



**SECOND REVISION:
2020 LINEAR
INFRASTRUCTURE
STANDARDS**

AUGUST 7, 2020

This revision modifies the text for Special Provision 46. CCTV Inspections:

CCTV inspections for all sizes of sewer pipe shall be undertaken using pan and tilt equipment capable of providing a clear view of lateral connections and deficiencies. ~~Inspection of laterals~~
Additionally, a CCTV inspection of each lateral service shall be performed from the mainline sewer shall be undertaken to the property line to check for deficiencies that occurred during or after installation. The video for each lateral inspected must clearly show the municipal address it is associated with. Significant deficiencies including but not limited to broken, damaged or separated infrastructure as well as blockages, must be communicated immediately to the City's contract administrator. CCTV is to include catch basin leads.

No other modifications were made.

Replace SP 46 CCTV Inspections (Page 40 of SP Section).

Revisions to 2020 Linear Infrastructure Standards

Standard Specifications		
Replace cover page, inside title page and side strip		
Replace list of specifications		
Special provisions: Replace entire section due to text clean-up, deletions and revisions		
Section	Deletions & Revisions	Page No.
SP	5. Traffic, Cyclist And Pedestrian Control (Additional text to include all road users)	Pg. 3
	Second paragraph under Traffic Control Plan (Modified text)	Pg. 4 & 5
	Word "cyclist" added under Daily Records and Audits	Pg. 5
	9. Temporary Construction Fencing And Tree Protection Fencing, under Scope of Work (Modified text)	Pg. 10
	12. Dust And Mud Control (Additional text)	Pg. 12
	14. Dewatering and Pumping (Additional text to include "or any other natural area")	Pg. 13
	15. Sediment and Erosion Control (Additional text to include "or any other natural area")	Pg. 13
	38. 150 Mm Subdrains (Provisional) - Additional text under installation	Pg. 33
	46. CCTV Inspections (Modified and additional text to include property address (street name). CCTV is to include catchbasin leads.	Pg. 40
	49. (Additional text) Replacement Of Existing Sanitary And Storm Maintenance Holes	Pg. 42
76. Tree Related Plans And Requirements Additional text: Refer to City of Guelph Tree Technical Manual. Removed entire text under Special Provision Number 76	Pg. 60 to 69	
Supplemental Specifications SS- 1 to SS-32	Replace SS-31: Tree protection zones (Only item Revised in 2020) or, for AODA compliant document, replace the entire section	
SS-100	Replace entire section due to text formatting, clean-up, deletions and revisions	
	Changes: 2.4 Precast Maintenance Holes. (Additional text)	Pg. 7
SS-200	Replace entire section due to text formatting, clean-up, deletions and revisions	
	2.2 Valves And Valve Boxes (Additional text)	Pg. 6
SS-300	Updates on page 8 and table A (pg. 1 to 4). Replace entire section due to text formatting, clean-up, deletions and revisions	
	1.12.3 Thermoplastic Pavement Marking Materials (Modified text)	Pg. 8

Standard drawings for construction projects	
Replace Drawing Index and drawings listed bellow.	
Section	Description
3	Pipes, storm, sanitary & drains
	3-21: Service Connections For New Developments And Unserved Lots R-2 - Revised 2020
4	Waterworks
	4-25b: Combined Hydrant & Water Service Installation To Commercial Properties - Deleted As Per 2020 Revision
6	Landscaping/ Erosion control
	6-87a: City Standards Trail Barrier Gate - R-2 - Revised 2020
	6-90a: Tree Protection Zone (Tpz) Fence Detail Deleted 2020Rev
	6-90b: Tree Planting On Public Boulevard Deleted As Per 2020 Rev
	6-90c: Tree Protection Zone (TPZ) Information Signage Detail Deleted As Per 2020 Revision
9	Traffic
	9-204 Concrete Mounting Pad For Traffic Controller Cabinet- R-7 Revised 2020
	9-210 Standard Typical Traffic Signal Wiring Details- R-6 Rev2020
	9-212 Standard Typical Traffic Signal Equipment Mounting Detail- R-6 Revised 2020
	9-213 Typical Traffic Signal Pole (4.0m) Steel Sectional - Used For Mounting Pedestrian Heads- R-3 Revised 2020
	9-223 Typical Traffic Conduit Layout For Signalized Intersections- R-5 Revised 2020
	9-226 Pole Mounted Traffic Signal Controller Cabinet Installation- Rev.1.1 Revised 2020
	9-405 New Standard Drawing: Speed Cushion Design Nov 26 th , 2019 - Added As Per 2020 Revision



**STANDARD
SPECIFICATIONS
2020**

List of Specifications 2020

Specification No.	No. of Pages	Date
Special Provisions	75	February, 2020
Supplemental Specifications	1	February, 2020
SS-1 Clearing and Grubbing	2	February, 2001
SS-3 Recoverable Granular Material	1	February, 2001
SS-4 Water for Compaction or Dust Laying	2	February, 2005
SS-12 Breaking out and Replacement of Existing Driveways, Private Walks and Curbs	2	February, 2005
SS-13 Catchbasins and Laterals	4	February, 2001
SS-14 Adjustments to Maintenance Holes and Valve	3	February, 2001
SS-16 Curb and Gutter	4	February, 2011
SS-17 Sidewalks	4	February, 2011
SS-18 Grouted Rip Rap	1	February, 2002
SS-20 Topsoil	2	February, 2017
SS-22 Seeding and Mulching	3	February, 2017
SS-24 Chain Link Security Fence and Gate	6	February, 2017
SS-26 Demolition and Removal of Structures	4	February, 2001
SS-27 Ready Mix Concrete	2	February, 2005
SS-29 Concrete Pavers	2	February, 2001
SS-30 Layout by Contractor	2	February, 2007
SS-31 Specifications for Trees	2	February, 2020
SS-32 Truncated Dome Detectable Warning Plates	1	February, 2017
SS-100Sewers	10	February, 2020
SS-200Watermains	14	February, 2020
SS-300	48 (total)	February, 2020
Traffic-Related Items (page 1 to 31)	31	February, 2020
TABLE "A" (page 32 to 36)	5	February, 2020
TABLE "B" (page 37 to 44)	8	February, 2011
TABLE "C" (page 45)	1	February, 2011
TABLE "D" (page 46)	1	February, 2011
TABLE "E" (page 47 to 48)	2	February, 2011



CITY OF GUELPH

SPECIAL PROVISIONS

SECOND REVISION - AUGUST, 2020

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1. Contractor's Schedule of Work and Constraints

Within seven (7) days after Award of the Contract, the Contractor shall submit, for the approval of the Engineer, a more detailed schedule showing the starting and completion dates of each section of the following major items for each stage of the work. They shall include as a minimum:

1. number of crews
2. listing of equipment
3. mobilization and preparation of the site
4. installation of erosion control measures
5. traffic management and related staging
6. temporary traffic signals
7. general removals
8. coordination of works by others
9. earth excavation
10. installation of sanitary sewers, storm sewers and catchbasins
11. installation of watermain
12. granular base and sub-base
13. concrete curb & gutter and peripheral curbs
14. concrete sidewalks
15. traffic signal underground and above ground works
16. hot mix paving of base and surface courses
17. line markings and sign installations
18. topsoil placement and sodding
19. demobilization and site restoration

This schedule shall take into account the sequence of construction and the completion dates contained in the Supplementary Special Provisions.

The Contractor shall consult his sub-contractors to obtain realistic data for the preparation of his schedules.

The Contractor shall be required to provide the Engineer with updated/ revised schedules at intervals of two weeks for the duration of the contract. Site meetings shall be scheduled every two weeks.

2. Pre-Condition Survey

The Contractor shall hire an Independent Vibration Specialist for this section of the work. A company with a minimum of ten (10) years' experience in loss control for heavy construction in urban areas. The Independent Vibration Specialist shall provide professional Errors and Omissions Liability Insurance certificate for a minimum of one million dollars. The certificate of insurance shall be filed with the City of Guelph before commencement of work.

The specialist shall conduct a Pre-Condition Survey which shall include, at a minimum, all structures immediately adjacent to the work area.

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-

Condition Survey report shall include as a minimum the following information and shall be made available to the City of Guelph at the Pre-Condition 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, water 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.
- 6) Video, including pictures, in menu driven USB flash drive of the completed inspection.

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.

The Contractor shall complete, prior to construction activity, at no expense, two copies of the Pre-Condition Survey Report including digital photos & videos. Photographs of exterior features such as driveways shall be provided to the Engineer. 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.

Payment

Payment on a lump sum basis for the above work shall be full compensation for all labour, equipment and material required to do the work.

3. Bonds and Insurance

The Contractor shall bear all costs associated with providing all bonds and insurance in accordance with the Contract Documents.

Payment

Payment on a lump sum basis for Bonding and Insurance shall be full compensation for all the required Bonding and Insurance listed in this Contract. One hundred (100%) of the tendered price for this Item will be paid under the first payment certificate.

4. Mobilization and Demobilization

The work shall include the cost of mobilizing onto the site, demobilization, and final clean up upon completion of the work. The Contractor shall bear all costs associated with the provision of temporary facilities for construction.

Basis of Payment

Payment will be made on a pro-rated basis of the percentage of the total mobilization and demobilization. Payment for this item of work shall be made as follows:

- 60% for mobilization
- 40% for demobilization

5. Traffic, Cyclist and Pedestrian Control

Reflectivity Requirements

The Contractor's attention is drawn to the new requirements of OHS Reg. 213/ 91 Section 67, 68 and 69, regarding Traffic Control Measures. TC-22 Stop/ Slow paddles, Traffic Control Persons and Worker Clothing requirements. Nylon vests must have front and side tear away feature. Night-time retro reflective silver stripes around each arm and leg shall be used if required.

Traffic Protection Plan

Prior to commencement of the work, the Contractor will provide the Engineer a written Traffic Protection Plan, including the identification of all hazards and all measures necessary to adequately protect the workers on site. The Plan shall protect all agents of the City of Guelph, including but not limited to the Inspectors, Supervisors, Surveyors, Operations Traffic personnel and the Engineer. The work zone design must be consistent, uniform and predictable. Traffic safety for all road users must be designed into work zones and provide for safety, mobility, advanced warning and positive guidance. The Traffic Protection Plan must be kept on site at all times for inspection by the Ministry of Labour. The Contractor shall be aware that delineation is required between opposing traffic on roads open to traffic.

Pedestrian Passage

Pedestrian facilities (footpaths) and access shall be maintained throughout the working area at all times and shall be controlled throughout the length of the project. Construction fencing shall be provided as required to prevent pedestrians from crossing into the work zone. Access to pedestrian push buttons shall be provided at all times. If construction traffic is required to cross a temporary or permanent pathway, the Contractor shall provide a full time flag person.

A level compacted gravel surface (50 mm of Granular 'A') shall be maintained for pedestrian traffic at all times.

Open Excavation

The Contractor shall schedule the work so that there will be no open excavation adjacent to a lane carrying traffic overnight and on non-working days. Excavations within 4 m of lanes carrying traffic shall be backfilled with the specified material up to profile grade and compacted prior to closing down operations.

Location and Storage of Materials and Equipment

Materials shall not be stored within 4 m of the travelled portion of any roadway. Equipment shall not be stored within 4 m of the travelled portion of any roadway. Notwithstanding the foregoing, the Contractor shall, at the Contractor's expense, remove any equipment or material which, in the opinion of the Engineer, constitutes a traffic hazard.

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Delivery and Trucking

The Contractor shall plan and schedule the routes of vehicles transporting all materials to, from or within the job, so that vehicular movements are accomplished with minimum interference and interruptions to traffic. This will necessitate vehicles to "slip on" in the direction of traffic in order to merge with and thereby avoid crossing traffic lanes.

The Contractor shall obtain the Engineer's approval for the location of any "slip-off" or "slip-ons".

The Engineer reserves the right to alter, reject or close same as considered necessary. The Contractor shall notify suppliers of materials and equipment of the above requirements.

Traffic Control Plan

The Contractor shall provide the Engineer a written Traffic Control Plan for motorist safety and mobility in accordance with the Ontario Traffic Manual (OTM) Book 7 – Temporary Conditions and to the satisfaction of the Engineer. Traffic control plans shall include location, dates & times of work, references to "typical layouts" from OTM-Book 7 and any site specific variances from typical layouts if necessary.

~~The Contractor may provide advisory speed signing as deemed necessary. The advisory speed must not reduce the posted regulatory speed by more than 20 km/hr. The Contractor must cover all regulatory speed signs within the limits of construction.~~

The Contractor may request for a reduction of the posted speed limit in a construction zone, as per the City's Delegation Authority Bylaw (2013) – 19529 schedule 'MM'. The request shall be received in writing addressed to the City's Engineer a minimum of four (4) weeks before construction is to begin. If the

request is approved by the City's Engineer, the Contractor shall follow the Conditions and Limitations set out in schedule 'MM'. The Contractor shall cover all regulatory speed signs within the limits of construction.

The Contractor shall not place any temporary traffic control signage in a designated bicycle lane, on a multi-use trail or path or on a sidewalk. The Contractor shall place all temporary traffic control signage in such a way that it does not impact the movement of road users.

Included in this item shall be the supply, installation and removal of all barriers, barricades, delineators, lane control devices, warning signs, flashing lights, flares, traffic control devices, sign trucks, crash trucks, blocker trucks, and speed control devices, as required to complete the work.

The work may include traffic control persons and Police Constables as required to safely control traffic, particularly when construction activities encroach the intersection. The Contractor is reminded that Police Constables are the only mechanisms for controlling traffic at the intersection.

It will be the Contractor's responsibility to determine the Duration of the Work as described in the OTM 0 Book 7.

The Contractor will provide written and oral instructions to all workers setting up and removing traffic control on the roadway or shoulder. The Contractor will provide a copy of the written instructions to the Engineer prior to commencement of the work. The Contractor is reminded that unacceptable traffic control equipment will not be acceptable on City construction projects; see OTM - Book 7 - Field Edition for details.

Daily Records and Audits

The Contractor is advised that the Engineer may conduct regular inspections and video recording of the Contractor's traffic, cyclists and pedestrian control activities. It will be the Contractor's responsibility to audit and maintain a daily record of the application of the Traffic Protection Plan and the Traffic Control Plan, and these records shall be made available to the Engineer immediately upon request.

Notice Requirements

The Contractor shall provide City staff with a minimum of 2 full weeks' notice for any road closure requiring a detour of traffic. Notice for other traffic interruptions that require a significant revision or modification to the traffic control plan will require a minimum of 2 business days' for review by City staff.

Payment

Payment on a lump sum basis for the above work shall be full compensation for all labour, equipment and material required to do the work.

Payment shall be made on a prorated basis per month for the term of the contract.

6. Temporary Buildings

The location of all temporary buildings and other facilities shall be subject to approval of the contract administrator.

7. Site Preparation and Utility Preservation

The requirements of OPSS 490 and OPSS 491 shall apply to this Contract and the Supplemental General Conditions.

The Contractor is responsible for keeping the property owners, who may be inconvenienced in any way by construction, informed prior to commencing the operation. This requirement applies to, but is not limited to, cutting off of driveways, disrupting services, removing mail boxes or in any way disrupting mail service, temporary drainage problems and encroachment on private property. (The Contractor shall also advise the City of any removal of mailboxes or disruption of mail service to permit the City to notify the Postmaster.)

The Contractor shall confirm the location of buried utilities in advance of the work. Should the location of utilities shown on the Contract Drawings be found to be incorrect incomplete or omitted, the Contractor shall have no claim for any damages or delay caused to them on this account. It is the duty of the Contractor to notify all local utility companies requesting the staking or marking of cable, conduit, etc. before the start of construction.

The Contractor shall exercise extreme caution while working in areas where utilities are located. The Contractor shall co-ordinate their work with the appropriate Utility Company in order to facilitate the safeguard and protection of the utilities during construction.

The Contractor shall also provide protection to property bars and monuments as required. The Contractor shall be responsible for any damage to existing bars, including replacement of the bars lost or damaged through the negligence of the Contractor.

The Contractor shall arrange with the Utilities where guy wires have to be relocated or disconnected. The City will pay the Utility Company directly. **If required by Guelph Hydro or Bell Canada, the Contractor will be responsible to brace and support poles and other facilities as directed. This will be considered to be incidental to watermain, sewer, road traffic signal underground, and other related construction and no extra payment will be made therefore.**

The Contractor shall carefully note the requirements of Section 7.12 of the Supplemental General conditions of Contract. In addition to these requirements, the Contractor shall, prior to excavating within 1.5 metres of any utility pole, notify Guelph Hydro at (59) 822-3017. Guelph Hydro will then investigate and provide instructions to the Contractor regarding the type of support required for this pole.

Utility Companies

The Contractor is responsible for the co-ordination and scheduling of their work with the adjacent projects and utility companies and shall work around their respective schedules to the extent possible. No additional payment will be made for delays due to coordination and maintaining access for adjacent development, railway and utility work within this contract.

Utility work which will be in progress during this contract is as follows:

Guelph Hydro Electric Systems Inc.

Guelph Hydro shall undertake/ complete the following work during construction:

1. Refer to the Supplemental Special Provisions for information on the Guelph Hydro relocations.

The Contractor is responsible for the following:

1. Provide access to the site for all works and alter methods of operation and sequence of work to avoid interference with any utility installation/ relocation.
2. Co-ordinate with Guelph Hydro the construction of all permanent relocation work.
3. The Contractor shall grade fill and cut platforms for new hydro poles as required by Guelph Hydro. No separate payment will be made for grading of platforms for new hydro poles.
4. Arrange for Guelph Hydro to verify the location of all services and ducts within the construction limits.
5. Protection of existing plant until relocation is completed.

The Contractor will be required to support and maintain existing and new hydro poles within the Contractor's excavation or pavement limits until relocation work is completed. Smaller sized excavating equipment may also be necessary to maintain adequate clearances from the existing and new hydro facilities. There will be no separate payment to the Contractor for supporting and maintaining hydro poles. No separate payment will be made to the Contractor for protecting the relocated hydro cables or underground duct structures.

Contractors should be aware of the Guelph Hydro approved list of contractors.

Bell Canada

Bell Canada shall undertake the following work during construction:

1. Provide locates for existing and new plant.
2. Refer to the Supplemental Special Provisions for information on the Bell relocations.

The Contractor shall be responsible for the following:

1. Provide access to the site for all works and alter methods of operation and sequence of work to avoid interference with utility installation.
2. Co-ordinate with Bell Canada the relocation of their plant where required.

3. Arrange for Bell Canada to verify the location of all services and duct structure within the construction limits.
4. Protection of existing plant. There will be no separate payment for protection of existing Bell cables or for delays due to Bell relocation.

