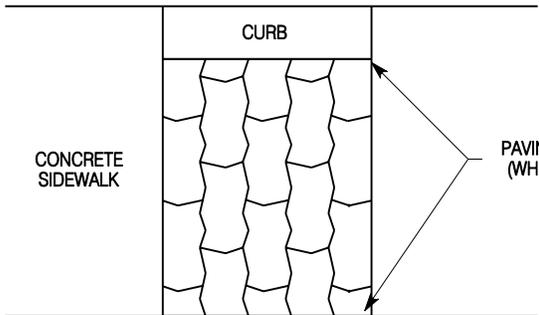
FORMERLY: RHS-302

HAMILTON STD No

RD-104

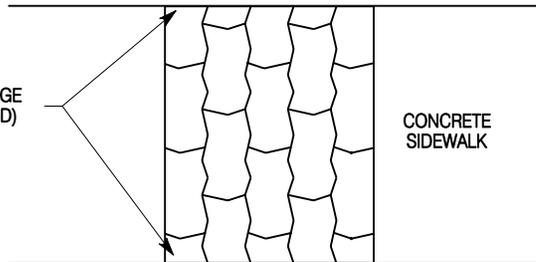


BOULEVARD



APPROVED INTERLOCKING PAVING STONE

COMBINED WALK AND CURB



APPROVED INTERLOCKING PAVING STONE

INDEPENDENT CURB AND WALK

NOTES:

1. BEDDING SAND TO BE COMPACTED TO 100% S.P.D.
2. GRANULAR 'A' TO BE COMPACTED TO 95% S.P.D.
3. PAVING STONE EDGE TO BE INSTALLED WHERE REQUIRED.

City of Hamilton
Public Works Department

INTERLOCKING PAVING STONE SIDEWALK

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

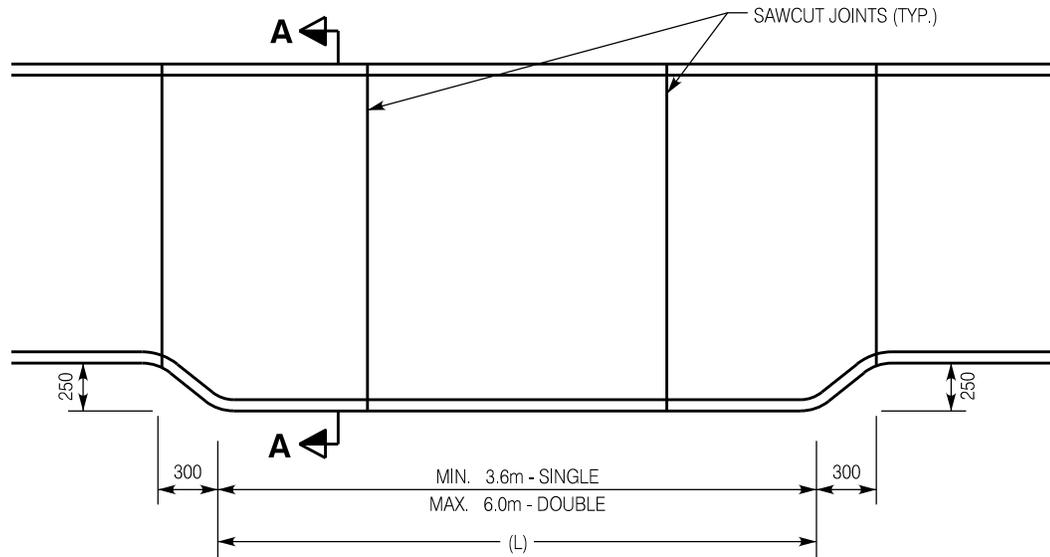
DATE
November 2005

REV No

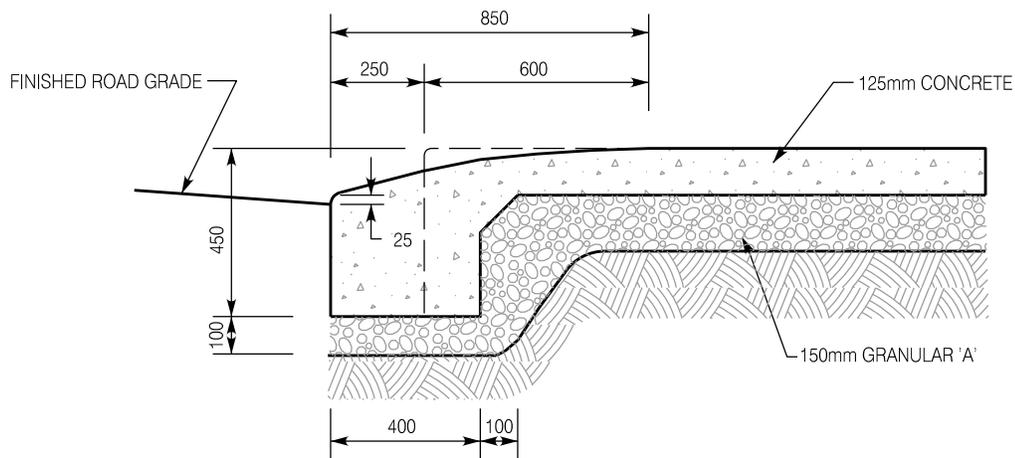
FORMERLY: RHS-311

HAMILTON STD No

RD-105



PLAN



SECTION A-A

NOTES:

1. ALL COMMERCIAL AND INDUSTRIAL APPROACHES & SIDEWALK THICKNESSES TO BE 200mm
2. METHOD OF FINAL PAYMENT MEASURED AS L (LENGTH OF APPROACH)

City of Hamilton
Public Works Department

STANDARD APPROACH

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

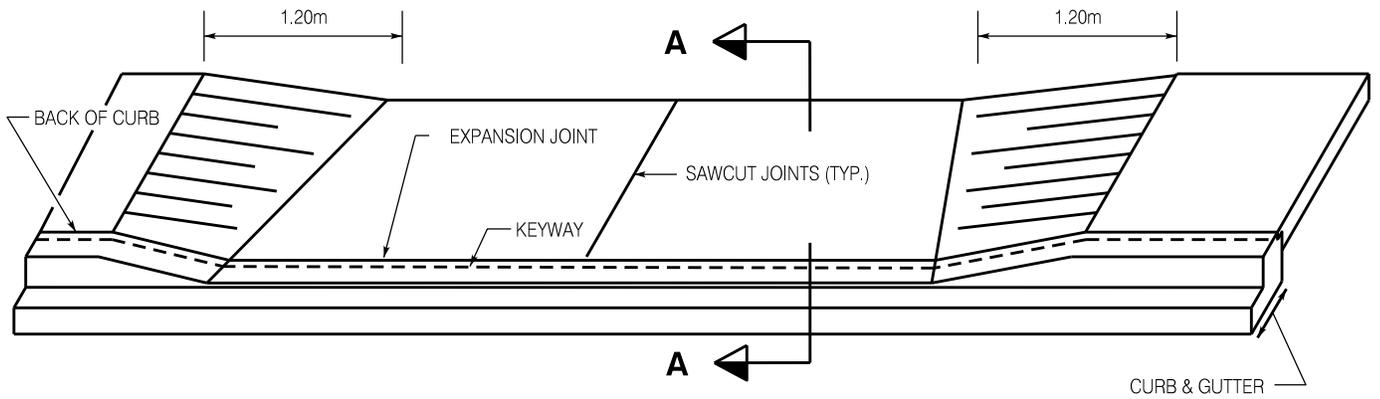
DATE
June 2017

REV No
2

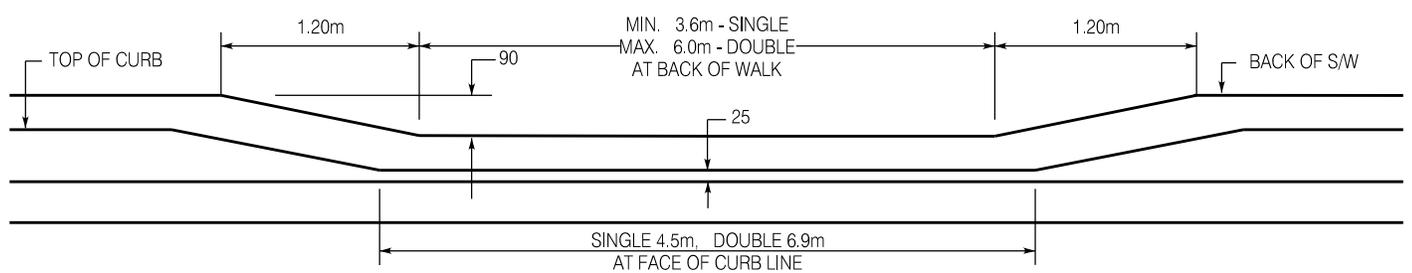
FORMERLY: RHS-400

HAMILTON STD No

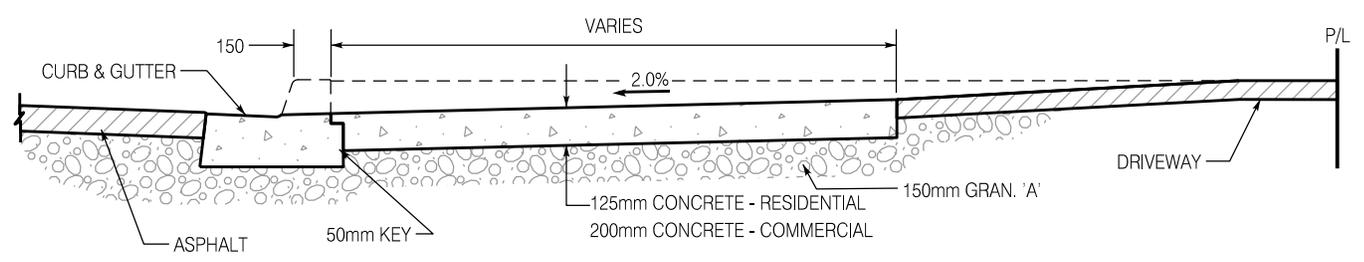
RD-106



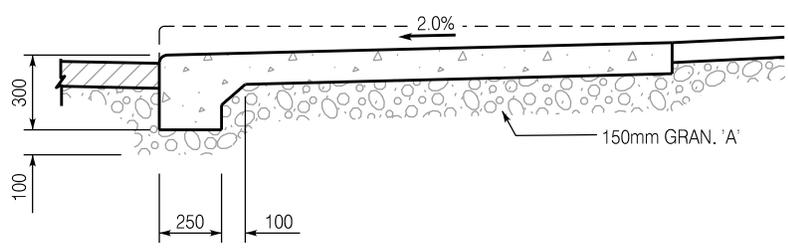
PLAN



PROFILE



SECTION A-A
(INDEPENDENT WALK ADJACENT TO CURB)

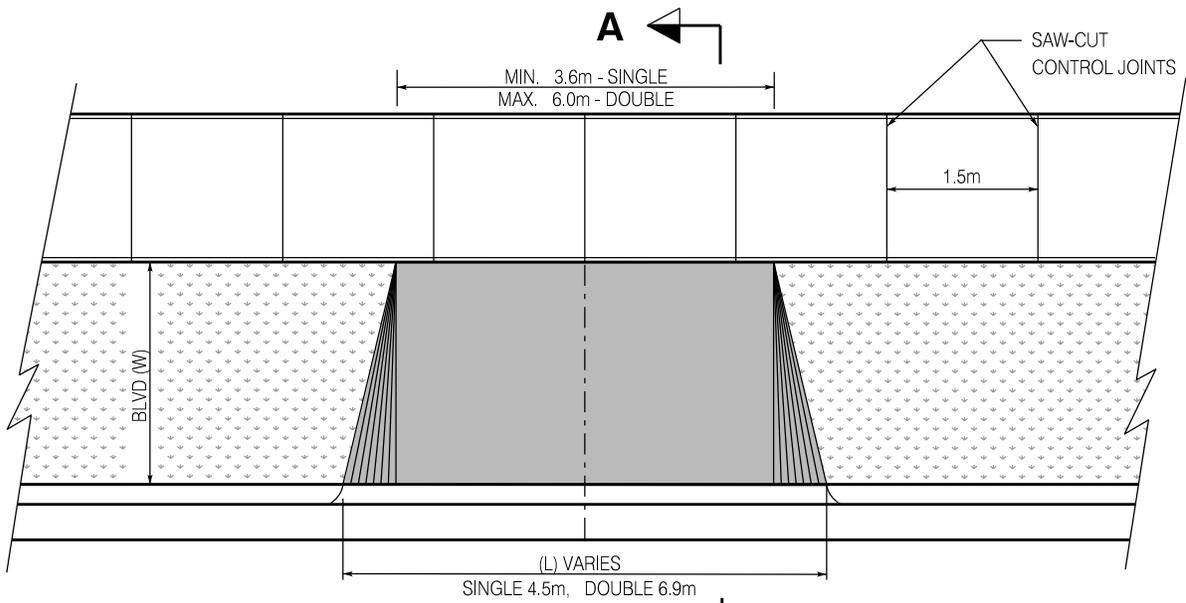


SECTION A-A
(COMBINED WALK AND CURB)

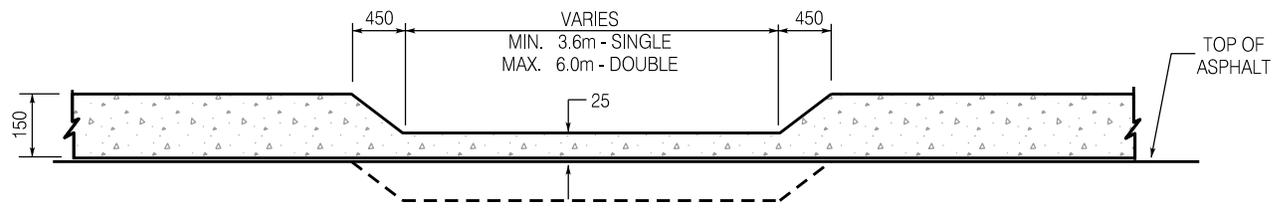
City of Hamilton
Public Works Department

CALIFORNIA STYLE APPROACH

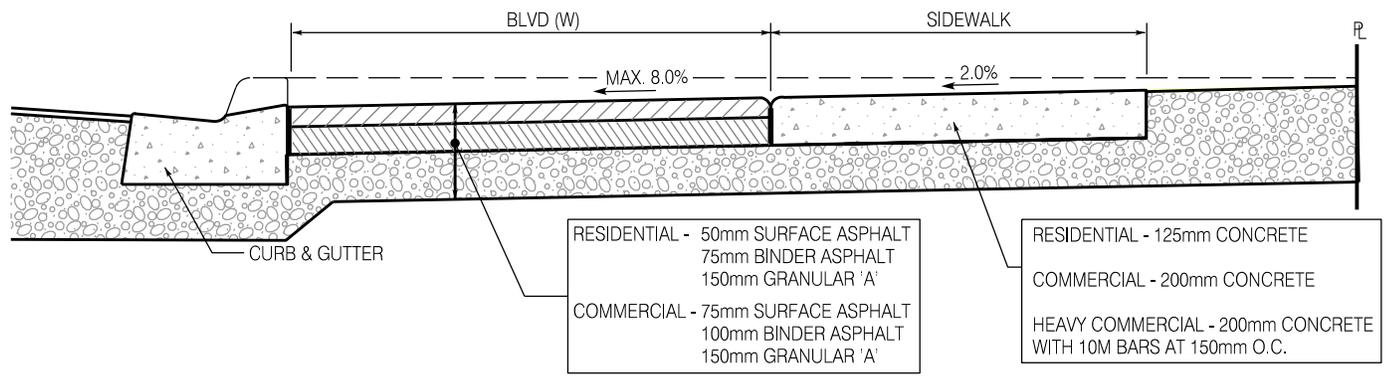
DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE June 2017	REV No 1	HAMILTON STD No	RD-107
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A ←
PLAN



PROFILE



SECTION A-A

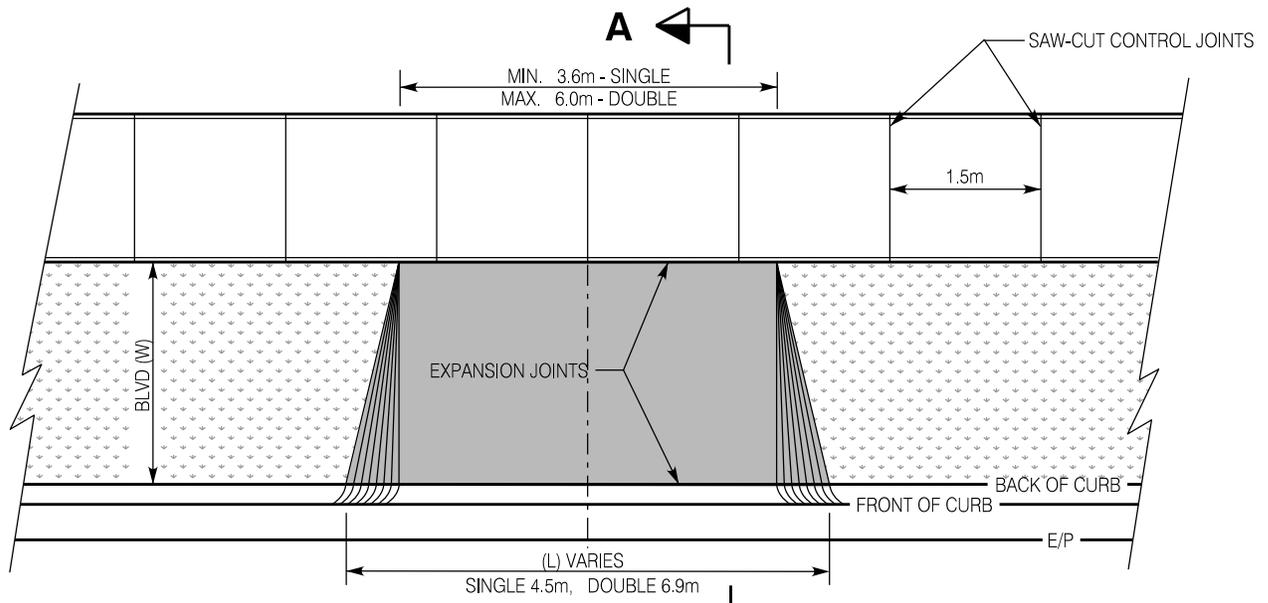
NOTES:

1. RESIDENTIAL DRIVEWAY ENTRANCE WIDTH DETERMINED BY GARAGE ENTRANCE WIDTH PLUS 0.3m ON EACH SIDE.
2. METHOD OF FINAL PAYMENT MEASURED AS $(A=L \times W)$

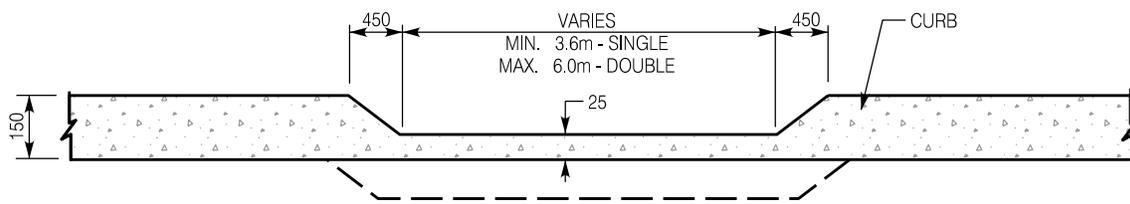
City of Hamilton
Public Works Department

ASPHALT DRIVEWAY APPROACH

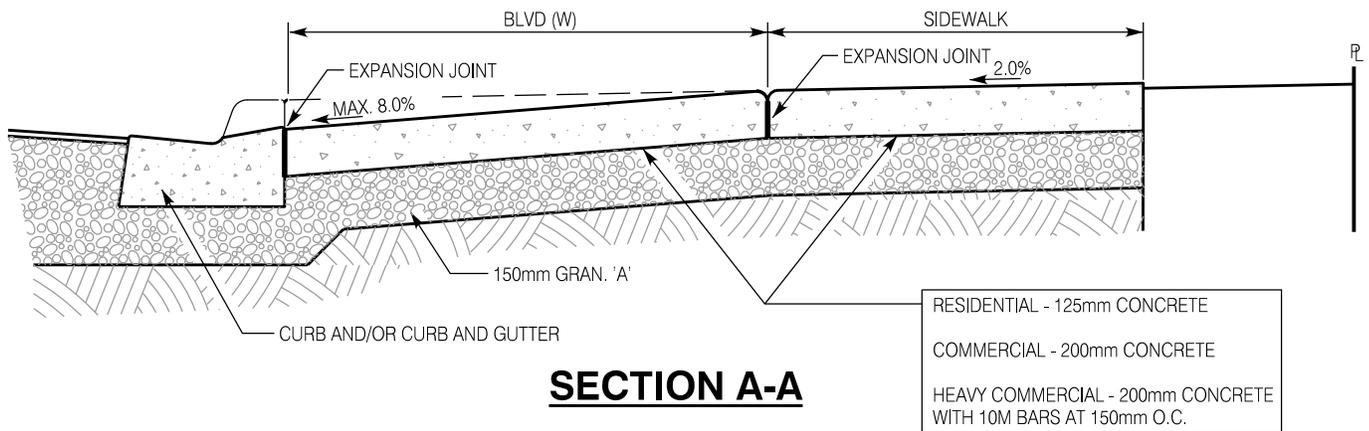
DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE June 2017	REV No 1	FORMERLY: RHS-403	HAMILTON STD No	RD-108
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PLAN



PROFILE



SECTION A-A

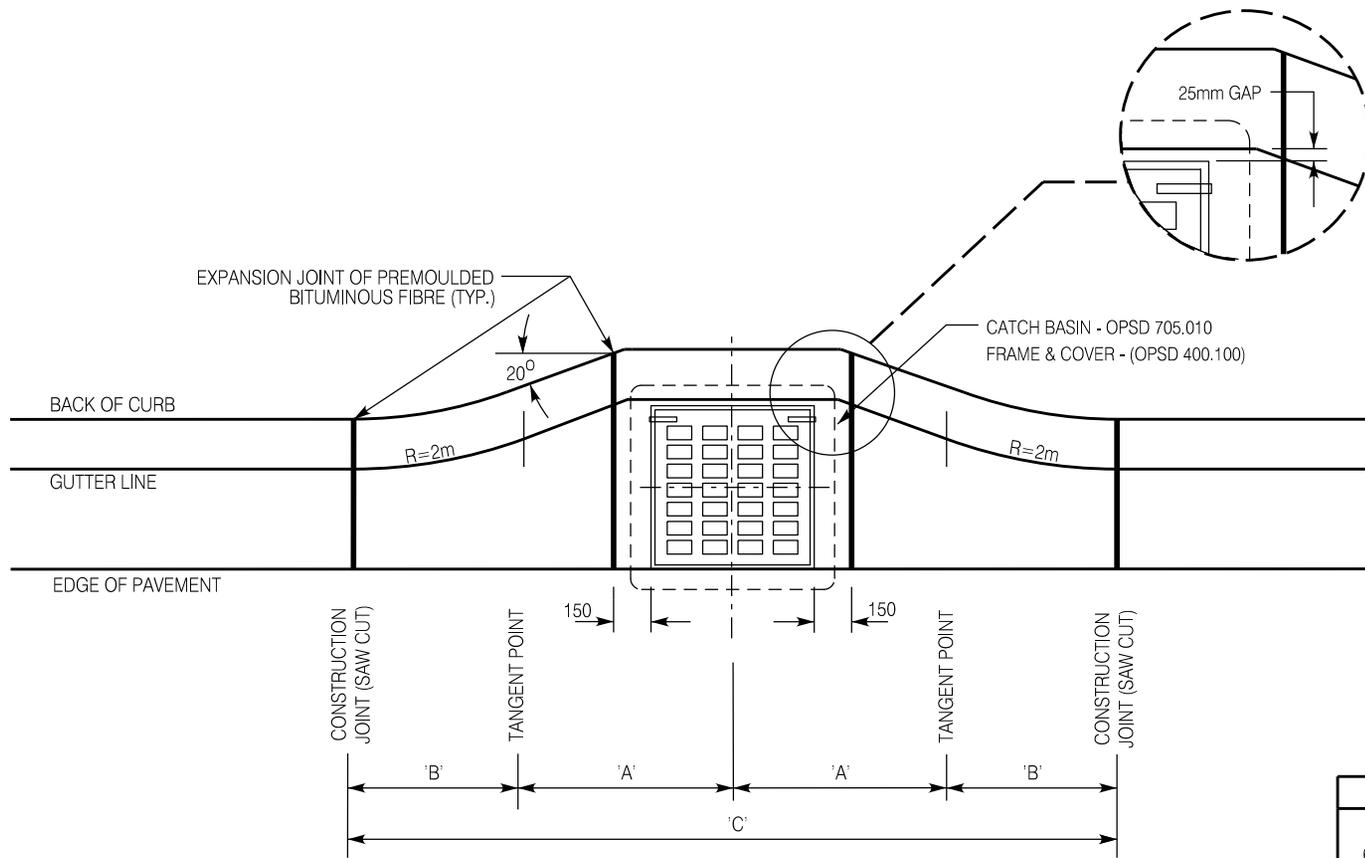
NOTES:

1. ALL COMMERCIAL AND INDUSTRIAL APPROACHES & SIDEWALK THICKNESSES TO BE 200mm
2. EXPANSION JOINTS REQUIRED AT BOTH SIDES OF APPROACH.
3. ALL CONCRETE IS TO HAVE A 28 DAY STRENGTH OF 32 MPa.
4. RESIDENTIAL DRIVEWAY ENTRANCE WIDTH DETERMINED BY GARAGE ENTRANCE WIDTH PLUS 0.3m ON EACH SIDE.
5. METHOD OF FINAL PAYMENT MEASURED AS (A = L x W)

City of Hamilton
Public Works Department

CONCRETE APRON APPROACH

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE June 2017	REV No 1	FORMERLY: RHS-402	HAMILTON STD No	RD-109
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		CURB TYPE		
		OPSD 600.010	OPSD 600.040	OPSD 600.080
DIMENSION (mm)	A	850	1100	1825
	B	700	700	700
	C	3100	3600	5050

City of Hamilton
Public Works Department

OFFSET CURB & GUTTER DETAIL AT SINGLE CATCH BASIN

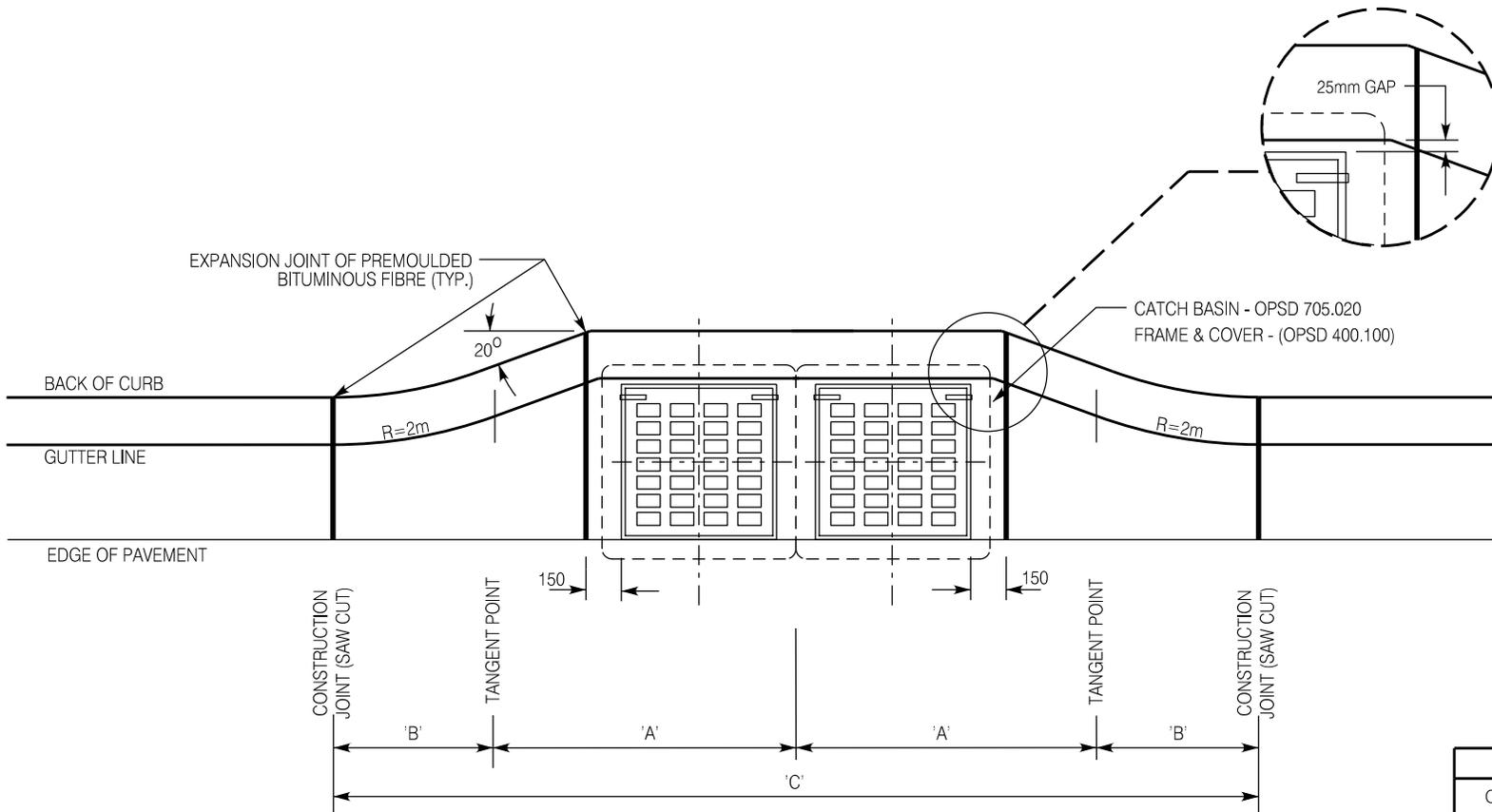
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED

DATE
June 2017

REV No
1

HAMILTON STD No

RD- 110.01



		CURB TYPE		
		OPSD 600.010	OPSD 600.040	OPSD 600.080
DIMENSION (mm)	A	1300	1550	2250
	B	700	700	700
	C	4000	4500	5900

City of Hamilton
Public Works Department

OFFSET CURB & GUTTER DETAIL AT DOUBLE CATCH BASIN

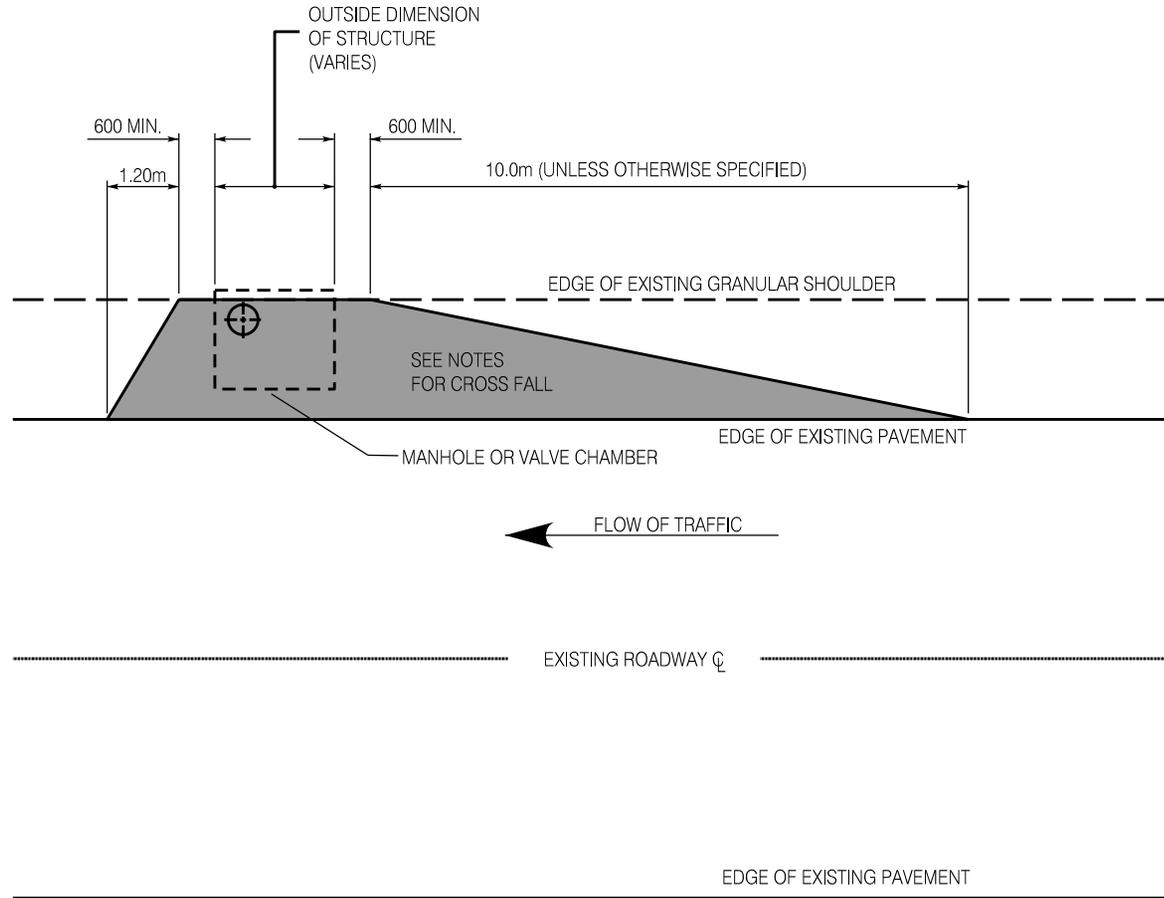
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED

DATE
June 2017

REV No
1

HAMILTON STD No

RD-110.02



NOTES:

1. CROSSFALL OF PROPOSED SHOULDER PAVING TO SUIT EXISTING CONDITIONS
2. CHAMBER COVERS TO BE SET TO MATCH SHOULDER PAVING CROSSFALL
3. AREA TO BE PAVED MINIMUM 75mm SURFACE ASPHALT

City of Hamilton
Public Works Department

SHOULDER PAVING FOR MANHOLES AND CHAMBERS IN SHOULDER OF ROADWAY

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (NTS)