Contractors should be aware of the Bell approved list of contractors.

Union Gas

The Contractor shall be responsible for the following:

1. Arrange for Union Gas to verify all services and main locations within construction limits.
2. Protection of existing plant.
3. Contact Union Gas for third party inspection.
4. Follow Union Gas representative's direction and construction guidelines.
5. Refer to the Supplemental Special Provisions for information on the Union Gas relocations.

Contractors should be aware of the Union Gas approved list of contractors.

8. Supply, Place And Maintain Temporary Erosion And Sediment Control Measures

Scope of Work

Work under this item shall be completed in accordance with OPSS 805 and as amended herein.

Erosion and sediment control measures shall be incorporated in the work to ensure sediment discharge to watercourses and/ or lands in or adjacent to the working area is minimized for the entire duration of the contract.

The fence shall be installed as OPSD 805 and the geotextile shall conform to OPSS 1860.

Payment at the Contract price bid shall be full compensation for supplying all labour equipment and materials for the installation of temporary silt fencing, check dams, sediment traps/ basin, for all excavation and disposal of related surplus material for supplying and placing filter berms, sandbags, concrete barriers, rip rap and sewer pipe, etc. as required; for pumping water to sediment basin; for carrying out all maintenance; for removal of temporary measures at completion of work and for all other works necessary to properly control the movement of sediment from excavations and disturbed areas.

Maintenance

The fencing shall be maintained in an upright and secure condition such that they remain fully functional for the duration of the contract. The fencing shall be inspected after each rainfall. The contractor shall remove and dispose of the build-up of sediment at the fence as required. Siltation fence shall remain in place until the sod or seed is established.

Removal

Once all disturbed areas have been re-vegetated, the silt deposits behind the fencing shall be removed and disposed of to ensure it does not enter the watercourse. All the fence materials shall then be removed. All material remains the property of the Contractor

Measurement and Payment

Measurement will be made on a prorated basis of the percentage of the total contract works completed. Payment for this item of work shall be made as follows:

- 50% for supply and installation
- 30% for maintenance
- 20% for removal

The payment for maintenance will be made upon satisfactory condition of the works and removal of any accumulated sediment at the time of payment. It is noted that measurement will be in metres, following the contour of the ground, of the actual length of silt fence installed.

9. Temporary Construction Fencing And Tree Protection Fencing

Scope of Work

Work under this provisional item shall include the supply, installation, maintenance and subsequent removal of 1.2 m high temporary orange plastic fencing and "T"-bars for delineation of pedestrian walkway areas from areas of active construction, to separate contractor work areas, and to provide temporary fencing for tree protection. New or salvaged plastic fence material may be used for the temporary working fence and tree protection, provided it is free of rips, tears, holes or missing segments. If salvaged material is used, it shall be in reasonable condition prior to erection and acceptable to the Engineer.

Temporary construction fencing shall be placed in a vertical orientation with a maximum spacing of 4m between "T"-bars and installed with the mesh material facing the public side (non-work area) and complete 2x4 wooden bracing to ensure that the fencing materials remain in a vertical condition. Fencing shall be adjusted to suit the work progress and shall be installed so as to direct pedestrians and others away from open excavations and/ or toward crossings of the construction site.

Tree fencing shall be placed in a vertical orientation with a maximum spacing of 4m between "T"-bars and installed with the mesh material facing the public side (non-

work area) with 2x4 wooden bracing to ensure that the fencing materials remain in a vertical condition. Fencing shall be adjusted to suit the work progress. Installed as per the Tree Technical Manual. Fencing may not be adjusted without prior consent of the City.

All temporary fencing placed on the project will be the property of the Contractor at the completion of construction.

Measurement for Payment

Measurement shall be in linear metres of construction fencing erected.

Basis of Payment

Payment at the Contract price for the above item shall be full compensation for all Labour, Equipment and Material to supply, erect, maintain and remove fencing as directed by the Engineer and where required for the duration of the Contract.

Partial payment for this work shall be on a pro-rated basis as follows:

- 60% - Supply and installation;
- 30% - Maintenance (pro-rated on the progress of the work); and
- 10% - Removal

10. Preconstruction Meeting

The Contractor shall attend a preconstruction meeting at the offices of the Owner or other location as determined by the Owner to review the approach to the project, introduce the various contact personnel involved in the project and to discuss the start-up procedure, coordination details, specific project scheduling issues, and other related coordination requirements.

The Contractor shall also coordinate and organize attendance at the Preconstruction Meeting representatives of major Subcontractors. The Engineer will arrange the attendance of other interested parties not responsible to the Contractor.

The Engineer will distribute copies of the meeting agenda prior to the meeting. The agenda will include but will not be limited to the following topics, as they pertain to the Contract:

1. Introduction of Project Personnel
2. Lines of Communication
3. Working Hours
4. Contractor's Schedule and Staging
5. Public Notifications
6. Contractor's Submittals/ Documentation
7. Contractor's Traffic Management Plan
8. Contractor's Erosion and Control Plan
9. Work by Others/ Adjacent Contracts
10. Contractor's Safety Program and documents
11. Pre-Construction Survey
12. Contractor's Temporary Facilities

- i. Site Office
- 13. Unique Contract Requirements
 - i. Traffic Control and Signage
 - ii. Pedestrian Access
 - iii. Driveway Access
 - iv. Temporary Potable Water Supply
 - v. Garbage and Recycling Collection
- 14. Contract Change Control
- 15. Progress Payments
- 16. Progress Meetings

The Engineer shall provide specific information relative to agenda items as they pertain to the Contract.

The Engineer will minute the meeting and distribute a copy of the meeting minutes to all attendees.

11. Project Progress Meetings

The Engineer shall call and chair the project progress meetings, anticipated to be held approximately bi-weekly at a pre-arranged location, preferably in the project site office or other mutually convenient location. The time and date of the site meetings will be determined at the initial pre-construction meeting and may be updated from time to time to suit the requirements of project progress.

The Contractor shall attend, coordinate and organize attendance of individual Subcontractors and material suppliers where and when requested by the Engineer. Relationships and discussions between Subcontractor participants are not the responsibility of the Engineer and do not regularly form part of the meeting content.

The Contractor shall ensure that Contractor representatives in attendance at meetings have knowledge of the Work and the required authority to commit the Contractor to actions agreed upon. The Owner, Contractor and the Engineer shall endeavour to assign the same persons to attend such meetings throughout the Contract duration and shall supplement attendance with specialist representatives as required throughout the course of the Project.

The agenda will include but will not be limited to the following topics, as they pertain to the Contract:

- 1. Review and agreement on previous minutes
- 2. Review of Work progress since previous meeting
- 3. Construction Safety
 - i. Traffic Management
 - ii. Pedestrian Access/ Protection
- 4. Coordination
 - i. Public Notification
 - ii. Garbage and Recycling Collection
 - iii. Work by Others
- 5. Environmental Protection
- 6. Status of Submittals

7. Quality Control
8. Coordination
 - i. Public Notification
 - ii. Utility Coordination
9. Work Plan for Next Two Weeks
10. Contract Construction Schedule Review, (Progress [Percentage Complete] problems, corrective measures and revisions)
 - i. Update Progress Schedules
 - ii. Update Working Days
11. Requests for Information/ Clarification
12. Contemplated Changes
13. Changes Completed
14. Contractor Performance Evaluation
15. Other business

The Contractor shall provide specific information relative to the agenda items at each meeting, as they pertain to the Contract.

The Engineer will minute each project progress meeting and distribute a copy of the meeting minutes to all attendees.

12. Dust and Mud Control

The Contractor shall carefully note the requirements of Section 7.06 of the Supplemental General Conditions of Contract. The Contractor shall be responsible for a prompt and **thorough** clean-up of mud and dust deposited on the public and or private property as a consequence of his operation on this Contract, **paying special attention to cycling facilities such as bike lanes and multi-use paths near the project site**. The Contractor shall sweep and remove mud and dust from the side streets as directed by the Engineer. In the event the Contractor fails in these obligations the Engineer may proceed with necessary clean up and charge all costs for the work to the Contractor.

Payment

Upon direction from the Engineer, the Contractor will be required to use a street sweeper to remove mud/ dirt/ debris from City streets adjacent to the construction site. Payment shall be per hour spent on site sweeping mud and travel time to and from the site shall be included in the hourly rate. Disposal of the sweepings shall also be included in the hourly rate.

13. Refuelling and Maintenance Areas

The Contractor shall undertake a detailed review of his proposed routes and fuelling areas. Refuelling and maintenance of equipment shall not be undertaken in or adjacent to watercourses storm sewers and or related inlet or outlet features. Suitable fuelling and maintenance areas shall be established and all maintenance and fuelling conducted in these areas. The locations of such areas are subject to approval and acceptance by the Engineer.

Procedures for the interception and rapid clean-up and disposal of spills that do occur shall be submitted to the Engineer for review prior to starting work. All materials required for clean-up of fuel spills shall be maintained readily accessible on-site.

The exception to this fuelling location requirement shall be generators, cranes, backhoes or shovels which may be fuelled at other than the designated fuelling areas. However, no fuelling of backhoes shall be carried out within thirty (30) metres of any watercourse including railway swales and/ or ditches unless authorized by the Engineer.

14. Dewatering and Pumping

Dewatering where specified and/ or required shall be carried out in accordance with OPSS 517 and OPSS 518. Dewatering (under 50,000 l. per day) shall not be paid for separately unless otherwise noted, but shall be included in the Contract price for the tender items.

The Contractor is responsible for the supply, design, labour, materials, equipment and services necessary for dewatering systems for the removal and control of water within excavation during construction. This shall include supply, design, labour, materials, equipment and services necessary for the installation and removal of temporary dewatering systems, including all pumping required to isolate work areas for the installation of the work in the dry and to prevent silt sediment from entering any sewer, watercourse, river, lake, pond or any other natural area. Temporary shoring system, cofferdams and dewatering where required shall be designed in accordance with the latest edition of the Canadian Foundation manual.

Shop drawings for the dewatering and shoring systems shall be submitted to the Engineer for review by Approval Authorities (i.e. Grand River Conservation Authority, Municipality, etc.). This shall include drawings, calculations, details of the type of dewatering system, complete with equipment and materials to be used, installation procedures, discharge locations, etc.

The Contractor shall adhere to provincial and federal requirements related to the protection of the environment and safety of construction and protection of workers.

The Contractor shall control their operations in such a way as to minimize erosion and discharge of sediment-laden water. Disturbed areas are to be stabilized as soon as possible. The operation of construction equipment and the placement of temporary material stockpiles are to be done so as to prevent the tracking or erosion of mud onto the adjacent roadway and properties.

15. Sediment and Erosion Control

The Contractor shall be solely responsible for the preparation and implementation of an erosion and sediment control strategy utilizing, in part, the elements indicated on the Contract Drawings, and/ or other suitable techniques and construction practices in order to control erosion and prevent silt and sediments from entering sewers, water courses, or any other natural area to meet the requirements of the authorities having jurisdiction.

Prior to commencement of construction, submit for review an overall "Sediment and Erosion Control Implementation Plan" in combination with the Contractor's construction practices and staging, to describe the overall erosion and sediment control strategy to meet all requirements. The "Sediment and Erosion Control Implementation Plan" shall be acceptable to the Engineer and the authorities having jurisdiction.

The Contractor will be paid under the appropriate tender items within the "Schedule of Unit Prices" for temporary works. All other works shall be included in the unit price bid for items requiring the control, dewatering, etc.

16. Lay-Out By City

Layout may be provided by City forces in accordance with Section 3.05 Supplemental General Conditions of the Contract. If the Form of Tender lists an Item for "Lay-Out by Contractor", then the Contractor SHALL perform the lay-out on the Contract as per SS-30 and this section of the Special Provisions shall not apply. If no Item for "Lay-Out by Contractor" is listed in the Form of Tender, then this section will apply and the City will perform the Contract lay-out.

The survey field crew will check, each day, with the inspector as to layout requirements and will provide line and grade referred stakes on an off-set as requested by the Contractor. Written information will be given to the Contractor in the form of grade sheets stating elevations of the stakes, proposed grades for the particular service, or road element as the case may be, along with cut and fill reductions.

It shall be the Contractor's responsibility to transfer the proper line and grade to the excavation or other work at hand. The Contractor shall have on site a "Dumpy Level" or better, levelling rod, and engineer's transit with trained personnel to assist the inspector in verifying grades and alignment as deemed necessary by the inspector.

The survey field crew will be called upon, by the inspector, to recheck grades only when a problem is suspected.

Upon completion of the work the field crew and/ or inspector will take the necessary measurements and elevations for final quantity reports and for City records.

Excavation and Grading

The Engineer will provide offset hubs at 10.0 metre intervals, on both sides of the right-of-way. The offset hubs will be accurate for the purposes of excavation and grading only. The offset hubs shall not be used for the setting of curb string line or the installation of maintenance holes and catch basins.

The Engineer will provide sufficient layout points to establish intersection radii for the purposes of excavation and grading

Maintenance holes

The Engineer will provide one offset hub and one marker stake for each maintenance hole. The hub will indicate an offset to the centerline of the grate. It will be the responsibility of the Contractor to determine any additional offsets required to ensure that the pre-manufactured structures are installed such that the final centerline of the grate is in accordance with the offset hubs. **It will be the responsibility of the Contractor to take into account the tapered sections of maintenance holes and their respective offsets to the center of the precast base. The Contractor shall measure the offset required for each structure delivered to the project site and submit a written account to the Engineer before installation of any maintenance hole.**

The stations, offsets and final top of grate elevation for maintenance holes shall be set in accordance with the structure tables included in the Contract Documents.

Line Painting

The Contractor shall be responsible for pre-marking the lane widths and tapers and shall complete all permanent pavement markings as shown on the Contract Drawings. The Contractor shall contact City of Guelph Traffic Investigations Staff to arrange for inspection of the pre-marking prior to painting lane markings.

The Contractor shall lay-out all other information necessary for the construction of the complete project in accordance with the Contract Drawings.

Daily Work Records

The Contractor shall maintain and keep accurate Daily Work Records in accordance with GC 8.02.07. Daily Work Records shall be signed by the Contractor's representative and shall be submitted to the Engineer on a weekly basis.

17. Engineer's Field Office

The Contractor shall provide service and maintain a weatherproof site office for the sole use of the Engineer and his staff for the duration of the Contract. The field office shall incorporate the following:

- 1) A minimum floor area of 12 square metres
- 2) Three opening windows
- 3) Fluorescent light fixtures to provide a 650 lux (60 ft. candle) level
- 4) Heating and Air conditioning unit
- 5) A door with a proper lock set and two keys
- 6) A desk and plan table and six standard office chairs
- 7) A temporary sanitary facility adjacent to the site trailer
- 8) A first aid box as required by the WSIB
- 9) Service, maintain and carry insurance on the site office and its contents

The location of the field office shall be determined by the Engineer at a location to be made available by the Contractor.

The office shall be cleaned weekly and the sanitary facilities checked and cleaned as necessary on a daily basis at the Contractor's expense.

The field office and the sanitary facilities shall be provided and maintained on the site by the Contractor, and may not be removed until the Engineer has notified the Contractor that all calculations are complete, up to a maximum of 60 days after acceptance of the work.

18. Street Signs and Mail Boxes

The work shall include the removal, salvage, and re-installation of mailboxes, and other items as required.

19. Sawcutting – General

Scope of Work

The Contractor is advised there will be no separate payment for saw cutting of materials of any kind on this Contract.

All saw cutting shall be made by means of suitable mechanical sawing equipment capable of making a clear cut and leaving a perfect edge.

Payment for all saw cutting will be incidental to the Work.

Saw cuts shall be made in the existing pavement where noted on the plans, or where directed by the Engineer. All saw cutting for removals shall be clearly marked in the field by non-permanent means (Chalk line, keel or other removable/erasable markings) and reviewed with Engineer's on-site representative prior to undertaking saw-cutting and removal activities

20. Removal Of Concrete Curb & Gutter (All Types And Sizes)

Scope of Work

Work under this item shall be completed in accordance with City of Guelph Standard Specifications, OPSS 510, and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

Concrete curb and gutters shall be saw cut at the limits of removal and removed as required to complete the Work and as noted on the Contract Drawings for the construction of new roadway and related infrastructure.

Additions and deletions (Adjusted Plan Quantity) of Removal and Disposal of Existing Concrete Curb and Gutters, where and if necessary, shall be calculated from field tape measurements agreed to by the Engineer and the Contractor and adjust the Plan Quantity accordingly.

All removed material is to be disposed of off-site, unless otherwise directed by the Engineer.

Measurement for Payment

Measurement shall be by Plan Quantity of linear metres as noted on the Contract Drawings and will not be measured directly but will be based on pro-rated progress of the Work.

Measurement may be revised by Adjusted Plan Quantity as specified in the Contract.

Basis of Payment

Payment at the Contract price shall be full compensation for all Labour, Equipment and Material to do the Work

21. Removal of Bituminous Pavement and Concrete Sidewalk or Concrete Slab

Scope of Work

Work under this item shall be completed in accordance with City of Guelph standard specifications, OPSS 510, and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

The work of this item includes saw-cutting, excavating, breaking, loading, haulage, and disposal of all bituminous pavement and concrete road base material exposed and encountered during the Work and includes but not limited to road construction, storm sewer, sanitary sewer and watermain installation. Evidence of backfilling of trenches with broken pavement/ concrete or containing broken concrete or boulders will result in non-payment for the removal item and non-payment for the pipe installation. In no case shall broken concrete (or boulders) be left in excavations for any reason whatsoever, unless delivered as part of an approved construction material meeting all quality and gradation specifications applicable to the work.

The Contractor shall refer to the Geotechnical Investigation report and borehole logs to ascertain the scope of work required under this item.

The existing sidewalk shall be left in place until immediately before its reconstruction.

All removed material is to be disposed of off-site, unless otherwise directed by the Engineer.

Measurement for Payment

Measurement for Payment and Basis of Payment shall be as per OPSS 510.

22. Removal of Sewers & Appurtenances

Scope of Work

Work under this item shall be completed in accordance with OPSS 510 and as amended herein.

All existing storm and sanitary structure frames and covers/ grates to be replaced shall be salvaged and delivered by the Contractor to the City of Guelph works yard.

Excavation within existing or future pavement limits shall be backfilled with Granular 'B' Type I.

Granular material shall be compacted to 100% of maximum dry density.

Excavation outside of existing or future pavement limits shall be backfilled with select suitable native material.

Native material shall be compacted to 95% of maximum dry density.

The requirements of OPSS 510 shall apply except that where concrete, masonry, timber or metal headwalls are encountered (either buried or exposed) in association with pipe culvert to be removed, the removal of the headwall will be included in the unit price bid for removal of the pipe culvert.

Where culverts are to be removed and no new culvert is to be placed at the same location, the Contractor shall supply and place Granular 'B' to backfill the excavation. The cost of this material shall be included in the cost for removal of pipe culverts and sewers, and will not be included for payment under the Granular 'B' item.

Measurement and Basis for Payment

Measurement and basis for payment shall be in accordance with OPSS 510.

23. Removal of Watermain & Appurtenances

Scope of Work

Work under this item shall be completed in accordance with the City of Guelph Standard Specifications, OPSS 510 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

The work under these items shall include but not limited to the removal of pipes, fittings, valves of all types and sizes, concrete thrust blocks, chambers, and hydrants.

All removed material is to be disposed of off-site, unless otherwise directed by the Engineer.

Measurement and Basis for Payment

Measurement and basis for payment shall be in accordance with OPSS 510.

24. Remove and Dispose of Existing Underground Utilities/ Traffic Signal Underground

Scope of Work

Work under this item shall be completed in accordance with City of Guelph Specification SS-300, OPSS 510 and 610 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

Removal of any underground utility and/ or traffic signal underground shall not be undertaken without written authorization from the Engineer and the utility owner, unless otherwise clearly indicated on the Contract Drawings. Notwithstanding the above, the Contractor shall confirm the nature and status of existing materials to be removed and shall confirm the removal with the appropriate utility/ owner representative(s) in advance of the work of removal. Any materials encountered in the field requiring removal but not shown on the plans shall be communicated to the Engineer at the time of exposure for assessment of the action to be taken.

The work of this item shall include carefully exposing, excavating and removal of existing abandoned underground utility plant and traffic signal underground found or abandoned prior to, or during, the Work of this Contract.

Payment for the above item(s) shall be at the Contract price listed in the Form of Tender.

In accordance with the foregoing Special Provision and the Standard Specifications, where no specific item for payment for removal and disposal off site exists, the work of removing incidental abandoned piping and structures shall be deemed to be included in the related work of other items in the Contract.

All removed material is to be disposed of off-site, unless otherwise directed by the Engineer.

Measurement for Payment

Measurement shall be by the applicable units in the Form of Tender.

Basis of Payment

Payment at the Contract price(s) for the above work shall be full compensation for all Labour, Equipment, and Material to do the work including all requirements of OPSS 510 and 610.

25. Excavation of Materials

Work under this item shall be completed in accordance with City of Guelph, "Specifications for Earth Excavation" OPSS 206 and as amended herein.

The Contractor shall employ suitable means of earth moving on the project so as not to compromise public safety, integrity of the Work, or protection of the environment. Where work near, or at, adjacent public roadways is undertaken, protection schemes acceptable to the City of Guelph and the Engineer shall be employed.

CITY OF GUELPH
SPECIAL PROVISIONS

The area of the excavation was based upon the area of the proposed work from 0.5m behind the existing or proposed curb, whichever is wider.

The Contract design cross sections will be available for review at the office of the City of Guelph during the tendering period at the following location:

City of Guelph

City Hall

Engineering

1 Carden Street, 3rd Floor

Guelph, Ontario N1H 3A1

In accordance with OPSS 206.07.09 – Quality Control, the Contractor is responsible for carrying out all quality control grade checks to ensure that horizontal and vertical grading tolerances as specified in the Contract Documents are met on all finished earth and rock grade surfaces. Submission of all Contractor grade checks shall be in accordance with OPSS 206.07.09.02.

The Engineer's on-site personnel may conduct random quality assurance (QA) grade checks. When requested in accordance with GC 7.01.10, the Contractor shall provide a person to assist the Engineer's on-site personnel in checking the grade.

If the Contractor believes that a cross-section is in error, the Contractor shall advise the Engineer who will section the area in question. If the Contractor believes such an error has been made, the Contractor must bring it to the attention of the Engineer in sufficient time to permit the Engineer's on-site personnel to take cross-sections before the next operation begins, otherwise no additional payment will be considered.

Excavation additions or deletion (Adjusted Plan Quantity), where and if necessary, shall be calculated from the field tape measurements/ elevations agreed to by the Engineer and the Contractor and the Plan Quantity adjusted accordingly.

The excavation of existing topsoil for cutting new topsoil & sod into the boulevards shall be included in this item. The excavation of topsoil shall be considered incidental to the excavation work and will not be paid by measured quantity.

Unless specified otherwise, all excavated materials become the property of the Contractor, and accordingly shall be disposed of off-site and not at the City's stockpile area.

If excavation is carried out beyond the design slopes, without the approval of the Engineer, no payment will be made for the additional excavation.

The Contractor shall perform all excavation operations in such a manner as to avoid ponding of water or the saturation by flooding of embankment materials. No separate payment will be made for pumping, installation of temporary storm sewers, etc.

Roadway sub-grades shall be maintained to the grades, tolerances and specified density until the surfaces are covered with granular materials. Any marks, ruts or indentations in the subgrade caused by vehicles, equipment or any other cause shall be removed prior to placing granular materials at no additional cost to the Owner. Damaged sub-grade materials shall be excavated and removed to a firmer

sub-grade level, acceptable to the Engineer and the excavated sub-grade materials disposed of and replaced with Granular 'B' Type II/ suitable select native material as determined by the Engineer. The cost associated with the additional excavation, disposal and additional granular road base shall be borne by the Contractor

When directed by the Engineer, the Contractor shall proof roll the subgrade with a heavy non-vibratory compaction unit and the cost of this Work shall be included in the Contract price for "Excavation of Materials (Grading)".

Select native fill material shall be placed in accordance with City of Guelph, Standard Specification OPSS 206.07.07.02, Layer Compaction Method, and compacted to a minimum of 95% of Maximum Dry Density.

Removal of Drains, Abandoned Utilities (Up to and Including 150mm Diameter), Boulders < 1m³, Etc.

Where items of the type listed above, or underground utilities to be abandoned, conflict with the line and grade of construction, or wherever directed by the Engineer, the Contractor shall remove these installations including trimming of such material, hauling and dispose of them off-site. No separate payment will be made for this work.

Excavation on Widening

Payment for temporary or permanent excavation on widening shall be paid under this item.

Adjust Existing Service Boxes

The unit price bid for Earth Excavation shall include protecting and adjusting, as often as necessary all existing water service boxes at the curb stops, to suit the final grade of the new pavement, sidewalk and/ or boulevards.

Dewatering Excavation

For the unit price bid for "Excavation of Materials (Grading)", the Contractor shall perform all excavation operations in such a manner as to avoid ponding of water or the saturation by flooding of earth and/ or soil materials. No separate payment will be made for pumping, installation of temporary storm sewers, etc.

Measurement for Payment

Measurement shall be by Plan Quantity as per the units in the Form of Tender of material excavated and will not be measured directly, but will be based on the pro-rated progress of Work and the checking of sub-grade elevations and plan measurement of the length of roadway cut to sub-grade.

Measurement may be revised by Adjusted Plan Quantity as specified in the Contract.

Basis of Payment

Payment at the Contract price shall be full compensation for all Labour, Equipment and Material to do the Work, including but not limited to additional traffic control, protection schemes, haulage and disposal of material off-site.

26. Rock Excavation

Scope of Work

The requirements of OPSS 206 and 403 shall apply to this item except as modified herein. **GC 8.01.02 as it applies to the Rock Excavation item is deleted and therefore does not apply.** This item is for rock requiring excavation that is encountered in trenches for sewer and watermain and/ or in areas of excavations for roadways or utility installations. The Contractor shall have no claim for payment under this item of work in the event that rock excavation is not required as part of the work.

Measurement for Payment

Measurement shall be by the applicable units in the Form of Tender. The measurement of the trench width for the volume of rock excavated shall be the theoretical minimum trench width as identified on 3-29.

Basis of Payment

Payment at the Contract price for the above work shall be full compensation for all Labour, Equipment, and Material to do the work including all requirements of OPSS 206 and 403. The Contract price shall include compensation for any equipment or labour downtime for the affected sewer or water crew during the rock excavation operation i.e. the time where the crew (labour) & equipment sit idle while the rock is being removed and loaded for disposal.

27. Select Subgrade & Trench Material (Provisional)

Scope of Work

Under this item and for the unit price bid per tonne, the Contractor shall supply all labour, equipment and materials for the supply, installation and compaction of select subgrade & trench material to 98% SPD in the event that the native soils are found to be unacceptable for the purposes of the contract work. The Contractor shall have no claim for payment under this provisional item of work in the event that select subgrade & trench material is not required as part of the work.

Measurement for Payment

Measurement shall be by the applicable units in the Form of Tender. Measurement for payment will be based on material weigh tickets for material used on site as determined by weigh tickets produced and delivered by the Contractor at the time of delivery from an approved weigh scale (per OPSS 102 and MTO SP101S18).

Basis of Payment

Payment at the unit price bid per tonne under this item shall also include all costs associated with the sub-excavation, loading, haulage and disposal of unsuitable material which is to be displaced. Payment at the Contract price for the above work shall be full compensation for all Labour, Equipment, and Material to do the work including all requirements of OPSS 120 and 206.

28. Granular "B" In Roadway

Work under this item shall be completed in accordance with City of Guelph Standard Specifications OPSS 314 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

The following gradations shall apply for Granular "B" per MTO Test LS-602 Sieve Analysis of Aggregates:

MTO Sieve Designation	Percentage Passing by Mass
150.0 mm	100
26.5 mm	50 - 100
4.75 mm	20 - 55
1.18 mm	10 - 40
300 um	5 - 22
75 um	0 - 8, (0 - 10)*

*Where aggregate is obtained from a quarry

Granular "B" for road base only shall be paid under this item.

In accordance with OPSS 314.07.08 – Quality Control, the Contractor shall carry out grade checks on the finished Granular "B" surfaces and carry out all QC grade checks required to ensure that the finished Granular "B" courses are built to within the specified tolerances for grade and cross-section. Submission of all Contractor grade checks related to Granular "B" finished surfaces shall be in accordance with OPSS 314.07.09.

Compaction of Granular "B" materials shall be 100% of Maximum Dry Density.

The Contractor shall summarize on a daily basis the applicable weigh tickets in a tabular form the Project Name and Contract Number, location, stage or phase, as applicable, for each applicable granular road base item, listing the ticket number and net weight of material, and summary total of material delivered to the site on the applicable item. The Contractor shall submit the summary table(s) and weigh tickets to the Engineer within 48 hours of delivery of material.

The Contractor's attention is drawn to various items in the drawings and contract documents which are inclusive of granular "B" materials. Where such materials are to be included in a separate payment item (i.e. commercial driveways, etc.) material delivery tickets shall be marked clearly to that effect, if delivered to personnel on site on the date of placement, and shall be deducted (or preferably excluded) from the Contractor's summary of materials placed. Under no circumstances shall materials that are included elsewhere for payment be included in the Contractor's total material payment quantity summary for Granular "B" road sub-base.

Measurement for Payment

Measurement shall be per tonne as evidenced by weigh scale tickets from an approved weigh scale (per OPSS 102 and MTO SP101S18).

Basis of Payment

Payment at the Contract shall be full compensation for all Labour, Equipment and Material to do the Work, including but not limited to provision of summary tables for material, additional traffic control, protection schemes, and maintenance of the completed works prior to the subsequent operations.

29. Granular "A" In Roadway

Work under this item shall be completed in accordance with City of Guelph Standard Specifications OPSS 314 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

In accordance with OPSS 314.07.08 – Quality Control, the Contractor shall carry out grade checks on the finished Granular "A" surfaces and carry out all QC grade checks required to ensure that the finished Granular "A" courses are built to within the specified tolerances for grade and cross-section. Submission of all Contractor grade checks related to Granular "A" finished surfaces shall be in accordance with OPSS 314.07.09.

Granular "A" for road base and temporary Granular "A" shall be paid for under this item.

Compaction of Granular "A" materials shall be 100 % of Maximum Dry Density.

The Contractor shall summarize on a daily basis the applicable weigh tickets in a tabular form the Project Name and Contract Number, location, stage or phase, as applicable, for each applicable granular item, listing the ticket number and net weight of material, and summary total of material delivered to the site on the applicable item. The Contractor shall submit the summary table(s) and weigh tickets to the Engineer within 48 hours of delivery of material.

The Contractor's attention is drawn to various items in the drawings and contract documents which are inclusive of granular "A" materials. Where such materials are to be included in a separate payment item (i.e. sidewalks, driveways, etc.) material delivery tickets shall be marked clearly to that effect, if delivered to personnel on site on the date of placement, and shall be deducted (or preferably excluded) from the Contractor's summary of materials placed. Under no circumstances shall materials that are included elsewhere for payment be included in the Contractor's total material payment quantity summary for Granular "A" road base.

Measurement for Payment

Measurement shall be per tonne as evidenced by weigh scale tickets from an approved weigh scale (per OPSS 102 and MTO SP101S18).

Basis of Payment

Payment at the Contract shall be full compensation for all Labour, Equipment and Material to do the Work, including but not limited to provision of summary tables for material, additional traffic control, protection schemes, and maintenance of the completed works prior to the subsequent operations.

30. Cold Plane Bituminous Pavement

Scope of Work

Work under this item shall be completed in accordance with City of Guelph Standard Specifications, OPSS 510, and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

For the purpose of this Contract the terms "Cold Planing", "Milling" and "Asphalt Milling" may be used interchangeably.

The Contractor shall not cold plane any pavement until the progress of the Works dictates that cold planning be completed in preparation for scheduled paving operations, except as approved or directed by the Engineer.

Additions and deletions (Adjusted Plan Quantity) of Cold Planing, where and if necessary, shall be calculated from field tape measurements agreed to by the Engineer and the Contractor and adjust the Plan Quantity accordingly.

Measurement for Payment

Measurement shall be by Plan Quantity of square metres as noted on the Contract Drawings and will not be measured directly but will be based on pro-rated progress of the Work.

Measurement may be revised by Adjusted Plan Quantity as specified in the Contract.

Basis of Payment

Payment at the Contract price shall be full compensation for all Labour, Equipment and Material to do the Work, including but not limited to additional traffic control, protection schemes, haulage and disposal of material off-site.

At the Contract price per square metre for the above tender item, the Contractor shall cold plane existing bituminous pavement where and as shown on the contract drawings.

Maximum depth of cold planning is 60 mm.

Payment shall be made at the Contract price bid per metre square regardless of depth.

31. Pre-Pave Meeting

The Engineer may call and chair pre-pave meetings prior to placement of any asphalt on the Contract to establish the lot testing and inspection procedures.

The Contractor shall attend all such meetings with appropriate subcontractors and asphalt suppliers, and ensure the Contractor's representative has the required authority to commit the Contractor to actions agreed upon.

The pre-pave meeting will include but not limited to the following topics, as they pertain to the Work.

1. Review required submissions (i.e. Mix designs)

2. Review all applicable special provisions and specifications, including asphalt acceptance
3. Review drawings/ Extent of the Work
4. Review Quality Control and Quality Assurance issues
5. Discuss distribution of test results
6. Establish persons in charge and representatives required at placement
7. Determine the date and time of placement, expected duration of placement and weather forecast

Discuss:

- i. Equipment requirements
- ii. Surface finishing
- iii. Protection of the work
- iv. Traffic control
- v. Etc.

The Engineer will minute the pre-pave meetings and distribute a copy of the meeting minutes to all attendees. The Contractor shall note that the City of Guelph will not permit road closure without a minimum of 2 weeks' notice. The Contractor shall review the paving operation with their paving sub-contractor well in advance of paving to ensure that there is sufficient notice to the City of Guelph if any road closures are required.

32. Hot Mix Hot Laid Asphalt (HL-8 and HL-3)

Scope of Work

Work under this item(s) shall be completed in accordance with City of Guelph Standard Specifications, OPSS 310, OPSS 1150 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

Mix Design

The Contractor shall utilize a laboratory that has current Canadian Council of Independent Laboratories (CCIL) Type "A" Certification or AMRL equivalent certification or other equivalent certified laboratory acceptable to the Engineer to conduct all mix designs, designate the mix proportions, and prepare the job-mix formulae. The Contractor will be responsible for all mix designs and the determination and designation of the job-mix formulae.

The Contractor shall provide the Engineer with their proposed mix design, a minimum of thirty (30) days prior to the placing of any asphalt. The Contractor shall not place any asphalt until the Engineer has approved the proposed mix design. The Engineer will provide in writing the above permission or the reason why the permission is being withheld within 10 business days of receipt, which commences when all of the required samples and documents have been submitted.

Asphalt mix shall be delivered as submitted during the pre-paving job mix formula approval phase. Field Job Mix revisions will not be entertained subsequent to the paving operation. All job mixes shall be accepted in advance of the paving operation.

The Contractor shall supply asphalt cement grade PGAC 58-28 or PGAC 64-28 as noted in the Form of Tender for all asphalt supplied for the road work.

Construction

The Contractor shall refer to the suggested staging of Work described herein to determine the sequence of paving operations, and quantities required to complete an appropriate paving schedule to satisfy each stage of the Work to be completed, including all costs of preparation, mobilization and staging of the work.

The Contractor shall provide a detailed asphalt placement plan to the Engineer at least two weeks in advance of placing asphalt.

Where asphalt is placed by machine, the Contractor shall ensure continuity of the pavement and to avoid cold joints and a poor appearance and quality of the pavement.

For asphalt thicknesses of 75 mm or more, the Contractor shall be required to place the asphalt in two separate lifts. Where two lifts of asphalt are to be placed to a partial width, a staggered joint width of 0.5 m will be required to offset the joints for each lift.

Under the HL8 Base asphalt item(s), the Contractor shall provide necessary asphalt ramping at the concrete gutters adjacent to pedestrian curb ramps to eliminate the concrete "lip" as directed by the Engineer and provide temporary asphalt curb and gutter at catch basins where concrete curb and gutter is to be completed at a later date. The Contractor may substitute a finer asphalt mix for placement as temporary asphalt ramps at intersections, with prior approval from the Engineer. No additional payment shall be made for the provision of asphalt ramps. The placement of asphalt ramps shall be reviewed in advance with the Engineer to assure that positive drainage is maintained and that the limit and extent of the required ramps is sufficient for the period of time in which the ramps will remain.

Under this item, the Contractor shall include all step and butt joints in existing asphalt as required as part of the staging of the Work and as noted on the Contract Drawings.

The Contractor shall construct all maintenance holes within the travelled surface of the roadways to the top of base course asphalt, and shall adjust affected maintenance holes, CB and water valves where required or as directed by the City to finished surface elevation on Streets to receive surface asphalt in the following year. Where surface asphalt will be placed final maintenance hole adjustments shall occur prior to the final surface course paving. No payment will be made for the adjustment of any new maintenance holes, CB and water valves.