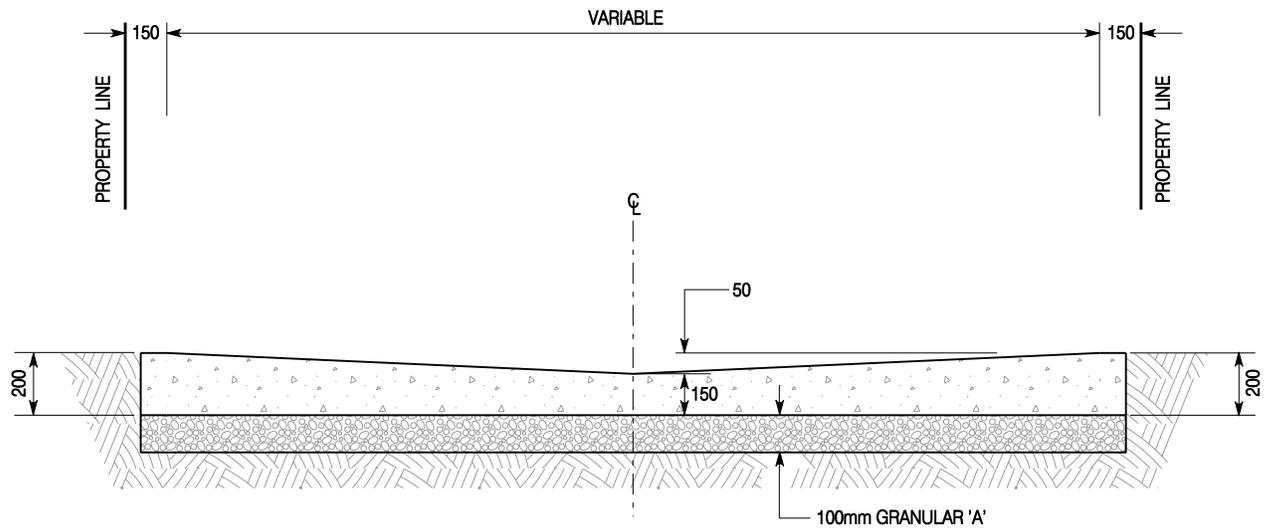
DATE
June 2017

REV No
1

FORMERLY: RHS-507

HAMILTON STD No

RD-111



City of Hamilton
Public Works Department

CONCRETE ALLEYWAY

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

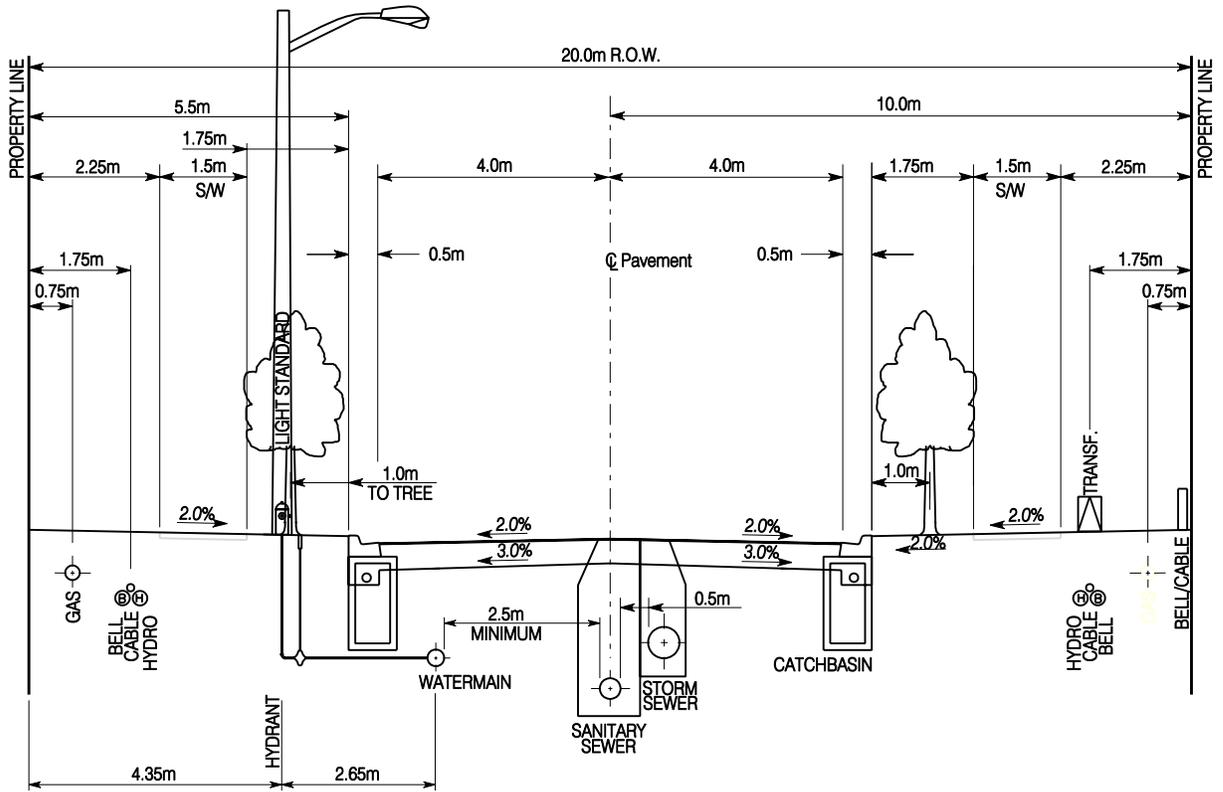
DATE
November 2005

REV No

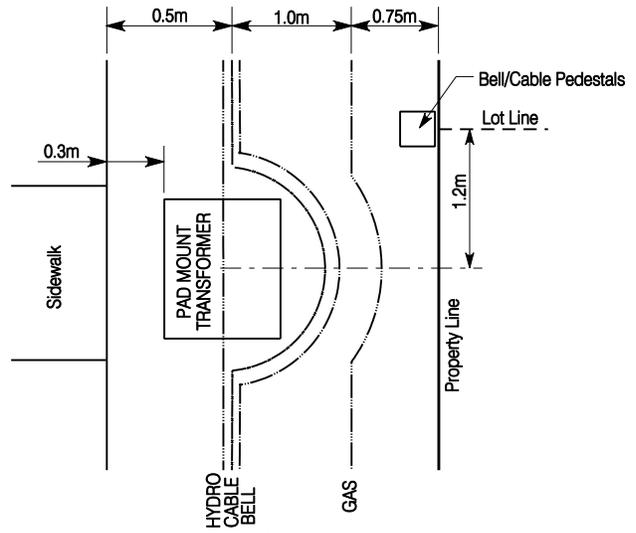
FORMERLY: RHS-202

HAMILTON STD No

RD-112



MINIMUM DEPTH OF COVER	
SANITARY SEWER	- 2.75m
STORM SEWER	- 2.75m
WATERMAIN	- 1.6m
HYDRO	- 0.9m
CABLE	- 0.9m
BELL	- 0.9m
GAS	- 0.6m



**PLAN
(AT PAD MOUNT TRANSFORMER)**

City of Hamilton
Public Works Department

LOCAL URBAN RESIDENTIAL - 20.0m R.O.W.

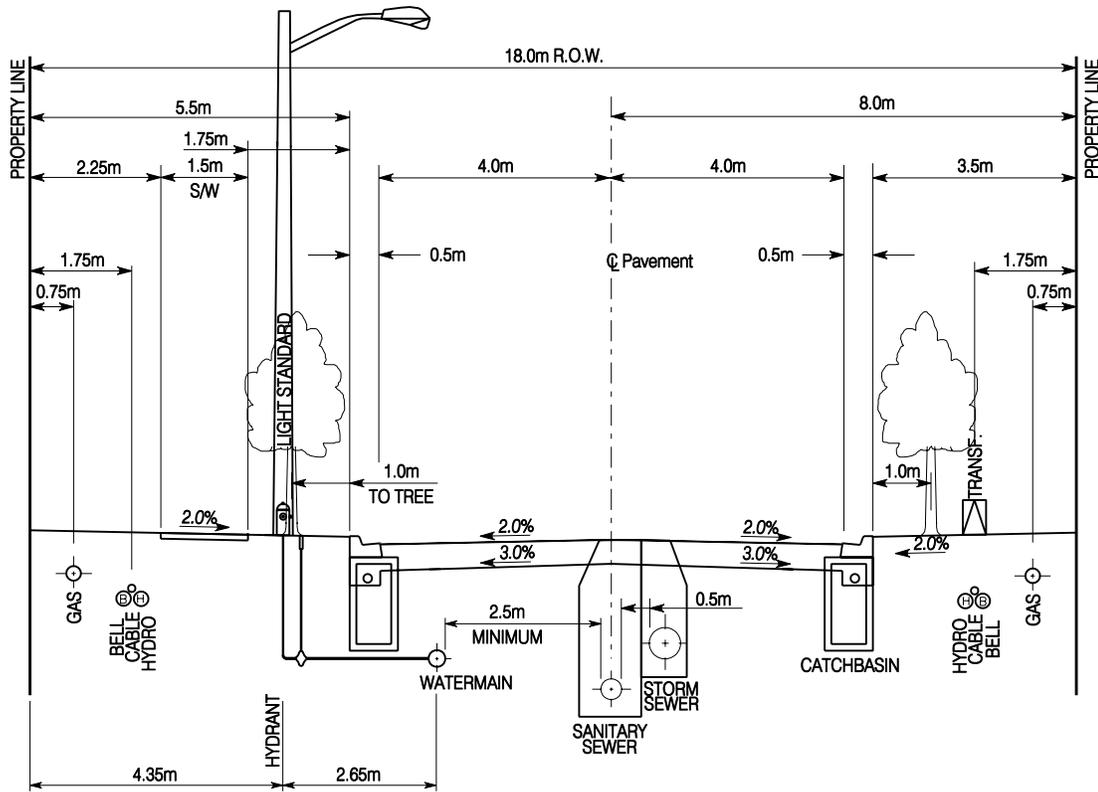
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
November 2005

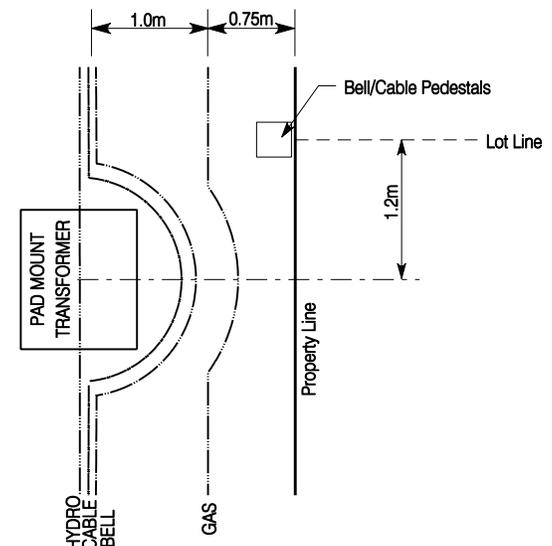
REV No

HAMILTON STD No

RD-113.01



MINIMUM DEPTH OF COVER	
SANITARY SEWER	- 2.75m
STORM SEWER	- 2.75m
WATERMAIN	- 1.6m
HYDRO	- 0.9m
CABLE	- 0.9m
BELL	- 0.9m
GAS	- 0.6m

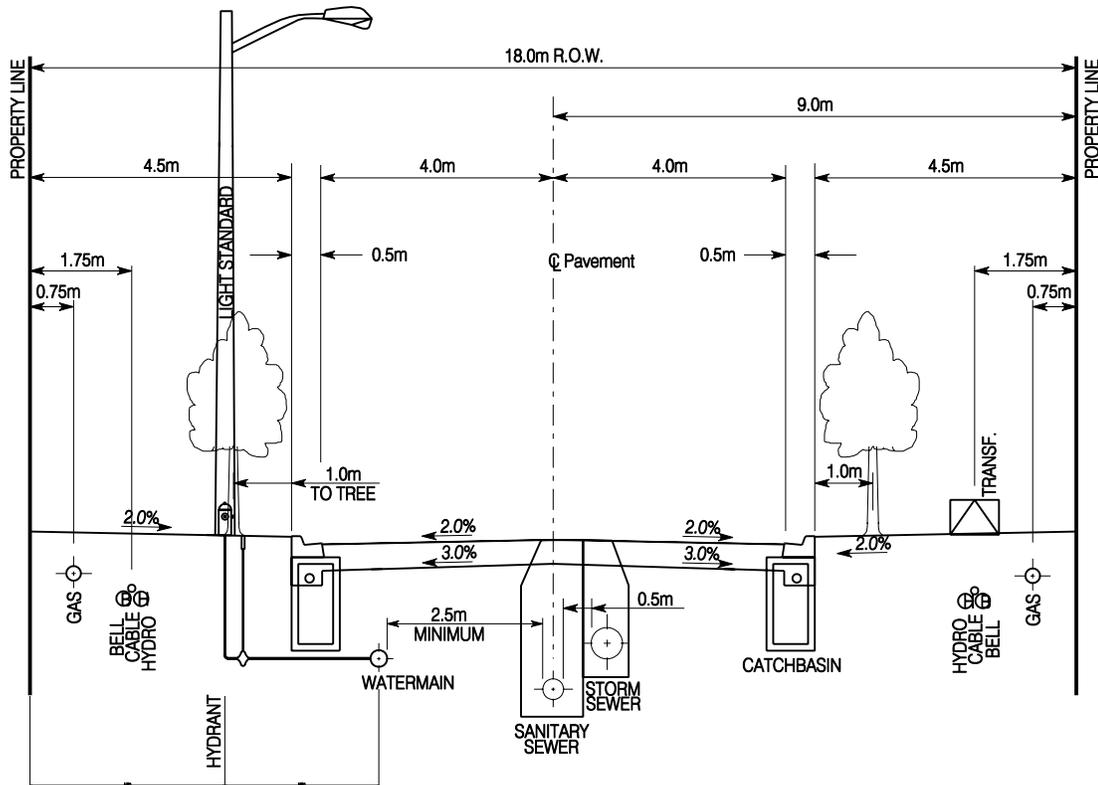


PLAN
(AT PAD MOUNT TRANSFORMER)

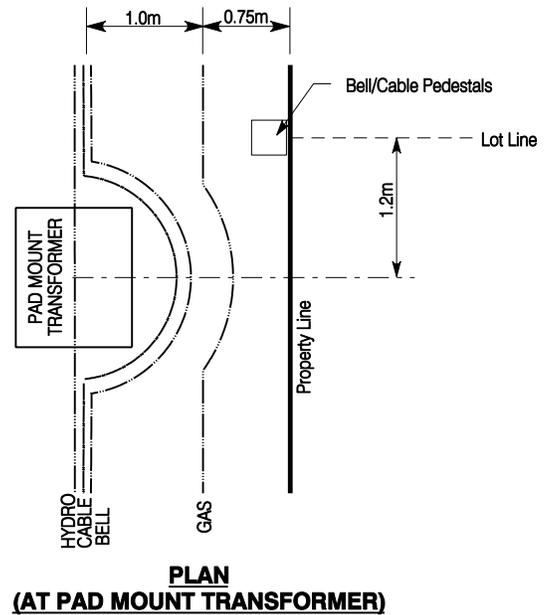
NOTE:
Transformers are to be located on the side opposite to the sidewalk.

City of Hamilton
Public Works Department

LOCAL URBAN RESIDENTIAL - 18.0m R.O.W.



MINIMUM DEPTH OF COVER	
SANITARY SEWER	- 2.75m
STORM SEWER	- 2.75m
WATERMAIN	- 1.6m
HYDRO	- 0.9m
CABLE	- 0.9m
BELL	- 0.9m
GAS	- 0.6m



City of Hamilton
Public Works Department

LOCAL URBAN RESIDENTIAL - 18.0m R.O.W. WITHOUT SIDEWALK & FOR CUL-DE-SAC'S

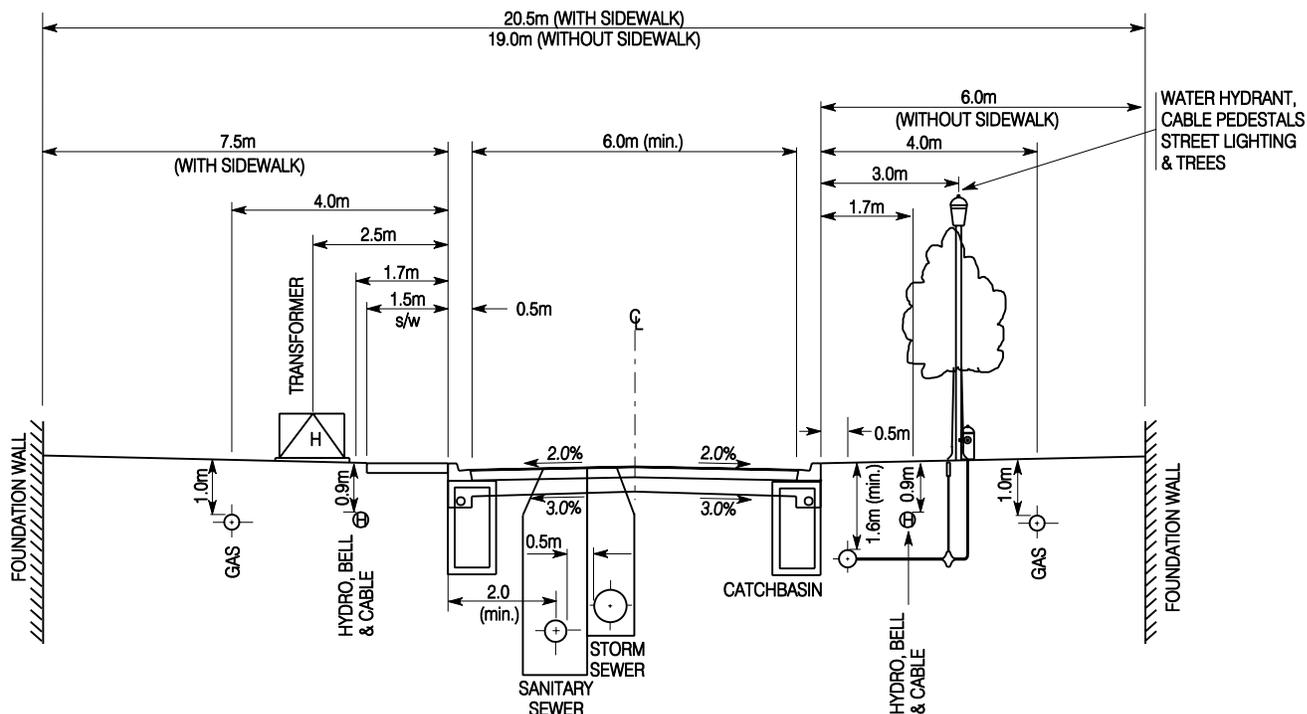
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
November 2005

REV No

HAMILTON STD No

RD-113.03



NOTE :

1. DIMENSIONS ARE FROM BACK OF CURB.
2. CABLE, HYDRO BELL & STREETLIGHTING CABLES MAY BE PLACED IN A COMMON TRENCH 1.7m FROM BACK OF CURB (as required).
3. UNDERGROUND UTILITY CABLES ARE TO BE ROUTED AROUND HYDRANT WITH 0.3m CLEARANCE. FOR WATERMAINS 400mm DIA. OR LARGER, UTILITY CABLES ARE TO BE ROUTED AROUND HYDRANT WITH 1.0m CLEARANCE.
4. TRANSFORMER LOCATIONS ARE TO BE DETERMINED BY HAMILTON HYDRO AND APPROVED BY THE PROJECT MANAGER.
5. STREETLIGHTS TO BE A MINIMUM 5.0m FROM TRANSFORMERS.
6. A MINIMUM 6.0m SETBACK FROM BACK OF CURB LINE OR SIDEWALK TO BUILDING FOUNDATION (including porches, stairwells, etc.) MUST BE MAINTAINED IF THE DESIGN OF THE TOWNHOUSE BLOCK PRECLUDES THIS SETBACK, ALTERNATE ARRANGEMENTS MUST BE MADE WITH GAS COMPANY.

City of Hamilton
Public Works Department

STANDARD ROAD SECTION FOR PRIVATE TOWNHOUSES

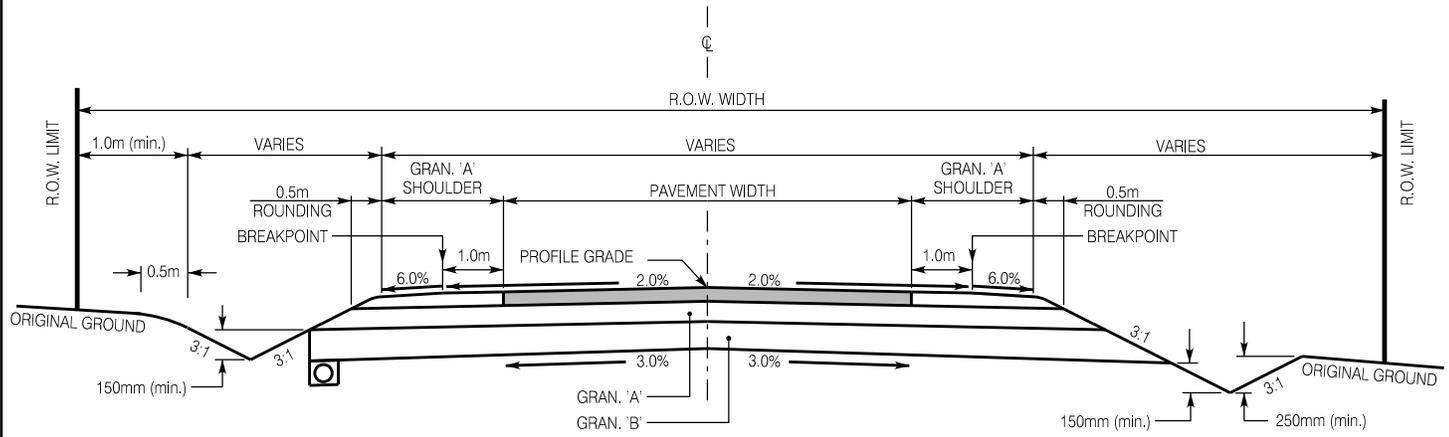
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
November 2005

REV No

HAMILTON STD No

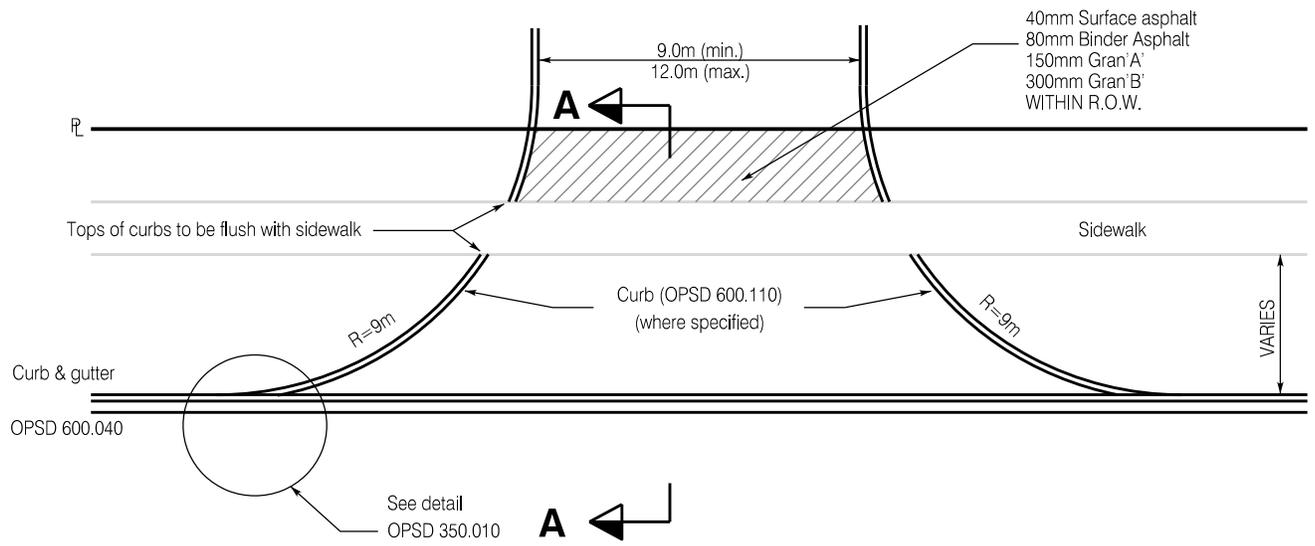
RD-113.04



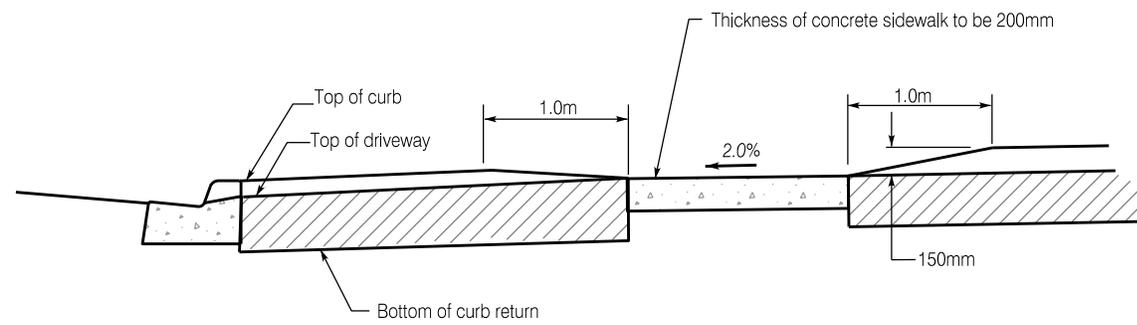
ROAD CLASSIFICATION	ROAD ALLOWANCE	PAVEMENT WIDTH	SHOULDER WIDTH	GRANULAR "B"	GRANULAR "A"	ASPHALT SURFACE
Residential	20m	6.7m	2.0m	300mm	150mm	40mm SURFACE 80mm BINDER
Industrial	26m	7.3m	2.5m	450mm	150mm	40mm SURFACE 100mm BINDER

City of Hamilton
Public Works Department

RURAL CROSS SECTION

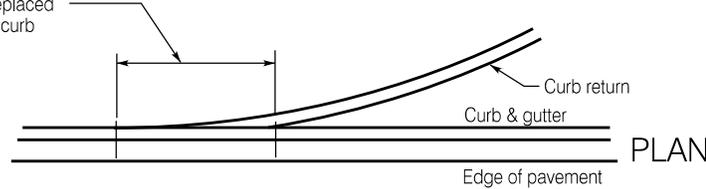


PLAN VIEW

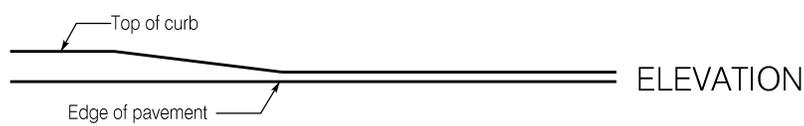


SECTION 'A-A'

1.0m of exist curb & gutter to be removed and replaced in one pour to match curb return



PLAN



ELEVATION

DETAIL

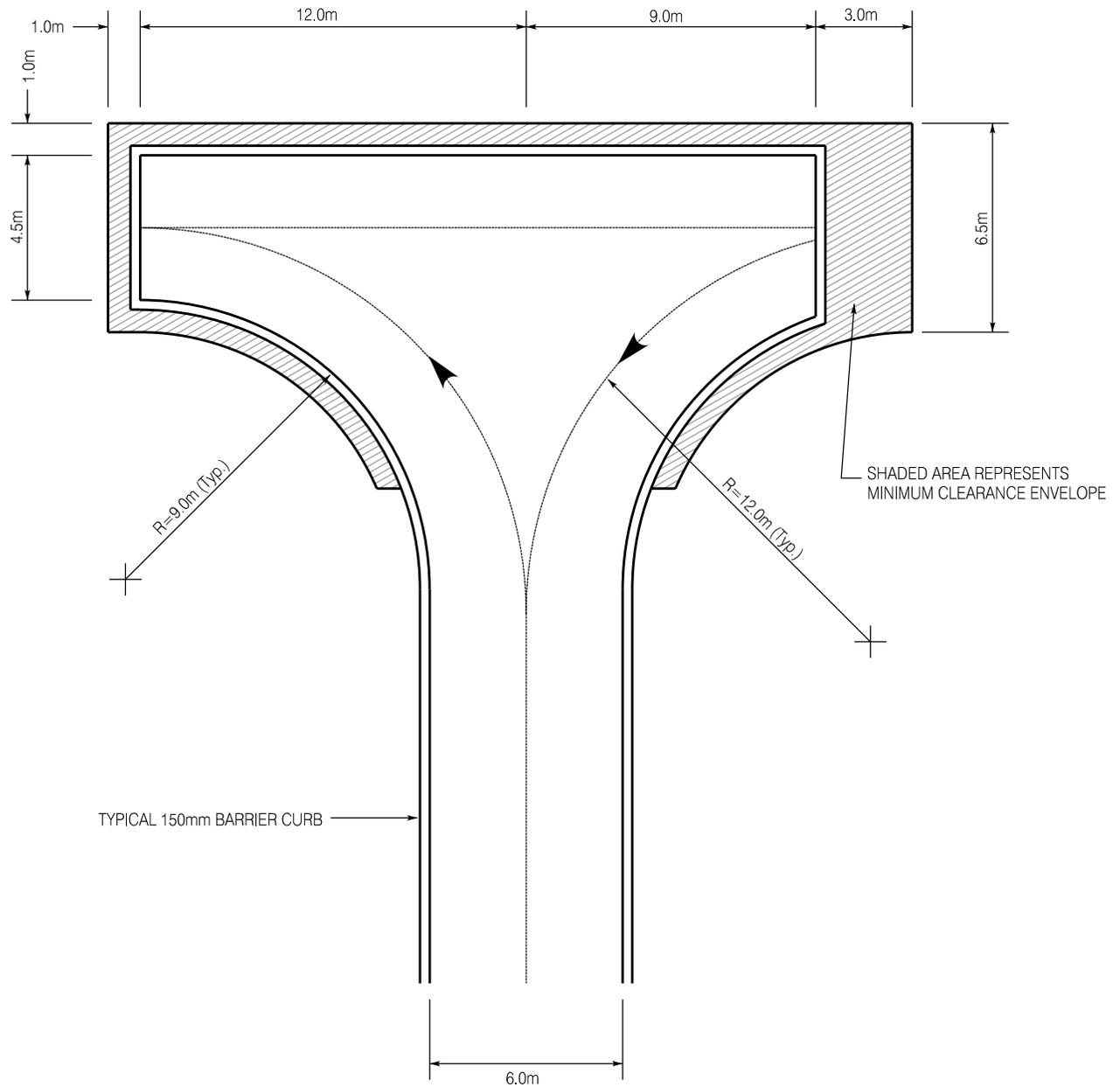
NOTES:

1. EXISTING CURB, GUTTER AND SIDEWALK ARE TO BE EXTENDED THROUGH THE ENTRANCE.
2. GRADES AND ELEVATIONS WITHIN THE ENTRANCE ARE TO BE SET TO ENSURE THAT ADEQUATE DRAINAGE IS PROVIDED.
3. BARRIER CURB WITHIN THE ENTRANCES IS TO BE ADJUSTED TO PROVIDE A FLUSH MATCH WITH THE SIDEWALK.

City of Hamilton
Public Works Department

UNSIGNALIZED INDUSTRIAL & COMMERCIAL ENTRANCE - URBAN SECTION

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE June 2017	REV No 1	HAMILTON STD No	RD-114
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NOTES:

1. MINIMUM TURNING MOVEMENT BASED ON RTAC; SU-9-SINGLE UNIT TRUCK,
WITH THE FOLLOWING DIMENSIONS: WHEELBASE - 6.1m
OVERALL LENGTH - 7.9m
(EXCLUDES OVERHANG AT REAR)
2. ALL DIMENSIONS ARE MINIMUM

City of Hamilton
Public Works Department

TYPICAL PERMANENT HAMMERHEAD TURNING MOVEMENT DIAGRAM

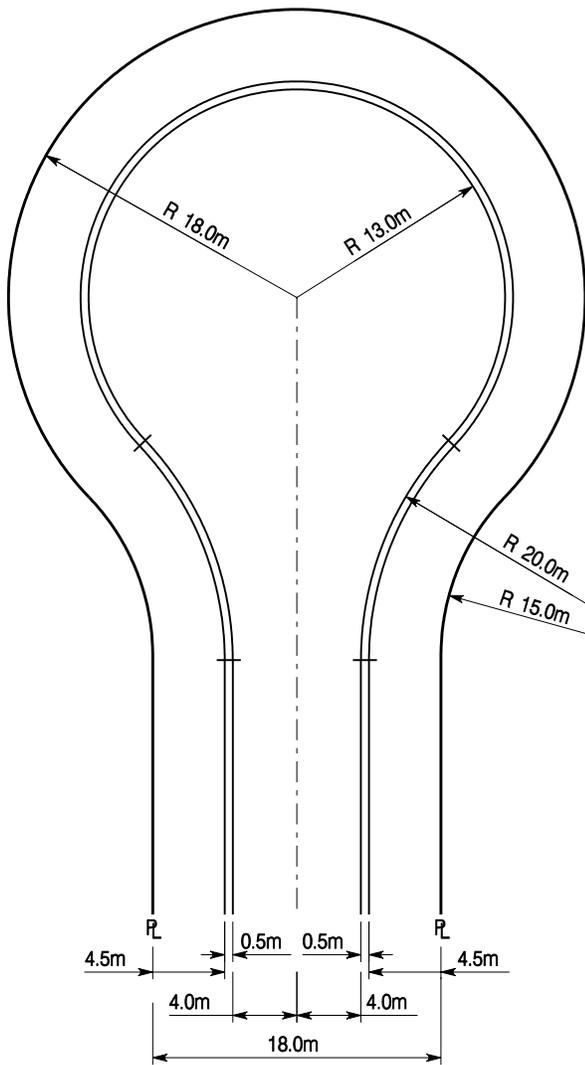
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
June 2017

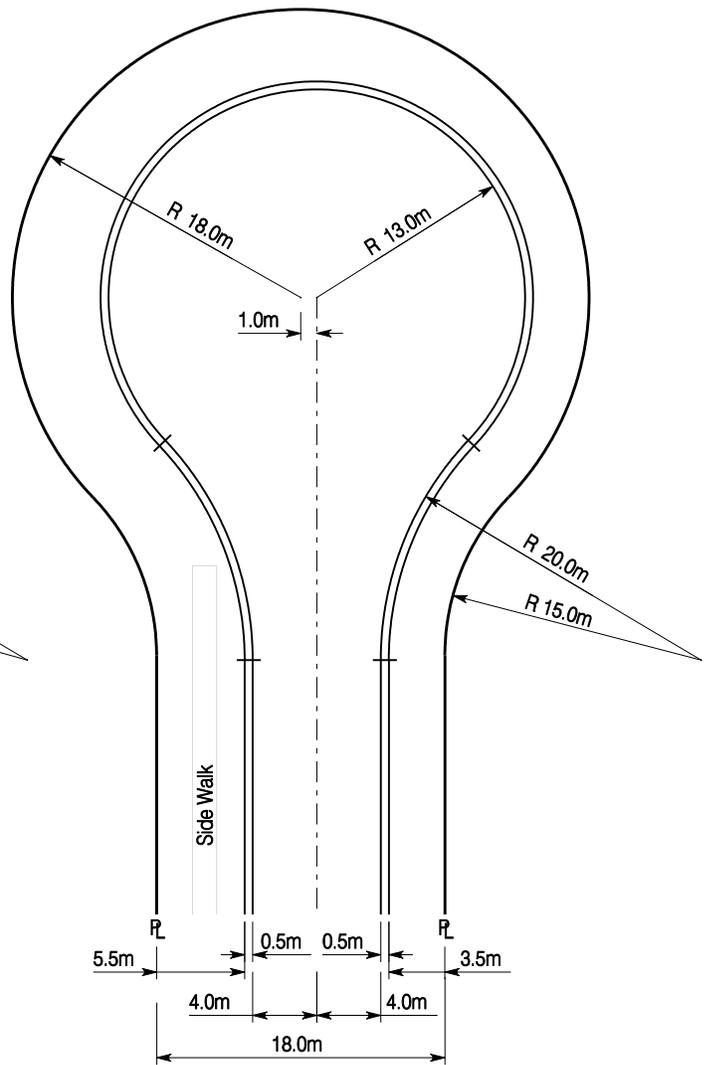
REV No
1

HAMILTON STD No

RD-115



18.0m R.O.W.
NO SIDEWALK



18.0m R.O.W.
WITH SIDEWALK
ONE SIDE

NOTES:

1. MINIMUM GUTTER SLOPE SHALL BE 0.75%
2. DETAIL FOR GRADING OF BULB AREAS SHALL BE SHOWN ON PLAN & PROFILE DRAWINGS
3. MINIMUM 3.5m BOULEVARD IN BULB WHEN BULB IS OFFSET TO ALLOW FOR ONE SIDEWALK.