The work of adjusting existing structures shall be paid under the appropriate adjustment items in the form of tender and the work of setting new structures to pavement grade shall be included as part of the work of the item for the new structure.

Testing

The Contractor is advised that results of asphalt laboratory testing must be transmitted to the City of Guelph Fax: 519-822-6194 or by email to the Engineer.

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The Contractor shall summarize on a daily basis the applicable weigh tickets in a tabular form the Project Name and Contract Number, location, stage or phase, as applicable, for each applicable asphalt item, listing the ticket number and net weight of material, and summary total of material delivered to the site on the applicable item. The Contractor shall submit the summary table(s) and weigh tickets to the Engineer within 48 hours of delivery of material.

The Contractor's attention is drawn to various items in the drawings and Contract Documents which are inclusive of Hot Mix Asphalt materials. Where such materials are to be included in a separate payment item (i.e. medians, boulevard paving, temporary walkways, residential and commercial driveways, etc.) material delivery tickets shall be marked clearly to that effect. Under no circumstances shall materials included elsewhere for payment be included in the Contractor's total material payment quantity summary for Hot Mix Asphalt (HL3F, HL-3, or HL-8) in Roadway.

Hot Mix Asphalt Pricing based on Performance Graded Asphalt Cement (PGAC) Price Index

The City of Guelph will adjust the payment to the Contractor based on changes to the Ministry of Transportation's (MTO) PGAC price index. The price index will be published monthly in the MTO Contract Bulletin and displayed on the OHMPA (www.ohmpa.org) and MTO website (www.raqs.mto.gov.on.ca). The price index will be used to calculate the amount of the payment adjustment per tonne of new asphalt cement accepted into the Work.

The price index will be based on the price, excluding taxes, FOB the depots in the Toronto area, of asphalt cement grade PG 58-28 or equivalent. One index will be used to establish and calculate the payment adjustment for all grades. As of July 2006 the price index for each month will reflect the average of the same month's prices and be published on the last day of the month and be retroactively applied to HMA laid in the same month.

A payment adjustment per tonne of new asphalt cement will be established for each month in which paving occurs when the price index for the month differs by more than \$15.00/ tonne from the AC price index for the month prior to tender opening. When the price index differential is less than \$15.00/ tonne, there will be no payment adjustment for that month. Payment adjustments due to changes in the price index are independent of any other payment adjustments made to the hot mix tender items.

The payment adjustment per tonne will apply to the quantity of new asphalt cement in the hot mix accepted into the Work during the month for which it is established. The payment adjustment for the month will be calculated by the following means:

- 1) When AC Prices are Rising by more than a \$15.00/ tonne difference: the payment adjustment to be paid to the Contractor is the result of subtracting the price index for the month prior to tender opening from the price index in effect when paving took place, minus the \$15.00 float, multiplied by the number of tonnes of PGAC incorporated in the mix(s) as determined by the job mix formula.

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- 2) When AC Prices are Falling by more than \$15.00/ tonne difference: the payment adjustment made in favour of the Owner is the result of subtracting the price index in effect when paving took place, plus \$15.00 float from the price index for the month prior to the tender opening, multiplied by the number of tonnes of PGAC incorporated in the mix(s) as determined by the job mix formula.

The quantity of new asphalt cement includes all grades of asphalt cement supplied by the Contractor with and without polymer modifiers. For each month in which a payment adjustment has been established, the quantity of the escalation/ de-escalation will be calculated using the hot mix quantity accepted into the Work and its corresponding asphalt cement content as required by the job mix formula except for mixes which contain reclaimed asphalt pavement.

For mixes which contain reclaimed asphalt pavement, or roof shingle tabs or both, the quantity of new asphalt cement will be determined from the difference between the asphalt cement required by the job mix formula and the asphalt cement content of the reclaimed asphalt pavement, or the roof shingle tabs or both incorporated into the hot mix, as calculated by the Engineer.

Example 1 – AC Prices Increasing

PGAC 58-28 specified, 3,000 tonnes of HL3 @ 5.2% AC with no RAP and all virgin AC (156.0 tonnes AC)

The effective Price Index on July 17, 2006 on tender opening is \$433.80 (June, 2006)/ tonne (PG 58-28)

The applicable Price Index as published on August 31st effective for the August 17-24 2007 actual paving dates is \$504/ tonne (PG 58-28)

Payment adjustment to be paid to the Contractor:

$$(\$504 - \$15) - \$433.80 \times 156 \text{ tonnes AC} = \$55.20 \times 156 \text{ tonnes AC} = \$8611.20$$

Example 2 – AC Prices Decreasing

PGAC 58-28 specified, 4,500 tonnes of HL8 @ 5.0% AC including 20% RAP containing 4.3% residual AC

$$\text{New virgin AC in mix} = (80\% \times 5.0\% + 20\% \times 0.7\%) \times 4,500 = 186.3 \text{ tonnes}$$

The effective Price Index on May 5, 2007 on tender opening is \$508.60 (April, 2007)/ tonne (PG 58-28)

The applicable Price Index as published on October 31 effective for the October 11-18, 2007 actual paving dates is \$451.35/ tonne (PG 58-28)

Payment for hot mix items reduced by:

$$\$508.60 - (\$451.35 + \$15) \times 186.3 \text{ tonnes AC} = \$42.25 \times 186.3 \text{ tonnes AC} = \$7945.75$$

Notes:

Contractors should bid the hot mix asphalt item using the cost of the grade of PGAC specified.

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- 1) The AC Price Index is only a tool for qualifying hot mix prices and is not intended as a standard AC price to be incorporated into the contract bid.
- 2) The payment adjustment calculated using this formula is full compensation for any and all PGAC grades specified.
- 3) If the AC Index has not changed more than \$15.00 per tonne up or down, no adjustment is required. Only the amount of the change that is greater than \$15.00 is used to calculate payment adjustments.
- 4) Beginning with the AC Index for July 2006 MTO will amend their past practice of establishing the monthly index amount on the 1st day of the month from the average of the four weekly AC prices received in the previous month to a calculation that takes in the average of the four weeks of the current month and is subsequently published on the last day of that month.

Past Practice Before August 2006:

The index for June is the result of the AC prices received in May and published June 1st.

New Standard:

The index for July is the result of AC prices received in July and published July 31.

- 5) As the result of the implementation of Note #4 and the subsequent issue of MTO SP 103820 the AC Price index for the month prior to tender opening will be used as the AC bid price to calculate AC adjustments.
- 6) No contractor mark up will be paid on the AC index price adjustment.

Measurement for Payment

Measurement shall be per tonne as evidenced by weigh scale tickets from an approved weigh scale (per OPSS 102 and MTO SP101S18).

Basis of Payment

Payment made under this item(s) shall be in accordance with OPSS 310.10 and shall include power sweeping or air cleaning the surface, removal of all dirt and foreign material, removing asphalt ramps, constructing asphalt ramps, applying bond breaker material, applying joint painting material, installation of shoulder treatments, ramping of catchbasins in concrete curb and gutter extending into the roadway beyond the curb line, all hand-placed asphalt as part of the roadway, all machine-laid asphalt paving, cleaning of castings, installation of hand-formed curb around catch basins at low points when specified or where concrete curb and gutter has been left out to be completed at a later date, and the provision of a detailed asphalt placement plan.

The unit price for the surface asphalt items shall include the removal of binder course asphalt used as ramping at the paving limits, and at gutters along pedestrian curb ramps, adjustment of new maintenance hole tops to final elevations and sweeping clean all road surfaces prior to the placing of the asphalt which is to be applied prior to completion of this Contract.

33. Paved Commercial Entrances

Scope of Work

The unit price bid per square metre shall include all saw cutting and excavation necessary to accommodate Granular 'A' base material and hot mix asphalt. The work shall include the supply, placement and compaction of 300 mm of Granular 'A', 50 mm HL8 hot mix base asphalt and 40 mm HL3F hot mix surface asphalt and all other work necessary to complete the work.

AC indexing shall be permitted on this item. The area of asphalt shall be converted to tonnes by multiplying the area of asphalt X the asphalt thickness X a theoretical density of 2.4 tonnes/ m³. Once the number of tonnes is calculated, Section 23 can be used to calculate the AC Indexing amount.

Measurement for Payment

Measurement shall be by the applicable units in the Form of Tender.

Basis of Payment

Payment at the unit price bid per square metre under this item shall also include all costs associated with the sub-excavation, loading, haulage and disposal of unsuitable material which is to be displaced. Payment at the Contract price for the above work shall be full compensation for all Labour, Equipment, and Material to do the work including all requirements of OPSS.

34. Paved Residential Entrances

Scope of Work

The unit price bid per square metre shall include all saw cutting and excavation necessary to accommodate Granular 'A' base material and hot mix asphalt. The work shall include the supply, placement and compaction of 200 mm of Granular 'A', 50 mm HL3F hot mix surface asphalt and all other work necessary to complete the work.

AC indexing shall be permitted on this item. The area of asphalt shall be converted to tonnes by multiplying the area of asphalt X the asphalt thickness X a theoretical density of 2.4 tonnes/ m³. Once the number of tonnes is calculated, Section 23 can be used to calculate the AC Indexing amount.

Measurement for Payment

Measurement shall be by the applicable units in the Form of Tender.

Basis of Payment

Payment at the unit price bid per square metre under this item shall also include all costs associated with the sub-excavation, loading, haulage and disposal of unsuitable material which is to be displaced. Payment at the Contract price for the above work shall be full compensation for all Labour, Equipment, and Material to do the work including all requirements of OPSS 120 and 206.

35. Remove, Store and Reinstall Paving Stones

Payment at the Contract price for this item shall include the removal, storage and reinstallation of the existing paving stones. The unit price shall include excavation, filling, grading, supply and construction of 300mm Granular "A" base compacted to 100% MDD and overlay with 50mm of limestone screenings, placing paving stones to the proposed grade and filling of voids between the paving stones with limestone screenings as per OPSS 355. The work shall include any cutting of the paving stones required to match the proposed grade. The Contractor shall replace any paving bricks broken as a result of the work or stolen from the stockpile at no additional cost to the City.

The Contractor shall supply professional and experienced paving stone installers from a Landscaping Contractor.

Basis of Payment

Payment for this item shall be based on the number of square metres of paving stone reinstalled.

The supply and installation of additional paving stones, if required, shall also be included in the bid price for this item.

36. Water For Compaction & Dust Control

Scope of Work

The Contractor shall, for the unit price bid, supply, transport, and apply water to aid in compaction and for dust control in accordance with City of Guelph Specification SS-4, and as directed by the Engineer.

Basis of Payment

Payment at the Contract price for this item shall be full compensation for all Labour, Equipment and Material to do the Work.

37. Calcium Chloride

Scope of Work

The Contractor shall, for the unit price bid, supply calcium chloride in accordance with the requirements of OPSS 501, in 45 kilogram bags, and shall apply the calcium chloride as an aid to compaction and for dust control, as directed by the Engineer. At all times a minimum of 25 bags shall be available on the job for dust control.

Basis of Payment

Payment at the Contract price for this item shall be full compensation for all Labour, Equipment and Material to do the Work.

38. 150 mm Subdrains (Provisional)

Scope of Work

Work under this item shall be completed in accordance with OPSD 216.021 and as amended herein.

Pipe sub-drain shall be installed in accordance with the typical details and as provided on the Contract Drawings and in sizes and orientation as specified in the Form of Tender. A 2.0m section of non-perforated sub-drain shall span across the excavation for catch basin maintenance holes and catch basins.

Bedding/ Backfill

Trench backfill shall be 19mm (3/4") stone, unless otherwise specified.

Pipe Material

Pipe material shall be HDPE corrugated perforated pipe meeting CSA Spec B182.6-M92. Pipe sub-drain shall be corrugated perforated polyethylene pipe complete with a geotextile sock.

Installation

Installation shall be in accordance with OPSS 405 ref OPSD 216.021.

Sub-drain to be wrapped with geotextile filter cloth.

Measurement for Payment

Measurement shall be by the linear metre of subdrain piping installed and connected to existing storm structures, including all necessary pre-manufactured fittings to complete the connections. All sub-drains shall be graded to provide positive drainage to the outlet end of the installed subdrain piping.

Basis of Payment

Payment at the Contract price for this item shall be full compensation for all Labour, Equipment and Material to do the Work, including but not limited to maintaining flows, cleanup as necessary, excavation, management and disposal of surplus materials, bedding, backfill, cover material, compaction, connections, fittings, and redline construction record preparation and delivery to the Engineer.

OPSS 405 shall apply to the construction of pipe subdrains. The Contractor shall note that the cost of the material used as bedding/ backfill for pipe subdrains will be paid for as part of the unit cost for this item and will not be paid for separately under other contract items for granular material. The unit price bid for this item shall include all excavation and connection to new maintenance holes and catch basins and existing subdrain.

39. Concrete Curb and Gutter

Scope of Work

Work under this item shall be completed in accordance with City of Guelph, "Specification for Curb and Gutter", SS-16, OPSS 353 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

Material

Concrete materials shall be in accordance with City of Guelph, Standard Specification for Curb and Gutter, SS-16.

Construction

Where concrete curb abuts a concrete sidewalk, concrete or asphalt pathway, concrete or asphalt boulevard edging or impressed concrete surface, the additional width (50 mm) as shown on the applicable OPSD shall be placed on the back of the curb to support the adjacent surface material.

The standard drawings for concrete curb and gutter shall be modified such that at all pedestrian ramps (dropped curb), the 25 mm "lip" shall be eliminated along the gutter line (minimum distance of 1.5 metres) during the forming and finishing of the gutter surface to provide a smoother, barrier free ramping for the disabled.

Concrete curb construction, which will temporarily restrict access to intersecting roadways, or driveways, must be done with advance notice and scheduling consultations with the Engineer and the affected occupants/ owners to ensure that alternative arrangements can be worked out for the period of restricted access.

Concrete finish shall be a medium broom textured finish perpendicular to the gutter line.

Where surface asphalt paving is delayed until the following construction season, the Contractor shall leave out the gutter at all catch basin and catch basin maintenance hole structures set in roadway at roadway grade.

Curing compound shall meet the requirements of OPSS 1315.

Supplementary Acceptance Criteria

The Contractor shall ensure that the concrete supplier utilizes appropriate aggregates that do not contain deleterious particles that cause concrete pop-outs. The maximum allowable tolerance for pop-outs will be 10 pop-outs per square metre of sidewalk, median, boulevard and/ or curb & gutter placed. Any concrete works with pop-outs greater than this tolerance shall be removed and replaced at the contractor's expense. A pop-out is defined as a deleterious particle size, a minimum of 13mm wide with a minimum depth of 3mm.

Measurement of Payment

Payment made under this item shall be in accordance with OPSS 353.09.01, except there will be no separate measurement for payment for setbacks and gutter outlets, and concrete placed around side inlet frames and covers will be measured for payment along the gutter line.

Basis of Payment

Payment at the Contract price for this item shall be full compensation for all Labour, Equipment and Material to do the Work.

40. Concrete Sidewalk

Scope of Work

Work under this item shall be completed in accordance with City of Guelph, "*Specification for Sidewalks*", SS-17, OPSS 353 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

Material

Concrete materials shall be in accordance with City of Guelph, Standard Specification for Sidewalks, SS-17.

Construction

Concrete sidewalks shall be constructed in accordance with City of Guelph Standard Detail Drawings and as illustrated on the Contract Drawings.

The concrete sidewalk shall be textured at each approach to the intersection. Texturing shall provide a coarse broomed texture, transverse to the direction of the concrete sidewalk to achieve a uniform 5-10 mm depth grooved surface in the finished concrete sidewalk. Final slopes, cross-falls and textured broom finish locations shall be reviewed and confirmed with the Engineer in advance of the concrete pour.

Sidewalk base material shall be Granular "A" with a minimum depth of 75 mm.

Sidewalk thickness will be checked by the Engineer to confirm the minimum specified depth(s) has been provided as well as the minimum depth of granular base material has been provided.

Sign Sleeve inserts including related layout shall be supplied by the City of Guelph and shall be installed by the Contractor as part of the work of concrete sidewalk, paved boulevard or median, and / or Concrete Boulevard or median construction. No separate payment will be made for the installation of sign sleeve inserts. The Contractor shall be responsible to communicate their schedule for the related works with City of Guelph staff in order to ensure the sign sleeve layout is coordinated with the proposed work of the Contractor.

Supplementary Acceptance Criteria

The Contractor shall ensure that the concrete supplier utilizes appropriate aggregates that do not contain deleterious particles that cause concrete pop-outs. The maximum allowable tolerance for pop-outs will be 10 pop-outs per square metre of sidewalk, median, boulevard and/ or curb & gutter placed. Any concrete works with pop-outs greater than this tolerance shall be removed and replaced at

the contractor's expense. A pop-out is defined as a deleterious particle size, a minimum of 13mm wide with a minimum depth of 3mm.

Measurement of Payment

Measurement for Payment made under this item shall be by the in-place square metre for concrete sidewalk constructed.

Basis of Payment

Payment at the Contract price shall be full compensation for all Labour, Equipment and Material to do the Work, including but not limited to, excavation for sidewalk, supply, placement and compaction of granular "A" base, installation of sign sleeves and supply, placement, finishing and saw cutting dummy joints of the concrete surface.

41. Supply & Install Road Signs

Scope of Work

The Contractor shall supply and install all traffic control signs as shown on the Contract Drawings.

Construction

Work under this item shall be in accordance with Section 2 of the SS-300 City of Guelph Linear Infrastructure Standards and in accordance with the Ontario Traffic Manual unless otherwise noted. The Contractor shall return all surplus signs to the City of Guelph as directed by the Engineer.

Basis of Payment

Payment at the price bid and units specified in the Form of Tender for the above item shall be compensation in full for all labour, equipment and materials required to complete the work as specified.

42. Pavement Markings – Paint Or Field Reacted Polymeric

Scope of Work

Work under this item shall be in accordance with Section 1 of the SS-300 City of Guelph "*Specifications for Traffic-Related Items*", OPSS 710 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

The specific requirement for Temporary Pavement Markings will be confirmed in the approved Traffic Control Plans.

The Contractor shall be required to mobilize as often as required to complete the Work per the Contractor's proposed staging of the Work and approved Traffic Control Plan(s).

The Contractor shall maintain all temporary pavement markings to the satisfaction of the Engineer. Pavement markings that become faded as a result of traffic or dirt or unsatisfactory to the Engineer shall be replaced immediately by the Contractor at the Contractor's own expense.

The Contractor is advised that all line painting requires two applications of paint.

Pavement marking obliterating shall be by mechanical means (grinding or abrasive blasting method), painting over will not be permitted unless otherwise directed by the Engineer.

Basis of Payment

Payment at the Contract price for the tender item shall be as noted in the Form of Tender and in accordance with City of Guelph Standard Specification SS-300. "Pavement Markings" shall be full compensation of all labour, equipment and materials to do the work.

43. Adjustment of Existing Maintenance Holes, Valve Boxes and Chambers

Scope of Work

Work under this item shall be completed in accordance with City of Guelph, "Specification for Adjustments to Maintenance Holes and Valve Chambers", SS-14, OPSS 408 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

The work shall include removal, salvage and replacement of existing frame and cover with a new frame and cover as specified in the Contract Documents or as directed by the Engineer. Salvaged frames and covers shall be delivered to the City of Guelph Works Yard.

The use of lift rings for final adjustments will not be permitted.

All frame and covers, which are adjusted to finished paving grade in advance of the paving operation, must be painted fluorescent orange on all exposed sides if they are to be left exposed to traffic.

Measurement for Payment

Payment for adjustments shall be based on the Contract price per each adjustment and not on the height of vertical adjustment unless otherwise noted.

Payment shall be made **only once** for the adjusting of all existing frames and covers, and valve boxes, within the road pavement areas to the specified elevations. Payment shall be made under this item following adjustment to the specified elevation, be that final elevation where in landscaped areas, concrete areas, or surface paved areas, or for adjustment to base asphalt (interim) elevation if surface asphalt will not be placed as part of the Work.

Measurement for payment of maintenance hole, catch basin, valve box and/ or valve chamber frames and grates/ covers including raising or lowering will be on an each basis for adjustments up to 0.3 m. in height, based on the difference between

the existing and proposed top of cover/ grate elevations. Additional unit payments will be made for adjustments greater than 0.3m in 0.3m increments.

Separate payments will be made for the installation of frames and grates/ covers provided by the Owner, where specified, and those to be supplied by the Contractor.

Adjustment to the design elevation and grade will be considered incidental to the work. In all cases, the range of adjustment units on structures shall not be less than 150 mm and not greater than 300 mm.

Basis of Payment

Payment at the Contract price shall be full compensation for all Labour, Equipment and Material to do the Work, including but not limited to, excavation to expose the existing maintenance hole, catch basin, valve box and/ or valve chamber frames and grates/ covers, supply and placement of adjustment precast concrete riser and/ or precast adjustment units, butyl tape, concrete mortar, parging the exterior of adjustment units with 3:1 non-shrink grout, and backfilling the excavation to subgrade with the appropriate base materials in accordance with the design location and specifications for same.

44. Temporary Maintaining Sanitary And Storm Flow

Scope of Work

The flow of the sanitary and storm sewers may fluctuate significantly. The Contractor shall have the proper pumps, pipes or other devices of adequate size, capacity and type to handle the fluctuating flow.

The Contractor shall submit details of any diversions for approval to the Engineer prior to interrupting any flows. Notwithstanding having the above approval, the Contractor shall remain responsible to divert the fluctuating flow in an adequate manner.

Pumping of flow shall occur only during the working day. Gravity flow shall be achieved between maintenance holes prior to the Contractor leaving the site at the end of each day or week end. If gravity flow cannot be achieved at night or on weekends, the Contractor shall take all necessary actions necessary to ensure that the Contractor will not be in violation of the City Noise By-law. The Contractor is responsible for providing a back up, bypass pumping system with staff continuously monitoring the bypass pumping system and flows.

Measurement for Payment

Measurement shall be by the applicable units in the Form of Tender. Measurements for payment for maintaining sanitary flow will be pro-rated on the following basis:

- 50% for set up of the temporary system
- 10% for the decommissioning of the temporary system
- The remaining 40% shall be prorated over the duration of the operation of the temporary system

Basis of Payment

Payment at the price bid and units specified in the Form of Tender for the above item shall be compensation in full for all labour, equipment and materials required to complete the work as specified.

45. Sanitary Sewer

Scope of Work

Work under this item shall be completed in accordance with the City of Guelph "Specifications for Sewers", SS-100, OPSS 407 and 410 and as amended herein. The latest revision at the time of tendering, shall apply to all sanitary sewer installations under the jurisdiction of the City of Guelph. The most stringent of the above specifications shall govern in case of conflict.

The Contractor shall prepare construction record drawings (redlines) marked legibly in red ink for all sanitary sewers installed and/ or intercepted and shall deliver same to the Engineer as part of the formal record of construction. Redline construction record drawings shall be provided to the Engineer prior to the certification for payment in the period in which the installed materials will be paid. A minimum of three swing ties shall be provided for each connection point and inverts at the connection, fitting types used and material type and size of sewer/ service piping to which new piping is being connected. Construction Record redlines by the Contractor shall be in accordance with the City of Guelph "Specifications for Sewers", latest revision at the time of tendering. Ties shall be related to existing surface features that will remain post construction.

The Contractor shall also redline all service tees installed at the main and deliver redlines with Contract chainage (station and offset) references and invert at the main.

Measurement for Payment

Measurement shall be by the applicable units in the Form of Tender. Measurements for payment of maintenance

holes will be pro-rated on the following basis:

- 100% for completed structure, set to grade, parged, and benched as required
- Deduction of 5% for structure not set to finished grade
- Deduction of 5% for structure not parged at pipe connections and adjustment units
- Deduction of 5% for structure not benched, where applicable
- Deduction of 5% for structure missing ladder rungs

Basis of Payment

Payment at the Contract price(s) for the respective items of work shall be full compensation for all Labour, Equipment and Material to do the Work, including but

not limited to maintaining flows, cleanup as necessary, excavation, management and disposal of surplus materials, bedding, backfill, cover material, compaction, dewatering, connections and fittings; and preparation and delivery of redline construction record drawings as specified to the Engineer.

46. CCTV Inspections

CCTV inspections for all sizes of sewer pipe shall be undertaken using pan and tilt equipment capable of providing a clear view of lateral connections and deficiencies. ~~Inspection of laterals~~ Additionally, a CCTV inspection of each lateral service shall be performed from the mainline sewer shall be undertaken to the property line to check for deficiencies that occurred during or after installation. The video for each lateral inspected must clearly show the municipal address it is associated with. Significant deficiencies including but not limited to broken, damaged or separated infrastructure as well as blockages, must be communicated immediately to the City's contract administrator. CCTV is to include catchbasin leads. Engineer to approve inspection report. Acceptance of the work for final payment and for commencement of the maintenance guarantee period will take place only after the Engineer has accepted and approved the inspection report.

Sanitary and Storm sewers shall be inspected by CCTV in accordance with the City of Guelph "*Specifications for Sewers*", SS-100 and OPSS 409. The cost of all labour, equipment and materials required to complete CCTV inspection shall be included in this item in the Form of Tender. Final acceptance of sanitary sewer installation will be contingent upon the Engineer's acceptance of the required CCTV reports, digital files and USB flash drive. It is recommended by the Engineer that the CCTV inspections be undertaken on a progress basis and that CCTV reports and related digital records be delivered prior to paving of the roadway to reduce the potential cost to the Contractor for necessary repairs to the sewer installation. CCTV inspection should take place after base asphalt installation but before top coat asphalt installation.

Inspect sewers in the direction of flow unless a reverse set up is required. Begin with the upstream sewer in the system and proceed downstream in a consecutive manner. Inspect all contributing upstream sewers before proceeding downstream.

Ensure that the start maintenance hole is clearly visible at the start of the inspection and perform the inspection from the centre of the start maintenance hole to the centre of the finish maintenance hole. At the start of the inspection, record the length of the sewer from the face of the maintenance hole to the cable calibration point and adjust the distance reading as the cable calibration point such that zero is at the face of the start maintenance hole to record the actual length of the pipe.

If deficiencies are found that require repair, a second CCTV inspection shall be performed by the Contractor at the Contractor's expense. In the event that further CCTV inspections are required, those costs shall also be borne by the Contractor.

Basis of Payment

Payment at the Contract price(s) for the CCTV inspections shall be full compensation for all Labour, Equipment and Material to do the Work.

47. Service Connection

Scope of Work

City of Guelph Standard Specification SS-100 shall apply for this work.

Where the same types of pipes are to be used for storm and sanitary lateral sewers, the Contractor shall paint a 100mm red stripe along the top of the storm lateral for its entire length.

All laterals connecting directly to maintenance hole shall incorporate P.V.C. sweep bends along the benched maintenance hole inverts to provide smooth flow surfaces within the maintenance hole. Payment for supplying, cutting and placing the sweep bends shall be included under the unit prices bid for lateral and maintenance hole construction.

The Contractor shall note that the sewer service lateral shall be installed at an angle no steeper than 45 degrees above the horizontal (see OPSD 1006.02). This maximum slope shall also apply to the deep service laterals. Any services installed steeper than 45 degrees will have to be removed and reinstalled at the Contractor's expense.

All sewer services shall be at the appropriate depth to provide gravity flows (2% grade) from the basements even if the existing services are not at such appropriate depths. The Contractor shall confirm the elevation of the basements and provide elbows and bends for such interim connections to existing shallow services near the property line (street line) where necessary.

Basis of Payment

Payment at the Contract price(s) for the service connections shall be full compensation for all Labour, Equipment and Material to do the Work.

48. Storm Sewer

Scope of Work

Work under this item shall be completed in accordance with the City of Guelph "Specifications for Sewers", SS-100, OPSS 407 and 410 and as amended herein. The latest revision at the time of tendering, shall apply to all watermain installations under the jurisdiction of the City of Guelph. The most stringent of the above specifications shall govern in case of conflict.

The Contractor shall prepare construction record drawings (redlines) marked legibly in red ink for all storm sewers and appurtenances installed, services installed and/or intercepted and shall deliver same to the Engineer as part of the formal record of construction. Redline construction record drawings shall be provided to the Engineer prior to the certification for payment in the period in which the installed materials will be paid. Construction Record redlines by the Contractor shall be in accordance with The City of Guelph "Specifications for Sewers", latest revision at the time of tendering. Ties shall be related to existing surface features that will remain post construction.

Measurement for Payment

Measurement shall be by the applicable units in the Form of Tender. Measurements for payment of maintenance holes will be pro-rated on the following basis:

- 100% for completed structure, set to grade, parged, and benched as required
- Deduction of 5% for structure not set to finished grade
- Deduction of 5% for structure not parged at pipe connections and adjustment units
- Deduction of 5% for structure not benched, where applicable
- Deduction of 5% for structure missing ladder rungs

Basis of Payment

Payment at the Contract price(s) for the respective items of work shall be full compensation for all Labour, Equipment and Material to do the Work, including but not limited to maintaining flows, cleanup as necessary, excavation, management and disposal of surplus materials, bedding, backfill, cover material, compaction, dewatering, connections and fittings; and preparation and delivery of redline construction record drawings as specified to the Engineer.

49. Replacement of Existing Sanitary and Storm Maintenance Holes

Scope of Work

The work will include the removal and disposal of existing brick or block maintenance holes, maintaining all flows, the supply and installation of a 1200 mm diameter precast maintenance holes as detailed in the Contract Drawings and the installation and adjustment of a new-maintenance hole frame and cover complete. The maintenance hole shall include inlet and outlet holes of sufficient diameter to accommodate the existing storm sewer pipes. The work will include the supply and installation of benching as required.

The work will include removal, salvaging and reinstallation of existing storm sewer pipes or new pipe as required.

Basis of Payment

Payment at the Contract price(s) for the respective items of work shall be full compensation for all Labour, Equipment and Material to do the Work, including supply and installation of benching, removal, salvaging and reinstallation of existing storm sewer pipes or new pipe as required.

50. Temporary Water Supply

Scope of Work

The Contractor will maintain water supply and maintenance of potable water throughout the duration of the work, including the supply of bottled water or pressure water truck as requested for the temporary period of the watermain shutdown to all customers.

The Contractor shall install temporary watermain including testing and inspection as required. The supply and maintenance of potable water is considered incidental to the work, and no additional payment or compensation will be made thereof.

Temporary watermains must be pressure tested and disinfected in accordance with the City of Guelph Standard Specification SS-200, prior to connection any building. The costs of testing shall be borne by the Contractor. The Contractor shall supply and install a backflow prevention system as shown on the Contract Drawings. The water meter shall be supplied by the City of Guelph Waterworks Department for the monitoring and tracking of water usage.

The work under this item includes the supply, installation, protection and removal of temporary watermain service connections to existing water service/ curb stop to all buildings to facilitate the construction of the sanitary sewer, storm and watermain on all labour and materials required to maintain the existing watermain in service until new watermain pipe is in service. The Contractor shall submit his proposed method of temporary water supply to the Engineer for approval within 2 weeks of the Contract award.

Measurement for Payment

Measurement shall be by the applicable units in the Form of Tender. Measurements for payment for the temporary water supply will be pro-rated on the following basis:

- 50% for set up of the temporary system
- 10% for the decommissioning of the temporary system
- The remaining 40% shall be prorated over the duration of the operation of the temporary system

No payment will be made if existing watermain is utilized as a source of temporary watermain

Basis of Payment

Payment on a lump sum basis for the above work shall be full compensation for all labour, testing equipment and material required to do the work.

51. Watermain

Scope of Work

Work under this item shall be completed in accordance with the City of Guelph "Specifications for Watermains", SS-200, OPSS 441, 442 and as amended herein. The latest revision at the time of tendering, shall apply to all watermain installations under the jurisdiction of the City of Guelph. The most stringent of the above specifications shall govern in case of conflict.

The Contractor shall prepare construction record drawings (redlines) marked legibly in red ink for all watermain and appurtenances installed, services installed and/ or intercepted and shall deliver same to the Engineer as part of the formal record of construction. Redline construction record drawings shall be provided to the Engineer prior to the certification for payment in the period in which the installed materials will be paid. Construction Record redlines by the Contractor shall be in accordance with The City of Guelph "Specifications for Watermains", latest revision at the time of tendering. Ties shall be related to existing surface features that will remain post construction item.

All planned disruptions in water service to reconnect existing watermains and services shall be coordinated with affected property owners and businesses.

Measurement of Payment

Measurement shall be by the applicable units in the Form of Tender. Measurements for payment of the watermain will be pro-rated on the following basis:

- 100% for completed, commissioned, connected and in service watermain
- Deduction of 10% for watermain testing and commissioning
- Deduction of 5% for continuity testing for the watermain tracer wire

Basis of Payment

Payment at the Contract price(s) for the respective items of work shall be full compensation for all Labour, Equipment and Material to do the Work, including but not limited to maintaining flows, cleanup as necessary, excavation, trench wall support, management and disposal of surplus materials, bedding, backfill, cover material, compaction, dewatering, connections, fittings, anodes, Petrolatum Tape System, preparation, testing & commissioning of the watermain and delivery of redline construction record drawings as specified to the Engineer.

52. Connection to Existing Watermains

Scope of Work

The Contractor is advised that the date(s) for the overnight new isolation water valve installation, to be completed by City of Guelph Waterworks Division, will be discussed and scheduled during the preconstruction meeting and that the work will take place on Sunday(s). The Contractor will be required to provide five (5) days written notice to the affected water users. By the end of the work day prior to the

valve installation, the Contractor will be required to have the existing watermain exposed at the installation locations, ready for the isolation valves to be installed by City of Guelph staff, and have the watermain joint restraints installed. Once the City has completed the overnight new water valve installation, the Contractor will be able to proceed with the watermain replacement portion of the contract. The Contractor shall note that the final main connections to existing watermains shall be performed by the Contractor after completion of the required testing and Chlorination/ disinfection of the new system. The Contractor shall provide the City Waterworks Department forty eight hours' notice to permit City Personnel to inspect the final connection.

Basis of Payment

Payment at the Contract price(s) for the respective items of work shall be full compensation for all Labour, Equipment and Material to complete the connection of the proposed watermain and appurtenances to the existing watermain as shown on the Contract Drawings including providing joint restraint calculations (shop drawings) to the Engineer for approval. City of Guelph Standard specifications SS-200 shall apply to this work.

53. Fire Hydrants

Scope of Work

City of Guelph Standard Specifications SS-200 SI shall apply to this work.

Basis of Payment

Payment at the unit price bid shall be compensation in full for supplying all materials, labour, and equipment necessary to install the hydrant to the elevation as indicated on the drawings complete with tee connection to the main, lateral pipe from main to the hydrant, tracer wire, valve and valve box, thrust block, restrained joints, bedding, and backfill as specified.

Compensation for supplying and installing extension kits, if required, to set the hydrant and valve to the specified grade shall be included in the unit price of the fire hydrant and no additional payment will be made therefore.

54. Restrain New Valves and Existing Valves Prior to Removing Existing Cast Iron or Ductile Iron Watermain

Scope of Work

The work of this item includes excavating, exposing existing valves and existing watermain joints, supply and installation of restrained joints on the existing cast iron or ductile iron watermains prior to the City of Guelph installing the new isolation valves and commencing the removal of the existing watermain.

Basis of Payment

Payment at the Contract Price for the above tender item shall be full compensation for all labour, equipment and materials required to do the work including providing joint restraint calculations (shop drawings) to the Engineer for approval.

55. Qualifications of Electrical Contractors

In addition to the requirements of OPSS 106, the following shall apply for the Corporation:

106.07 Construction

106.07.01 Qualification of Workmen

The only Contractors currently recognized by the Operating Authorities as having the necessary qualifications are as follows:

- a) Black & MacDonald Limited
- b) Communication and Cabling Contractors
- c) Enasco Limited
- d) EARTH Holdings Inc.
- e) Guild Electric Limited
- f) IEC Group Inc.
- g) Reyner Electrical Construction Incorporated
- h) TM3 Incorporated
- i) TransPower Utility Contractors Inc.
- j) Utility Installation Limited
- k) Weinmann Electric Limited

OR; any other Electrical Contractor having a minimum of five (5) previous years' experience in the construction of traffic signals and street lighting systems and approved by the Operating Authority prior to the submission of tender.

106.07.01.01 Contractor's Representative

For electrical work, the Contractor or Subcontractor shall have a licensed master electrician on staff, and shall use workers qualified to do work in accordance with OPSS 106 and the following:

- a) All electrical work shall be performed under the supervision of a licensed (Construction and Maintenance, 309A) electrician.
- b) Personnel certified under "The Apprenticeship and Tradesman's Qualification Act" shall perform all electrical work. All personnel performing electrical work shall carry proof of their certification under the Act on their person at all times while on the work site.
- c) Electrical work at a traffic signal equipment installation shall be performed by an electrician or an electronic technician who have completed the IMSA Level I and II, Traffic Signal Technician Certification program; or be a worker who is similarly qualified by training and experience and is acceptable to the Operating Authority.