City of Hamilton
Public Works Department

PERMANENT CUL-DE-SAC FOR LOCAL RESIDENTIAL STREETS
(SYMMETRICAL - 18m R.O.W.)

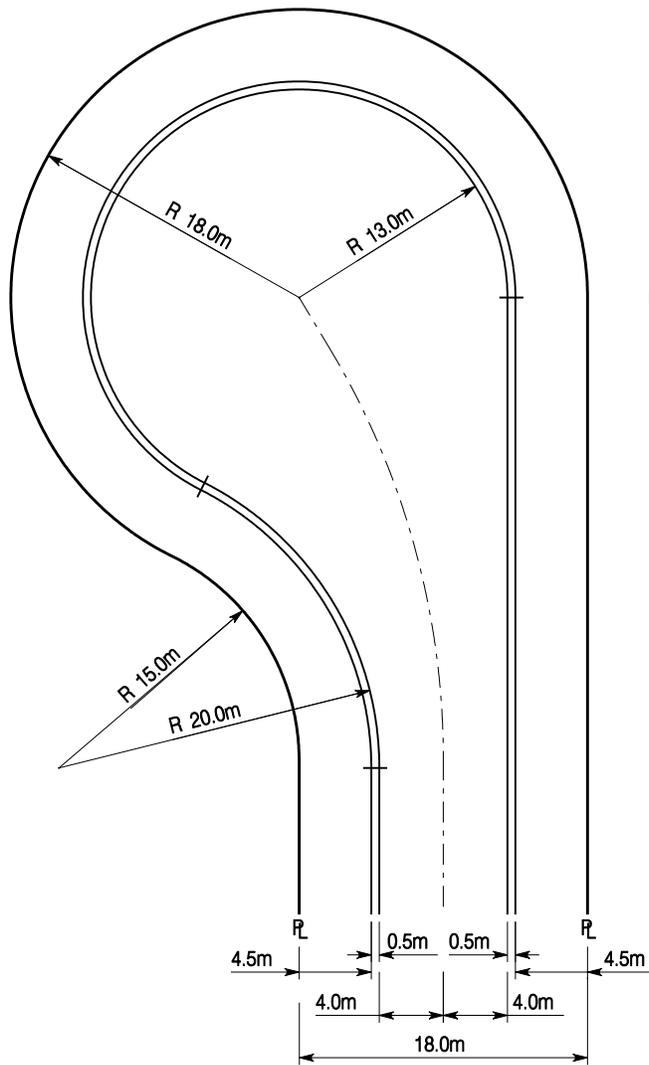
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
November 2005

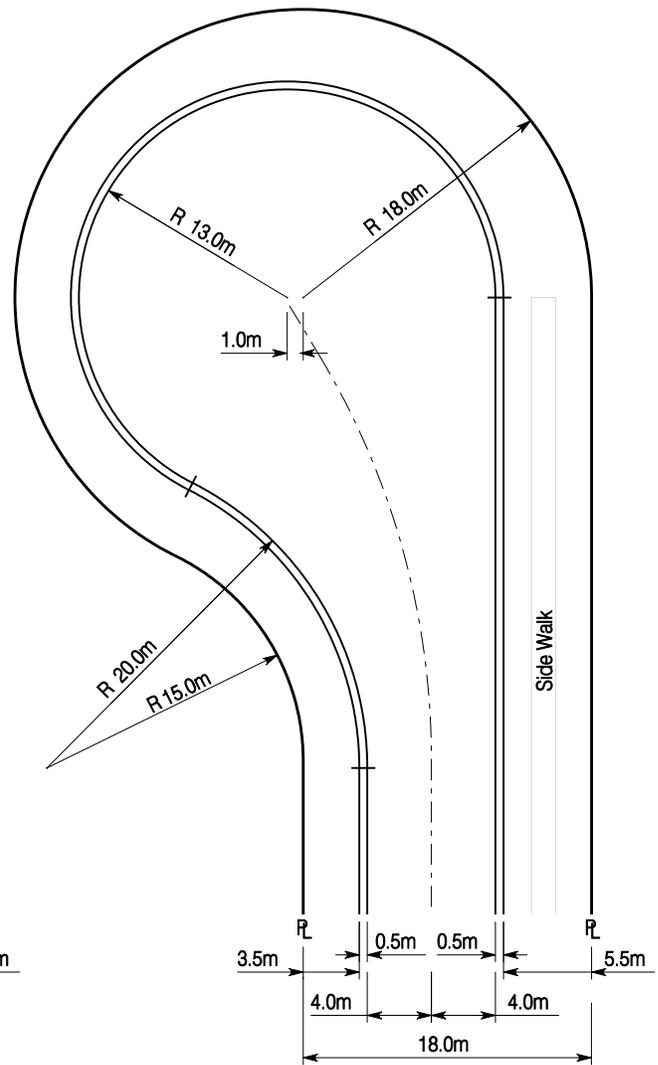
REV No

HAMILTON STD No

RD-116.01



18.0m R.O.W.
OFFSET LEFT
NO SIDEWALK



18.0m R.O.W.
OFFSET LEFT
WITH SIDEWALK
ONE SIDE

NOTES:

1. MINIMUM GUTTER SLOPE SHALL BE 0.75%
2. DETAIL FOR GRADING OF BULB AREAS SHALL BE SHOWN ON PLAN & PROFILE DRAWINGS
3. MINIMUM 3.5m BOULEVARD IN BULB WHEN BULB IS OFFSET TO ALLOW FOR ONE SIDEWALK.

City of Hamilton
 Public Works Department

PERMANENT CUL-DE-SAC FOR LOCAL RESIDENTIAL STREETS
(OFFSET LEFT - 18m R.O.W.)

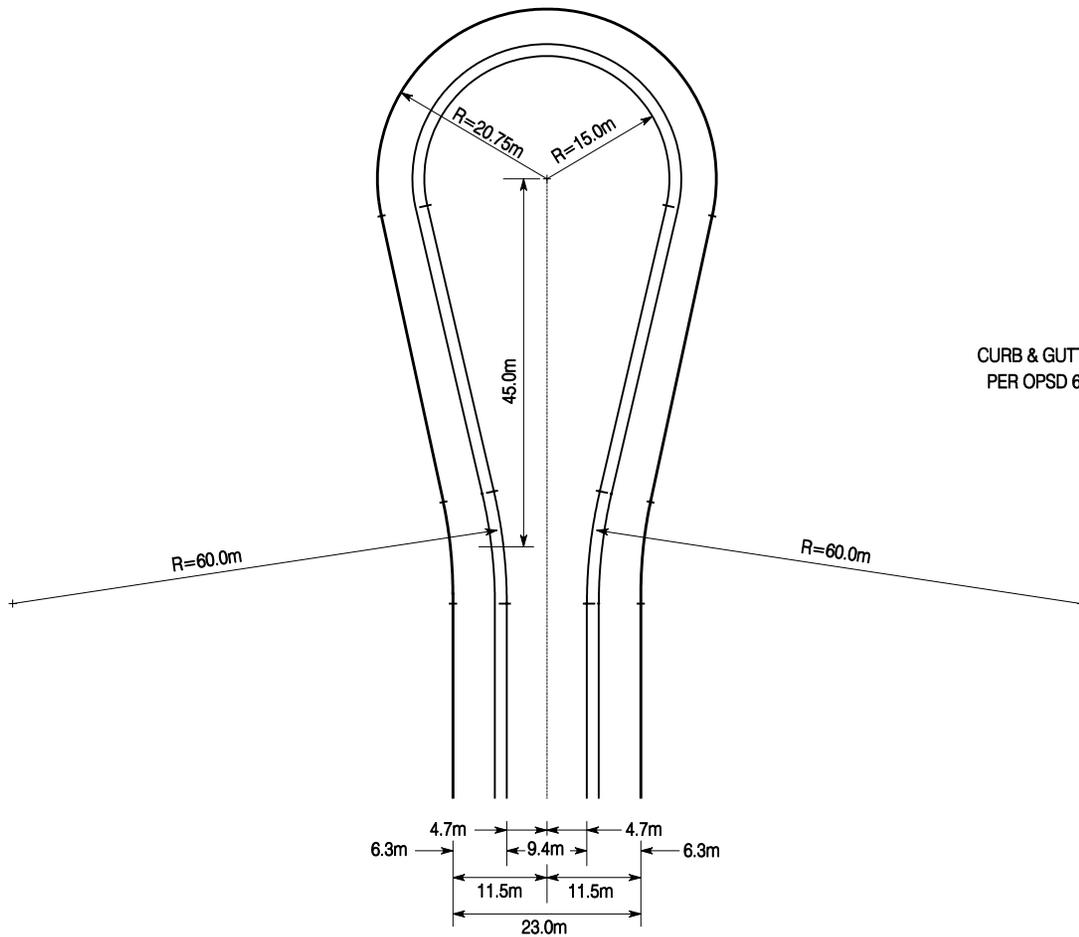
DIMENSIONS SHOWN ARE IN MILLIMETRES
 UNLESS OTHERWISE NOTED (N.T.S.)

DATE
 November 2005

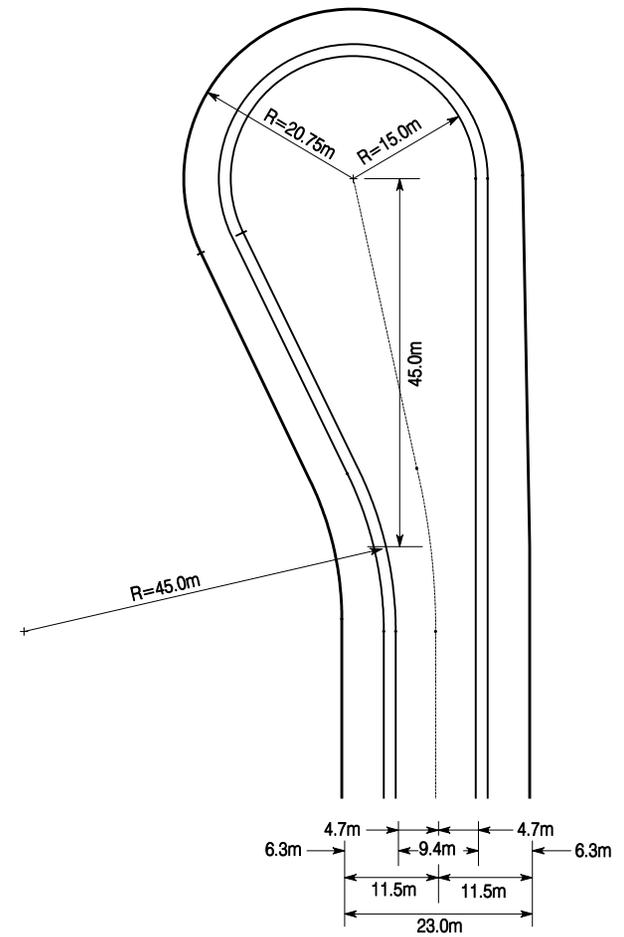
REV No

HAMILTON STD No

RD-116.02



CURB & GUTTER AS
PER OPSD 600.07



SYMETRICAL

OFFSET LEFT

NOTES:

1. MINIMUM GUTTER SLOPE TO BE 1.0%
2. DETAIL FOR GRADING OF BULB AREAS OF CUL-DE-SAC TO BE SHOWN ON PLAN & PROFILE DRAWINGS

City of Hamilton
Public Works Department

TYPICAL CUL-DE-SAC FOR INDUSTRIAL AND COMMERCIAL STREETS

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED

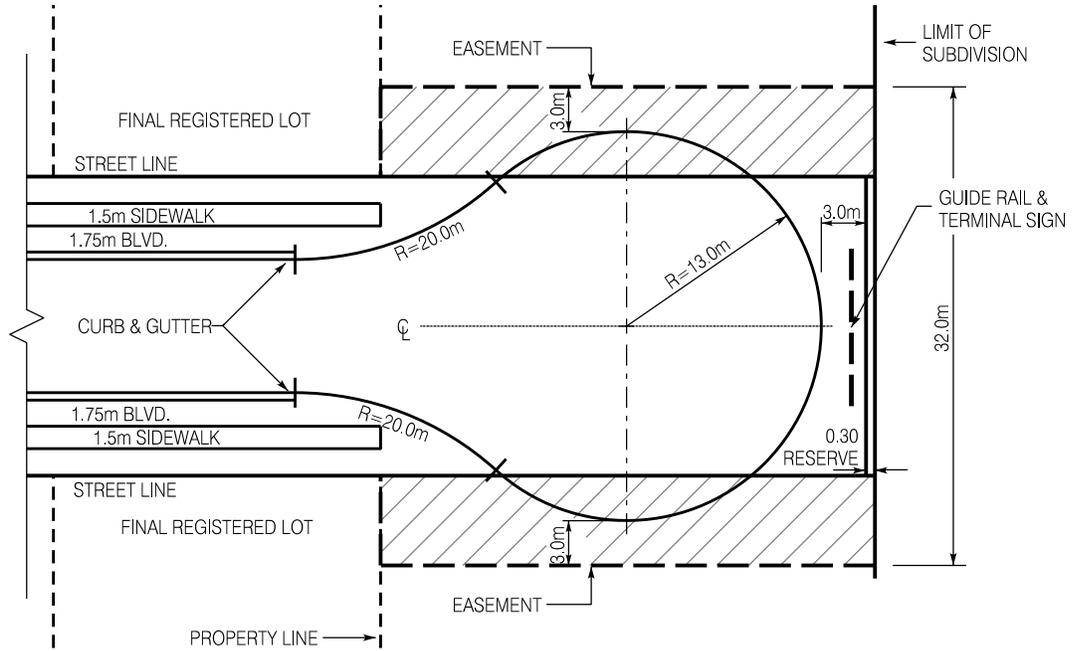
DATE
November 2005

REV No

HAMILTON STD No

RD-116.03

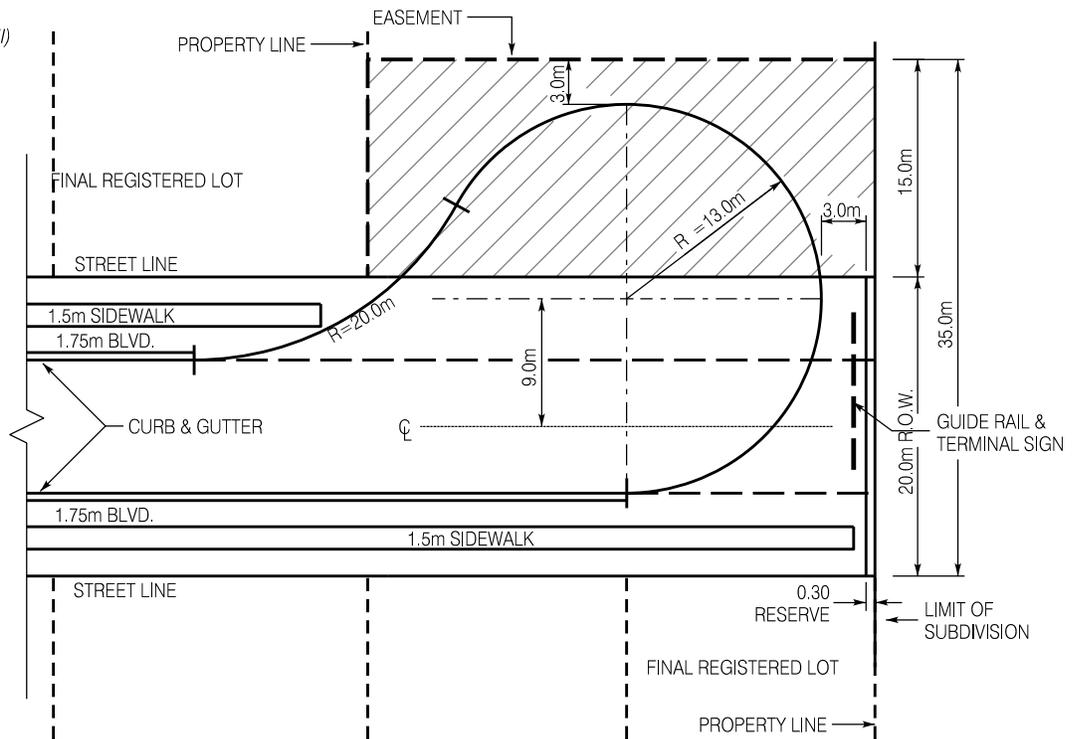
TYPE 1



PAVEMENT DESIGN:

40mm SURFACE ASPHALT
 80mm BINDER ASPHALT
 150mm GRANULAR 'A'
 300mm GRANULAR 'B' (TYPE II)

TYPE 2



City of Hamilton
 Public Works Department

**TEMPORARY TURNING CIRCLE
 (20m R.O.W.)**

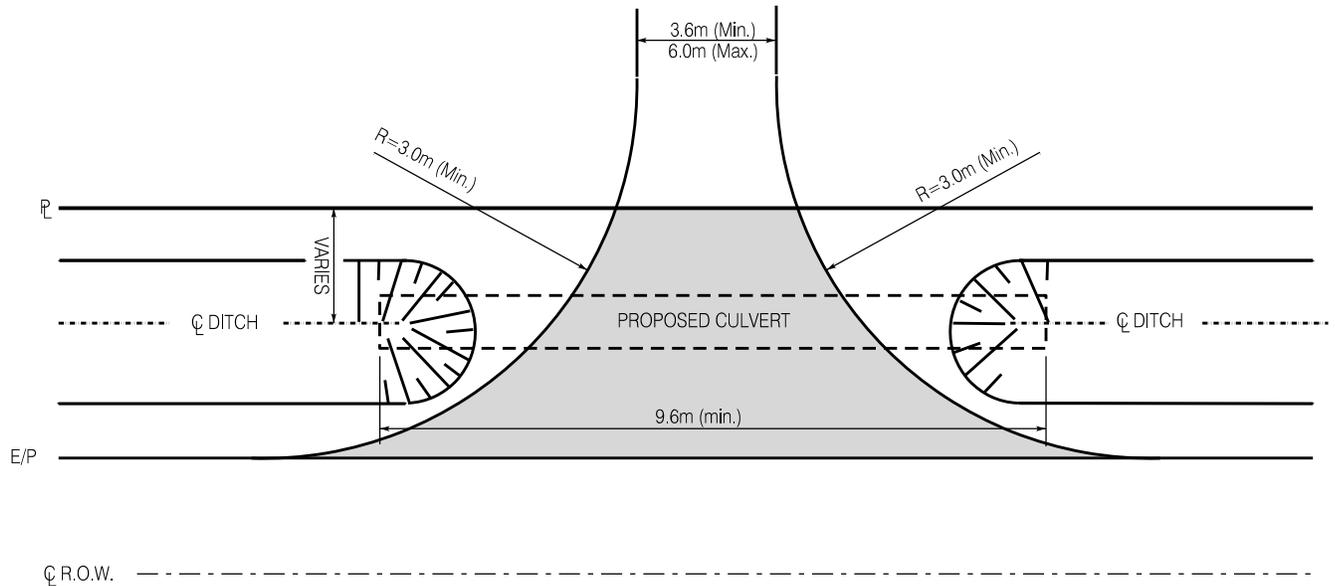
DIMENSIONS SHOWN ARE IN MILLIMETRES
 UNLESS OTHERWISE NOTED (NTS)

DATE
 June 2017

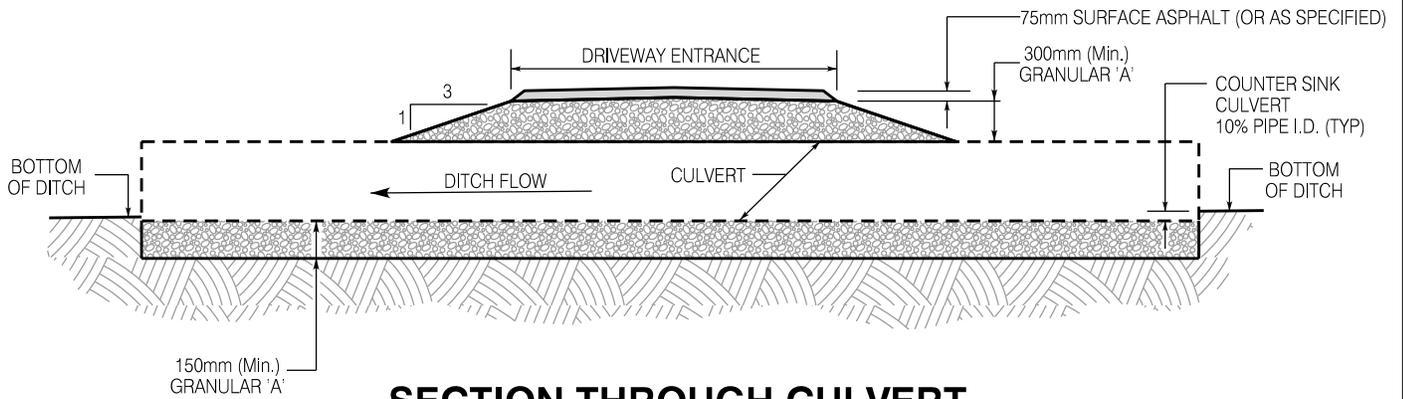
REV No
 1

HAMILTON STD No

RD-116.04



PLAN VIEW



SECTION THROUGH CULVERT

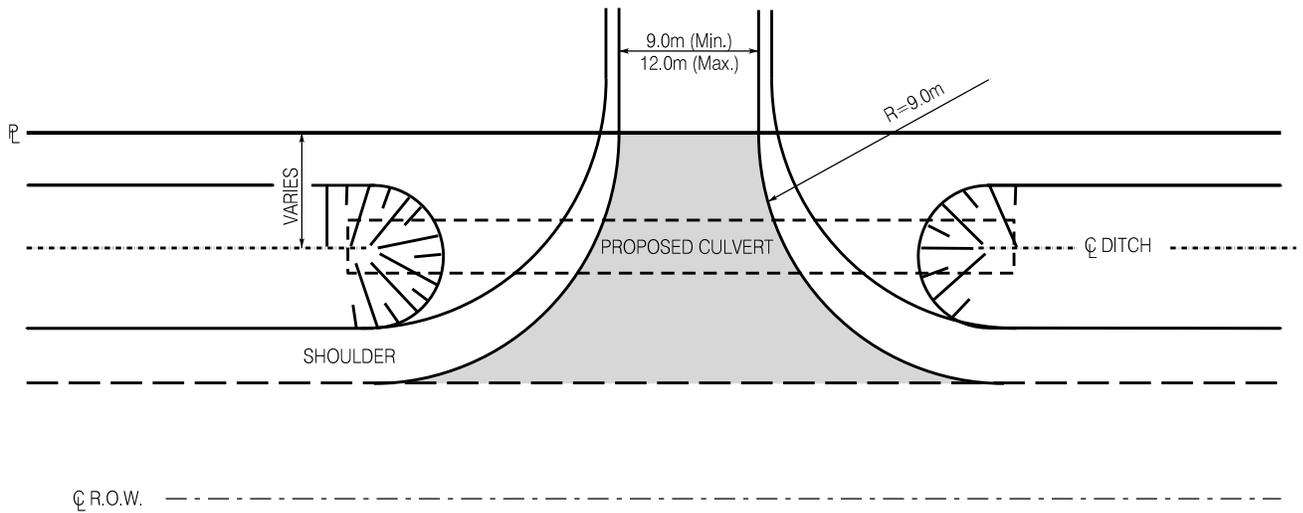
NOTES:

1. MINIMUM COVER ON CULVERT TO BE 300mm GRANULAR 'A' WITHIN CITY PROPERTY WHERE APPLICABLE.
2. ALL DIMENSIONS ARE TO CONFORM TO CITY BY-LAWS AND AMENDMENTS, REGULATING THE LOCATION OF ENTRANCES.
3. CULVERT PIPE TO BE PLACED ON 150mm OF GRANULAR 'A'.
4. ASPHALT DRIVEWAY APPROACH TO CONSIST OF 300mm GRANULAR 'A' AND 75mm SURFACE ASPHALT (OR AS SPECIFIED)
5. AT EXISTING ENTRANCES, FINAL ENTRANCE TO MATCH EXISTING MATERIAL

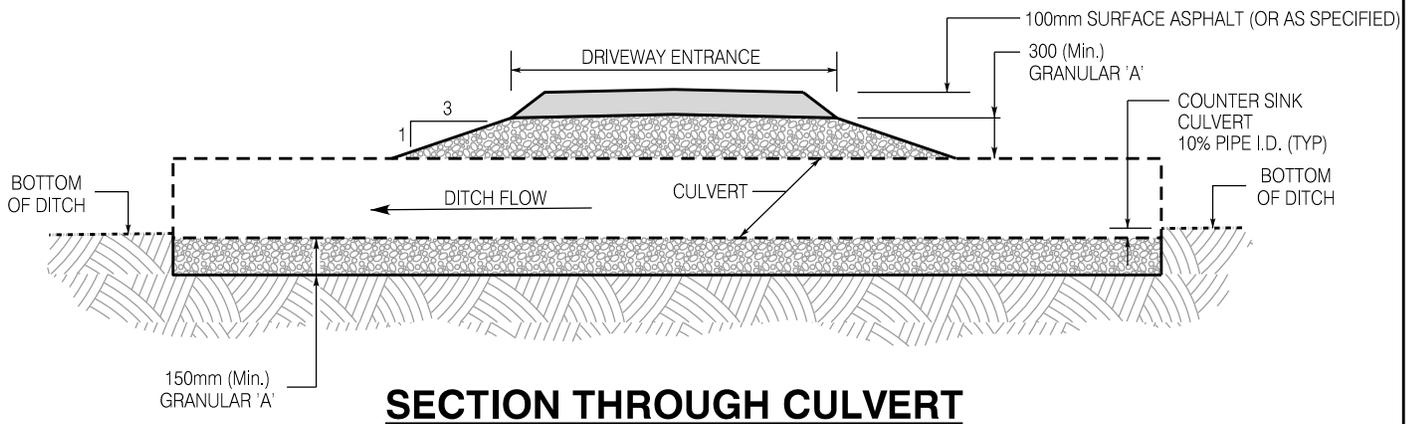
City of Hamilton
Public Works Department

RURAL RESIDENTIAL ENTRANCES

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE June 2017	REV No 1	HAMILTON STD No	RD-117
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PLAN VIEW



SECTION THROUGH CULVERT

NOTES:

1. MINIMUM COVER ON CULVERT TO BE 300mm GRANULAR 'A' WITHIN CITY PROPERTY WHERE APPLICABLE.
2. ALL DIMENSIONS ARE TO CONFORM TO CITY BY-LAWS AND AMENDMENTS, REGULATING THE LOCATION OF ENTRANCES.
3. CULVERT PIPE TO BE PLACED ON 150mm GRANULAR 'A'.
4. ENTRANCE TO BE 100mm SURFACE ASPHALT (OR AS SPECIFIED) AND 300mm OF GRANULAR 'A' WITHIN ROAD ALLOWANCE.