- d) Electrical work at a traffic signal control equipment installation shall be performed by an electrician or an electronic technician who have successfully completed the IMSA Level I and II, Traffic Signal Technician Certification program and having a minimum of five years previous experience in the assembly and maintenance of microprocessor based traffic controllers.
- e) Personnel shall have related experience in the overall fields of traffic signal and street lighting installations.
- f) A qualified representative must be present and on-site whenever work is being carried out under the Contract.

The Engineer reserves the right to deny any proposed Electrical Sub-contractor by the General Contractor. If the Sub-contractor is denied, the General Contractor shall then provide an alternate Electrical Sub-Contractor for approval by the Engineer at no additional compensation or adjustments to the overall tender bid price submitted by the General Contractor for this project.

56. Qualifications of Traffic Underground Contractors

In addition to the "Qualification of Workmen" within Section 46 the following shall apply for the Corporation:

The only Contractors currently recognized by the Operating Authorities as having the necessary qualifications to install traffic underground are:

- a) Black & MacDonald Limited
- b) Drexler Construction Limited
- c) Enasco Limited
- d) EARTH Holdings Inc.
- e) Folmur Construction Limited
- f) Grimsby Utility Construction Incorporated
- g) Guild Electric Limited
- h) I.E.C. Group Incorporated
- i) J.C.H. Contracting Limited
- j) Just Loops Underground Traffic Installation
- k) Network Site Services Limited
- l) TM3 Incorporated
- m) Utility Installation Limited
- n) Weinmann Electric Limited
- o) Underground Conduit Solutions

These companies may install underground conduits, pole bases, concrete controller pad and traffic signal loops only. No electrical work, including the installation of traffic signal cables may be performed by the Contractors in the aforementioned list.

The Engineer reserves the right to deny any proposed Traffic Underground Sub-contractor by the General Contractor. If the Sub-contractor is denied, the General Contractor shall then provide an alternate Traffic Underground Sub-Contractor for approval by the Engineer at no additional compensation or adjustments to the overall tender bid price submitted by the General Contractor for this project.

57. Handwells

Scope of Work

Work under this item shall be in accordance with Section 5 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 602 and as amended herein.

This special provision covers the requirement for the installation of the handwells for the traffic signals, as identified and noted in the contract drawings.

Construction

Handwells shall be installed in accordance with procedures specified by the manufacturer and/ or Engineer and as indicated in the contract drawings and specifications. The Contractor shall supply the pull chambers/ handwells as required for this contract and as specified on the Contract Drawings.

Basis of Payment

Payment at the Contract price for the tender item "Handwells" shall be full compensation of all labour, equipment, and materials to do the work.

58. Rigid Ducts

Scope of Work

Work under this item shall be in accordance with Section 6 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 603 and as amended herein. This special provision covers the requirements for the supply and installation of rigid ducts in boulevard and roadway.

Directional Boring

The Contractor shall employ a directional boring method of installation for all road crossings. When directional boring methods are used the Contractor shall use Driscopipe, high density polyethylene SDR13.5, 1000 series.

The directional boring method must be able to consistently install the specified conduit(s) to the specified line and grade. However, the Contractor, in order to avoid obstructions, may place the conduit up to 450 mm lower than the specified grades. The Contractor shall obtain the necessary information from all utility companies in order to maintain proper clearances. The measurement for payment for conduit installed by directional boring method shall be made from the centre of the handwell to centre of the handwell for each run of conduit.

If the directional boring operation advances one-half way or more across the leg of an intersection and then encounters an obstruction or resistance, the Contractor will be permitted to complete the balance of the crossing by the open cut method. The Contractor shall make the final decision whether to complete the crossing by open cut or to withdraw the directional boring equipment and open cut the full width of the crossing.

Where the conduit is installed partially by directional boring and partially by open cut, the measurement for payment for directional boring shall be made from centre

of the handwell to the end of the directional boring; the measurement for payment for open cut in the roadway shall be made for the open cut installation in the roadway; and the measurement for payment for open cut in boulevard, sidewalk and shoulder shall be made for the open cut installation in the boulevard, sidewalk and shoulder. Should the Contractor elect to withdraw the directional boring equipment and open cut the full crossing, payment will be made for open cut installation and no payment will be made for any part of the directional boring.

Should it be necessary to expose utilities beneath the traveled portion of the road, in advance of directional boring, the unit price for road crossing shall be paid for the length of the exposing trench in addition to the total lengths of the directional bore under the road surface.

The open cut method shall only be used when the City of Guelph is satisfied that the directional boring method is not practical, due to location specific considerations, including ground condition and utility location.

Rigid Ducts

The Contractor shall supply and install all underground and above ground conduits including the riser conduits complete with service entrance fittings onto wood poles for the traffic signal equipment.

Rigid ducts shall be installed in accordance with procedures specified by the manufacturer and/ or Contract Administrator and as indicated in the contract drawings and specifications.

Above ground riser conduits shall be securely fastened to the wood poles as recommended by the Ontario Electrical Safety Code.

Basis of Payment

Payment at the Contract price for the tender item "Rigid Ducts" shall be full compensation of all labour, equipment, and materials to do the work.

59. Low Voltage Cables in Ducts

Scope of Work

Work under this item shall be in accordance with Section 7 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 604 and as amended herein. This special provision covers the requirements for the installation of low voltage and extra low voltage cables supplied by the Contractor including roadway lighting, traffic signal, pre-emption and power cables. The contractor is not responsible for the installation of any traffic signal system communication cables.

Construction

Low voltage cables in ducts shall be installed in accordance with procedures specified by the manufacturer and/ or Engineer and as indicated in the contract drawings and specifications.

The contractor shall install all necessary underground roadway street lighting cables supplied by the contractor into the assigned underground ducts as illustrated in the

contract drawings. All cables shall be tagged to identify intended use and power source of circuit.

Basis of Payment

Payment at the Contract price for the tender item "Low Voltage Cables in Ducts" shall be full compensation of all labour, equipment, and materials to do the work.

60. Grounding

Scope of Work

Work under this item shall be in accordance with Section 8 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 609 and as amended herein. This special provision covers the requirements for the supply and installation of grounding including ground wires and ground plates, as identified and noted in the contract drawings.

Construction

Ground wires and ground plates shall be installed in accordance with procedures specified by the manufacturer and/ or Engineer and as indicated in the contract drawings and specifications. High pressure irreversible compression connectors for grounding shall be:

- a) Made of pure wrought copper extrusion,
- b) Made of the same material as the conductors,
- c) According to CSA 22.2 No. 41, UL 467, and IEEE 837,
- d) Connected according to the manufacturer's recommendations, and
- e) Connected using a minimum compressive force of 100 KN and a minimum compressive pressure of 70 MPa.

High pressure irreversible compression connectors shall have crimp verification for the inspection and verification of CSA and UL compliance markings. Moulded type ground connectors or high pressure irreversible compression connectors shall be used at power supply locations, and all locations where the ground connectors are direct buried or inaccessible.

Basis of Payment

Payment at the Contract price for the tender item "Grounding" shall be full compensation of all labour, equipment, and materials to do the work.

61. Remove/ Salvage and Dispose of Existing Traffic Signal Equipment

Scope of Work

Work under this item shall be completed in accordance with Section 9 of the City of Guelph Specification SS-300, OPSS 610 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

Removal of any underground utility and/ or traffic signal underground shall not be undertaken without written authorization from the Engineer and the utility owner, unless otherwise clearly indicated on the Contract Drawings. Notwithstanding the above, the Contractor shall confirm the nature and status of existing materials to be removed and shall confirm the removal with the appropriate utility/ owner representative(s) in advance of the work of removal. Any materials encountered in the field requiring removal but not shown on the plans shall be communicated to the Engineer at the time of exposure for assessment of the action to be taken.

The work for this item shall include carefully exposing, excavating and removal of existing abandoned underground utility plant and traffic signal underground found or abandoned prior to, or during, the work of this contract.

Payment for the above item(s) shall be at the Contract price listed in the Form of Tender.

All removed material is to be disposed of off-site, unless otherwise directed by the Engineer.

Basis of Payment

Payment at the Contract price(s) for the above work shall be full compensation for all Labour Equipment, and Material to do the work including all requirements of OPSS 610.

62. Power Supply Assemblies

Scope of Work

Work under this item shall be in accordance with Section 10 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 614 and as amended herein. This special provision covers the requirements for the installation of power supply assemblies supplied by the Contractor for the traffic signal and roadway illumination, as identified and noted in the contract drawings.

Construction

Power supply assemblies shall be installed in accordance with procedures specified by the manufacturer and/ or Engineer and as indicated in the contract drawings and specifications.

Basis of Payment

Payment at the Contract price for the tender item "Power Supply Assemblies" shall be full compensation of all labour, equipment, and materials to do the work.

63. Traffic Signal Poles, Base Mounted

Scope of Work

Work under this item shall be in accordance with Section 11 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 615 and as amended herein. This special provision covers the requirements for the installation of traffic signal poles

supplied by the Contractor for the traffic signal system and roadway illumination, as identified and noted in the contract drawings.

Construction

Traffic Signal poles shall be installed in accordance with procedures specified by the manufacturer and/ or Engineer and as indicated in the contract drawings and specifications.

Basis of Payment

Payment at the Contract price for the tender item "Traffic Signal Poles Base Mounted" shall be full compensation of all labour, equipment, and materials do the work.

64. Concrete Foundations

Scope of Work

Work under this item shall be in accordance with Section 12 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 616 and as amended herein. This special provision covers the requirements for the supply and installation of concrete foundations for the sectional steel poles and traffic signal controller cabinets including reinforcing steel bars as identified in the contract drawings and specifications.

Construction

Concrete foundations shall be installed in accordance with procedures specified by the manufacturer and/ or Engineer and as indicated in the contract drawings and specifications.

Concrete Pole Foundations

The location of the concrete foundations for the sectional steel poles and the traffic controller cabinet shall be approved in the field by City of Guelph Traffic Signal staff prior to installation.

The concrete pole foundations may be located adjacent to existing underground utilities. No additional compensation shall be made to the Contractor for excavating these areas where the pole foundation is adjacent to existing underground utilities by hand digging or Hydro Vac excavation.

Anchorage Assembly

The anchorage assembly studs shall be coated with white non-staining grease and inserted to full depth into the threaded steel sleeve. The anchorage assembly shall be adjusted level. Upon initial concrete set, the wood template shall be removed and the top of the foundation shall be tapered from the centre outwards to allow run-off and hand trowelled smooth as indicated in the standard drawing 9-201, 9-201a, 9-201b, 9-201c and 9-201d. Once the concrete is set, ensure that the studs are adjustable.

Basis of Payment

Payment at the Contract price for the tender item "Concrete Foundations" shall be full compensation of all labour, equipment, and materials to do the work.

65. Supply and Install Street Lighting Luminaires and Bracket Assemblies

Scope of Work

Work under this item shall be in accordance with Section 13 and the City of Guelph Linear Infrastructure Standards, OPSS 617, and as amended herein.

This special provision covers the requirements for the installation of the street luminaires and brackets supplied by the Contractor, as identified and noted in the contract drawings.

Material

Street lighting luminaires and bracket assemblies shall be according to Guelph hydro standards.

Construction

The Contractor shall install street lighting luminaires as specified on the contract drawings.

Street lighting luminaires shall be installed in accordance with procedures specified by Guelph Hydro indicated in the contract drawings and specifications.

Basis of Payment

Payment at the Contract price for the tender item "Street lighting luminaires and bracket assemblies" shall be full compensation of all labour, equipment, and materials to do the work.

66. TRAFFIC SIGNAL AND PEDESTRIAN SIGNAL HEADS

Scope of Work

Work under this item shall be in accordance with Section 14 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 617 and as amended herein.

This special provision covers the requirements for the installation of the traffic signal heads and pedestrian signal heads supplied by the Contractor, as identified and noted in the contract drawings.

Construction

Traffic signal and pedestrian signal heads shall be installed in accordance with procedures specified by the manufacturer and/ or Engineer and as indicated in the contract drawings and specifications. All traffic and pedestrian signal heads shall

include L.E.D.s (light emitting diodes), meeting the latest specifications of ITE (Institute of Transportation Engineers).

The contractor shall record the manufacturer and serial number of each L.E.D. used for the permanent traffic signal. The contractor shall forward this information to the Engineer upon the activation of the permanent traffic signal.

All traffic signal and pedestrian signal heads shall be covered with an opaque material when not in operation.

Basis of Payment

Payment at the Contract price for the tender item "Traffic Signal and Pedestrian Signal Heads" shall be full compensation of all labour, equipment, and materials to do the work.

67. Traffic Signal Mast Arms and Brackets

Scope of Work

Work under this item shall be in accordance with Section 14 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 620 and as amended herein. This special provision covers the requirements for the installation of the traffic signal single member arms and signal head support brackets supplied by the contractor, as identified and noted in the contract drawings.

Construction

Traffic signal single member arms and signal head support brackets shall be installed in accordance with procedures specified by the manufacturer and/ or Engineer and as indicated in the contract drawings and specifications.

Basis of Payment

Payment at the Contract price for the tender item "Traffic Signal Mast Arms and Brackets" shall be full compensation of all labour, equipment, and materials to do the work.

68. Installation and Activation of Traffic Signal Cabinet and Timer Unit for Permanent Traffic Signal System

Scope of Work

Work under this item shall be in accordance with Section 15 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 620 and as amended herein. This special provision covers the requirements for the installation and activation of the traffic signal controller cabinet supplied by the owner, as identified and noted in the contract drawings.

A new traffic signal controller and timer unit will be provided by the Owner to operate the permanent traffic control signal. The contractor shall provide a

minimum of 48 hours' notice to the Engineer before pick-up of the traffic signal controller and timer.

Signal Timings

The Owner will perform all signal timing changes as required in the field. The Owner is to be notified a minimum of two (2) working days prior to the change of any construction staging.

Basis of Payment

Payment at the Contract price for the tender item "Traffic Signal Cabinet" shall be full compensation of all labour, equipment, and materials to do the work.

69. Pedestrian Push Buttons

Scope of Work

Work under this item shall be in accordance with Section 14 of the City of Guelph Linear Infrastructure Standards, OPSS 620 and as amended herein. This special provision covers the requirements for the installation of the pedestrian push buttons as identified and noted in the contract drawings.

Construction

Where Accessible Pedestrian Pushbuttons (APS) are to be installed, the City shall supply the Contractor the accessible pedestrian pushbuttons. The accessible push buttons will be programmed by the City and the Contractor shall install the accessible push buttons in the field. The accessible push buttons shall be clearly identified by the City for installation location.

Where APS is not required, the Contractor shall supply and install push buttons as identified on the Contract Drawing(s).

All push buttons shall be installed in accordance with procedures specified by the manufacturer and/ or Contract Administrator and as indicated in the contract drawings and specifications. The pushbutton shall be mounted at 1.02 metres above finish grade to centre of pushbutton. Upon completion of the installation of pedestrian pushbuttons, the system shall be tested at the controller cabinet. The inspection, testing, and test results shall be witnessed by the Contract Administrator.

Basis of Payment

Payment at the Contract price for the tender item "Pedestrian Push Buttons" shall be full compensation of all labour, equipment, and materials to do the work.

70. Vehicle Loop Detectors

Scope of Work

Work under this item shall be in accordance with Section 14 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 620 and as amended herein. This special provision covers the requirements for the supply and installation of the vehicle loop detectors, as identified and noted in the contract drawings.

Construction

Vehicle loop detectors shall be installed in accordance with procedures specified by the manufacturer and/ or Engineer and as indicated in the contract drawings and specifications.

Prior to sealing slots, loop wiring shall be tested for continuity, for leakage to ground and for inductance. Resistance to ground shall be 10 MW or greater.

Upon completion of splices, installation of extra low voltage cable, sealing of slots and backfilling of trenches, the foregoing tests shall be repeated at the controller cabinet.

Any loop detector required to be replaced shall be re-cut in the original slot with new wiring and sealant installed. All such loops shall be tested to conform to the foregoing requirements.

Basis of Payment

Payment at the Contract price for the tender item "Vehicle Loop Detectors" shall be full compensation of all labour, equipment, and materials to do the work.

71. Overhead Vehicle Detectors

Scope of Work

Work under this item shall be in accordance with Section 14 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 620 and as amended herein. This special provision covers the requirements for the installation of the vehicle loop detectors, as identified and noted in the contract drawings.

Construction

The Contractor shall install the overhead vehicle detector(s) as identified on the Contract Drawing(s). The overhead vehicle detectors will be supplied by the City.

The Contractor shall be required to aim/ adjust the overhead vehicle detectors as directed by the Contract Administrator during configuration of the overhead vehicle detectors.

Basis of Payment

Payment at the Contract price for the tender item "Overhead Vehicle Detectors" shall be full compensation of all labour, equipment and materials to do the work.

72. Emergency Pre-Emption System

Scope of Work

Work under this item shall be in accordance with Section 14 of the SS-300 City of Guelph Linear Infrastructure Standards, OPSS 620 and as amended herein. This special provision covers the requirements for the Contractor to supply and install a new emergency pre-emption system, as identified and noted in the contract drawings.

Construction

Emergency pre-emption system equipment shall be installed in accordance with procedures specified by the manufacturer and/ or Engineer and as indicated in the contract drawings and specifications.

Upon completion of the installation of emergency pre-emption system, the system shall be tested as per manufacturer's recommendations. The inspection, testing, and test results shall be witnessed by the Engineer or designate. The contractor shall perform all necessary aiming of the pre-emption system to ensure optimum operation of the device without seeking additional compensation for this work.

Basis of Payment

Payment at the Contract price for the tender item "Emergency Pre-emption System" shall be full compensation of all labour, equipment, and materials to do the work.

73. Imported Screened Topsoil

Work under this item shall be completed in accordance with City of Guelph, "Specification for Topsoil", SS-20, OPSS 802 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

Import topsoil shall be screened topsoil. Topsoil delivered in an unscreened condition will not be accepted under any circumstances. All topsoil shall be tested as per SS-20.

Notwithstanding the City of Guelph standard specification, the specified topsoil thickness for this contract shall be a minimum of 150 mm Topsoil thickness will be checked to confirm the minimum specified depth(s) has been provided. Where the minimum depth has not been achieved, no measurement for payment will be made.

Areas damaged by the Contractor beyond the project limits shall be restored with topsoil where necessary prior to carrying out sod or seed repairs. No measurement or payment will be made for this work.

Measurement for Payment

Measurement shall be by the in-place measurement in square metre for areas of imported topsoil placed.

Basis of Payment

Payment at the Contract price for the above item shall be full compensation for all Labour, Equipment and Material to do the work.