City of Hamilton
Public Works Department

RURAL INDUSTRIAL & COMMERCIAL ENTRANCES

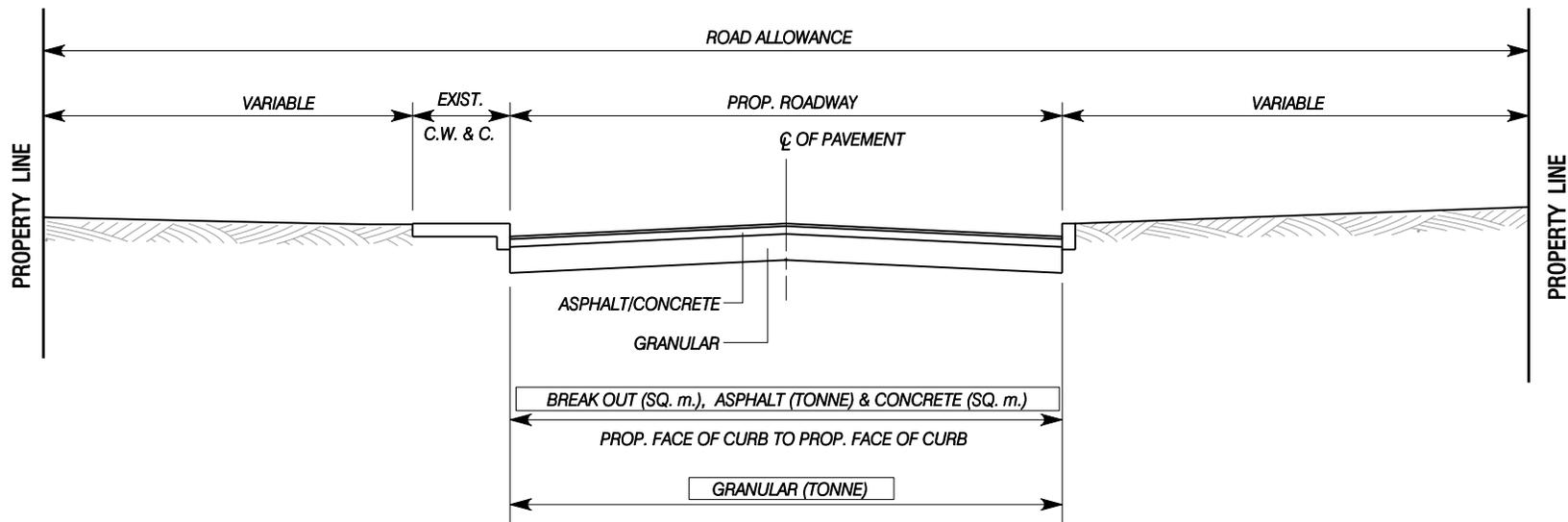
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
June 2017

REV No
1

HAMILTON STD No

RD-118



City of Hamilton
Public Works Department

**MEASUREMENT FOR PAYMENT DIAGRAM
ROAD RECONSTRUCTION ONLY**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED

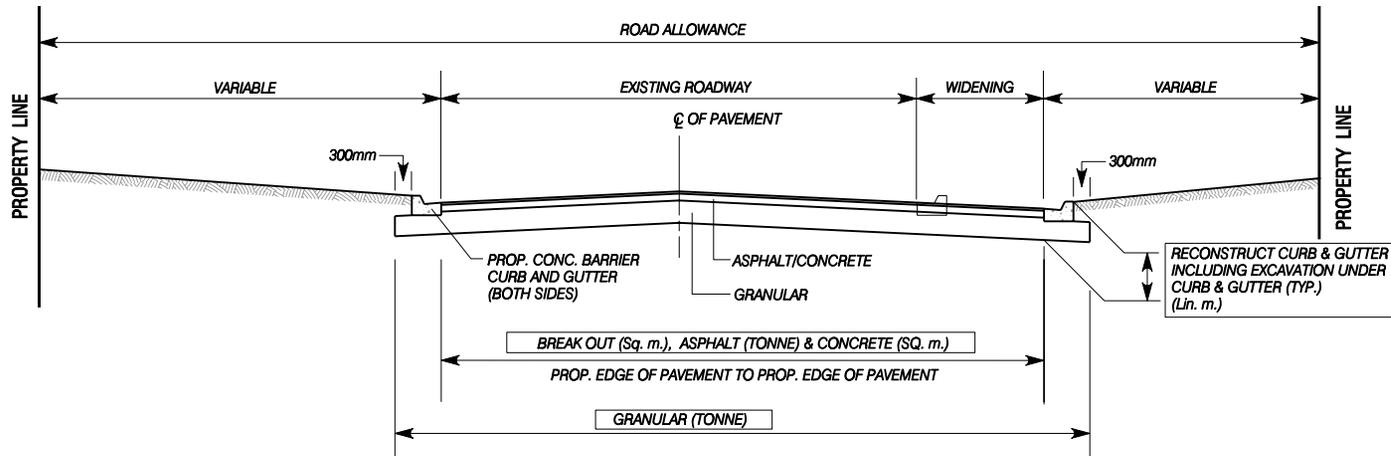
DATE
November 2005

REV No

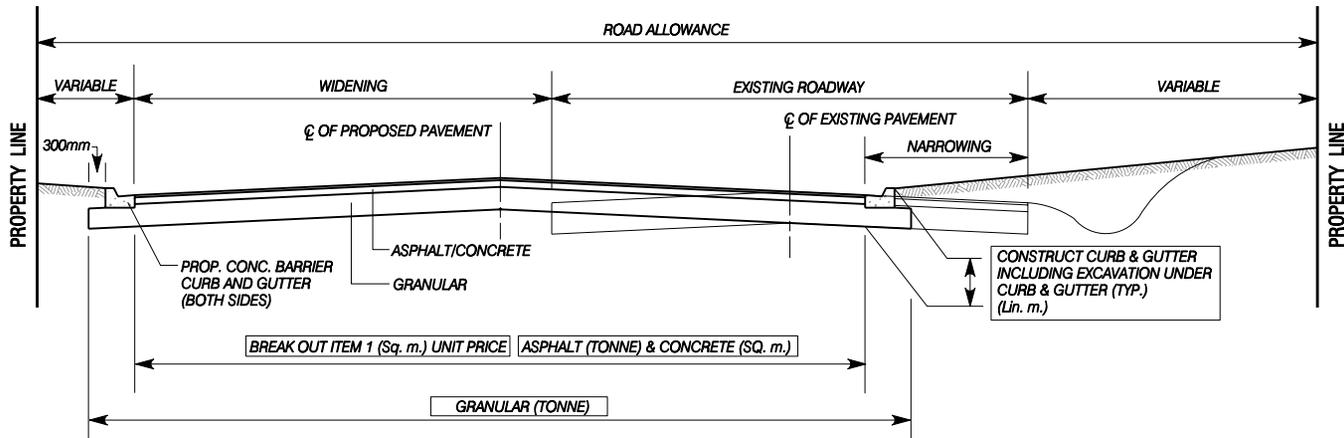
HAMILTON STD No

RD- 119.01

MEASUREMENT FOR PAYMENT (WIDENING)



MEASUREMENT FOR PAYMENT (REALIGNMENT/WIDENING/NARROWING)



City of Hamilton
Public Works Department

**MEASUREMENT FOR PAYMENT DIAGRAM
REALIGNMENT/WIDENING/NARROWING**

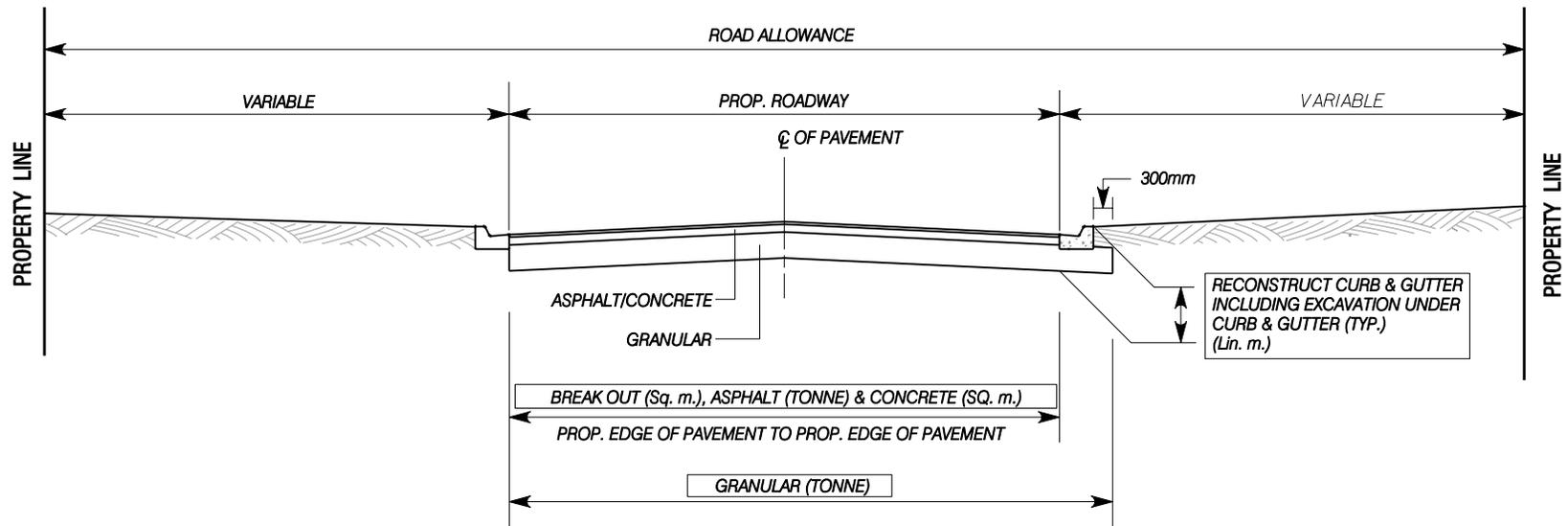
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED

DATE
January 2011

REV No
1

HAMILTON STD No

RD- 119.03



City of Hamilton
Public Works Department

**MEASUREMENT FOR PAYMENT DIAGRAM
ROAD AND INDEPENDENT CURB & GUTTER CONSTRUCTION**

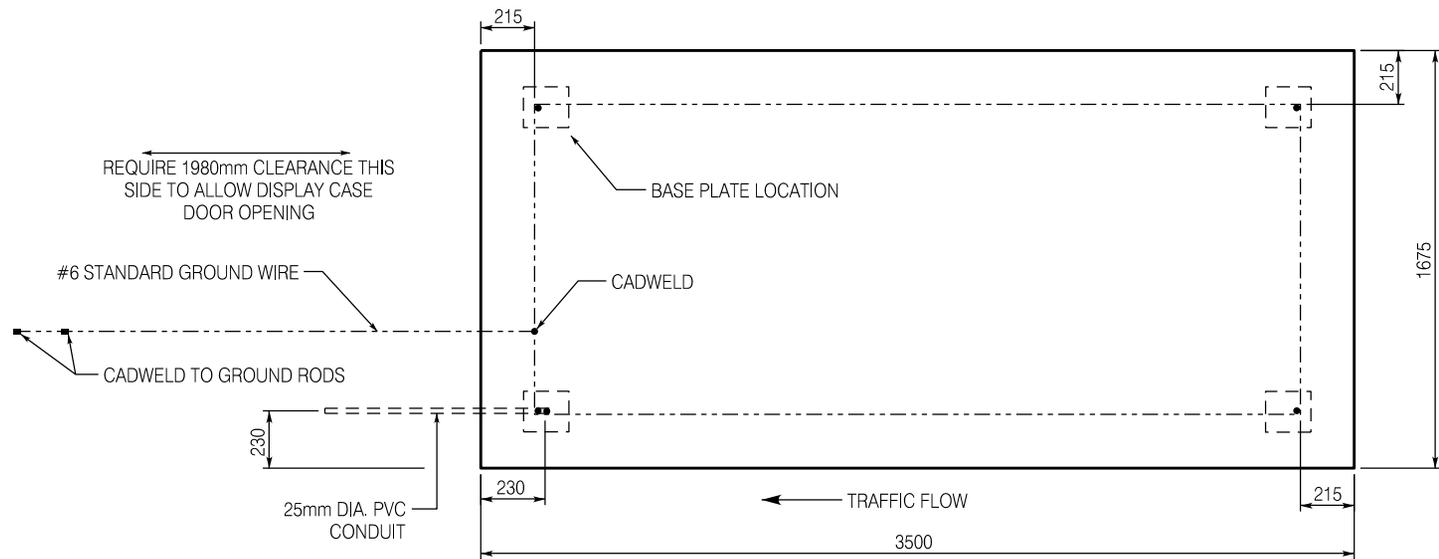
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED

DATE
November 2005

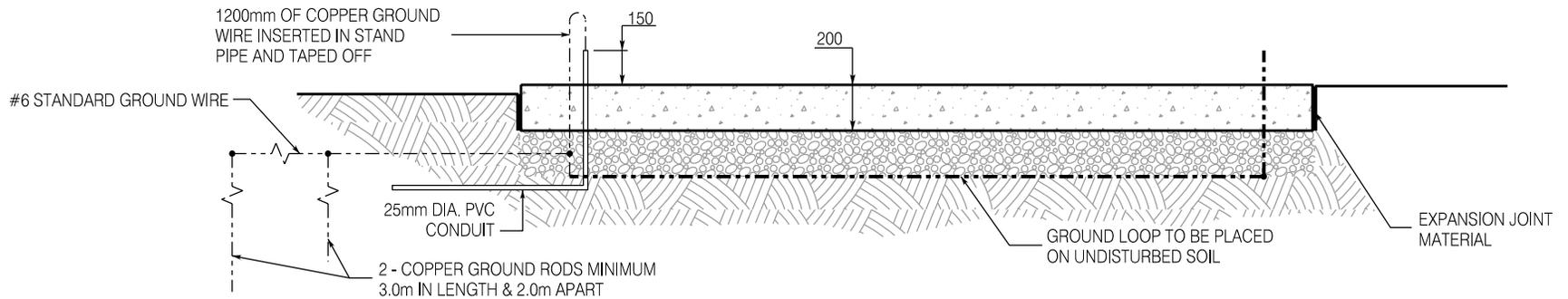
REV No

HAMILTON STD No

RD- 119.04



TRANSIT SHELTER CONCRETE PAD PLAN



SECTION AT CONDUIT

NOTE :

1. SHELTER MUST BE GROUNDED AS PER LOCAL ELECTRICAL CODES
2. CONCRETE PAD TO BE AS PER LOCAL CODES FOR SIDEWALK CONSTRUCTION
3. ALL CONCRETE PADS MUST BE LEVEL
4. CONCRETE SHALL HAVE A MIN. 28 DAY STRENGTH OF 32 MPa.
PAD SURFACE SHALL BE BROOM FINISHED

City of Hamilton
Public Works Department

TYPICAL TRANSIT SHELTER PAD FOR 1.2m X 3.0m SHELTER

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED

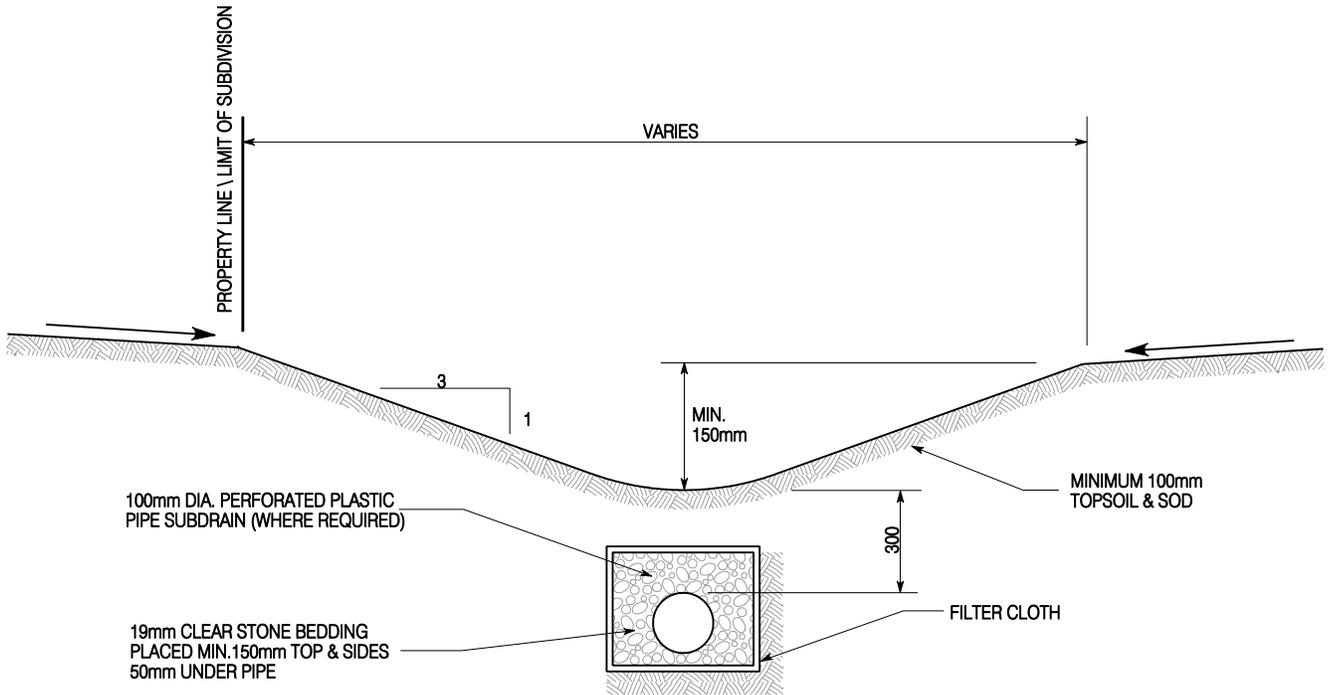
DATE
June 2017

REV No
1

FORMERLY M-012 (HSR)

HAMILTON STD No

RD-120



NOTES:

1. MINIMUM SLOPE ON REAR YARD SWALES TO BE 1.0%.
2. REAR YARD SWALES WITH SLOPES LESS THAN 2.0% TO BE PROVIDED WITH SUB-DRAINS.

City of Hamilton
Public Works Department

TYPICAL REAR YARD SWALE DETAIL

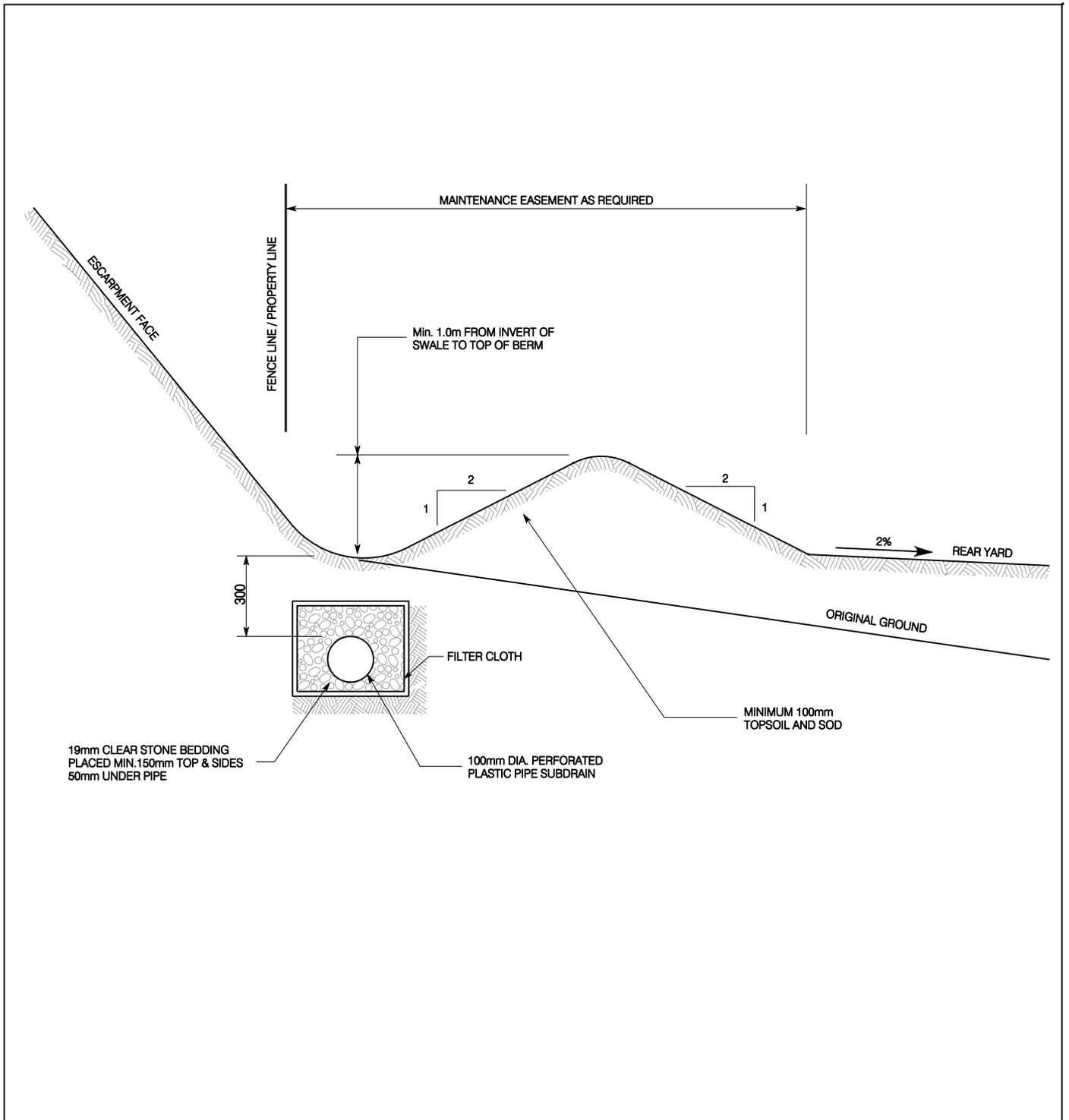
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
November 2005

REV No

HAMILTON STD No

RD-121



NOTES:

1. VEGETATION COVER AND GRADES ON ESCARPMENT FACE ARE NOT TO BE DISTURBED.
2. BERM TO BE CONSTRUCTED FROM IMPERVIOUS, COHESIVE SOIL
3. MINIMUM SLOPE ON SWALE TO BE 1.0%.

City of Hamilton
Public Works Department

TYPICAL TOE OF ESCARPMENT SWALE & BERM DETAIL

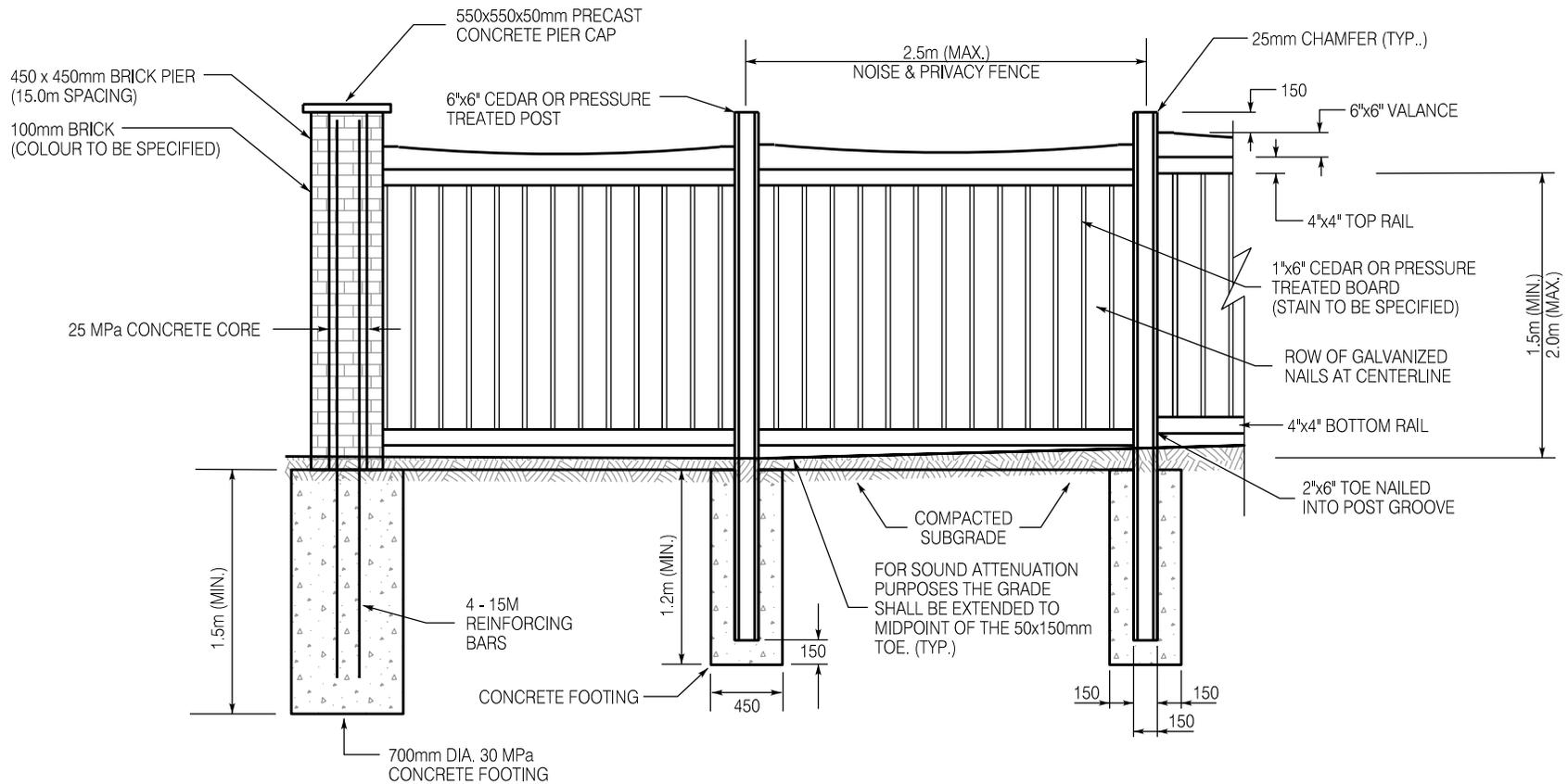
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
November 2005

REV No

HAMILTON STD No

RD-122



NOTES:

1. ALL CONCRETE SHALL BE 32 MPa IN 28 DAYS MINIMUM.
2. ALL SUBGRADE SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY.
3. ALL WOODEN BOARDS TO BE CEDAR OR PRESSURE TREATED.
4. ALL LUMBER TO BE SECURED WITH GALVANIZED NAILS.
5. MASONRY PIERS SHALL BE CONSTRUCTED OF BRICK (100mm IN HEIGHT), COLOUR TO BE SPECIFIED.
6. BRICK PIERS SHALL BE CONSTRUCTED AT 15.0m INTERVALS.
7. ANY EXPOSED TRIM OF LUMBER SHALL BE TREATED WITH END PRESERVATIVE.
8. A MINIMUM DENSITY FOR WOOD OF 19.6 kg/m² IS REQUIRED FOR SOUND ATTENUATION PURPOSES.
9. BRICK COLOUR AND WOOD STAIN TO BE SPECIFIED AND APPROVED BY THE PROJECT MANAGER PRIOR TO CONSTRUCTION.
10. SEE RD-123.02 FOR FENCE DETAILS.

City of Hamilton
Public Works Department

PRIVACY FENCE

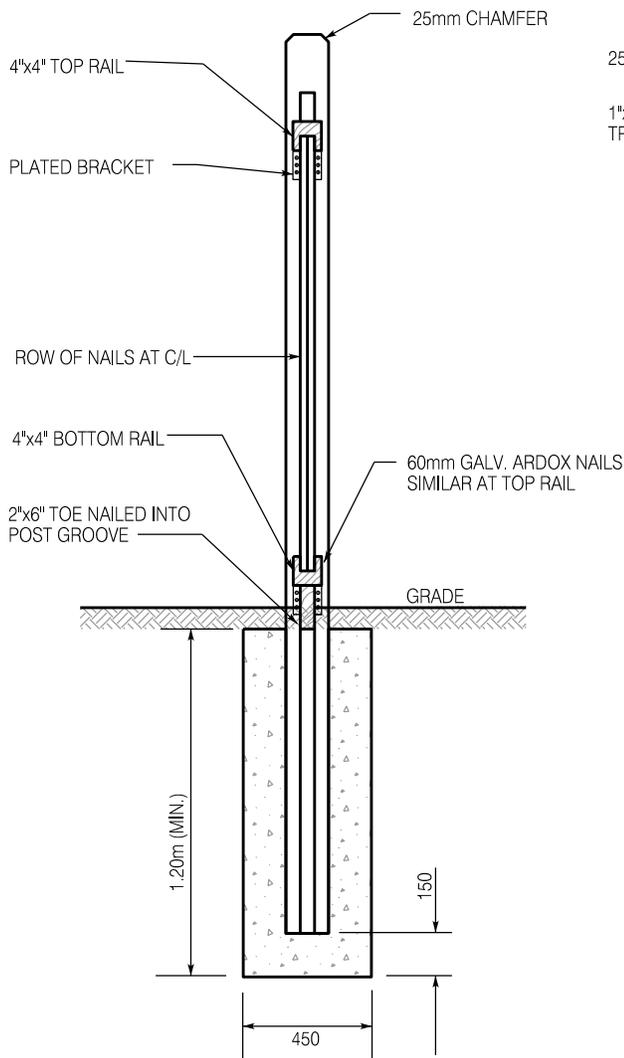
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
June 2017

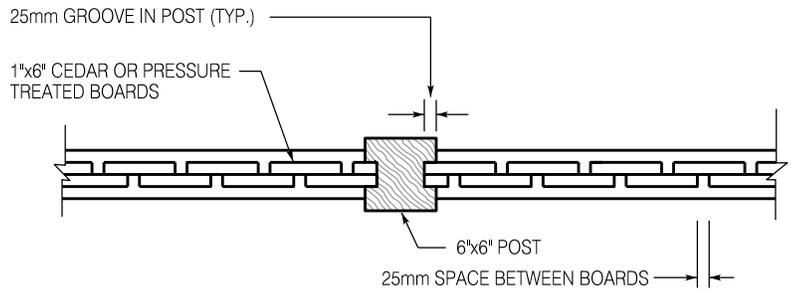
REV No
1

HAMILTON STD No

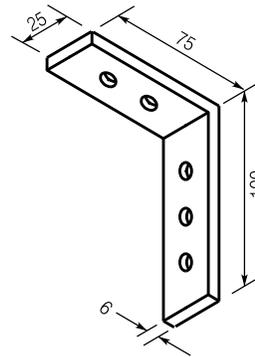
RD-123.01



TYPICAL SECTION



PLAN



PLATED BRACKETS

NOTES:

1. ALL CONCRETE SHALL BE 32 MPa IN 28 DAYS MINIMUM.
2. ALL SUBGRADE SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY.
3. ALL WOODEN BOARDS TO BE CEDAR OR PRESSURE TREATED.
4. ALL LUMBER TO BE SECURED WITH GALVANIZED NAILS.
5. MASONRY PIERS SHALL BE CONSTRUCTED OF BRICK (100mm IN HEIGHT), COLOUR TO BE SPECIFIED.
6. BRICK PIERS SHALL BE CONSTRUCTED AT 15.0m INTERVALS.
7. ANY EXPOSED TRIM OF LUMBER SHALL BE TREATED WITH END PRESERVATIVE.
8. A MINIMUM DENSITY FOR WOOD OF 19.6 kg/m² IS REQUIRED FOR SOUND ATTENUATION PURPOSES.
9. BRICK COLOUR AND WOOD STAIN TO BE SPECIFIED AND APPROVED BY THE PROJECT MANAGER PRIOR TO CONSTRUCTION.
10. SEE RD-123.01 FOR FENCE DETAILS.

City of Hamilton
Public Works Department

PRIVACY FENCE DETAILS

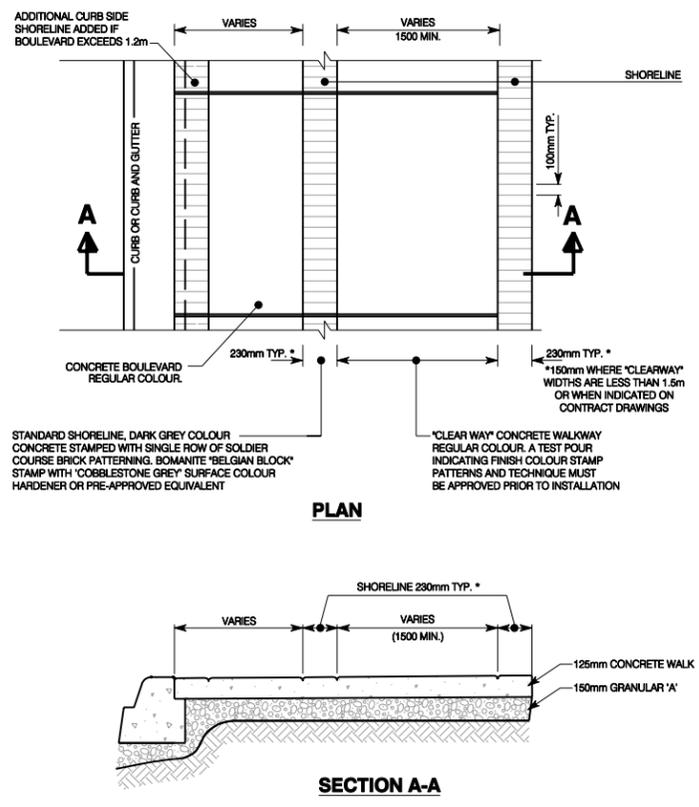
DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
June 2017

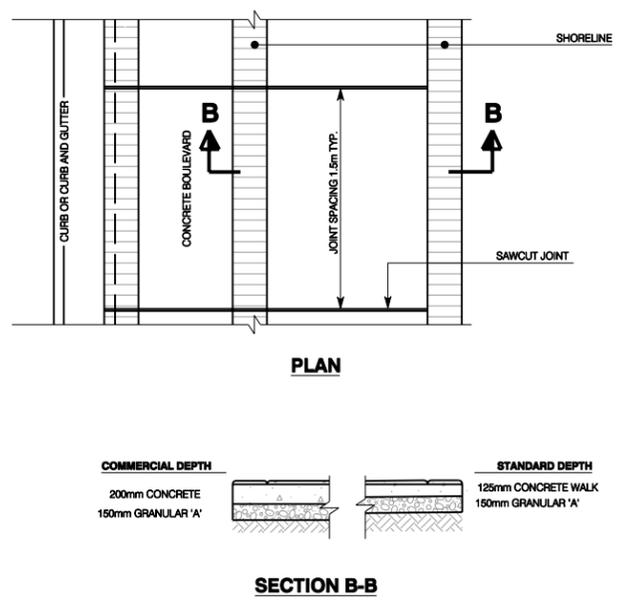
REV No
1

HAMILTON STD No

RD-123.02



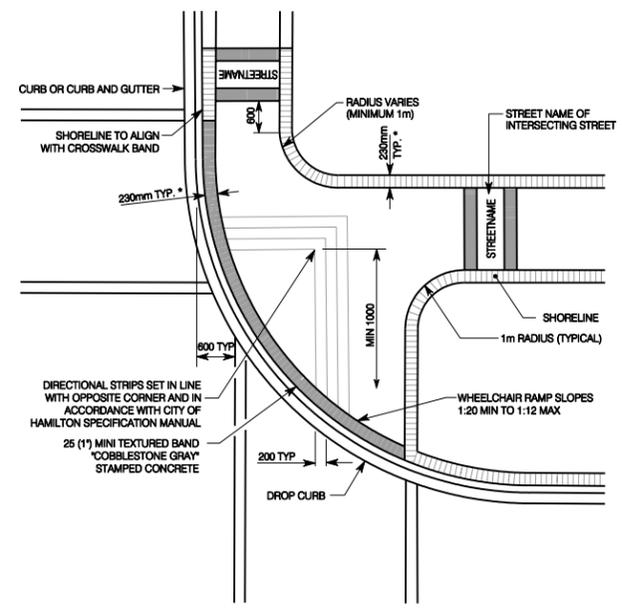
1 SIDEWALK/BOULEVARD - SECTIONS AND DETAILS



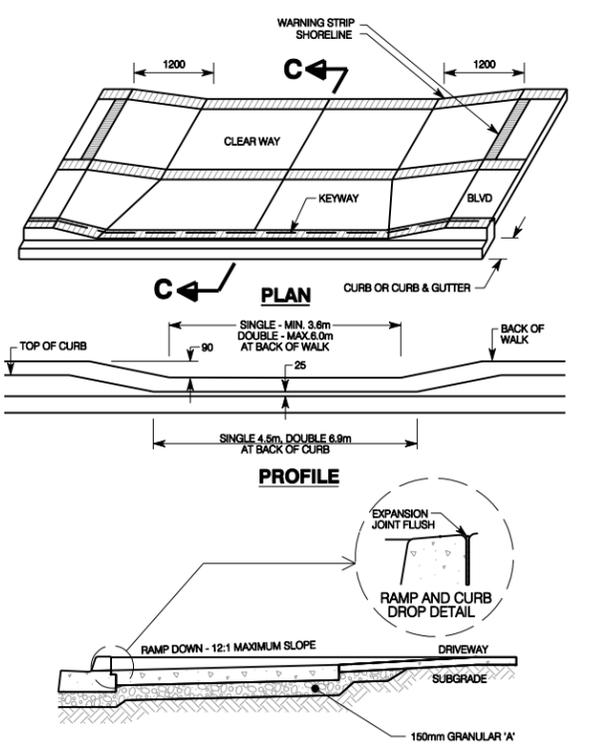
NOTES:

1. FINISH AND COLOUR OF URBAN BRAILLE SIDEWALK AND BOULEVARD SHALL MATCH KING STREET EAST.
2. FINISH, SURFACE COLOUR HARDENER AND STAMP PATTERN ACCORDING TO BOMANITE METHODS AND SPECIFICATIONS OR PRE-APPROVED EQUIVALENT.
3. HIGH PENETRATING ACRYLIC SEALER TO BE APPLIED AFTER APPROVAL OF FINISHED SURFACE.

2 COMMERCIAL AND STANDARD DEPTHS

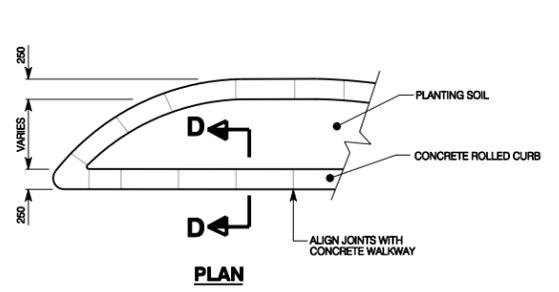


3 RAMP DETAIL AND DIRECTIONAL STRIPS

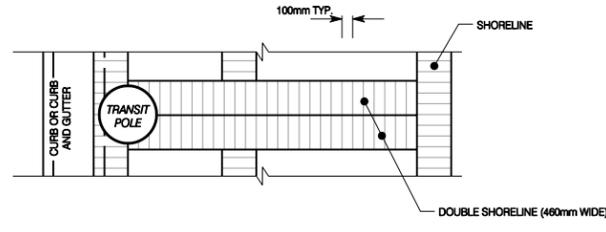


NOTE: APPROACH CURB MAY BE MONOLITHIC POUR, REINFORCE UNDERSIDE AT CURB READ THIS DETAIL TOGETHER WITH DETAILS FOR CONCRETE CURB AND PAVING

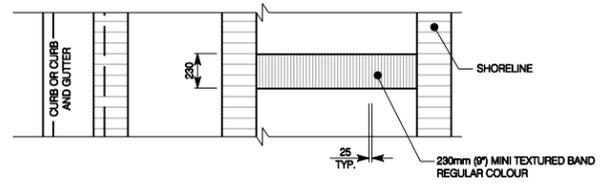
4 APPROACH



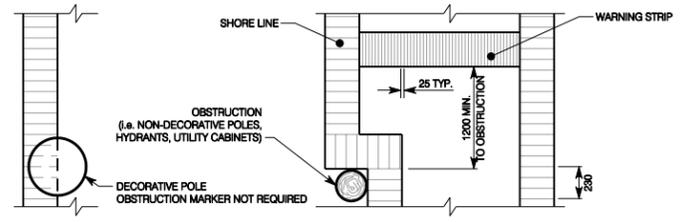
5 ROLL CURB PLANTER



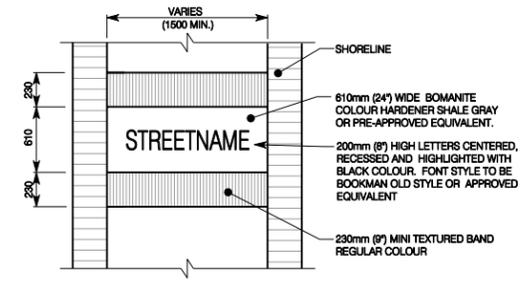
6 TRANSIT STOP TREATMENT



7 WARNING STRIP

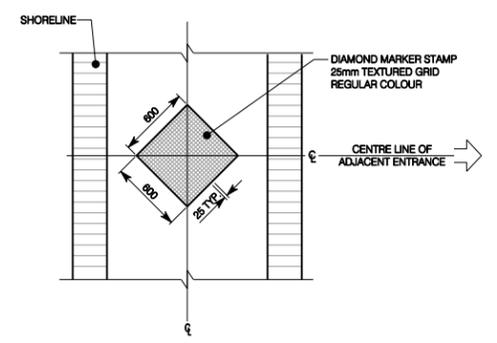


8 OBSTRUCTION MARKER

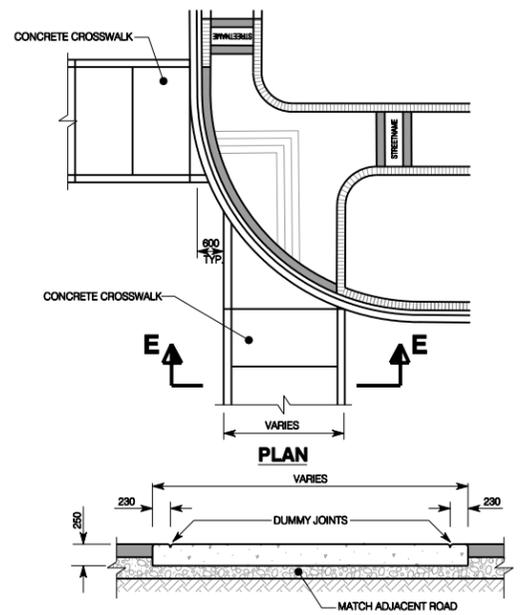


NOTE: STREETNAME SHALL FACE PEDESTRIANS APPROACHING INTERSECTING STREET

9 STREET NAME TABLET



10 ENTRANCE DIAMOND MARKER

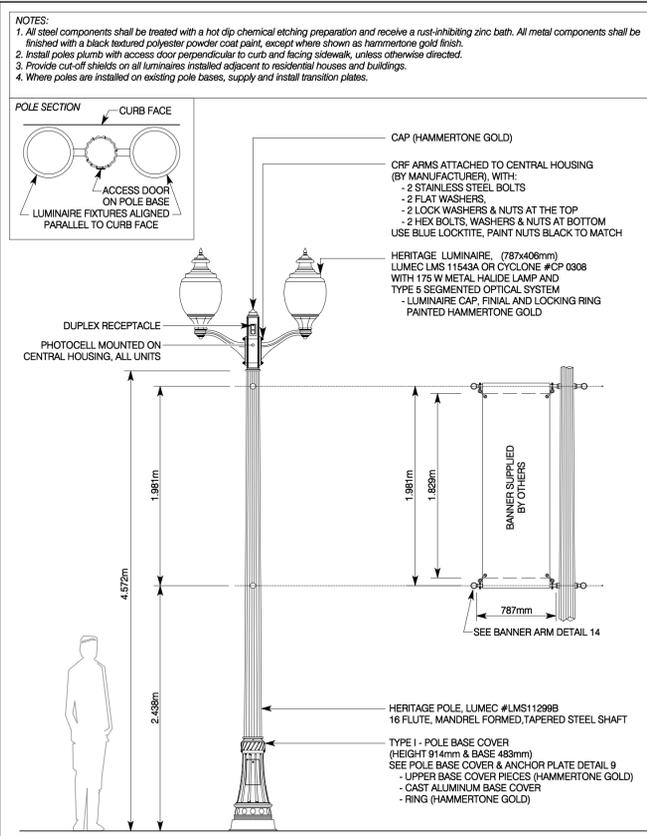


NOTES:

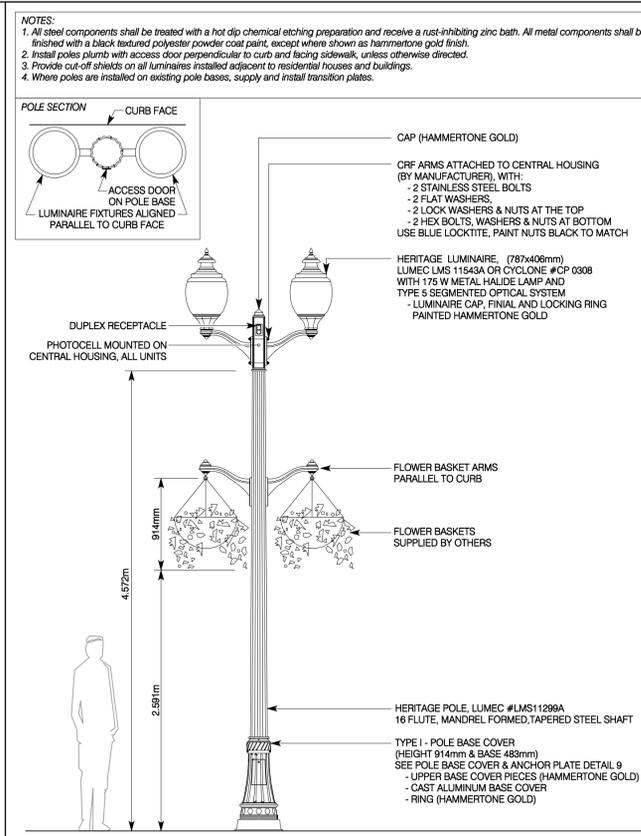
1. PROVIDE CLEAN STRAIGHT EXPANSION JOINTS BETWEEN EXISTING ROAD, STRUCTURES, AND CROSSWALKS AND CAULK WITH APPROVED ELASTIC JOINT SEALANT.
2. EXPANSION JOINTS AT EVERY 3.0m MAX.
3. CONTROL JOINTS AT EVERY 1.5m MAX. FORMED USING PROPER HAND TOOL.

POUR CROSSWALK TO CENTRE OF ROADWAY AND MAINTAIN TRAFFIC AS DIRECTED. KEY CENTRE CONSTRUCTION JOINT AND INSERT 450x20mm DOWELS AT 1.0m O.C.

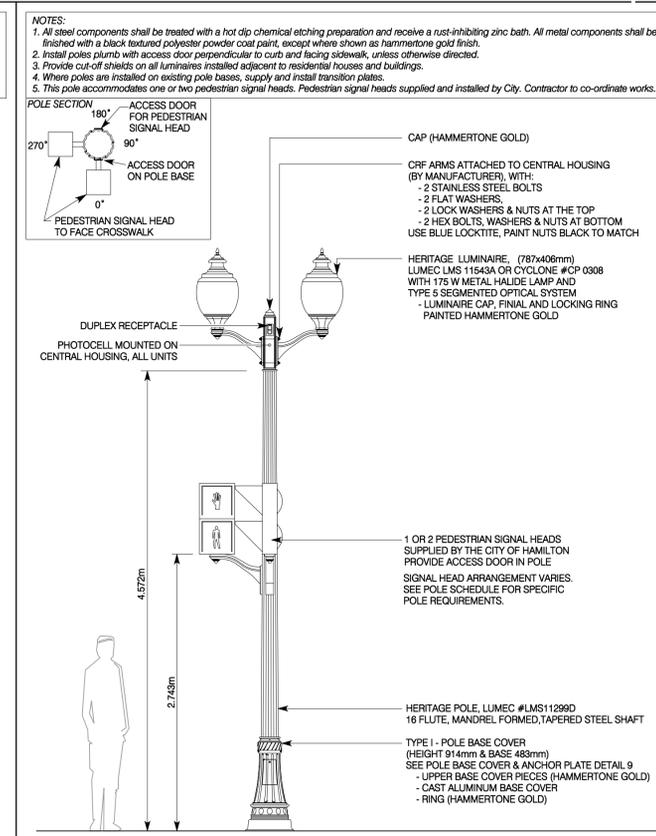
11 CONCRETE CROSSWALK



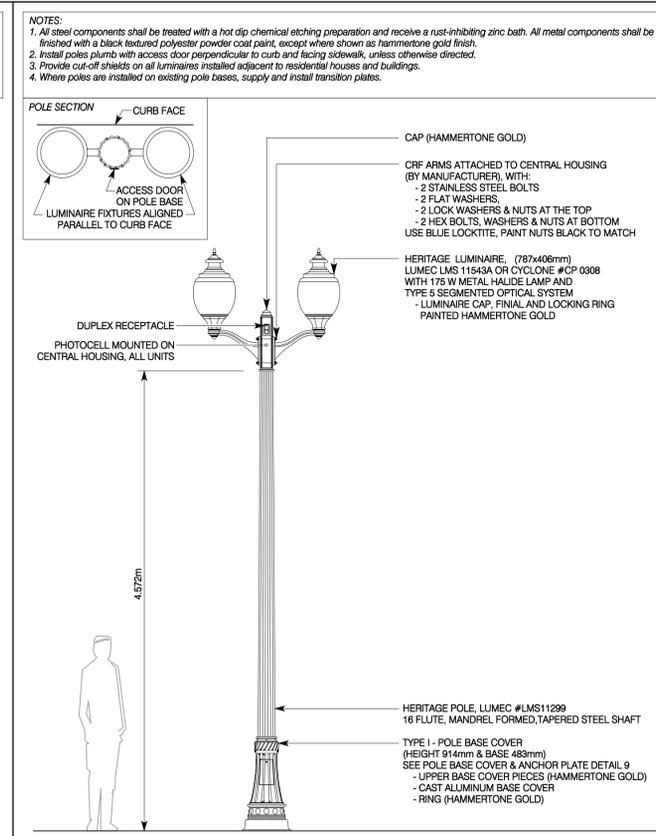
1 HERITAGE POLE - Type HLP-1 (Illumination)



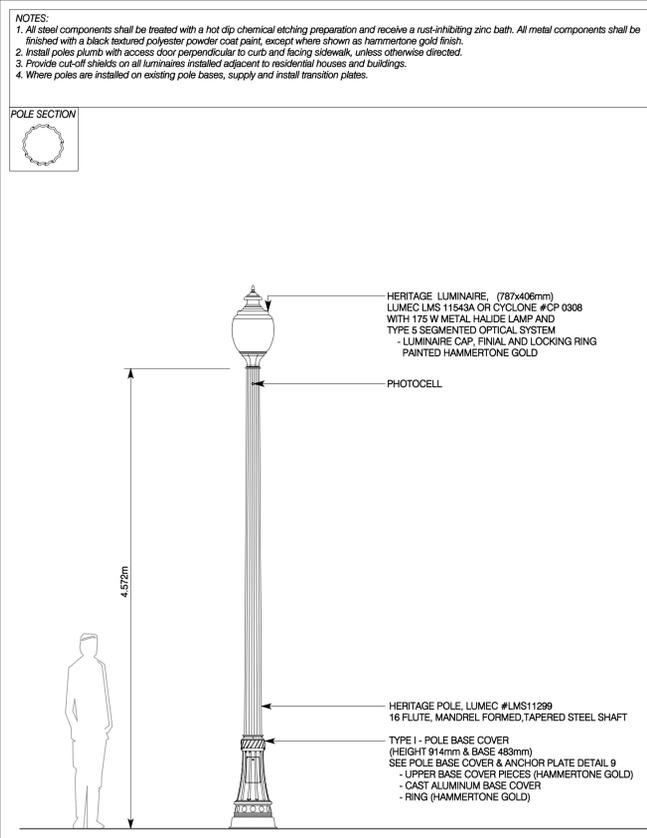
2 HERITAGE POLE - Type HLP-2 (Illumination)



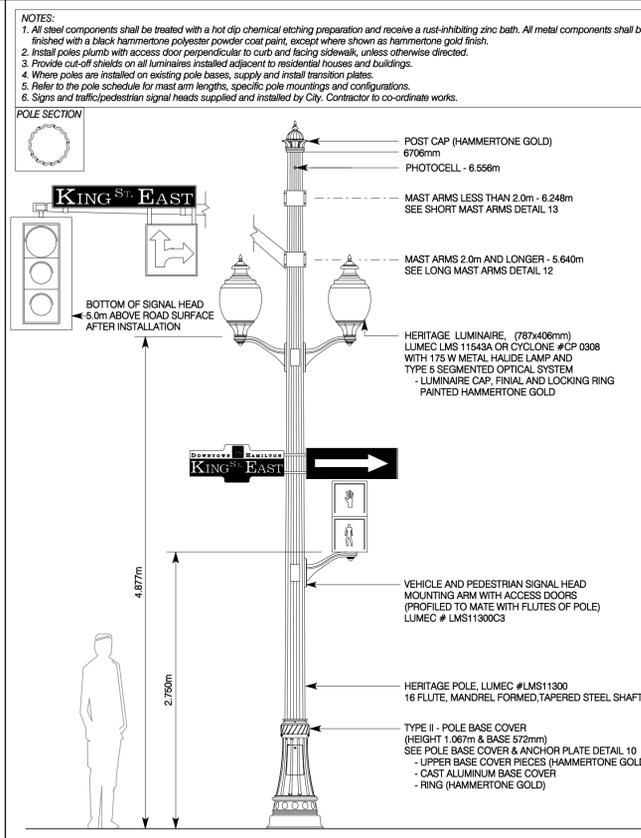
3 HERITAGE POLE - Type HLP-5 (Illumination)



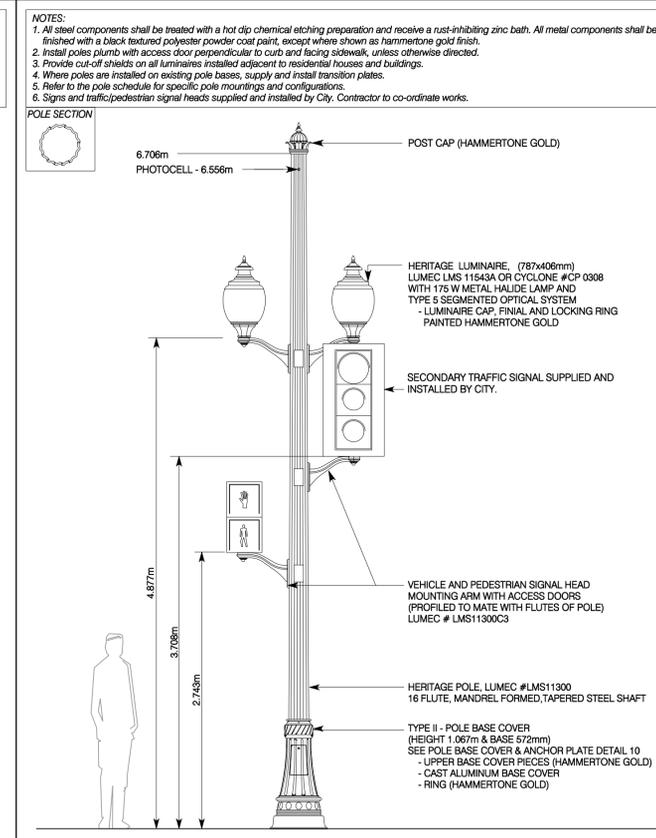
4 HERITAGE POLE - Type HLP-9 (Illumination)



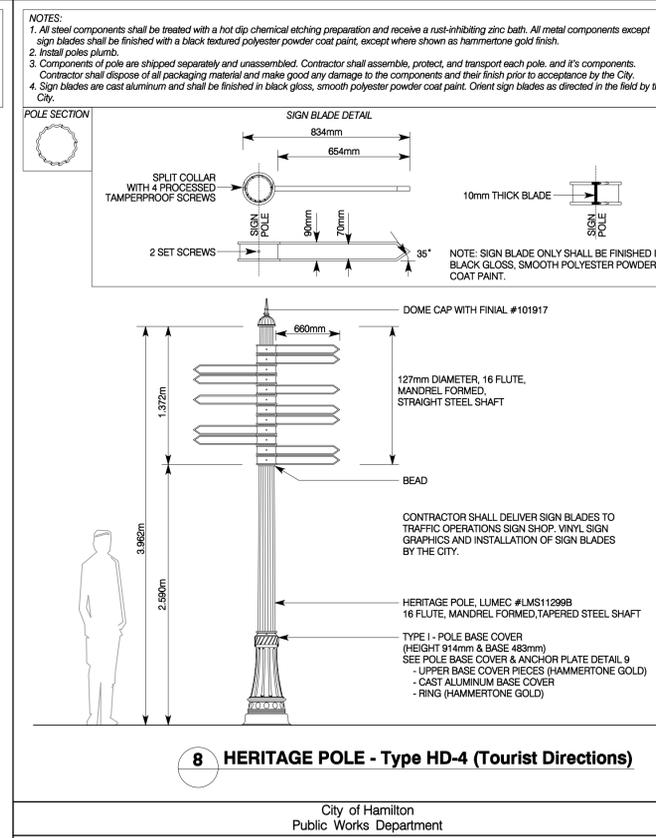
5 HERITAGE POLE - Type HLP-10 (Illumination)



6 HERITAGE POLE - Type HTP-1 (Traffic)

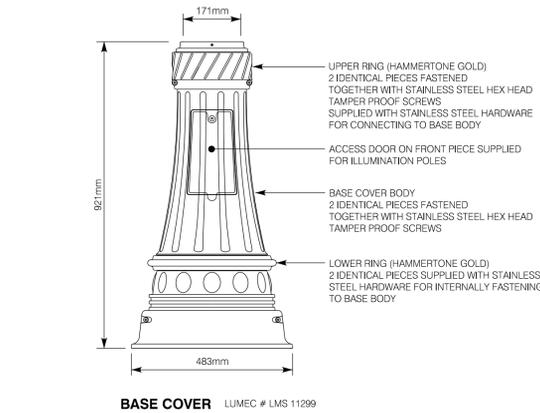


7 HERITAGE POLE - Type HTP-5 (Traffic)

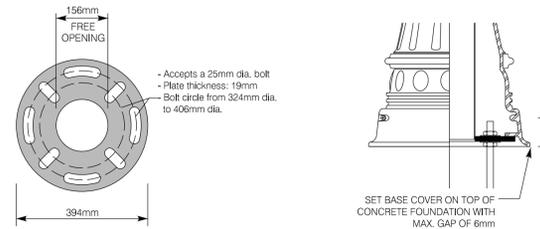


8 HERITAGE POLE - Type HD-4 (Tourist Directions)

NOTES:
1. Fully galvanized anchor bolt sets, supplied by the contractor: 4-25mm x 914mm with 75mm "J-Bend", 8-nuts/flat washers & 4-lock washers
2. Contractor shall cover any field cut bolts with anti-corrosion paint.



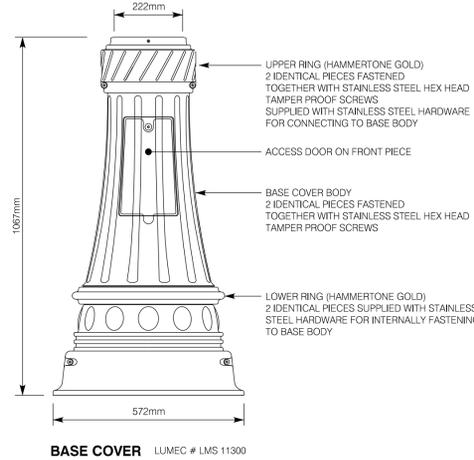
BASE COVER LUMEC # LMS 11299



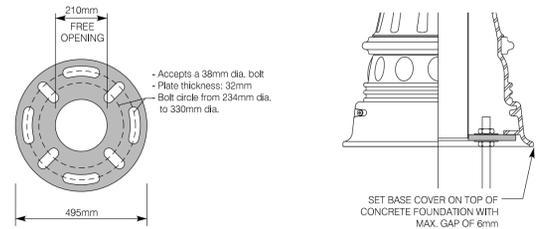
ANCHOR PLATE & BOLTS

9 BASE COVER AND ANCHOR PLATE DETAILS - TYPE I
Heritage Pole - Types HLP-1, HLP-2, HLP-5, HLP-9, HLP-10 & HD-4

NOTES:
1. Fully galvanized anchor bolt sets, supplied by the contractor: 4-38mm x 1549mm with 100mm "J-Bend", 8-nuts/flat washers & 4-lock washers
2. Contractor shall cover any field cut bolts with anti-corrosion paint.



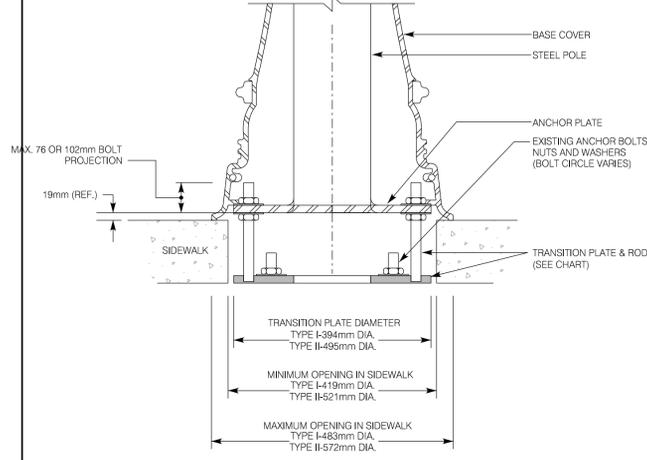
BASE COVER LUMEC # LMS 11300



ANCHOR PLATE & BOLTS

10 BASE COVER AND ANCHOR PLATE DETAILS - TYPE II
Heritage Pole - Types HTP-1 & HTP-5

NOTES:
1. All steel components shall be hot dip galvanized.
2. Plates engineered by the vendor's manufacturer to support the specified wind loads. Vendor responsible for measuring existing anchor bolts to ensure fit.

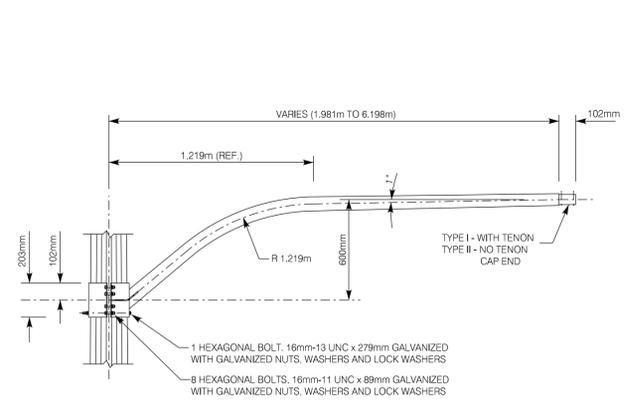
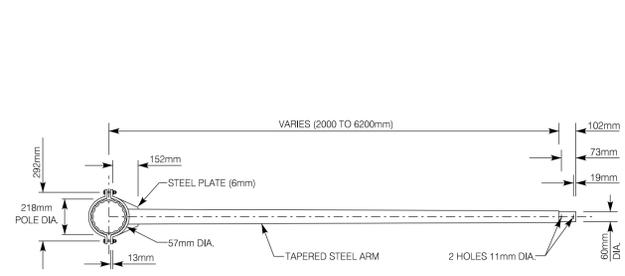


	TRANSITION PLATE (Type I)	TRANSITION PLATE (Type II)
PLATE DIAMETER	394mm	495mm
PLATE THICKNESS	19mm	32mm
ROD DIAMETER	25mm	38mm
ROD LENGTH:		
SHORT	191mm	203mm
MEDIUM	267mm	229mm
LONG	343mm	267mm
ROD BOLT CIRCLE DIAMETER	330mm	406mm

Type I transition plate accepts a bolt circle from 190mm to 330mm
Type II transition plate accepts a bolt circle from 324mm to 406mm

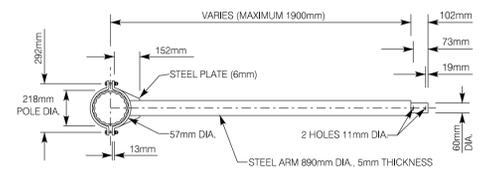
11 TRANSITION PLATES - TYPES I & II
Heritage Pole - Types 1, 2, 3, 4, 5, 6, 7 & 8

NOTES:
1. All steel components shall be treated with a hot dip chemical etching preparation and receive a rust-inhibiting zinc bath. All metal components shall be finished with a black textured hammertone polyester powder coat paint finish, as per the specifications.
2. This drawing shows the general configuration of a mast arm. Refer to the pole schedule for mast arm lengths, pole mountings and orientations.



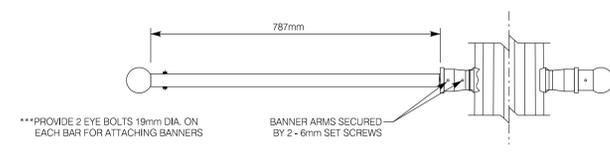
12 LONG MAST ARMS - TYPE I AND II
2.0m and longer

NOTES:
1. All steel components shall be treated with a hot dip chemical etching preparation and receive a rust-inhibiting zinc bath. All metal components shall be finished with a black textured hammertone polyester powder coat paint gold finish, as per the specifications.
2. This drawing shows the general configuration of a mast arm. Refer to the pole schedule for mast arm lengths, pole mountings and orientations.



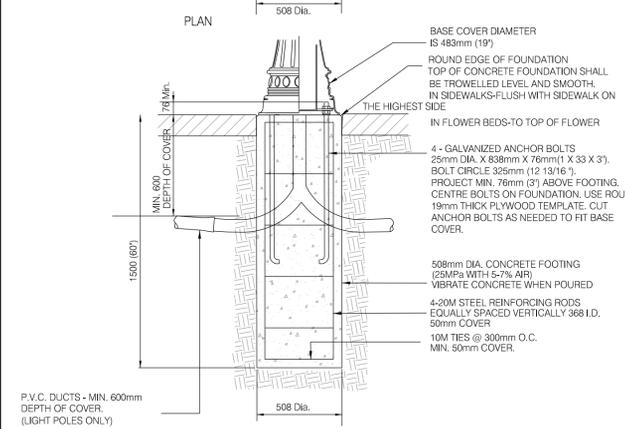
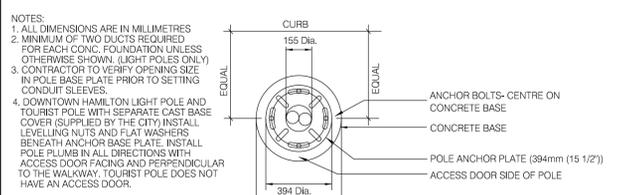
13 SHORT MAST ARMS
Under 2.0m

Arm: Black steel pipe 32mm O.D. by 4mm thick.
Banner Arm Fitter: Black steel pipe 33mm O.D. by 3mm thick, inserted through pole via threaded two opposite 35mm holes. Ends of pipe are threaded for mechanically assembled central tubing to easily slip-fit banner arms.
Adaptor: Cast aluminum designed to fit fluted poles.
Hardware: Stainless steel.
Finish: Decorative end of arm cast aluminum ball 63mm dia. with set screws.
Finish: Electrostatically applied thermoset polyester powder-coat with the XL4 four part corrosion inhibiting process.



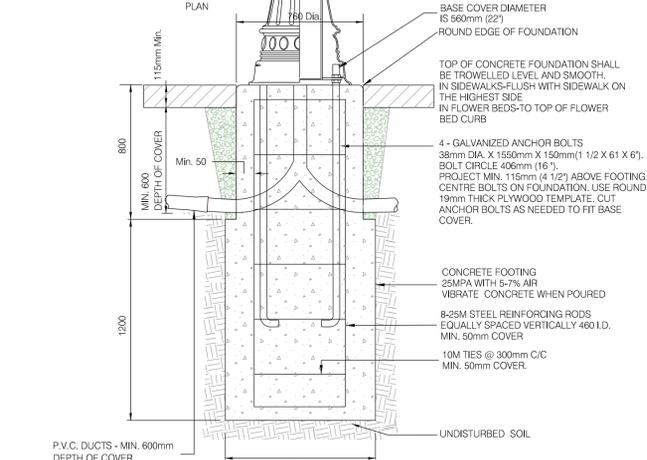
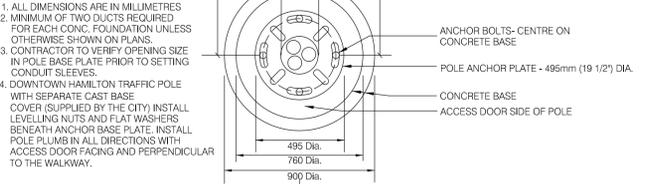
14 BANNER ARM DETAIL
Heritage Pole - Type 1

INSTALL BASE CASTING WITH CITY OF HAMILTON CREST FACING THE WALKWAY, UNLESS DIRECTED OTHERWISE.