74. Supply and place sod (nursery no. 1), water and fertilizer

Scope of Work

Work under this item shall be completed in accordance with OPSS 803 and for the unit price bid shall include the following:

- No. 1 nursery sod supplied and placed by a professional landscaper cut-in to match adjacent existing sod.
- Watering of sod at a rate of not less than 22.5 litres per square metre (unless otherwise directed by the Engineer) as often as required to assure growth until maintenance period elapses.
- Adequate rolling of sod to the satisfaction of the Engineer.
- Hardwood stakes driven flush with top of sod where directed by the Engineer.
- Where new sod abuts existing sod, the Contractor shall countersink the new sod to match the existing sod.

On contracts that include the surface layer of asphalt, the placement of the surface asphalt will not be permitted until all sodding has been completed unless otherwise authorized by the Engineer.

Areas where the ground cover has been damaged by the Contractor beyond the project limits shall be restored at the Contractor's expense and shall not be included in the area measured for payment. If the nature of the proposed Contract work does not permit completion of activities without damage beyond the Contract grading limits illustrated on the plans, then the Contractor shall review all anticipated areas where it is felt unavoidable damage will occur and shall allow for the necessary restorative measures and their related costs to complete the respective items of work.

Construction

Sod operations shall not proceed until clearance to do so has been provided by the Engineer following checking of topsoil depth and placement grading.

Fertilizer 8-32-16 shall be applied uniformly at a rate of 5kg per 100m² of surface area. Fertilizer shall be applied prior to, and up to a maximum of 48 hours before, sod placement.

The Contractor shall roll the sod in all boulevards, in front of residential areas, and all other areas where the grass will be maintained by mowing.

All sod edges matching against existing hard surfaces or materials shall be placed such that ponding at the edges does not occur. This may mean cutting into existing base material prior to topsoil placement or building up sufficiently with topsoil to ensure positive drainage to the nearest outlet. The Contractor shall also cut in sod

at the interface to existing turf over the entire length of the interface to ensure a uniform, level edge with existing turf and without gaps or overlaps.

The staking specified in OPSS 803.07.04 shall be a suggested procedure only as the Contractor is responsible for acceptance growth as specified elsewhere in these specifications and the Contractor shall take whatever necessary precautions to obtain acceptable growth.

The Contractor shall water the sod as required to obtain growth acceptable to the Engineer. The Contractor shall continue to provide ongoing maintenance, including watering to the sodded areas for a period of six (6) weeks from the installation of the sod. There will be no separate payment for the application of water. The cost of water and watering the sod to obtain growth acceptable to the Engineer is considered incidental to the item for Sod. The Contractor shall also include provision in the Contract price for two (2) cuttings of the sodded areas.

The Contractor will be responsible for the protection of sodded areas. This protection shall include the repair of sodded areas with additional sod, including the restoration of the slope itself and the supply of additional topsoil, until the final acceptance of the sodded areas, subject to the following paragraph.

If sodding has not been completed and accepted by November 15th, such areas will not be accepted until the following year when it can be determined that acceptable growth has taken place; unless it is obvious to the Engineer that acceptable growth has taken place. The Contractor shall be responsible for complete maintenance of the sod up to May 15th of the following year.

This period of maintenance will apply even if the Contract is completed, but the sodding is not completed and accepted by the date specified above and the Contractor shall allow for such repair work in his Contract prices.

Measurement and Basis of Payment

OPSS Subsection 803.09 and 803.10 are amended by deleting separate tender items for staked and un-staked sod. Staking shall be carried out where required and as called for in the Contract Documents and shall be included in the Contract price.

Re-measurements

The following shall form part of the sodding specification:

If the Contractor requests a re-measurement of the sod area and the re-measured area is less than or equal to the area measured for proposed payment, then the re-measured area will be used for payment and the Contractor will pay all costs for the re-measurement and recalculation of the quantity.

If the re-measured area exceeds the area measured for proposed payment, the re-measured quantity will be used for payment and the Owner will bear all costs of re-measurement and recalculation.

Payment

Payment shall be made at the Contract price for the areas receiving sod. Payment at the Contract unit price shall be full compensation for sod, fertilizer and water for

sod and for all other items of work necessary to complete the sodding of surfaces in accordance with the Contract requirements.

75. Hydroseed and mulch

Scope of Work

Work under this item shall be completed in accordance with City of Guelph OPSS 804 as amended herein. The most stringent of the above specifications shall govern in case of conflict. The Contractor shall supply a standard roadside mix for the seed or as specified in the Form of Tender.

Areas damaged by the Contractor beyond the project limits shall be restored with topsoil where necessary prior to carrying out seed repairs. No measurement or payment will be made for this work.

Measurement for Payment

Measurement shall be by the in-place measurement in square metre for areas of hydroseed and mulch.

Basis of Payment

Payment at the Contract price for the above item shall be full compensation for all Labour, Equipment and Material to do the work.

76. Tree Related Plans and Requirements

"Refer to City of Guelph Tree Technical Manual"

~~1) Nursery Stock Selection and Minimum Stock Requirements~~

- ~~1) Only planting stock which meets the latest size and quality standards outlined by Canadian Nursery Landscape Association in the *Canadian Standards for Nursery Stock* shall be established.~~
- ~~2) Planting stock shall be of uniform high quality, true to name and type, and representative of its species, variety and/ or cultivar.~~
- ~~3) Planting stock shall have been nursery grown for a minimum of 2 years in climatic conditions similar to those of the City of Guelph. The tree establishment Contractor shall provide a list of the proposed sources of nursery stock to the City of Guelph upon request. When available, the City of Guelph stock grown from source-identified seed, where the seed source is comparable in climate to Guelph.~~
- ~~4) Planting stock shall be healthy, vigorous, well branched, densely foliated (if in-leaf), and wholly free of disease and insect pests.~~
- ~~5) Trees shall have healthy, well developed root systems and shall be free from physical damage or other conditions that may prevent healthy long term growth.~~
- ~~6) Planting stock with damaged leaders, poorly attached branches, sunscald, bark damage, decay, unhealed wounds and/ or other objectionable disfigurements~~

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~~shall be considered unacceptable and shall not be established. Trees with multiple leaders shall only be considered acceptable if clump type forms are specified for establishment.~~

~~The following stock types are acceptable, provided the characteristics described below are present:~~

- ~~• *Balled and burlapped/ wire basket:* root balls shall be tight, solid and of appropriate size relative to caliper. Minimum root ball diameter for a 50 mm caliper tree shall be 750 mm. Root balls shall be tightly wrapped with untreated, non-synthetic fully biodegradable burlap and non-synthetic biodegradable rope or twine. The root collar or flare shall be visible at the root-soil interface (i.e., surface of the soil ball).~~
- ~~• *Container:* Container-grown trees shall be well-established in the container prior to planting. Root systems must not be container bound, and shall not display circling, kinked, girdling or bent roots. The root collar or flare shall be visible at the root-soil interface.~~
- ~~• *Bare root:* Bare root stock shall display a vigorous and well-formed root system, with no circling, kinked, girdling or bent roots. Bare root trees must be dug and planted during the dormant season only. Anti-desiccant hydrogel may need to be applied to bare root stock in between digging and transplanting if necessary to prevent root drying. Given the low costs and potentially high quality of bare-root planting stock, consideration should be given to its use, particularly in conjunction with enhanced rooting environment techniques.~~

~~The following size requirements are applicable to all street tree plantings and other tree establishment activities on City of Guelph lands:~~

- ~~• Any deciduous trees planted on City of Guelph streets shall be at least 60 mm caliper. Caliper shall be measured in accordance with standards of the Canadian Nursery Landscape Association.~~
- ~~• The minimum height of the lowest branch of any deciduous tree to be established on City of Guelph streets shall be 1.75 metres.~~
- ~~• Any coniferous trees planted on City of Guelph streets shall be a minimum height of 250 cm.~~
- ~~• The size (caliper or height) of trees planted in parks, open spaces and natural areas shall be specified on a case-by-case basis, for approval by the City of Guelph.~~

~~The following guidelines shall be used to guide the selection of acceptable nursery stock:~~

- ~~• Planting stock should ideally be inspected in the nursery, prior to shipping to the planting site, to ensure conformance with these guidelines and standards, including the presence of a visible root flare at the root-soil interface.~~
- ~~• The north side of the trunk should be marked in the nursery to enable planting in the same orientation, thereby reducing the likelihood of frost cracking or sun scald.~~

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- ~~In development scenarios, the development proponent's Landscape Architect or Project Consulting Arborist shall be responsible for ensuring that all planting stock meets or exceeds the guidelines and standards laid out in this document.;~~
- ~~Trees established as part of capital projects or other non-development (i.e., non-Site Plan or Subdivision) works shall be inspected by the contractor to ensure that all planting stock meets or exceeds the guidelines and standards laid out in this document.~~
- ~~The City of Guelph reserves the right to conduct sample-based or complete inspections of all planting stock to ensure conformance with the guidelines and standards laid out in this document. Planting stock failing to conform to these standards may be rejected by the City, and will be replaced with acceptable planting stock at the development proponent's or contractor's sole expense.~~
- ~~The City of Guelph must be provided with the opportunity to inspect planting stock before it is installed.~~
- ~~Acceptance of planting stock does not limit the City of Guelph's right to inspect and reject stock during the course of works or during the warranty and maintenance period.~~

~~The following guidelines relate to proper packaging, transportation, handling and storage of planting stock to and on the planting site:~~

- ~~Planting stock should not be dug, balled and burlapped or moved with a spade during the active growth period, unless the root ball is large enough to ensure survival.~~
- ~~During transportation, the contractor shall take all necessary precautions to prevent physical injury, heating, freezing or drying out of planting stock, and shall handle all material in such a manner as to avoid any damage.~~
- ~~Ball and burlap or wire basket planting stock shall always be handled by the soil ball. Under no circumstance should trees be dragged, lifted or pulled by the trunk or canopy. Trees should never be thrown or bounced off a truck or loader. Trees with broken or cracked root balls will be considered as unacceptable planting stock.~~
- ~~If necessary, branches shall be tied with rope or twine only, and in such a manner as to prevent damage to branches or bark.~~
- ~~In cases where trees may have their trunks scarred during the planting operation, the trunks shall be protected with wrap or padding, which is to be removed after planting.~~
- ~~On the planting site, all material should be handled, secured and shaded or covered so as to prevent damage from wind, sun or vibration. Bare root stock shall at all times be covered by an appropriate moisture retaining medium and tarps, if used, shall be of the Silvicool type.~~
- ~~Trees which cannot be planted on the day of delivery shall be stored as described above, and root balls shall be stored in soil or mulch and kept well watered. No planting stock shall remain unplanted for longer than 3 days following delivery, and;~~
- ~~Any abrasions of the bark or branches, or broken limbs caused during the planting operation shall be immediately treated in an arboriculturally correct manner.~~

2) ~~Planting of Tree~~

~~This section outlines guidelines and standards for the process of planting of tree, beginning with layout and ending with post-planting treatments.~~

~~Initial Layout~~

- ~~1) The contractor responsible for the planting of trees will lay out locations of all trees by use of wooden stakes and/ or paint, as appropriate based on site condition. Locations will indicate species to be planted, using code corresponding to the approved Landscape or Street Tree Plan.~~
- ~~2) Locations laid out on site shall conform to locations proposed in the approved plans. All utility locates, including but not limited to public and private underground electric or telephone lines, gas lines, waterlines, or any other utilities, shall be secured prior to initial layout.~~
- ~~3) The contractor shall notify the City of Guelph no later than 3 business days prior to beginning the planting of any street trees or trees in parks, open spaces or natural areas. The City of Guelph shall reserve the right to inspect the on-site layout for conformance with approved plans and potential on-site conflicts, as well as any planting stock for conformance with the guidelines and standards laid out in this document. No planting pits shall be dug or prepared until their location is approved by the City of Guelph, or until the City has declined the opportunity to inspect the layout.~~
- ~~4) Upon receipt and approval of the submitted Landscape or Street Tree Plan, the contractor will be provided with authorization from the City of Guelph to proceed with the planting of the street, park, open space or natural areas trees during the next available planting season.~~
- ~~5) The contractor shall be responsible for all costs associated with transplanting plant material that is deemed to have been planted in conflict with utilities, setback requirements, or the approved plan(s).~~

Timing of Planting

~~Appropriate timing of planting of tree depends upon species, type of planting stock, climate, weather conditions and other factors. The following section provides guidelines and standards for the timing of tree planting activities. Timing of tree planting should be outlined in the Landscape or Street Tree Plan, and should be based upon the recommendations and experience of the project Landscape Architect or Consulting Arborist.~~

- ~~6) Generally, spring is the best time to plant most species. Spring planting should be undertaken after the ground thaws and before tree buds break.~~
- ~~7) Summer planting should be avoided, but can be undertaken if extreme care is taken to prevent drying and to ensure adequate water is provided before, during and well after planting.~~
- ~~8) Fall planting is also acceptable, provided that trees are planted before soil is frozen in order to permit some root development.~~
- ~~9) Planting seasons may be longer or shorter, depending upon prevailing weather conditions.~~

Planting Hole Preparation

- ~~10) The contractor shall ensure that planting layout has been reviewed and accepted by the City of Guelph prior to preparing the planting hole. The contractor shall be responsible for all costs associated with transplanting plant material that is deemed to have been planted in conflict with utilities, setback requirements, or the approved plan(s).~~
- ~~11) The contractor shall ensure that all public and private utility locates are secured prior to preparing the planting hole. The contractor shall be responsible for any damage to utilities resulting from a failure to secure or understand utility locates.~~
- ~~12) Holes shall be dug at the time of planting, and shall not be left empty or uncovered at the end of the working day. Planting holes not filled with trees at the end of the work day shall be filled with soil, covered or barricaded with warning devices that conform to the *Highway Traffic Act* and the *Manual of Uniform Traffic Control Devices*, and re-excavated the following working day.~~
- ~~13) Circular pits with sloping sides shall be excavated for all ball and burlap, wire-basket and container grown trees. Excavation shall be done by hand (i.e., shovel), backhoe, or stump grinder. Hydraulic excavation (i.e., Hydro Vac) can be used provided that native topsoil can be returned as backfill without becoming contaminated in the process. A soil auger or tree spade shall not be used.~~
- ~~14) All planting pits should be at least three times the diameter of the soil ball, unless otherwise specified. The glazed and compacted walls of the planting pit shall be scarified by a shovel or rake to enable improved root penetration into the parent soil. Alternately, a planting hole at least 2 times the diameter of the soil ball shall be dug and the soil shall be loosened at least one ball diameter's distance beyond the hole to a minimum depth of 200 mm using a rotary tiller.~~
- ~~15) The planting hole shall be dug to a depth such that the top of the root collar will be no lower than level with or a maximum of 50 mm above the surrounding grade after planting and settling. The bottom of the planting hole should be firm and undisturbed to minimize or eliminate settling. Planting hole depth should account for possible settling of the soil ball after watering. Bare root trees may require scarification of the bottom of the planting hole to enable adequate root distribution. For trees to be planted in planting soil that is deeper than the root ball depth, compact the soil under the root ball to assure firm bedding for root ball.~~
- ~~16) Proper drainage shall be assured. The contractor shall notify the City of Guelph, in writing, of any soil conditions or other obstructions that the contractor may consider detrimental to tree growth. Such conditions and suggestions for correcting them shall be described.~~
- ~~17) Where soil conditions or below ground obstructions which cannot be remedied are encountered, the City of Guelph shall designate alternate planting locations. The City of Guelph shall not bear any costs associated with such relocation.~~

Tree Planting

- ~~18) Trees shall be installed plumb and centred in the planting hole. Trunk position shall be visually confirmed from at least two perpendicular directions. Trees with~~

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appreciable sweep (i.e., stem curvature) shall be set such that their growth will enable self-correction as soon as possible.

- ~~19) Trees shall be positioned in the same cardinal orientation as in the nursery.~~
- ~~20) Ball and burlap and wire basket trees shall have all foreign materials removed from at least the top half of the root ball. Wire baskets shall, at minimum, be cut or bent back from the top half of the root ball.~~
- ~~21) Container grown trees shall have containers removed entirely before planting. Roots shall be gently separated from the surface of the soil root mass. Circling roots shall be cut, and excessively girdled or pot-bound planting stock shall be rejected.~~
- ~~22) Bare root trees shall have their roots spread to a natural position. No root pruning shall be conducted unless girdling roots are present.~~
- ~~23) For all trees moved with a tree spade, all holes and cavities between the ball and the surrounding soil should be filled.~~
- ~~24) All plastic ties, ropes, strings, wire baskets, burlap and other wrappings must be removed from the tree and hole. The ball shall be in the hole and well supported before the material is removed.~~
- ~~25) The root collar must be exposed prior to backfilling, and must be at or no more than 50 mm above final grade. If the root flare is not visible, excess should be removed from around the trunk by hand or using a hand trowel.~~
- ~~26) Planting holes shall be backfilled with excavated native topsoil, if soil testing dictates that no amendments are necessary. Soil shall be tamped in the hole in 150 mm lifts. When holes are approximately two thirds full, they shall be watered thoroughly.~~
- ~~27) A 100 mm high ring of soil shall be formed around the top of the root ball perimeter of the planting hole. No soil shall be backfilled to within 100 mm of the root collar or around the trunk.~~
- ~~28) The entire planting area should be thoroughly watered after planting.~~

Tree Support Systems

Support, typically in the form of staking, may be required to stabilize newly planted trees in a vertical position and to provide anchorage to enable root establishment. The following guidelines and standards pertain to the design, planting and maintenance of tree support systems:

- ~~29) Staking shall be required when soil conditions will not enable newly planted trees to maintain their vertical position without support.~~
- ~~30) If required, trees shall be staked with two 2.0 m (min.) wooden stakes. Stakes shall be driven in to the ground at the outer edge of the root ball to a depth sufficient to prevent shifting or movement. Stakes shall be aligned in the direction of the prevailing winds or parallel to the curb for street planting.~~
- ~~31) Trees shall be tied to stakes using Arbortie or approved equivalent in a figure 8 pattern that shall remain tight, soft and pliable under all weather conditions.~~
- ~~32) The condition of tree support systems should be monitored throughout the warranty and maintenance period.~~

- ~~33) Unless otherwise specified or required based on site inspections, tree support systems should be removed at the end of the next growing season following planting.~~
- ~~34) Alternative methods of tree support, such as guying, root ball anchorage or three point staking may be approved by the City of Guelph on a case by case basis, if required due to site conditions.~~

Trunk Protection

~~Trunk protection is required when damage from sun scald, frost cracking, and lawn maintenance equipment damage are likely. The following guidelines and standards pertain to the proper installation of trunk protection:~~