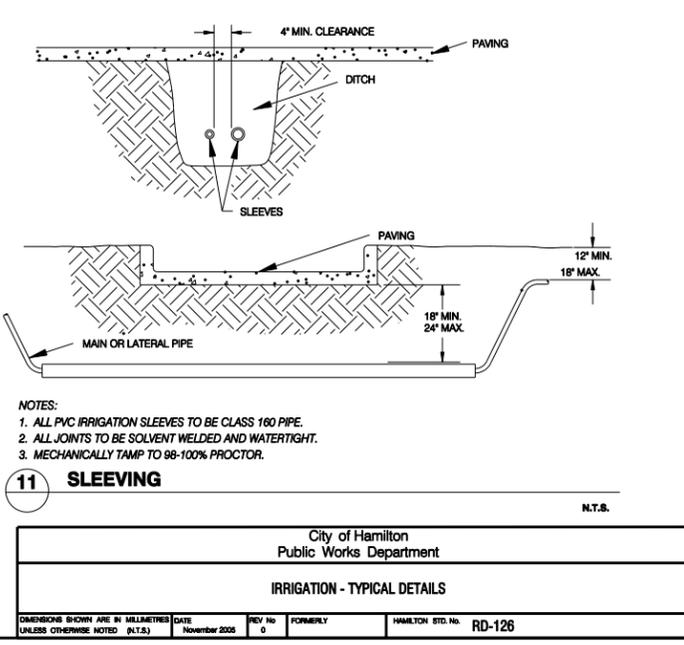
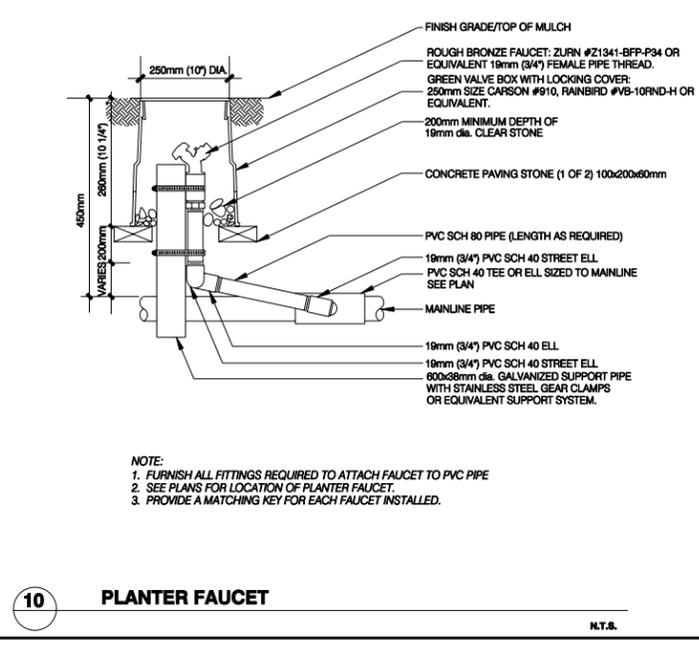
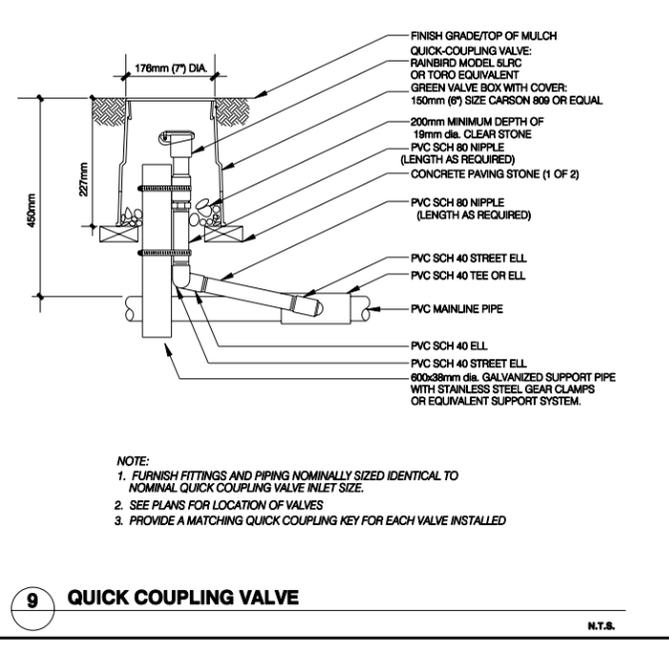
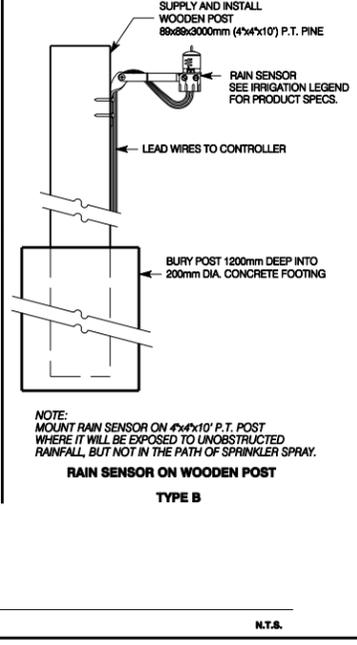
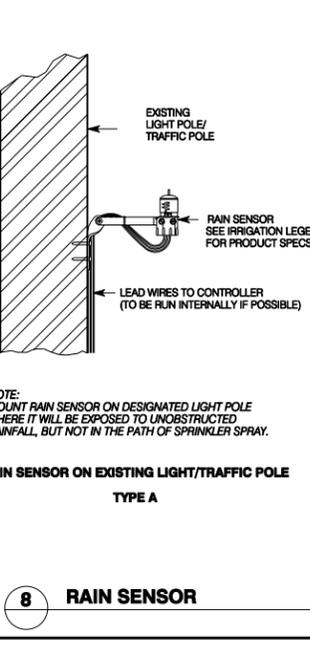
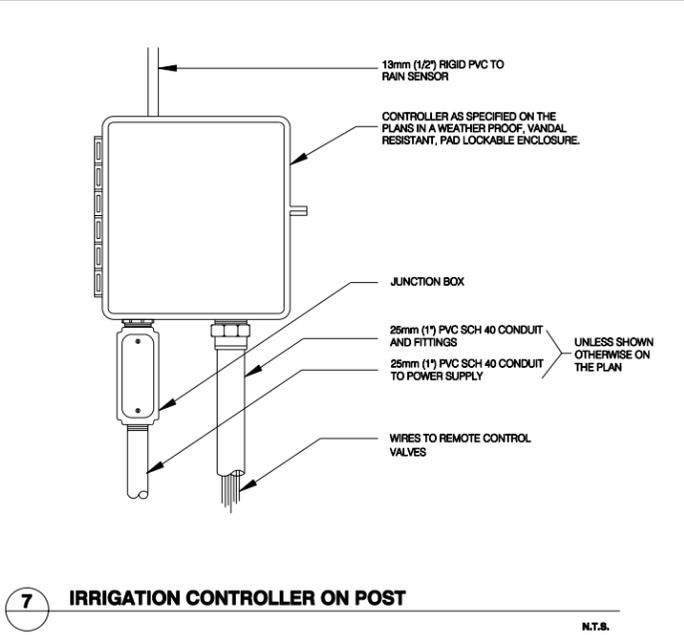
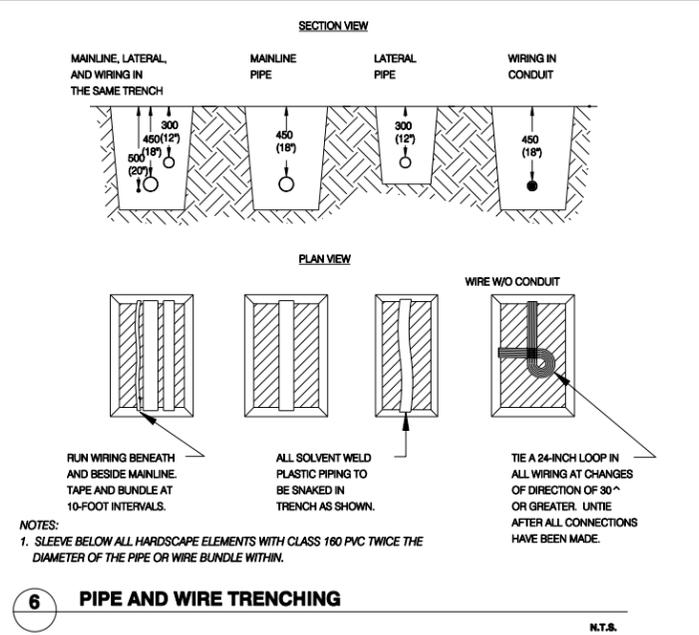
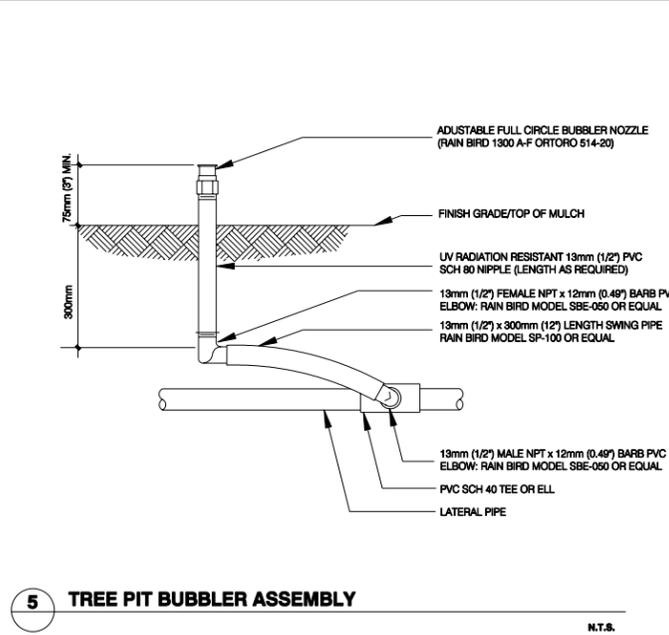
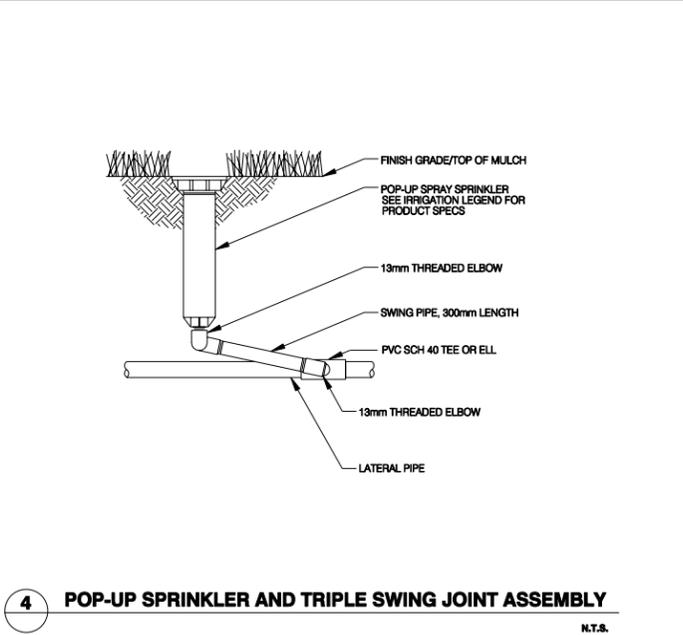
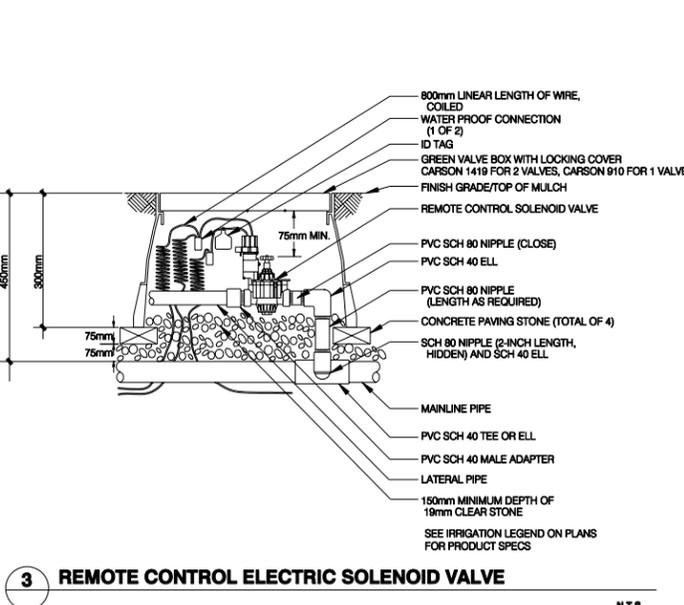
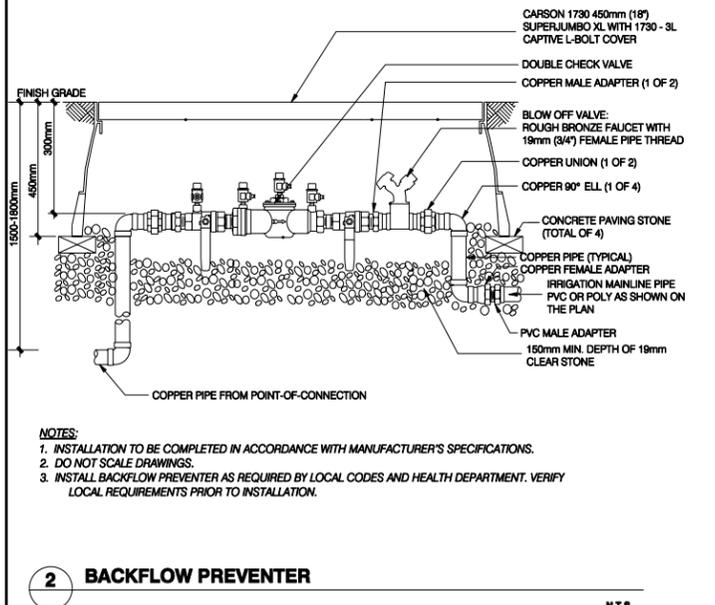
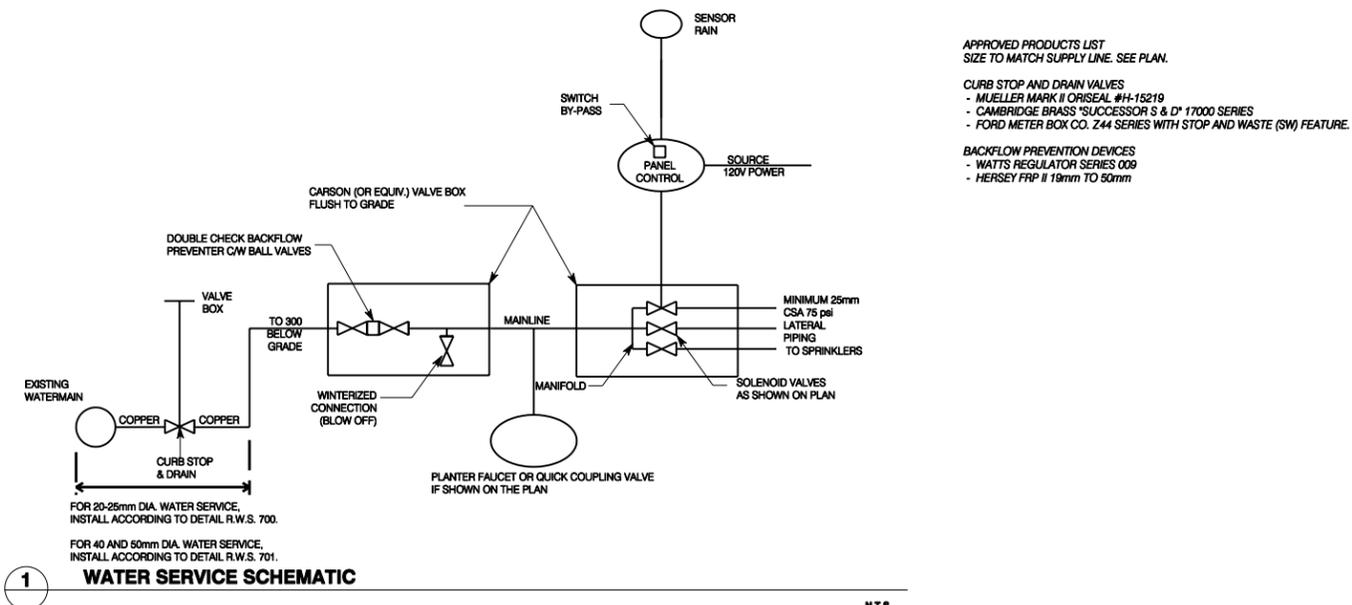


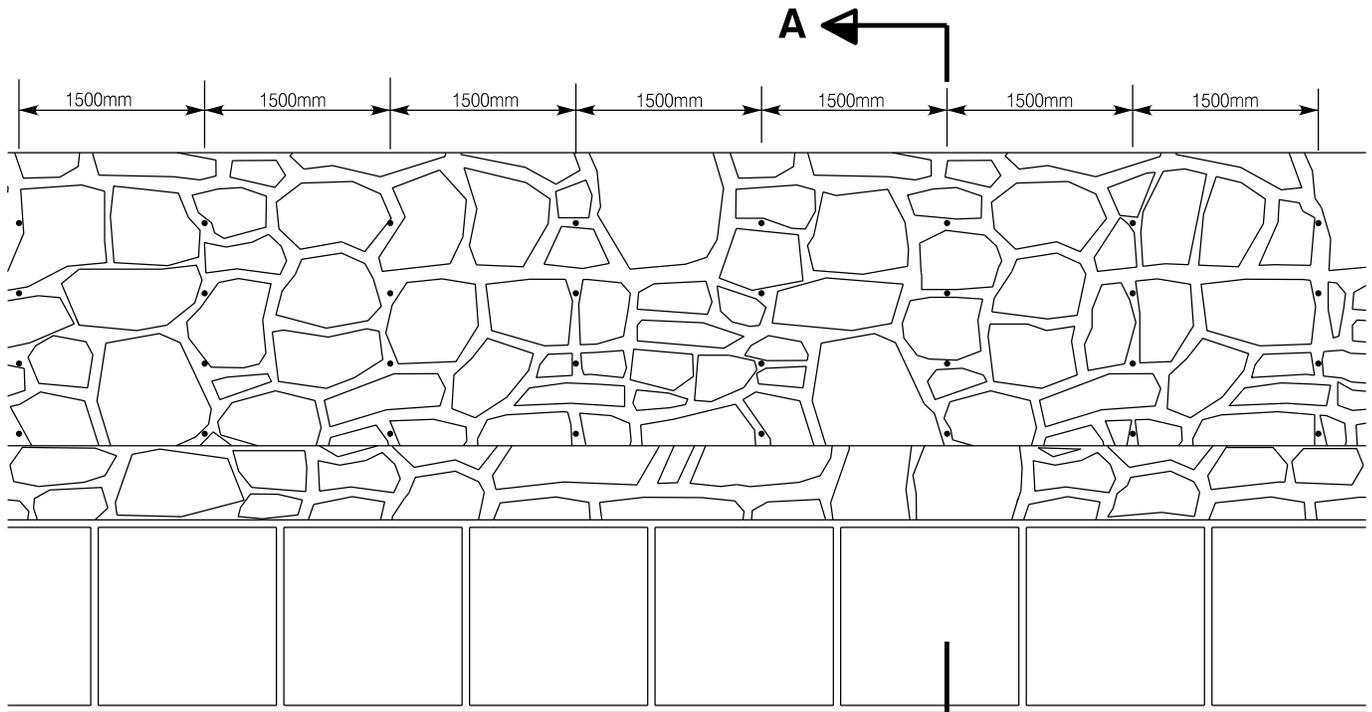
15 HERITAGE LIGHT/TOURIST SIGN POLE BASE - TYPE I

INSTALL BASE CASTING WITH CITY OF HAMILTON CREST FACING THE WALKWAY UNLESS DIRECTED OTHERWISE.



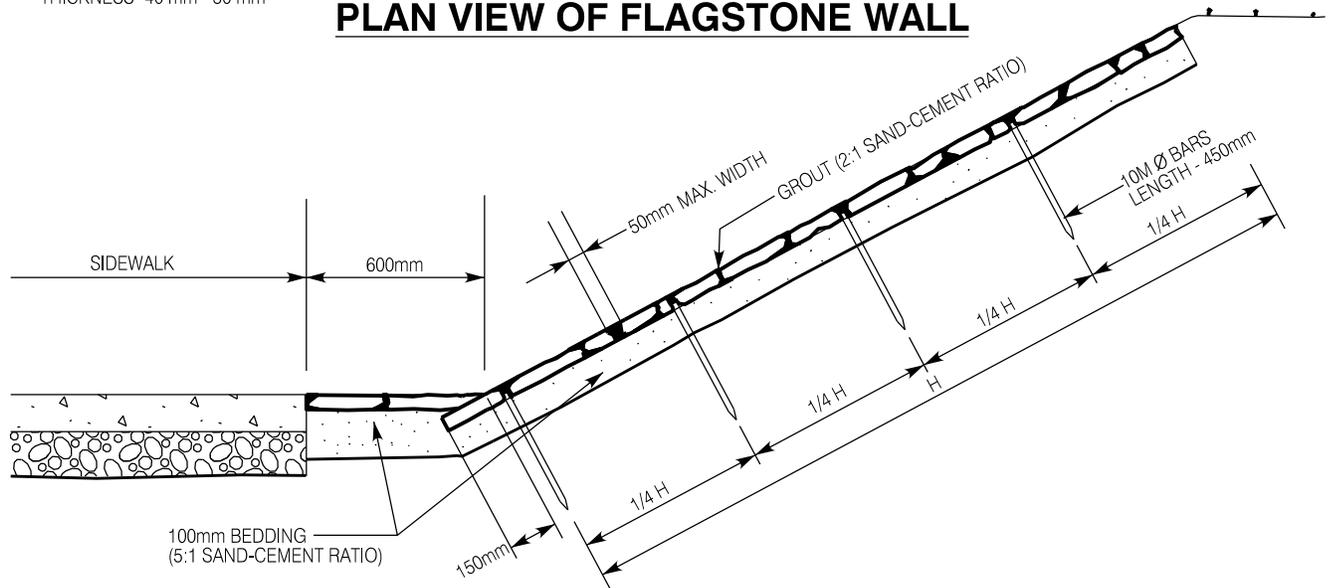
16 HERITAGE TRAFFIC POLE BASE - TYPE II





STONE
MIN SIZE- 120 SQ. cm
THICKNESS- 40 mm - 50 mm

PLAN VIEW OF FLAGSTONE WALL



SECTION A-A

- A GROUTED RIP RAP
BEFORE APPLYING MORTAR, THE SUFACE OF THE STONE SHALL BE AMPLY WETTED. THE SPACES BETWEEN THE STONES SHALL BE FILLED WITH CEMENT MORTAR COMPOSED OF 1 PART PORTLAND CEMENT AND 2 PARTS FINE AGGREGATE AND SHALL BE OF SUCH CONSISTENCY THAT IT CAN BE PLACED WITH A MASONS TROWEL. EXCESS MORTAR SHALL BE REMOVED WITH A STIFF BRUSH. GROUTED RIP RAP SHALL BE CURED IN ACCORDANCE WITH THE CURING REQUIREMENTS FOR CONCRETE.
- B RATIO SAND - CEMENT FOR STONE BASE 5:1.
RATIO SAND - CEMENT FOR GROUT 2:1.

City of Hamilton
Public Works Department

TYPICAL CONSTRUCTION OF FLAGSTONE WALL ON SLOPE

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
June 2017

REV No

FORMERLY: RHS-1500

HAMILTON STD No

RD-127

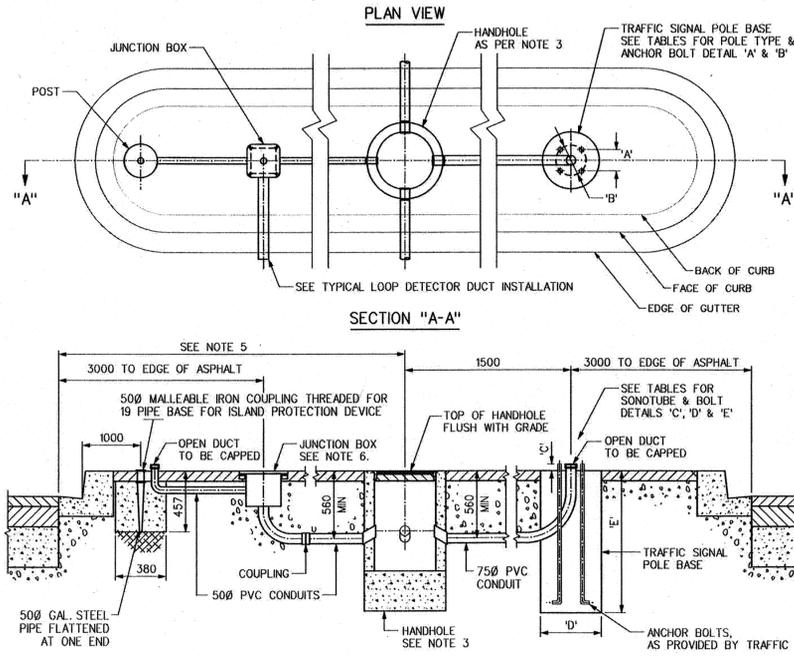
POLE TYPE & ANCHOR BOLT TABLES

ALUMINUM SIGNAL UTILITY POLES		
POLE SIZE	POLE No.	BASE TYPE
SU4.6T	TP-6415-AB	1
SU5.8T	TP-8619-AB	2
SU5.8T HEAVY DUTY	TP-10819H-AB	3

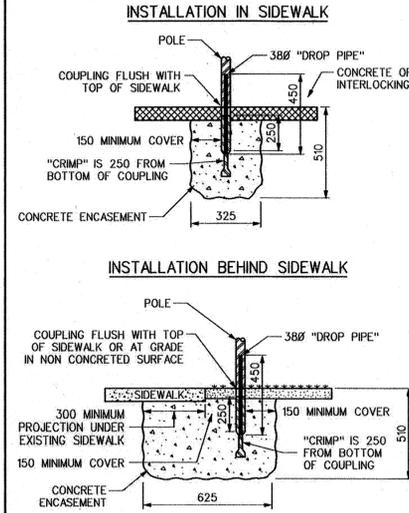
DIMENSION	TABLE OF ANCHOR BASE DETAILS		
	BASE TYPE 1	BASE TYPE 2	BASE TYPE 3
'A' BOLT SPACING (6 3/4")	171 (6 3/4")	206 (6 3/4")	287 (11 3/8")
'B' BOLT CENTRE DIAMETER	241 (9 1/2")	292 (11 1/2")	406 (16")
'C' BOLT PROJECTION	100	100	100
'D' SONOTUBE DIAMETER	450	760	760
'E' SONOTUBE DEPTH	1200	1200	1200
ANCHOR BOLT SIZE	19 x 610 (3/4" x 24")	25 x 762 (1" x 30")	32 x 1219 (1 1/4" x 48")

* ABOVE FINISHED GRADE

TYPICAL INSTALLATION IN TRAFFIC ISLAND



500 ROUND POLE & INSERT



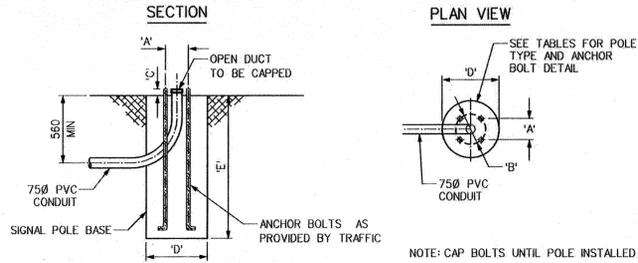
STANDARD PRACTICES, UNLESS NOTED

DIMENSIONS WITH DECIMAL PLACES ARE METRES, DIMENSIONS IN WHOLE NUMBERS ARE MILLIMETRES, UNLESS NOTED

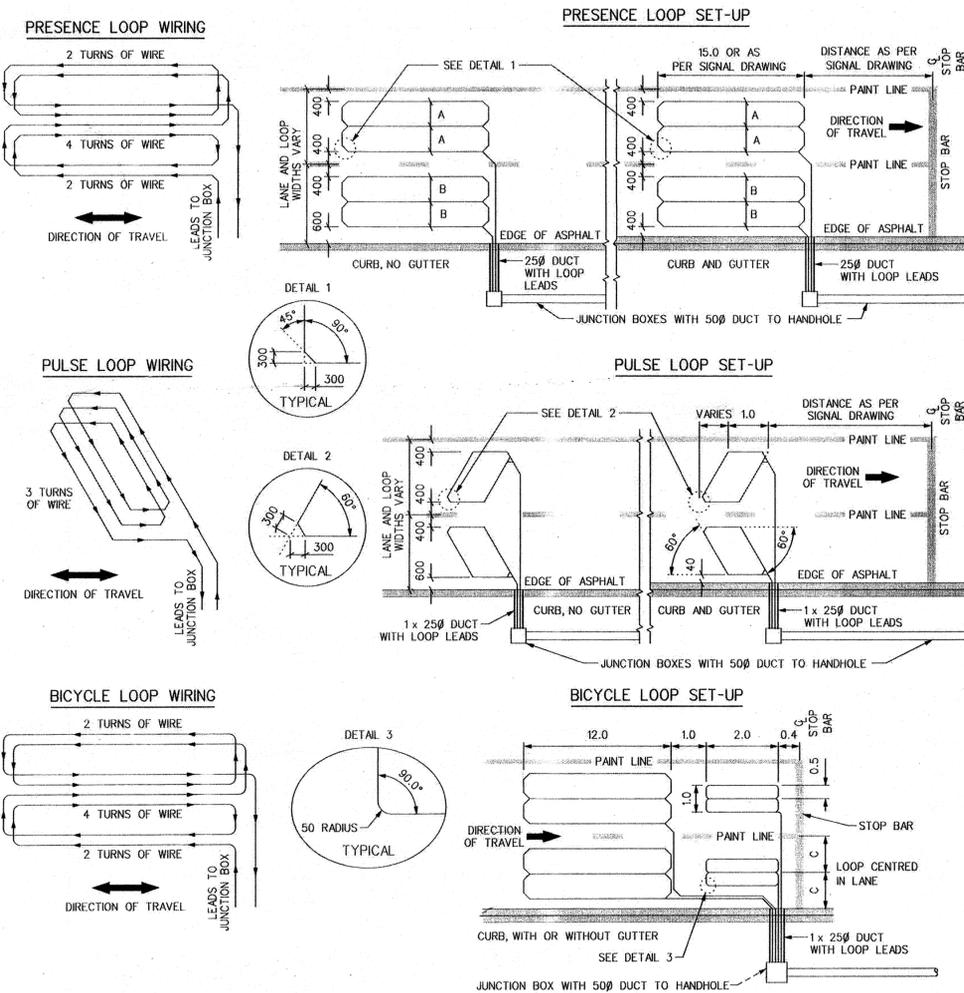
NOTES

- SEE DRAWING DT-0111-02, TYPICAL INSTALLATION OF GROUNDING & BONDING FOR TRAFFIC CONTROL DEVICES
- 1a). PVC DUCT & FITTINGS ARE TO BE HEAVY DUTY, NEMA STANDARD TC-2 SCHEDULE 80 OR EQUIVALENT, CSA APPROVED. NO CONCRETE ENCASUREMENT.
- 1b). 600 MINIMUM RADIUS ON ALL 500 AND 750 PVC CONDUIT, 90 DEGREE BEND.
- 1c). ALL JOINTS FOR PVC DUCT TO BE CEMENTED USING IPEX 100 CONDUIT SOLVENT CEMENT, PRODUCT CODE 074717.
- 1d). NYLON CORD "FISH" SHALL BE PULLED INTO ALL INSTALLED DUCTS, HANDHOLE TO HANDHOLE TO ALLOW FOR CONFIRMATION OF DUCT INTEGRITY AND TO REMAIN FOR CABLE INSTALLATION. ALL DUCT OPENINGS SHALL BE CAPPED TO ALLOW FOR CABLE INSTALLATION.
- 2. MINIMUM DIMENSION FACE OF CURB TO FACE OF POLE IS TO BE 230.
- 3. ALL NEW HANDHOLES ARE TO BE POLYMER RECTANGULAR HANDHOLES TO MEET OPSD 2113.010, TYPE 2-MEDIUM. RECTANGULAR HANDHOLES SHALL HAVE A CONCRETE COLLAR TO MEET OPSD 2112.02 UNLESS OTHERWISE SPECIFIED. WHERE ROUND HANDHOLES, COVERS AND FRAMES ARE SPECIFIED THEY ARE TO MEET OPSD 2112.02 UNLESS OTHERWISE SPECIFIED.
- 4. CONCRETE FOR ALL TRAFFIC WORK TO BE CLASS 'A' CONCRETE AS PER RHW FORM 1200.
- 5. ISLAND PROTECTION DEVICE, JUNCTION BOXES AND 500 CONDUIT IN ISLAND TO BE INSTALLED AS PER CONSTRUCTION DRAWING.
- 6. JUNCTION BOXES TO BE FLANGED WITH COVER, H-10 HIGHWAY LOADING FIBRE REINFORCED PVC - 205 x 205 x 185 (8" x 8" x 7 1/4"). JUNCTION BOXES SHALL BE DRILLED TO MATCH DUCT CONNECTIONS SHOWN ON DRAWING.
- 7a). LOOP WIRE SHALL BE RWU-90 "X-LINK" #14 STRANDED BLACK WIRE, AND SHALL BE SUPPLIED BY THE VENDOR. WIRE SHALL BE INSTALLED BY LAYING IN THE BOTTOM OF THE CUT AND CLEANED SLOT. WIRE SHALL BE CONTINUOUS, LOOPED AROUND THE SLOT IN THE NUMBER OF TURNS INDICATED ON THIS DRAWING. WIRES SHALL BE EXTENDED CONTINUOUSLY TO THE BACK OF CURB. SUFFICIENT LENGTH OF WIRE SHALL BE COILED AND STORED AT THE BACK OF CURB TO ALLOW FOR CONNECTION TO ELECTRICAL EQUIPMENT, AS DETAILED BY TRAFFIC OPERATIONS. NO ELECTRICAL CONNECTIONS ARE REQUIRED OF THE CONTRACTOR.
- 7b). LOOP SEALANT SHALL BE INSTALLED AFTER WIRE INSTALLATION. SEALANT SHALL BE CHEMQUE CANADA LTD. Q-SEAL 290-S, DETECTOR LOOP SEALANT, OR EQUIVALENT AS APPROVED BY TRAFFIC OPERATIONS. LOOP SEALANT SHALL BE PROVIDED BY THE CONTRACTOR. LOOP SEALANT SHALL BE AS PER CHEMQUE PRODUCT BULLETIN, AND SHALL BE FILLED TO TOP OF ROAD SURFACE. CONTRACTOR SHALL BE RESPONSIBLE TO CONDUCT INSTALLATION OF LOOP SEALANT IN A MANNER THAT PREVENTS TRACKING.
- 7c). TRAFFIC OPERATIONS SHALL VERIFY THE CONDUCTIVE INTEGRITY OF THE WIRE INSTALLED AFTER WIRE INSTALLATION IS COMPLETE AND LOOP SEALANT IS CURED. NO PAYMENT SHALL BE MADE FOR EITHER SLOT CUTTING OR WIRE INSTALLATION/SEALING IN CASES WHERE WIRE IS FOUND TO BE NON-CONDUCTIVE.

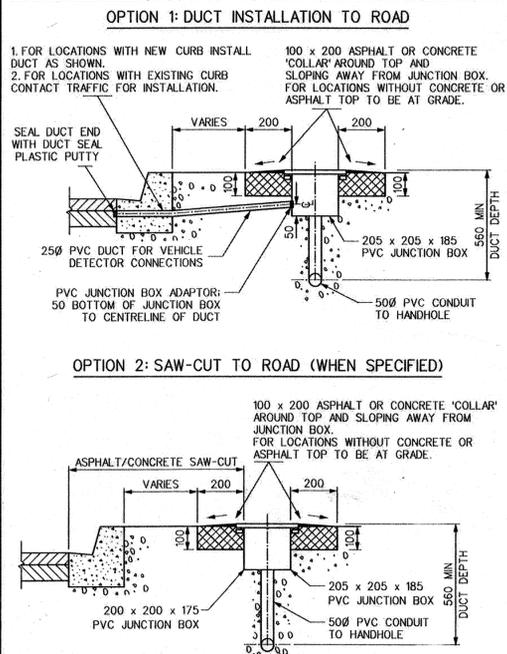
ALUMINUM SIGNAL UTILITY POLE - BASE INSTALLATION



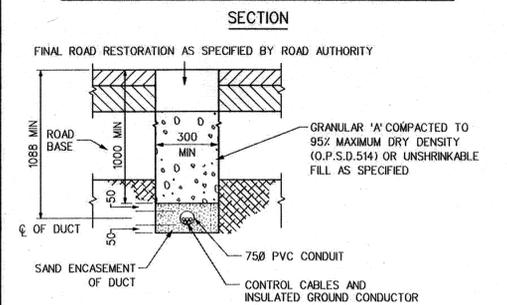
DETECTOR LOOP WIRING AND SET-UP



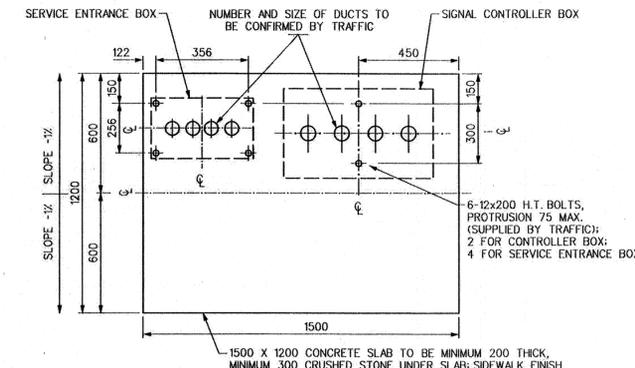
LOOP DETECTOR DUCT INSTALLATION: CONTACT TRAFFIC FOR INSTALLATION OPTION



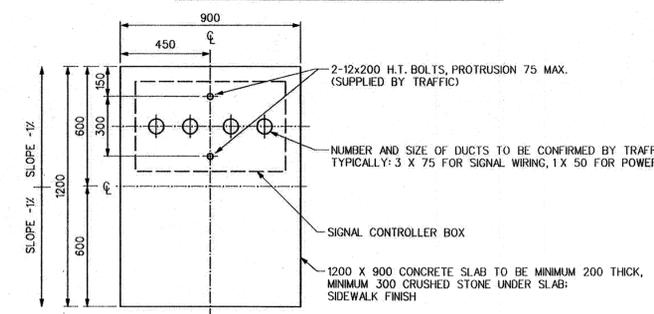
ROAD CROSSING DUCT INSTALLATION



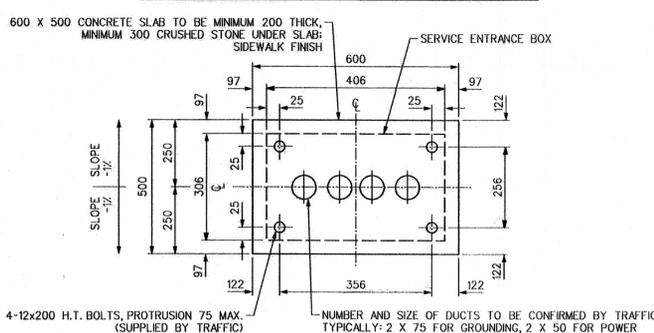
CONTROLLER AND SERVICE ENTRANCE PAD - COMBINED



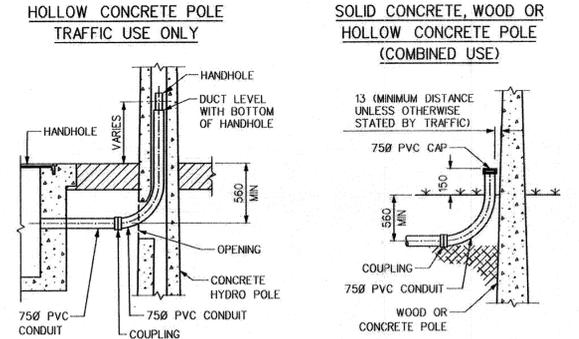
CONTROLLER PAD - SEPARATE



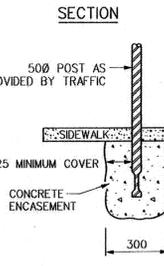
SERVICE ENTRANCE PAD - SEPARATE



DUCT CONNECTION TO POLES



METER POST



No.	DATE	DRAWN	REVISION DETAILS
9	2015.09	SAL	ISSUED FOR CONSTRUCTION. NOTE 3 REVISED REGARDING SIZE & TYPE OF HANDHOLES. SUPERSEDES DT-0111-01, REV.8, 2011.03

SCALE: N.T.S.

CHECKED: *RH*
Plotted: September 21, 2015

DRAWING No.: DT:0111-01

TRAFFIC SIGNAL STANDARDS
TYPICAL INSTALLATION
OF UNDERGROUND
TRAFFIC CONTROL DEVICES
IN THE CITY OF HAMILTON
PREPARED BY THE CITY OF HAMILTON,
TRAFFIC OPERATIONS AND ENGINEERING, ENERGY FLEET AND TRAFFIC SECTION,
CORPORATE ASSETS AND STRATEGIC PLANNING, PUBLIC WORKS DEPARTMENT

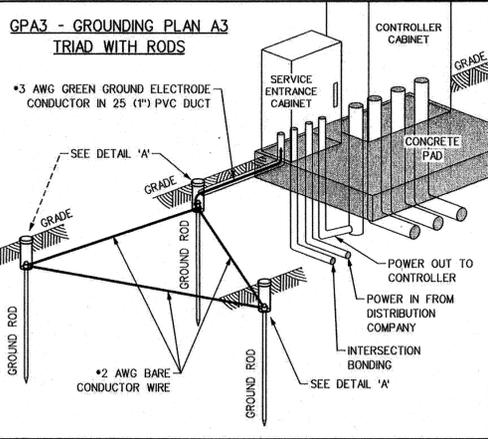
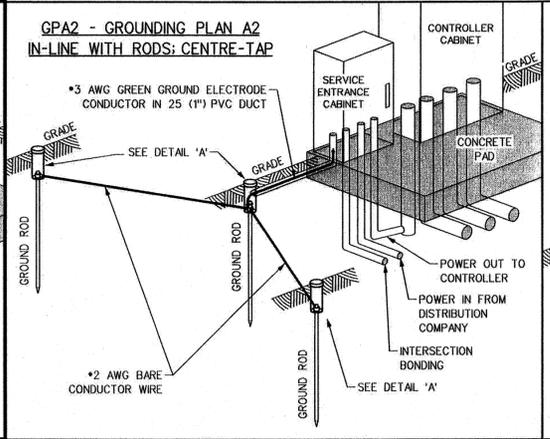
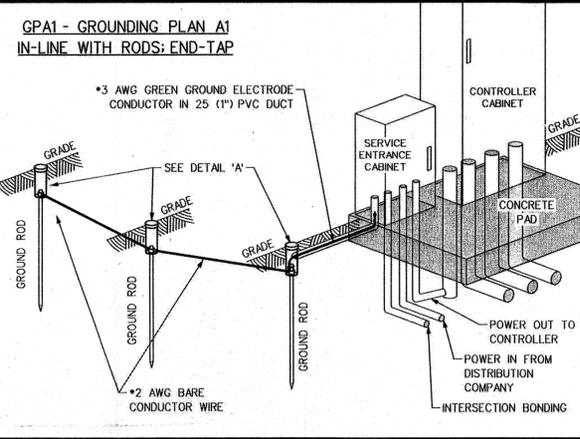
APPROVALS LEGAL APPROVAL PURSUANT TO SECTION 14.4 (31) OF H.T.A.



SUPERINTENDENT OF TRAFFIC ENGINEERING MM/DD/YY MANAGER OF TRAFFIC OPERATIONS AND ENGINEERING MM/DD/YY

TYPICAL INSTALLATION OF GROUNDING AND BONDING FOR TRAFFIC CONTROL DEVICES

DRAWING No.: DT-0111-02



STANDARD PRACTICES, UNLESS NOTED
DIMENSIONS WITH DECIMAL PLACES ARE METRES; DIMENSIONS WITH WHOLE NUMBERS ARE MILLIMETRES

CONSTRUCTION NOTES

- 1.0 MATERIAL REQUIREMENTS**
- GROUNDING RODS SHALL BE 3.0m X 19mm (10'-0" X 3/4"), UL LISTED, CSA C22.2 NO. 41-M (1987) APPROVED, COPPER-CLAD, STEEL GROUNDING ELECTRODES.
 - GROUNDING PLATES SHALL BE 254mm X 400mm X 6mm (10" X 16" X 1/4"), UL LISTED, CSA C22.2 NO. 41-M (1987) APPROVED, GALVANIZED STEEL GROUNDING ELECTRODES WITH A MINIMUM TOTAL SURFACE AREA OF 0.2 SQUARE METERS.
 - INSPECTION WELLS MUST BE RATED TO WITHSTAND ANY LOADING FORCES WHICH THEY ARE LIKELY TO BE EXPOSED TO. COVERS MUST BE A SECURE, BOLT-ON STYLE AND MUST BE IDENTIFIED AS "TRAFFIC" OR "GROUNDING".
 - ELECTRODE CONNECTORS SHALL BE A COPPER, FIGURE-8 COMPRESSION TYPE, RATED FOR DIRECT BURIAL HAVING UL, CSA OR IEEE 837 APPROVAL FOR DIRECT BURIAL APPLICATIONS. EXOTHERMIC WELDING IS AN ACCEPTABLE ALTERNATIVE. MECHANICAL LUGS SHALL NOT BE USED UNLESS OF A TYPE WHICH IS SPECIFICALLY APPROVED FOR DIRECT BURIAL.
 - GROUND ELECTRODE CONDUCTORS (FOR MAKING CONNECTIONS BETWEEN GROUNDING ELECTRODES AND THE SERVICE PANEL) SHALL BE CSA APPROVED, #3 AWG, GREEN, RWU90, XLPE INSULATED, STRANDED, COPPER WIRES.
 - GROUND ELECTRODE BONDING WIRE (FOR MAKING DIRECT BURIAL CONNECTIONS BETWEEN 'SERVICE' GROUNDING ELECTRODES) SHALL BE SOLID, #2 AWG, SOFT DRAWN, BARE (UN-INSULATED) COPPER WIRE.
 - BONDING CONDUCTORS FOR MAKING CONNECTIONS BETWEEN POLES, HANDHOLES, AND 'INTERSECTION' GROUNDING ELECTRODES SHALL BE CSA APPROVED, #6, GREEN, RWU90, XLPE INSULATED, STRANDED, COPPER WIRES.
 - GROUND ENHANCEMENT MATERIAL OR CONDUCTIVE CONCRETE MAY BE OBTAINED FROM:

A) CONDUCTRETE BY SAE INC.	19 CHURCHILL DRIVE, BARRIE, ONTARIO 1-877-234-2502
B) GEM BY ERCO	31700 SOLON ROAD, OH 44139 1-800-677-9089
C) ULTRAFIL BY HARGER LIGHTNING & GROUNDING	301 ZIEGLER DRIVE, GRAYSLAKE, IL 1-800-842-7437

2.0 GENERAL CONSTRUCTION METHODS

- WHERE GROUND RODS ARE INSTALLED, THEY SHALL BE DRIVEN TO THEIR FULL LENGTH AND IN A MANNER WHICH DOES NOT DAMAGE THE ROD. GROUND RODS SHALL BE PLACED NO CLOSER THAN 3.0m (10'-0") APART. IT MAY BE ADVISABLE TO ATTACH COMPRESSION CONNECTORS, PRIOR TO DRIVING THE ROD.
- WHERE GROUND PLATES ARE PERMITTED, THEY SHALL BE BURIED TO A MINIMUM DEPTH OF 600mm (24") BELOW GRADE AND MAY BE PLACED NO CLOSER THAN 2.0m (6'-7") APART FROM EACH OTHER.
- GROUND ELECTRODE CONNECTIONS MAY BE BY EXOTHERMIC WELDS OR BY COMPRESSION FITTINGS. MECHANICAL LUGS ARE NOT ACCEPTABLE IN DIRECT BURIED APPLICATIONS.
- BURY ALL #2 BARE GROUND ELECTRODE BONDING CONDUCTORS TO MINIMUM DEPTH OF 600mm (24") BELOW GRADE. TRENCHING MUST PROVIDE A SMOOTH, LEVEL SURFACE FOR CONDUCTORS TO LAY IN.
- INSTALL ALL GREEN, INSULATED #3 AWG GROUND ELECTRODE CONDUCTORS INSIDE PVC DUCT FOR PROTECTION.
- COILING EXCESS BONDING CONDUCTOR IN A HANDHOLE OR ELECTRICAL PANEL IS NOT ACCEPTABLE. ALL GROUNDING AND BONDING CONDUCTORS SHOULD BE FREE OF KINKS, HAVE NO SHARP 90 DEGREE BENDS AND AS SHORT AS PRACTICALLY POSSIBLE.
- BONDING CONDUCTORS MAY BE SPLICED AT HAND WELLS AND HANDHOLES ONLY. GROUND ELECTRODE CONDUCTORS SHALL NOT BE SPLICED.
- DO NOT CONNECT TRAFFIC GROUNDING ELEMENTS TO WATER PIPES, REBAR OR METAL BUILDING STRUCTURES OR GROUNDING ELECTRODES INTENDED FOR OTHER ELECTRICAL SYSTEMS.
- CONTACT THE CITY OF HAMILTON TRAFFIC ENGINEERING SECTION TO COORDINATE INSPECTIONS AND TESTS. BOND CONTINUITY, BOND RESISTANCE, AND EARTH RESISTANCE TESTING MAY BE REQUIRED. IF THE EARTH-TO-GROUND RESISTANCE IS GREATER THAN TEN (10) OHMS, THE CITY MAY REQUIRE THE INSTALLATION OF ADDITIONAL ELECTRODES.

3.0 SERVICE GROUNDING

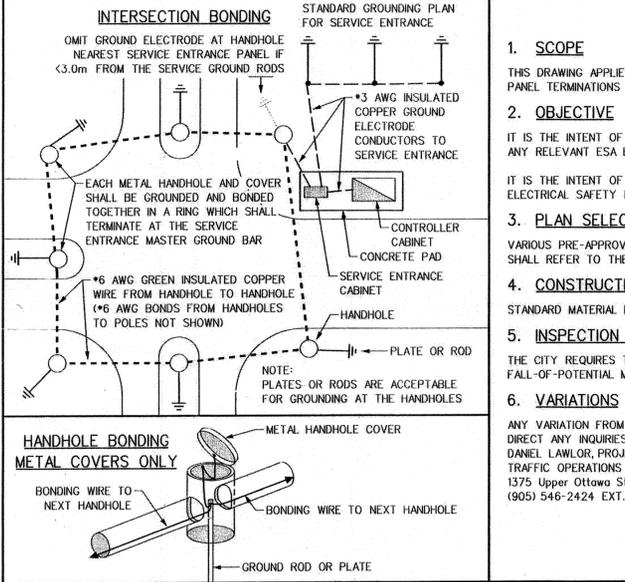
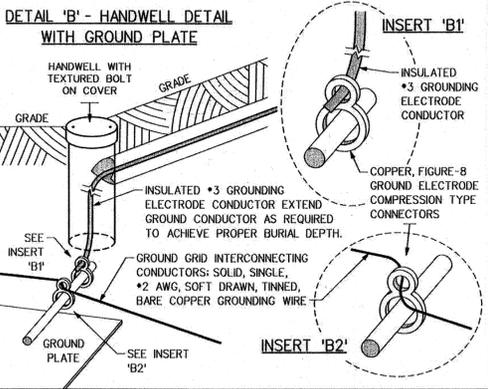
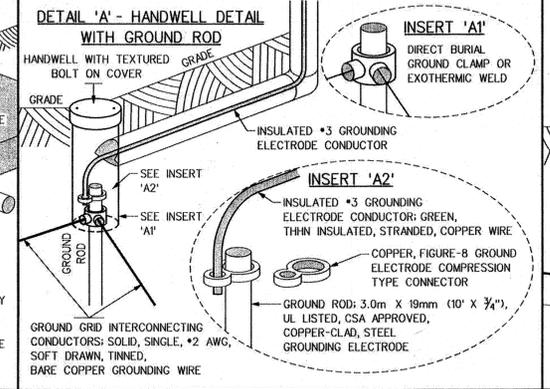
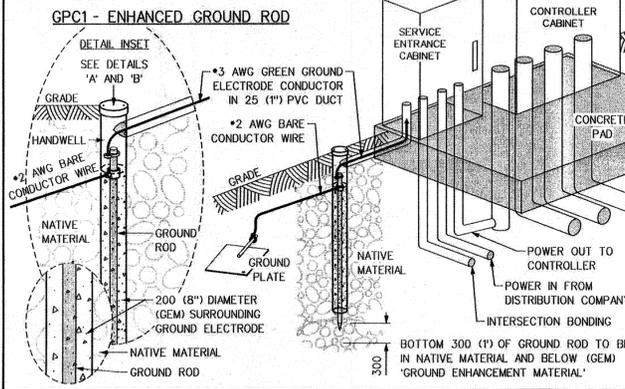
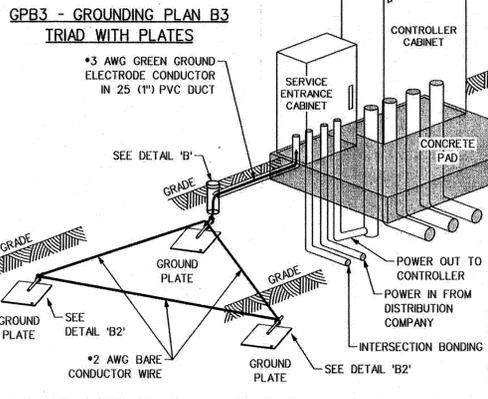
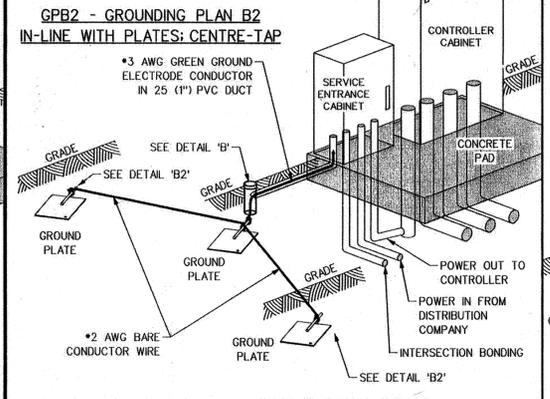
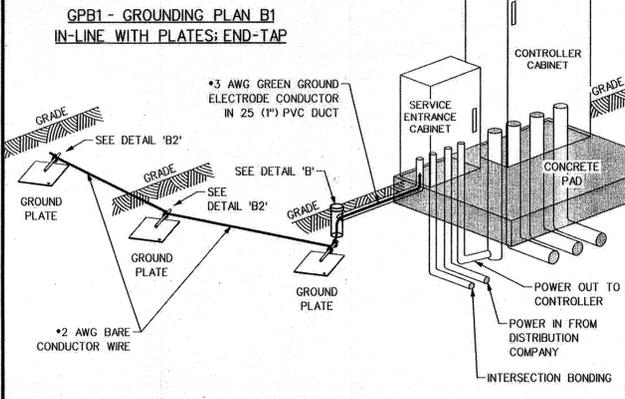
- INSTALLING A SINGLE GROUND PLATE AT THE TRAFFIC SIGNAL SERVICE ENTRANCE PANEL IS NOT ACCEPTABLE TO THE CITY OF HAMILTON. THE MINIMUM REQUIREMENT FOR SERVICE GROUNDING IS 3 INTERCONNECTED GROUND RODS OR WHERE IT CAN BE DEMONSTRATED THAT GROUND RODS CANNOT BE DRIVEN, 3 (THREE) INTERCONNECTED GROUND PLATES. AS A THIRD ALTERNATIVE, WHERE MINIMAL SURFACE AREA IS AVAILABLE A SINGLE GROUND ROD MAY BE PLACED IN A WELL BACKFILLED WITH GROUND ENHANCEMENT MATERIAL AND SUPPLEMENTED WITH A SINGLE GROUND PLATE.
- INSPECTION WELLS SHALL BE PROVIDED OVER EACH GROUND ELECTRODE USED AT THE SERVICE ENTRANCE, FOR INSPECTION AND TEST PURPOSES. THE TOP PORTION OF THE ROD SHALL BE ACCESSIBLE IN THE WELL FOR CONNECTION TO TEST EQUIPMENT. WHERE THE INSTALLATION OF AN INSPECTION WELL IS NOT PRACTICAL, THE CITY SHALL BE GIVEN THE OPPORTUNITY TO WITNESS THE INSTALLATION OF THE ELECTRODES PRIOR TO EQUIPMENT BURIAL AND MAY REQUEST THAT PHOTOGRAPHIC RECORDS BE PROVIDED. ONLY ONE INSPECTION POINT IS REQUIRED WHERE PLATES ARE USED.
- SERVICE GROUND ROD INTER-CONNECTIONS SHALL BE MADE USING #2 AWG, SOFT ANNEALED, BARE COPPER GRID WIRE. THESE CONDUCTORS MUST BE BURIED IN DIRECT CONTACT WITH THE EARTH (NOT IN A DUCT) TO A MINIMUM DEPTH OF 600mm (24") BELOW GRADE. TRENCHING SHOULD PROVIDE A SMOOTH, LEVEL SURFACE FOR THE CONDUCTORS.
- GROUNDING GRID SHALL THEN BE CONNECTED TO THE SERVICE PANEL USING A #3 AWG, GREEN, RWU90 XLPE INSULATED, CONDUCTOR WHICH IS TO BE INSTALLED INSIDE A PVC DUCT FOR PROTECTION.

4.0 INTERSECTION GROUNDING

- IN ADDITION TO GROUNDING THE SYSTEM AT THE SERVICE PANEL, SUPPLEMENTARY GROUNDING AND BONDING MUST BE INSTALLED AROUND THE INTERSECTION. ONE GROUND ELECTRODE IS REQUIRED AT (OR IN) EACH HANDHOLE ON EACH CORNER AND ON EACH MEDIAN AT THE INTERSECTION. THESE ELECTRODES WILL BE BONDED TOGETHER BY A #6 AWG, GREEN, RWU90 XLPE INSULATED, STRANDED COPPER WIRE WHICH IS RUN THROUGH THE UNDERGROUND DUCTS. POLES AND METAL HAND WELLS WILL ALSO BE BONDED TO THE INTERSECTION EQUIPMENT GROUNDING SYSTEM.
- INSTALL THE FIRST ELECTRODE WITHIN 1.0m (3'-3") OF THE PAD OR POLE BASE ON WHICH THE SERVICE IS MOUNTED.
- INSTALL GROUND RODS IN THE HANDHOLES AROUND THE INTERSECTION. BOND THESE ELECTRODES USING #6 AWG, GREEN, RWU90, XLPE INSULATED COPPER WIRE, IN A CONTINUOUS RING AROUND THE INTERSECTION. BOND METAL SIGNAL POLES TO THE CLOSEST GROUND ROD USING THE #6 AWG WIRE. BOND THE INTERSECTION GROUNDING RING TO THE SERVICE ENTRANCE PANEL USING #3 AWG, GREEN, RWU90, XLPE INSULATED, COPPER WIRE INSTALLED IN PVC DUCT.
- METAL HANDHOLE FRAMES MUST BE BONDED TO THEIR COVERS AND THE LOCAL GROUND ELECTRODE USING #6 AWG, GREEN, RWU90, XLPE INSULATED, COPPER WIRE OR FLAT, PLATED, COPPER BRAD OF EQUIVALENT AMPACITY WHICH IS CONNECTED VIA AN APPROVED MECHANICAL LUG. AT LEAST 600mm (24") OF WIRE SHALL BE PROVIDED FOR COVER REMOVAL.

5.0 ENHANCED GROUNDING ELECTRODE METHODS

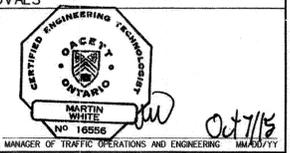
- EXCAVATE A 3.0m DEEP X 203mm (10'-0" DEEP X 8") CIRCULAR WELL USING A HYDRO-VAC MACHINE OR AN AUGER. HYDRO-VAC IS THE RECOMMENDED APPROACH TO ENSURE SAFETY AROUND BURIED STRUCTURES AND UNDERGROUND UTILITIES. DRAIN ANY GROUND WATER FROM THE HOLE.
- CRIMP THE #3 AWG, GREEN, INSULATED COPPER ROUND ELECTRODE CONDUCTOR TO THE TOP OF THE GROUND ROD PRIOR TO DRIVING THE ROD INTO THE EARTH.
- CENTER AND DRIVE THE 3.0m (10'-0") GROUND ROD, SUCH THAT 305mm (12") OF ROD IS BELOW THE BOTTOM OF THE HOLE.
- MIX THE CONDUCTIVE CONCRETE OR GROUND ENHANCEMENT MATERIAL WITH THE CORRECT PROPORTION OF WATER IN A STANDARD CEMENT MIXER IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. A SUFFICIENT QUANTITY OF WATER MUST BE KEPT ON HAND TO PRODUCE A POURABLE SLURRY (IMPORTANT).
- BACKFILL THE HOLE WITH A SLURRY OF CONDUCTIVE CONCRETE OR GROUND ENHANCEMENT MATERIAL AND TAMP AS REQUIRED.
- FEED THE GROUND ELECTRODE CONDUCTOR THROUGH A 25mm (1") PVC DUCT TO THE SERVICE ENTRANCE PANEL AND TERMINATE ON THE MASTER EQUIPMENT GROUNDING BUS BAR.
- INSTALL A STANDARD GROUNDING PLATE (SEE MATERIAL REQUIREMENTS) AND CONNECT TO THE 'ENHANCED' GROUND ROD VIA A #2 BARE COPPER GRID WIRE, USING RATED CONNECTORS TO SATISFY MINIMUM O.E.S.C. REGULATIONS WHICH STIPULATE THE USE OF EITHER TWO RODS OR ONE PLATE. BURY THIS PLATE NO LESS THAN 600mm (24") BELOW GRADE.
- COVER THE ELECTRODE WITH AN INSPECTION WELL WITH TEXTURED BOLT ON COVER.
- CLEAN UP CONSTRUCTION MATERIALS, RESTORE SURFACE CONDITIONS TO THEIR ORIGINAL STATE.



TRAFFIC ENGINEERING - GROUNDING & BONDING POLICY

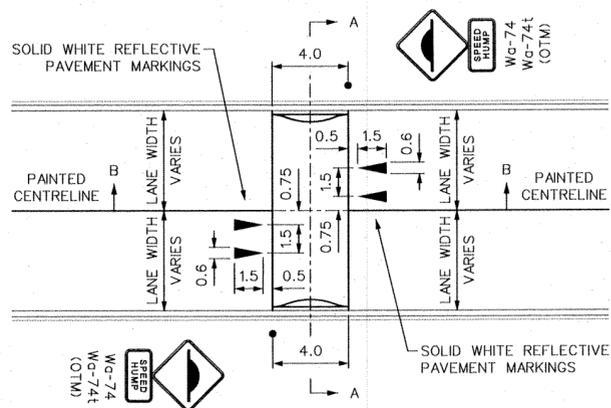
- SCOPE**
THIS DRAWING APPLIES TO ALL NEW CONSTRUCTION AND MAJOR RECONSTRUCTION PROJECTS; IT SPECIFIES UNDERGROUND CONSTRUCTION REQUIREMENTS ONLY. FOR A COMPLETE SPECIFICATION INCLUDING PANEL TERMINATIONS REFER TO THE CITY'S GROUNDING & BONDING STANDARD MANUAL.
- OBJECTIVE**
IT IS THE INTENT OF THE CITY THAT THIS SET OF SPECIFICATIONS, MEET OR EXCEED THE REQUIREMENTS OF THE ONTARIO ELECTRICAL SAFETY CODE AND THE ELECTRICAL SAFETY AUTHORITY INCLUDING ANY RELEVANT ESA BULLETINS.
IT IS THE INTENT OF THE CITY, IN DEVELOPING AND DEPLOYING THIS STANDARD TO PROVIDE A SUPERIOR DEGREE OF ELECTRICAL PROTECTION FOR SENSITIVE ELECTRONIC EQUIPMENT AND A MEASURE OF ELECTRICAL SAFETY FOR BOTH WORKERS AND THE PUBLIC WHICH EXCEEDS MINIMUM REQUIREMENTS.
- PLAN SELECTION**
VARIOUS PRE-APPROVED, DETAILED SERVICE GROUNDING PLANS ARE PROVIDED ON THIS DRAWING IN ORDER TO ADDRESS THE VARIETY OF SITE CONDITIONS THAT ARE TYPICALLY ENCOUNTERED. CONTRACTORS SHALL REFER TO THE CONTRACT DRAWING SET FOR INSTRUCTION AS TO WHICH GROUNDING PLAN APPLIES AT EACH INTERSECTION.
- CONSTRUCTION SPECIFICATIONS**
STANDARD MATERIAL REQUIREMENTS AND CONSTRUCTION METHODS ARE SPECIFIED ON THIS DRAWING.
- INSPECTION AND TESTING**
THE CITY REQUIRES THAT SERVICE GROUNDING ARRAYS BE CONSTRUCTED IN SUCH A MANNER AS TO PROVIDE A MAXIMUM RESISTANCE TO EARTH OF TEN (10) OHMS AS MEASURED BY THE 3 POINT FALL-OF-POTENTIAL METHOD. VERIFICATION TESTING, VISUAL CONFIRMATION AND/OR PHOTOGRAPHIC RECORDS MAY BE REQUIRED AT THE DISCRETION OF THE CITY.
- VARIATIONS**
ANY VARIATION FROM THIS DRAWING OR FROM THE GROUNDING AND BONDING STANDARD MANUAL MUST BE APPROVED BY THE TRAFFIC ENGINEERING SECTION OF THE PUBLIC WORKS DEPARTMENT.
DIRECT ANY INQUIRIES TO:
DANIEL LAWLOR, PROJECT MANAGER, ELECTRICAL
TRAFFIC OPERATIONS AND ENGINEERING, ENERGY FLEET AND TRAFFIC SECTION
1375 Upper Ottawa Street, Hamilton ON, L8W 3L5
(905) 546-2424 EXT. 2048 EMAIL: dlawlor@hamilton.ca

1	2015.09	SAL	REVISIONS TO NOTE 5.8 AND DETAILS 'A' & 'B' REGARDING HANDWELL COVERS SUPERSEDES DT-0111-02, REV. 0, 2010.11
REVISION DETAILS			
No.	DATE	DRAWN	CHECKED:
			TRAFFIC SIGNAL STANDARDS
			TYPICAL INSTALLATION
			OF GROUNDING AND BONDING
			FOR TRAFFIC CONTROL DEVICES
			IN THE CITY OF HAMILTON
DRAWING No.:			PREPARED BY THE CITY OF HAMILTON, TRAFFIC OPERATIONS AND ENGINEERING, ENERGY FLEET AND TRAFFIC SECTION, CORPORATE ASSETS AND STRATEGIC PLANNING, PUBLIC WORKS DEPARTMENT
DT-0111-02			MANAGER OF TRAFFIC OPERATIONS AND ENGINEERING
APPROVALS			
PROJECT MANAGER, ELECTRICAL		MANAGER OF TRAFFIC OPERATIONS AND ENGINEERING	



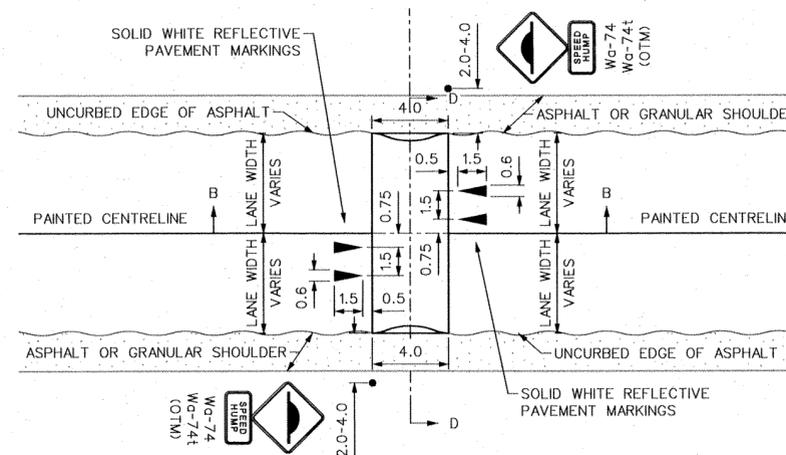
2011 BASE

TYPICAL INSTALLATION OF GROUNDING AND BONDING FOR TRAFFIC CONTROL DEVICES



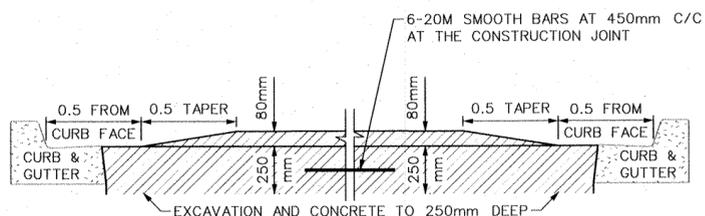
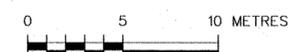
**URBAN ROADWAY
PLAN VIEW
CONCRETE SPEED HUMP LAYOUT,
PAVEMENT MARKINGS AND SIGNAGE**

SCALE 1:250



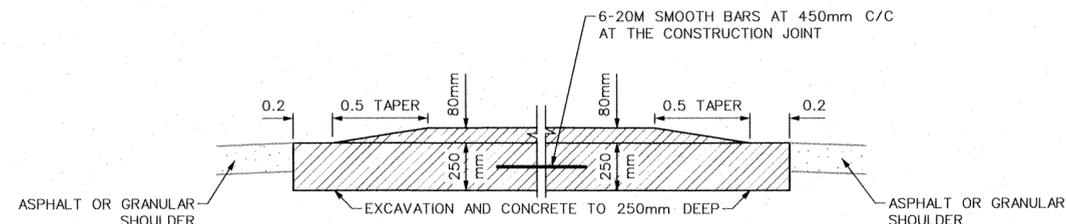
**RURAL ROADWAY
PLAN VIEW
CONCRETE SPEED HUMP LAYOUT,
PAVEMENT MARKINGS AND SIGNAGE**

SCALE 1:250



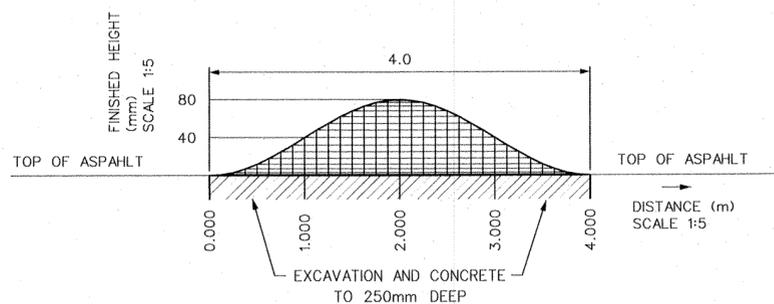
**DETAIL 'A' - SECTION C-C
URBAN ROADWAY**

NOT TO SCALE



**DETAIL 'C' - SECTION D-D
RURAL ROADWAY**

NOT TO SCALE



**DETAIL 'B' - SECTION B-B
URBAN AND RURAL ROADWAY**

NOT TO SCALE

STANDARD PRACTICES, UNLESS NOTED

DIMENSIONS WITH DECIMAL PLACES ARE METRES
DIMENSIONS IN WHOLE NUMBERS ARE MILLIMETRES

APPROVAL

MANAGER OF TRAFFIC OPERATIONS AND ENGINEERING

0	2016.12	SAL	NEW DRAWING
No.	DATE	DRAWN	REVISION DETAILS

SCALE: NOTED

DESIGN: SL/SC

CHECKED:

DRAWING DATE:
2017.01

Printed:
January 13, 2017

DRAWING No.:
DT:0119-01

**CITY OF HAMILTON
INSTALLATION STANDARDS**

STANDARD DESIGN FOR SPEED HUMPS

PREPARED BY THE CITY OF HAMILTON, TRAFFIC OPERATIONS AND ENGINEERING
ENERGY FLEET AND TRAFFIC SECTION, CORPORATE ASSETS AND STRATEGIC PLANNING
PUBLIC WORKS DEPARTMENT

DRAWING No.	DATE	DESCRIPTION
WM-200.01	May 2013	Bedding & Backfill for Concrete & PVC Watermains and Water Services
WM-200.02	November 2005	Bedding & Backfill for Ductile Iron Watermains and Water Services
WM-201.01	June 2017	1200mm Dia. Precast Valve Chamber for 300mm Dia. Watermains & Smaller
WM-201.02	June 2017	Tapping Valve Installation for D.I. Watermain 300mm Dia. and Smaller
WM-201.03	June 2017	Level Valve Chamber – 150mm Dia. to 300mm Dia. Watermains
WM-202	June 2017	Valve Box Installation For 100mm to 300mm Dia. Watermains
WM-203.01	November 2005	Hydrant Installation
WM-203.02	November 2005	Hydrant Installation using Anchor Tee
WM-203.03	November 2005	Relocation of Ditches at Hydrants
WM-203.04	January 2011	Operating Nut Adaptor for Use on Open Right (Clockwise) Valves
WM-204.01	January 2011	Concrete Anchor Blocks For 300mm Dia. Watermains And Smaller
WM-204.02	January 2011	11-1/4° & 22-1/2° Angle Anchor Block Details for 400mm to 600mm Dia. D.I. Watermains
WM-204.03	January 2011	45° Angle Anchor Block Details for 400mm to 600mm Dia. D.I. Watermains
WM-204.04	January 2011	45° Angle Anchor Block with Leg for 400mm to 600mm Dia. D.I. Watermains
WM-204.05	January 2011	90° Angle Anchor Block Details for 400mm to 600mm Dia. D.I. Watermains
WM-204.06	January 2011	90° Angle Anchor Block with Leg for 400mm to 600mm Dia. DI Watermains
WM-204.07	January 2011	Tee Anchor Block Details for 400mm to 600mm Dia. D.I. Watermain Branches
WM-204.08	January 2011	Tee Anchor Block with Leg for 400mm to 600mm Dia. D.I. Branch Watermains

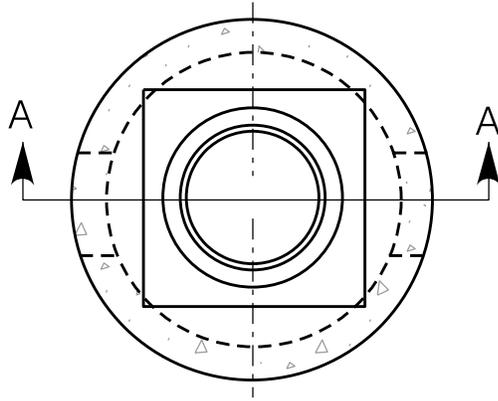
*24' x 36' size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
WM-204.09	January 2011	Concrete Thrust Block for 400mm to 600mm Dia. D.I. Watermains
WM-204.10	January 2011	Concrete Anchor Blocks for 100mm to 300mm Dia. D.I. Watermains at 11 ¹ / ₄ ° & 22 ¹ / ₂ ° Vertical Bends
WM-204.11	January 2011	Concrete Anchor Blocks for 100mm to 300mm Dia. D.I. Watermains at 45 ° Vertical Bend
WM-204.12	January 2011	Vertical Bend Anchor Block 7 ¹ / ₂ ° to 22 ¹ / ₂ ° for 400mm Dia.D.I. Watermain
WM-204.13 (1 of 2)	November 2005	Concrete Anchor Block for 100mm to 300mm Dia. Watermain Lowering
WM-204.13 (2 of 2)	January 2011	Concrete Anchor Block for 100mm to 300mm Dia. Watermain Lowering
WM-205.01	March 2008	50mm Dia. Watermain Looping in Cul De Sacs (20.0 m R.O.W.)
WM-205.02	March 2008	50mm Dia. Watermain Looping in Cul De Sacs (18.0 m R.O.W.)
WM-206	November 2005	50mm Dia. Dead End Blow-Off
WM-207.01	November 2005	Piping Arrangement for 19-25mm Dia. Water Service Connection and Yard Service
WM-207.02	November 2005	Piping Arrangement for 19-25mm Dia. Water Service Connections in a Common Trench
WM-207.03	November 2005	Insulation Details for Water Services at Gooseneck
WM-207.04	November 2005	Piping for 100mm to 300mm Dia. Water Service Connection & Yard Service to Meter with Cut in Tee & Sleeve
WM-207.05	November 2005	Piping for 100mm to 300mm Dia. Water Service Connection & Yard Service to Meter using Tapping Sleeve & Valve
WM-208	November 2005	Remote Receptacle Installation for Meter Chambers
WM-209	June 2017	Piping & Chamber for 16-50mm Dia. Meter Installation
WM-210	November 2005	Piping for 16-250mm Dia. Meter for Internal Installation
WM-211.01	November 2005	Standard Remote Installation for 16-25mm Dia. Meters
WM-211.02	November 2005	Alterations of Existing 16-25mm Dia. Piping Prior to Meter Installation

*24' x 36' size drawings are not bound in this document

DRAWING No.	DATE	DESCRIPTION
WM-211.03	November 2005	Single Family Residential Water Meter Installation for 16-25mm Dia. Services
WM-211.04	November 2005	Meter Pipe Spacer Installation
WM-212.03	November 2005	Valve Key Frame & Cover
WM-213	November 2005	Chamber End Plates for 100mm Dia. to 300mm Dia. Watermains
WM-214	November 2005	Removable Slab Lifting Hole Details & Lifting Hook Detail for Chambers
WM-215.01	November 2005	Valve Support
WM-215.02	November 2005	Pipe & Valve Support
WM-216	November 2005	Blow-Off Connection at Access Chamber
WM-217	November 2005	Pitometer Connection for Steel & Concrete Pipe
WM-230	January 2011	2400mm Precast Valve chamber for 400mm Dia. Concrete or Ductile Iron Pipe with 50mm Air Valve & 100mm Blow-Off (Size 24" x 36")
WM-231	January 2011	1800mm x 2400mm Precast Valve Chamber for 450mm Dia. or 500mm Dia. Concrete or Ductile Iron Pipe *(Size 24" x 36")
WM-232	January 2011	1800mm Precast Valve Chamber for 400mm to 500mm Dia. Concrete or Ductile Iron Pipe with 50mm Air Valve & 100mm Blow-Off *(Size 24" x 36")
WM-233	January 2011	1800mm x 3000mm Precast Valve Chamber for 400mm Dia. Concrete or Ductile Iron Pipe with 100mm Dia. to 300mm Dia. Branch *(Size 24" x 36")
WM-234	November 2005	1800mm x 2400mm and 1800mm x 3000mm Precast Meter Chambers for 100mm Dia. To 250 mm Dia. Water Services *(Size 24" x 36")
WM-235	November 2005	1800mm x 2400mm Precast Tapping Valve Chamber for 100mm to 300mm Dia. D.I. Pipe Tapping off 400mm to 600mm Dia. Watermain *(Size 24" x 36")

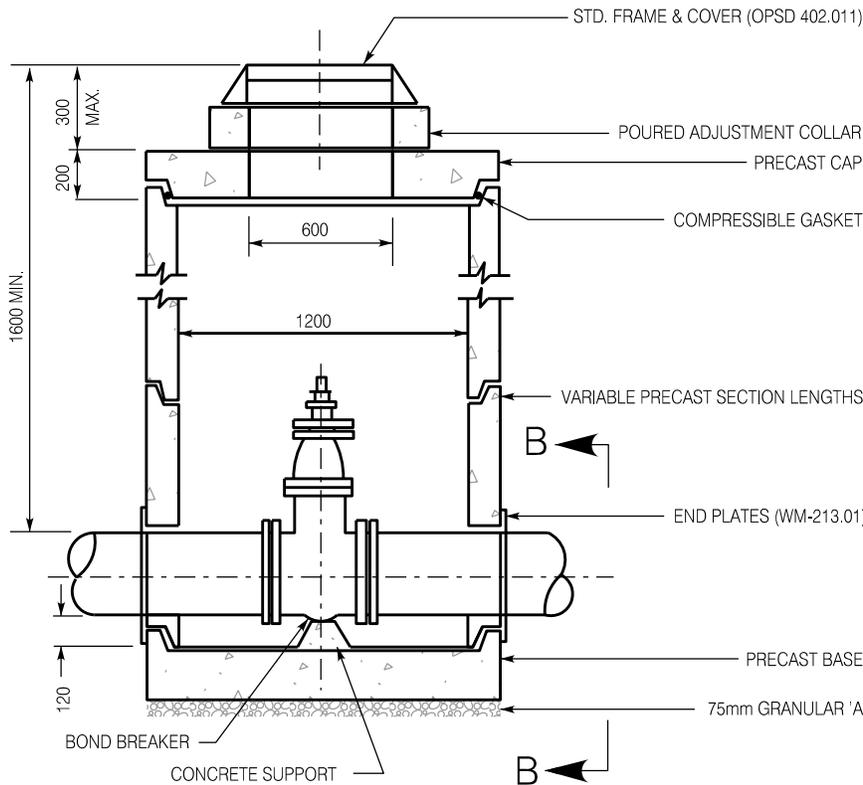
*24' x 36' size drawings are not bound in this document



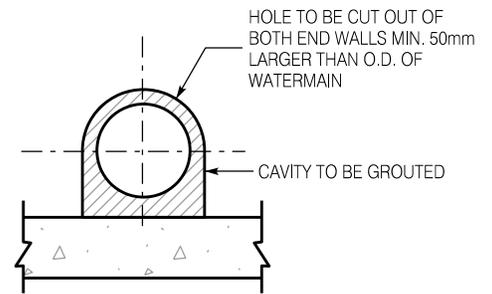
PLAN

NOTES:

1. PRECAST SECTIONS TO BE MANUFACTURED TO ASTM C-478 AND CSA SPECIFICATIONS.
2. FILL ALL JOINTS AND LIFTING HOLES (INSIDE & OUT) 15mm THICK WITH 1:3 NON-SHRINK MORTAR MIX.
3. ALL ADJUSTMENTS TO CHAMBER AND KEY COVERS SHALL BE MADE WITH POURED CONCRETE.
4. ALL CONCRETE TO BE 30 MPa., TYPE 50 CEMENT.
5. ALL REINFORCING TO BE HIGH BOND STRUCTURAL GRADE.
6. FASTEN INSULATION TO CEILING WITH 50mm Ø WASHERS (GALVANIZED) & 6mm Ø TAPCON CONCRETE ANCHORS @ 450mm CENTRES.
7. DOGHOUSE OPENING TO BE CUT OUT MIN. 50mm LARGER THAN O.D. OF WATERMAIN. PIPE TO BE WRAPPED WITH MIN. 50mm THICK OF PLAST MASTIC MATERIAL. REMAINING CAVITY TO BE GROUTED. (SEE DOGHOUSE DETAIL).
8. ALL METAL COMPONENTS INSIDE VALVE CHAMBER, INCLUDING STAINLESS STEEL NUTS AND BOLTS, SHALL HAVE A PROTECTIVE CORROSION TAPE COATING SYSTEM (PRIMER, MASTIC AND TAPE). PROTECTIVE CORROSION TAPE COATING (PRIMER, MASTIC AND TAPE) IS NOT REQUIRED ON VALVE BODIES.



SECTION A-A



SECTION B-B

City of Hamilton
Public Works Department

**1200mm DIA. PRECAST VALVE CHAMBER FOR
300mm DIA. WATERMANS AND SMALLER**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

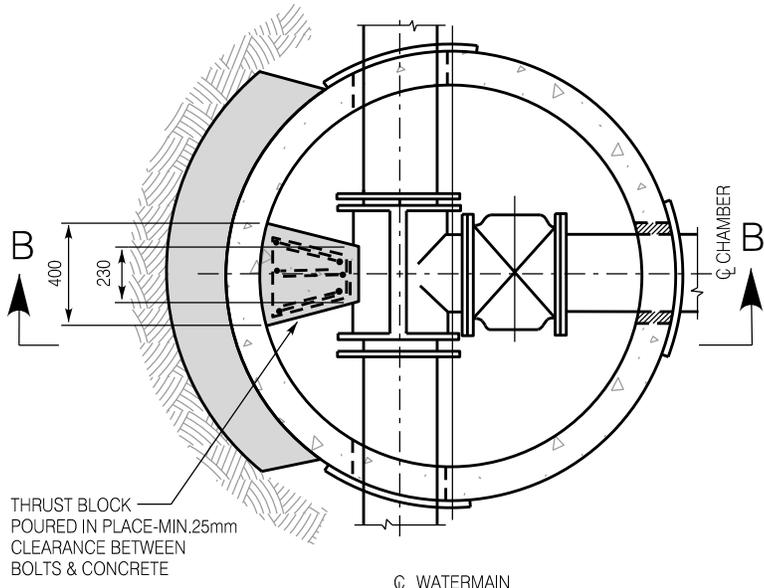
DATE
June 2017

REV No
1

FORMERLY: RWS-301

HAMILTON STD No

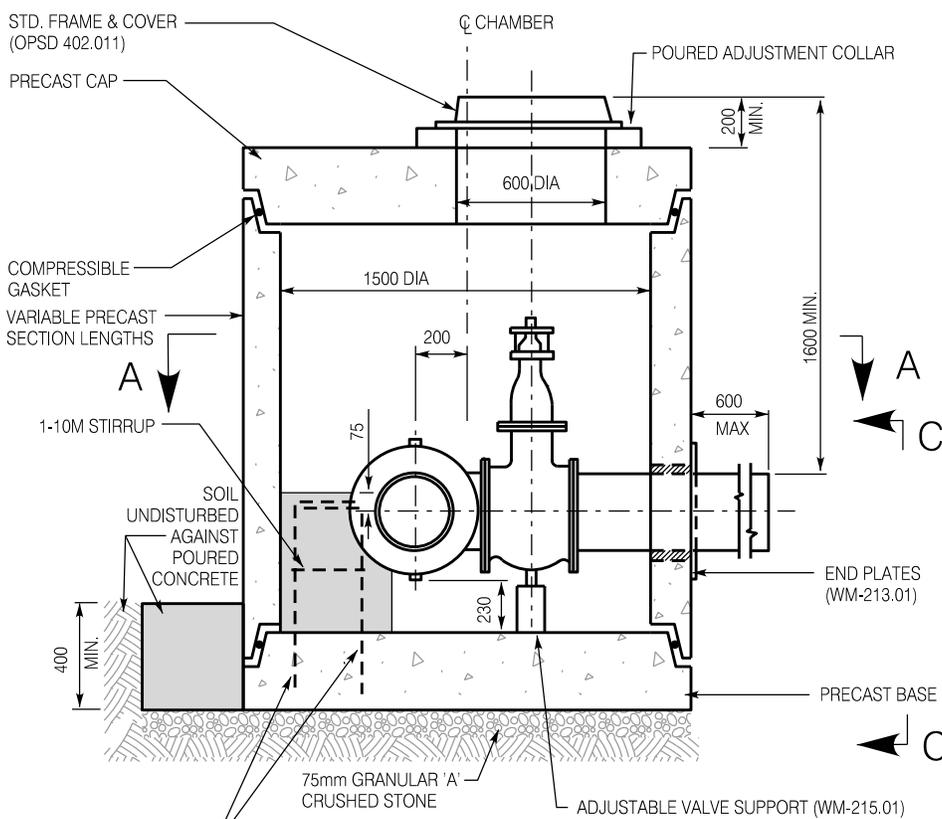
WM-201.01



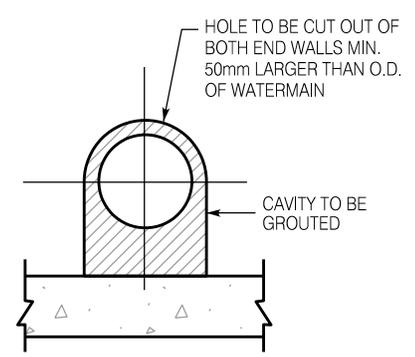
SECTION A-A

NOTES:

1. PRECAST SECTIONS TO BE MANUFACTURED TO ASTM C-478 AND CSA SPECIFICATIONS.
2. FILL ALL JOINTS AND LIFTING HOLES (INSIDE & OUT) 15mm THICK WITH 1:3 NON-SHRINK MORTAR MIX.
3. ALL ADJUSTMENTS TO CHAMBER AND KEY COVERS SHALL BE MADE WITH POURED CONCRETE.
4. ALL CONCRETE TO BE 30 MPa, TYPE 50 CEMENT.
5. ALL REINFORCING STEEL TO BE HIGH BOND STRUCTURAL GRADE MIN. 50mm OF CONCRETE COVER OVER REINFORCING.
6. DOGHOUSE OPENING TO BE CUT OUT MIN. 50mm LARGER THAN O.D. OF WATERMAIN. PIPE TO BE WRAPPED WITH MIN. 50mm THICK OF PLAST MASTIC MATERIAL. REMAINING CAVITY TO BE GROUTED. (SEE DOGHOUSE DETAIL).
7. ALL FLANGES TO BE IN ACCORDANCE WITH ANSI / AWWA.
8. ALL METAL COMPONENTS INSIDE VALVE CHAMBER, INCLUDING STAINLESS STEEL NUTS AND BOLTS, SHALL HAVE A PROTECTIVE CORROSION TAPE COATING SYSTEM (PRIMER, MASTIC AND TAPE). PROTECTIVE CORROSION TAPE COATING (PRIMER, MASTIC AND TAPE) IS NOT REQUIRED ON VALVE BODIES.
9. WALL THICKNESS FOR PRECAST CHAMBER SHALL BE 200mm MIN. CAP AND BASE TO BE 250mm MIN.



SECTION B-B

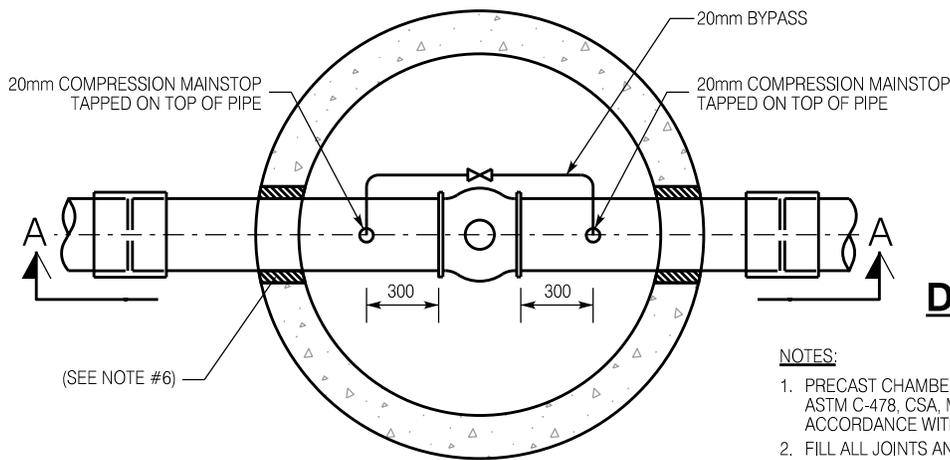


SECTION C-C

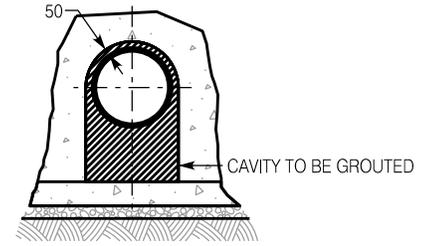
City of Hamilton
Public Works Department

**TAPPING VALVE INSTALLATION FOR
D.I. WATERMANS 300mm DIA. AND SMALLER**

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE June 2017	REV No 1	FORMERLY: RWS-392	HAMILTON STD No WM-201.02
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PIPING LAYOUT

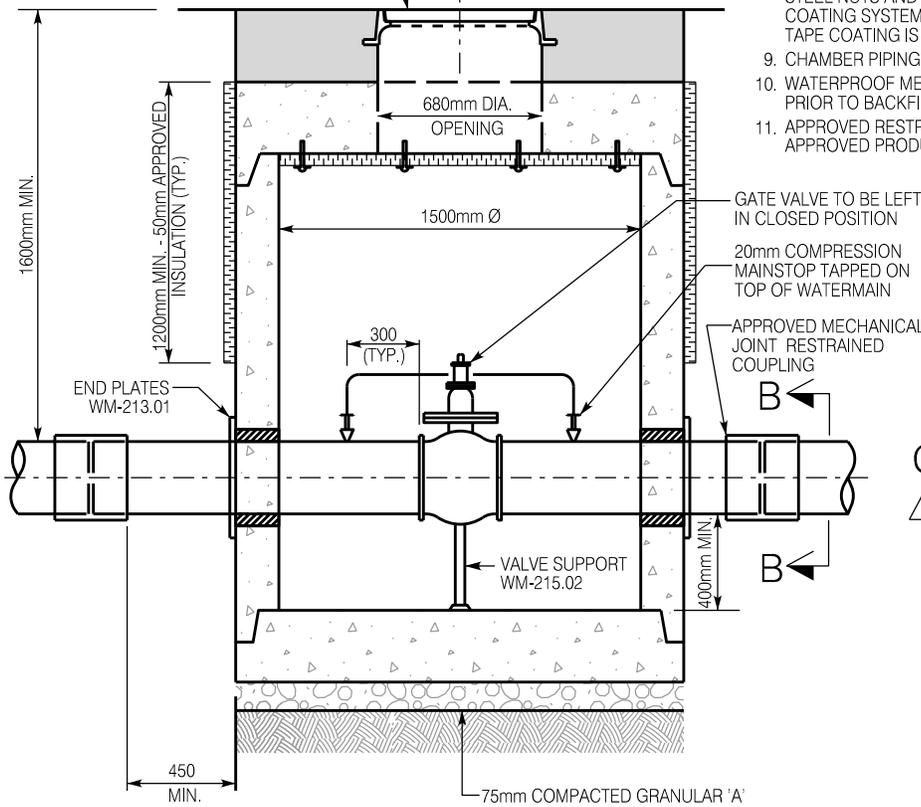


**SECTION B-B
DOGHOUSE DETAIL**

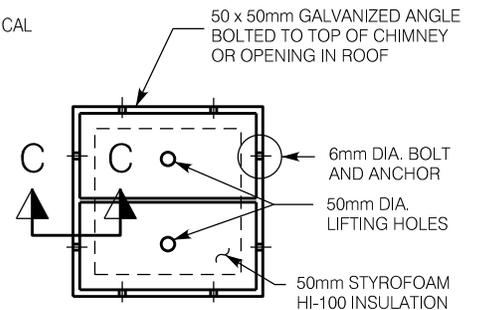
NOTES:

1. PRECAST CHAMBERS AND SECTIONS SHALL BE MANUFACTURED TO ASTM C-478, CSA, MEET H-20 S16 LOADING REQUIREMENTS AND IN ACCORDANCE WITH THE APPROVED PRODUCTS LIST.
2. FILL ALL JOINTS AND LIFTING HOLES (INSIDE & OUT) 15mm THICK WITH 1:3 NON-SHRINK MORTAR MIX.
3. ALL ADJUSTMENTS TO CHAMBER AND KEY COVERS SHALL BE MADE WITH POURED CONCRETE.
4. ALL CONCRETE TO BE 32 MPa., TYPE 50 CEMENT.
5. FASTEN INSULATION TO CEILING WITH 50mm DIA. WASHERS (GALVANIZED) & 6mm DIA. TAPCON CONCRETE ANCHORS @ 450mm CENTRES.
6. DOGHOUSE OPENING TO BE CUT OUT MIN. 50mm LARGER THAN O.D. OF PROPOSED WATERMAIN. PIPE TO BE WRAPPED WITH MIN. 50mm THICK OF PLAST MASTIC MATERIAL. REMAINING CAVITY TO BE GROUTED.
7. ALL FLANGES TO BE IN ACCORDANCE WITH ANSI / AWWA
8. ALL METAL COMPONENTS IN VALVE CHAMBERS, INCLUDING STAINLESS STEEL NUTS AND BOLTS, SHALL HAVE A PROTECTIVE CORROSION TAPE COATING SYSTEM (PRIMER, MASTIC AND TAPE). PROTECTIVE CORROSION TAPE COATING IS NOT REQUIRED ON VALVE BODIES.
9. CHAMBER PIPING SHALL BE DUCTILE IRON CLASS 54.
10. WATERPROOF MEMBRANE SHALL BE APPLIED TO ALL CHAMBER WALLS PRIOR TO BACKFILLING.
11. APPROVED RESTRAINED COUPLING SHALL BE IN ACCORDANCE WITH THE APPROVED PRODUCTS LIST.

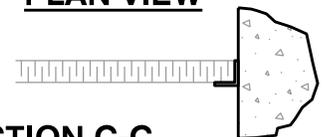
VALVE CHAMBER FRAME & COVER OPSPD 402.011
TO BE PLUMBED FROM VALVE SPINDLE



SECTION A-A



**CHAMBER COVER
INSULATION DETAIL
PLAN VIEW**



SECTION C-C

City of Hamilton
Public Works Department

**LEVEL VALVE CHAMBER
150mm DIA. TO 300mm DIA. WATERMANS**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

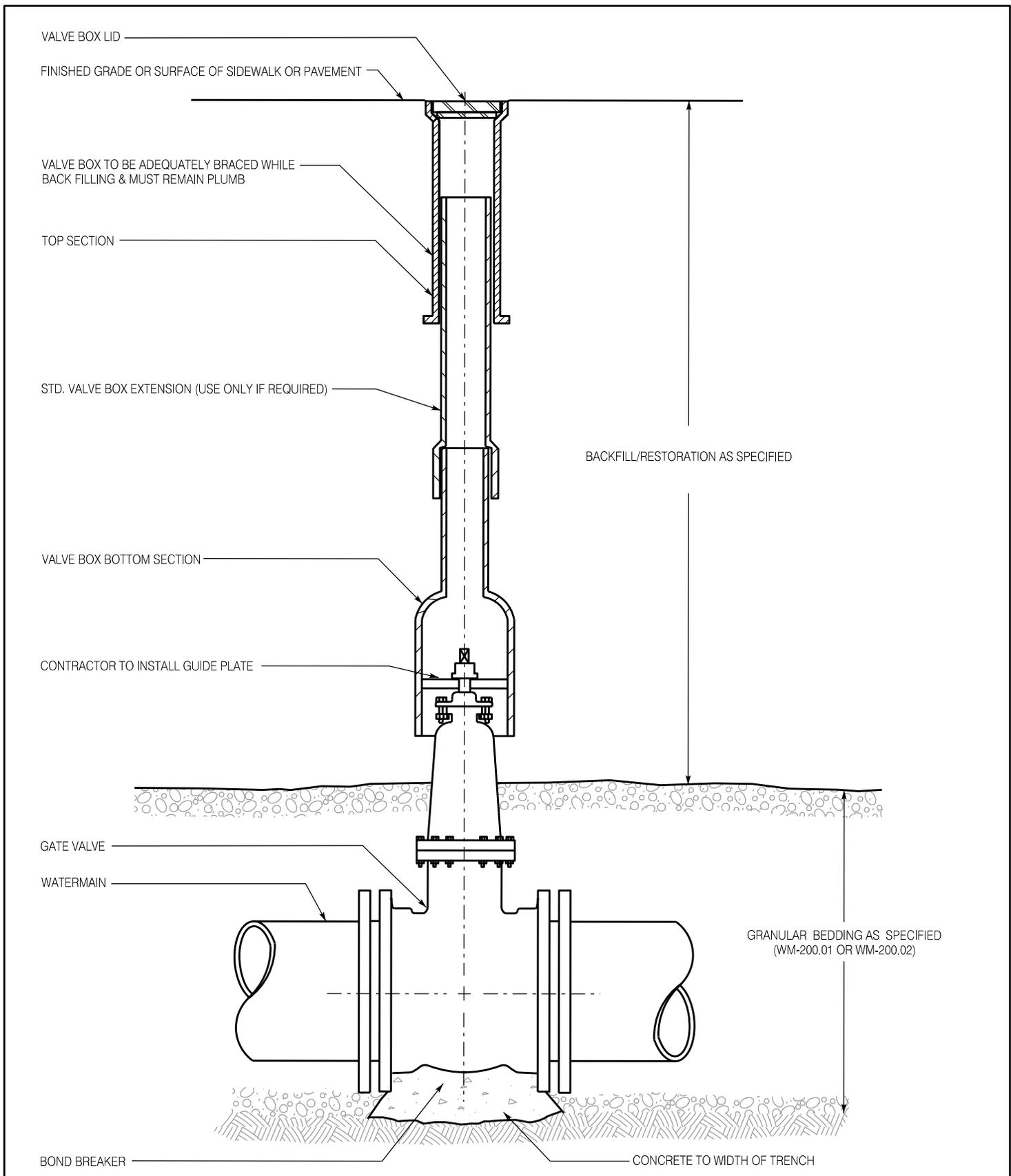
DATE
June 2017

REV No

FORMERLY:

HAMILTON STD No

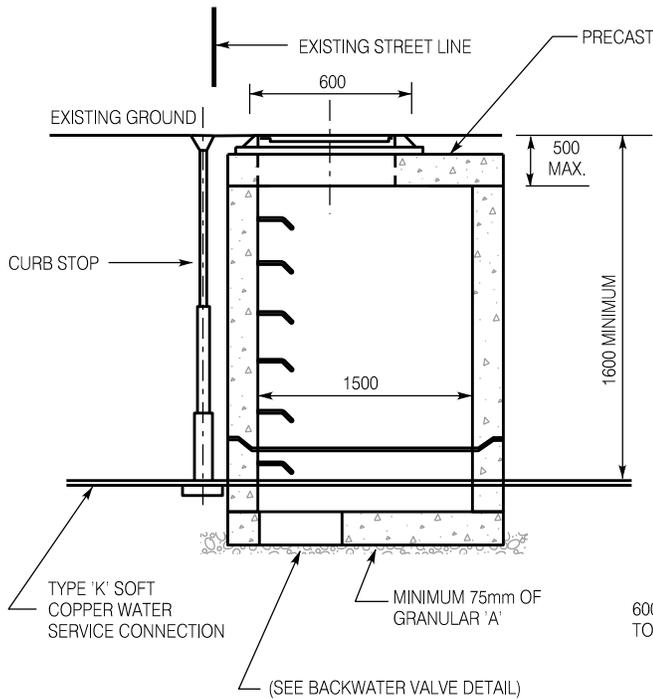
WM-201.03



City of Hamilton
Public Works Department

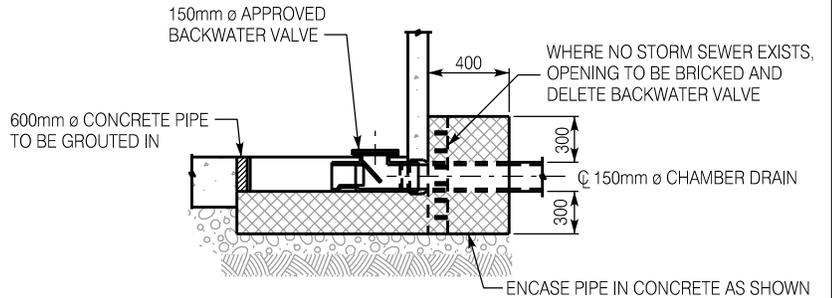
**VALVE BOX INSTALLATION FOR
100mm TO 400mm DIA. WATERMAINS**

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED (N.T.S.)	DATE June 2017	REV No 1	FORMERLY: RWS-309	HAMILTON STD No	WM-202
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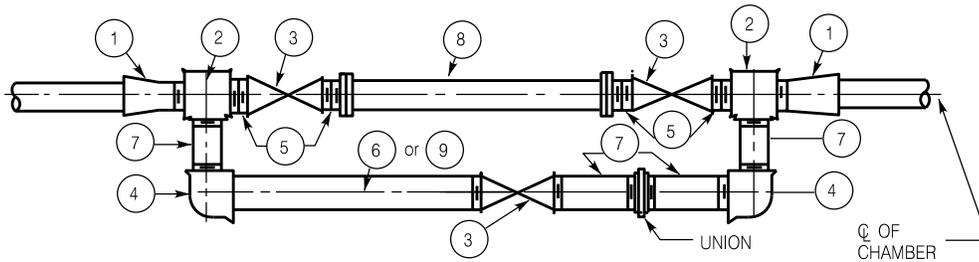


NOTES:

1. CHAMBER DIA. TO BE 1500mm.
2. CHAMBER FRAME AND COVER (OPSD 402.010).
3. PRECAST CONCRETE SECTIONS TO CONFORM TO A.S.T.M. C-478.
4. ALL CONCRETE TO BE 30 MPa., 28 DAY STRENGTH, TYPE 50 CEMENT.
5. ALL ADJUSTMENTS TO CHAMBER COVERS SHALL BE MADE WITH POURED CONCRETE.
6. STEPS TO BE GALVANIZED OR ALUMINUM PLACED AT 300mm C.C.
7. METER SUPPLIED AND INSTALLED BY CITY.
8. CHAMBER TO BE LOCATED ON PRIVATE PROPERTY AT THE STREET LINE.
9. FRAME & COVER TO BE CENTRED OVER METER.



BACKWATER VALVE DETAIL



FOR 16mm DIA., 19mm DIA. AND 25mm DIA. METERS

NOTES:

- | | |
|--|---|
| A. ALL VALVES TO BE GATE VALVES | D. PIPING TO BE TYPE K SOFT COPPER |
| B. BY-PASS TEES, ELBOWS TO BE BRASS, ALL ENDS C.F. | E. METER SPACER AND COMPANION FLANGES |
| C. METER COUPLINGS TO BE F.I.P. TO C.F. | F. BY-PASS PIPING NOT REQUIRED FOR SINGLE FAMILY DWELLING |

FOR 40mm DIA. TO 50mm DIA. METERS

NOTES:

- | | |
|--|--|
| ① COUPLING - C.F. TO M.I.P. | ⑥ BRASS PIPING (M.I.P. BOTH ENDS) |
| ② BRASS TEES F.I.P. ALL ENDS | ⑦ 150 LONG BRASS NIPPLES (M.I.P. BOTH ENDS) |
| ③ GATE VALVES. - (F.I.P. ENDS) | ⑧ METER SPACER & COMPANION FLANGES |
| ④ BRASS ELBOWS (F.I.P. BOTH ENDS) | ⑨ TYPE K SOFT COPPER PIPE WITH APPROPRIATE FLARED FITTINGS MAY BE USED IN LIEU OF BRASS PIPE |
| ⑤ BRASS CLOSE NIPPLES (M.I.P. BOTH ENDS) | |

City of Hamilton
Public Works Department

**PIPING AND CHAMBER FOR
16mm TO 50mm DIA. METER INSTALLATION**

DIMENSIONS SHOWN ARE IN MILLIMETRES
UNLESS OTHERWISE NOTED (N.T.S.)

DATE
June 2017

REV No
1

FORMERLY: RWS 709

HAMILTON STD No

WM-209