- ~~35) Trunk guards shall be white spiral plastic. Tree guards shall be loosely installed around the trunk to a maximum height of 500 mm. Larger metal guards may be specified for trees planted in areas of high pedestrian traffic on a case by case basis. However, metal tree grates and guards are not typically considered desirable surface treatments, and more innovative and tree friendly treatments are strongly encouraged.~~
- ~~36) Trunk guards shall be white spiral plastic. Tree guards shall be loosely installed around the trunk to a maximum height of 500 mm. Tree bark protectors may be specified in streetscapes and parks where tree trunks may be subject to mechanical abuse (Specification: black extruded resin mesh, 4" wide, 5' long as manufactured by Industrial Netting, Minneapolis, MN, USA or approved equal).~~
- ~~37) Burlap trunk wrap shall only be used for trees with known predisposition to frost cracking in areas with a strong south and west exposure. Burlap trunk wrap shall be removed after the first winter following the planting of tree.~~
- ~~38) The condition of all trunk protection materials must be regularly inspected and monitored to ensure no interference with tree growth (i.e., girdling or bark scraping).~~
- ~~39) Unless approved by the City of Guelph, all trunk protection material shall be removed at the end of the warranty and maintenance period.~~

Root Pruning

~~Root pruning can help ease the stresses experienced by a tree with root damage, encourage the growth of new fine and feeder roots, and prevent the spread of decay. Proper root pruning should be done in advance of anticipated root damaging excavation, or immediately afterwards if such injury was unforeseen.~~

- ~~40) Roots that are severed, exposed, or diseased and are greater than 20 mm in diameter should be properly pruned by a Certified Arborist. All roots shall be pruned with clean hand tools only. Shovels, picks or other construction tools shall not be used to prune roots.~~
- ~~41) Roots shall be pruned in a similar fashion as branches, taking care to maintain the integrity of the root bark ridge.~~
- ~~42) Wood dressing or pruning paint shall not be used to cover the ends of any root pruning cut.~~
- ~~43) Prolonged exposure of tree roots shall be avoided. Exposed roots shall be kept moist and covered with soil, mulch, irrigation, or at least moistened burlap if they are to be exposed for longer than 3 hours.~~

Mulching

Mulching is required for all trees planted on streets, unless otherwise specified, and in parks, open space and natural areas. Mulch provides organic matter, retains soil moisture, reduces soil temperature fluctuations, and provides protection against physical damage from lawn maintenance equipment. The following guidelines and standards pertain to the proper installation of mulch:

- 44) Mulch shall consist of loose composted wood chips (except in designated Termite Management Areas) and shall be free of weed and grass seeds or rhizomes, or other materials which may be harmful to plant growth.
- 45) Only mulches listed as Approved on the City of Guelph Approved Top Mulch and Soil Amendment Materials list shall be applied in designated Termite Management Areas.
- 46) Mulch shall be spread in a 'donut shaped' ring around the planting hole to a depth of no less than 100 mm and no more than 200 mm. Mulch shall have the same diameter as that of planting hole, but shall be kept back a minimum of 100 mm from the trunk.
- 47) Under no circumstances shall mulch be piled up around the trunk in a 'volcano' shape.
- 48) Mulch should be kept weed free throughout the course of the warranty and maintenance period.
- 49) Mulch should be replenished as required during the course of the warranty and maintenance period.

Watering

Watering is critical to the success of tree establishment and long term health. The following guidelines and standards pertain to watering of trees:

- 50) All newly planted trees shall be surface watered with a minimum of 40 litres of water immediately following planting.
- 51) The Street Tree Plan shall outline a schedule for watering (outlined in Section 3 – Maintenance during Warranty Period) of all street trees during the warranty and maintenance period. Watering schedules for trees planted in parks, open spaces and natural areas shall be determined in consultation with the City on a case by case basis.

3) ~~Warranty, Maintenance and Inspection~~

All street, park, open space and natural area tree planting undertaken by contractors when on behalf of the City of Guelph, shall be supported by a warranty, as well as a maintenance period during which time the contractor will endeavour to ensure the establishment, survival and good health of planted trees. The following sections outline the guidelines, standards and requirements for warranty and maintenance periods, and outline inspection and acceptance procedures.

Acceptance, Warranty and Inspection

- 1) Upon completion of all street, park, open space or natural areas tree planting, the developer or contractor shall request an inspection by the City of Guelph. All deficiencies will be noted in site inspection minutes and sent to all parties

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involved (i.e., city staff, contractor, sub-contractor, etc.). Deficiencies will be corrected as soon after notification as possible.

- 2) ~~The contractor shall provide to the City of Guelph, in writing, a minimum two-year warranty for any and all trees planted by the contractor on streets or in parks, open spaces and natural areas. The written warranty shall include a commitment to full implementation of the maintenance program outlined in the approved Plan, which shall include watering, mulching, weed removal, stake removal and maintenance, and general inspection and Plant Health Care. Inspection should be undertaken by the contractor's Landscape Architect or Consulting Arborist at least once every two months. If such a program was not described prior to approval of the plan, it shall be provided at this time. Failure to commit to a maintenance program will result in the withholding of securities by the City of Guelph.~~
- 3) ~~The warranty period shall begin at the time of acceptance of works by the City of Guelph (typically after final inspection and correction of any deficiencies), and shall terminate no sooner than two full calendar years after the time of acceptance.~~
- 4) ~~Any trees determined by the City of Guelph to be in unsatisfactory condition during the warranty period shall be replaced at the sole expense of the contractor to the satisfaction of the City of Guelph. Unacceptable defects and deficiencies may include, but are not limited to:~~
 - ~~slow growth (typically less than 50 mm annual twig growth);~~
 - ~~crown dieback;~~
 - ~~clear loss of overall vigour, or;~~
 - ~~disease and decay related to conditions prior to planting~~
- 5) ~~The guarantee is not expected to cover losses or damage related to vandalism, storms, animals or mechanical damage not related to the contractor's activities.~~
- 6) ~~Unless otherwise specified by the City of Guelph, all replacement trees shall be of the same species, variety, cultivar (if applicable), stock type and size as the initial planting. All replacement costs shall be borne by the contractor. The guidelines and standards relevant to the initial planting shall apply in whole to the replacement planting.~~
- 7) ~~The guarantee period for replacement trees shall be for the greater of the remainder of the guarantee period or an additional period of one year from the date of acceptance after replacement.~~
- 8) ~~Final acceptance of plantings will be completed through an inspection at the end of the warranty period and will be provided in writing by City staff.~~

Maintenance during the Warranty Period

~~The developer or contractor is expected to adequately and regularly maintain newly-planted trees throughout the warranty and maintenance period, in accordance with the maintenance plan outlined in the Street Tree Plan or other approved plan. Each site will have specific maintenance requirements. However, the following guidelines and standards pertain to maintenance during the warranty and maintenance period:~~

- 9) ~~Trees shall be inspected by the contractor's Landscape Architect or Consulting Arborist at a regular schedule, as approved by the City of Guelph. All deficiencies will be noted in site inspection minutes and sent to all parties involved (i.e., city~~

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- staff, contractor, sub-contractor etc.). Deficiencies will be corrected as soon after notification as possible.
- ~~10) Trees shall be regularly and adequately watered. Watering shall be more frequent for new plantings, which should be regularly monitored for signs of drought or overwatering. In general, newly planted trees should be watered daily for the first two (2) weeks following planting and every other day for the period from the second to the fourth week following planting. Following which newly planted trees shall be watered every 10 days between early May and late August, and every 20 days between September and mid-November. Water shall penetrate the full depth of the growing medium, and frequency shall be increased or decreased based upon the frequency and intensity of natural rainfall.~~
 - ~~11) Trees shall only be fertilized if soil test results or foliar conditions suggest nutrient deficiencies. During periods of extreme heat and humidity, root feeding with watering probe is the preferred method of watering.~~
 - ~~12) Mulch shall be periodically maintained and reapplied to suppress weed development, improve soil moisture conditions, and improve general appearance of the planting area. If determined necessary by the City of Guelph during the course of regular inspections, the contractor shall undertake mulch maintenance at his or her sole expense.~~
 - ~~13) Maintain all plants in a plumb position throughout the warranty period. Straighten all trees that move out of plumb. Plants to be straightened should be excavated and root ball moved to a plumb position and then re-backfilled.~~
 - ~~14) Unless otherwise determined during site inspections, tree support systems should be removed at the end of the next growing season following their planting. Stakes should be removed earlier if trees are stable. No stakes shall remain in place at the end of the warranty and maintenance period.~~
 - ~~15) All trunk protection should be removed before the end of the warranty and maintenance period.~~
 - ~~16) Newly planted trees should be carefully pruned, if necessary, to encourage the development of good canopy structure. Co-dominant unions, crossing and broken branches, and other defects should be removed by pruning. Pruning must be conducted by an ISA Certified Arborist at the appropriate time according to species requirements. Proper pruning during the warranty and maintenance period is critical to the development of well formed and healthy trees.~~
 - ~~17) All newly planted trees should be inspected for pests and diseases throughout the warranty and maintenance period. Integrated Pest Management (IPM) and Plant Health Care (PHC) principles should be applied to the control of all pests and diseases.~~

77. Precast Segmental Retaining Wall

Under this Item and for the Contract price, the Contractor shall supply all labour, equipment and materials required to complete the following works in accordance with the Contract Drawings and to the satisfaction of the Engineer:

- a) Clearing and grubbing all trees, stumps and brush to accommodate the retaining walls as required.
- b) Removing and disposing of all obstacles of the rubble boulders, timbers, etc., not specifically provided for under other Tender Items, to accommodate the installation of the new retaining wall.
- c) Clean-up and all incidental work not included in specific Tender Items.

All removals from the site shall remain the property of the Contractor to be disposed of by the Contractor off the limits of the Contract. All brush, logs, stumps and other debris resulting from the Contractor's operations under this Item shall be disposed of by the Contractor off site at a location to be arranged by the Contractor at no additional cost to the Municipality and to the satisfaction of the Engineer. Burning of trees, brush and other debris will not be permitted within the limits of the contract. When hauling rubble, excavated material or fill materials from or to the site, the Contractor shall comply with the requirements of the Highway Traffic Act.

Any damaged caused by the Contractor's operations to the surrounding property shall be repaired by the Contractor at no additional cost to the Municipality and to the complete satisfaction of the Engineer.

The price tendered for these Items shall be compensation in full for all work associated with this Item.

Work under this Item shall not commence without prior approval in writing from the Engineer.

The unit price for the precast retaining wall will include the following work, as shown on the Drawings and as directed by the Engineer:

- a) All execution of the gravity and reinforced precast concrete segmental retaining walls called for or implied by the drawings and specifications, together with all necessary incidentals whether referred to or not, as will be required to complete the work to the full intent and meaning of the drawings and specifications. The work includes but is not limited to the following:
 - i. The design, inspection and certification of the precast retaining wall by a qualified professional Engineer, licensed in the Province of Ontario.
 - ii. Supply and installation of precast concrete retaining wall complete with geogrid reinforcing as required to suit site soil, geometric and loading conditions.

Submittals and Shop Drawings

The Contractor will provide submittals at a time that will not adversely affect the construction schedule.

The Contractor will submit shop drawings bearing stamp and signature of a professional engineer registered in the Province of Ontario with at least 5 years' experience for the Retaining Wall System and for all items of work where shop drawings are required by standards and the specifications.

- a) The Contractor shall submit the following information for approval five (5) days prior to the construction of the retaining wall.
 - i. Design Submittal – Provide three (3) sets of stamped construction drawings and detailed design calculations, completed and sealed by the Engineer in accordance with the design requirements outlined by the manufacturer.
 - ii. Materials Submittal – Manufacturer's certifications, stating that the retaining wall units and imported aggregates and soils meet the requirements of this specification and the Engineer's design.
 - iii. Installer Qualifications – The Contractor must be able to demonstrate that their field construction supervisor has the necessary experience for the project by providing documentation showing that they have successfully completed projects of similar scope and size.

Engineering Design and Certification

- a) The term Engineer shall refer to the individual or firm who has been retained by the Contractor to provide design and inspection services for the retaining wall. The Engineer must be qualified in the area of retaining wall design and construction and must be licensed to practice engineering in the Province of Ontario where the wall is to be constructed.
- b) The Engineering will perform the following tasks:
 - i. Produce sealed construction drawings and detailed design calculations for review.
 - ii. Review the site soil and geometric conditions to ensure the designed wall is compatible with the site prior to construction.
 - iii. Carry out periodic inspections during construction to ensure conformance with the design drawings and submit inspection reports to the Owner during construction.
 - iv. Provide the Owner with a Certificate of Conformance at the completion of construction certifying that the retaining walls were constructed in accordance with the design drawings and current industry standards.

The retaining wall shall be designed in accordance with the National Concrete Masonry Associations Design Manual for Segmental Retaining Walls. The walls shall be designed to suit the soil conditions, geometric dimensions and loading conditions shown on the drawings.

Excavation to the lines and grades as shown on the drawings, including disposal of all surplus excavated materials. If after excavating to the elevation shown on the drawings, the material encountered should prove unacceptable to the Engineer as

a foundation, the contractor shall perform additional excavation as directed by the Engineer.

If rock is encountered within the excavation limits of the proposed retaining wall, the quantity of rock removal will be paid for under the rock excavation item, as directed and approved by the Engineer.

The Contractor shall supply the Engineer, a minimum of 48 hours prior to the offsite disposal or reuse of excess material, a plan illustration the proposed place of reuse or disposal.

Supply and placement of the 1 to 19 mm well graded crushed angular material base including compaction. The well graded crushed angular material base is to be placed on original competent soil or compacted structural fill with a minimum bearing capacity not less than 150 kPa. The soil bearing capacity is to be verified by the Engineer prior to placing the well graded crushed angular material base.

Well graded crushed angular material base is to be compacted to not less than 98% Standard Proctor Maximum Dry Density. Compaction of the base is to be tested by a qualified testing and inspection company prior to placing the first course of precast units.

The Contractor shall supply and place the precast concrete stone units and coping units, as shown on the drawings and as directed by the Engineer. The units shall be "Grande, 250, 375, 750, and 1125" or reviewed equivalent, including coping units "Grande 250-C, and 438-C" as manufactured by Hanson Hardscape Products or approved equal Installation of Precast Units:

- a) The precast stone units shall be installed as per the manufacturer's recommendations.
- b) The bottom course of units is to be leveled to meet the tolerances specified herein. The bottom course of units is not to be installed until the compaction of the well graded crushed angular material base has been deemed acceptable by the Engineer.
- c) No cracked or chipped units are to be installed. Any damaged units are to be removed if requested by the Engineer.
- d) The Joints between adjacent units should align with the middle of the unit above and below to create a running bond.
- e) The Contractor shall check the level of the wall with each lift to ensure that no gaps are formed between successive lifts. Care shall be taken to ensure that the precast concrete stone units and geotextile are not broken or damaged during handling and placement. The units shall be installed as shown on the drawings.

Construction Tolerances

- a) Vertical Control: ± 30 mm maximum over a 3 metre distance; 75 mm maximum
- b) Horizontal Control: -Straight Lines: ± 30 mm over a 3 metre distance; 75 mm maximum
- c) Rotation: $\pm 2.0^\circ$ from design wall batter

- d) Bulging: 25 mm over a 3 metre distance

The Supply and Placement of Geogrid Reinforcement

The geogrid reinforcement shall be a Polymer grid structure having tensile strength and durability properties that are suitable for soil reinforcement applications and are compatible with the precast concrete retaining wall units.

- a) The Geogrid is to be installed at the locations shown on the retaining wall design drawings.
- b) The Geogrid is to be placed with the strong direction perpendicular to the wall face.
- c) The Geogrid must be precut to the length shown on the retaining wall design drawings and must be placed within 25 mm of the front face of the precast wall units to ensure maximum connection between geogrid and wall facing.
- d) The Geogrid is to be placed on a flat level surface and is to be pulled tight and held in place with wooden stakes or other approved methods prior to placing backfill on top of the geogrid.

The supply and installation of perforated sub-drain pipe complete with filter cloth. The subdrain pipe shall be HPDE or PVC perforated pipe with a minimum diameter of 100 mm, protected with geotextile filter cloth to prevent the migration of soil particles in the pipe. The subdrain pipe shall be placed behind the retaining wall face, accurately aligned and securely coupled and laid at a minimum gradient of 2% to ensure adequate drainage to free outlets. Only standard fittings for bends, caps and intersections shall be used. Outlet shall be every 15 m (50 ft.) and at corners and at ends of the wall.

The unit price shall also include all labour, equipment and materials to connect the free outlet ends of the subdrain pie to the new roadway subdrains, as shown on the drawings and as directed by the Engineer.

Supply and installation of geotextile filter cloth as shown on the drawings and as directed by the Engineer. The filter cloth shall be non-woven geotextile, Terrafix 270R or reviewed equivalent. Geotextile filter cloth shall be placed from the lowest point upward. Each section of fabric shall overlap the preceding section a minimum of 600 mm.

Supply and placement of free draining sand and gravel material backfill including compaction. The placement of the free draining sand and gravel backfill materials shall be in maximum 200 mm lift thickness. At no time should the height exceed two (2) courses without back filling unless otherwise directed by the Engineer.

The compaction of the free draining sand and gravel backfill material shall not be less than 95% Standard Proctor Maximum Dry Density. Material are to have less than 8% passing the No. 200 sieve.

Heavy compaction and construction equipment shall not be allowed to operate within 1500 mm of the back face of the retaining wall. The Contractor shall monitor the retaining wall for outward rotation and movement during backfilling operations. The Contractor shall notify the Engineer immediately if wall movement occurs during backfilling which exceed the maximum allowable tolerances noted above.

Measurement for Payment

Measurement for Payment will be made in square metres of the face at the front wall only from the top of the coping stone to the bottom of the wall approximately 200mm below field grade. Payment at the contract unit price per square meter shall include compensation in full for placing Granular "A" bedding for the wall, filter cloth, supplying and erecting all precast units including Geogrid, any site dewatering as required and performing all other work necessary to complete the retaining wall as detailed on the drawings. The Contract unit price shall also include the cost of engineering, labour and equipment required to perform the work.

Basis of Payment

Payment at the Contract price for the above item shall be full compensation for all Labour, Equipment and Material to do the work.

78. Granular 'A' for road and sidewalk maintenance

The work of this item includes the supply, placement and compaction of granular A for the purpose of maintaining road and sidewalk traffic.

Basis of Payment

Payment for granular materials must be accompanied by an appropriate weigh ticket. Tickets must be presented to the site inspector upon arrival on site. Placement of any material not accompanied by a ticket, will not receive payment.

79. Allowance to Expose Existing Utilities/ Municipal Services

Scope of Work

The Contractor shall be required to expose existing facilities in advance of certain works of the contract. The purpose of the exposures is to determine the specific elevation, offsets and related conditions at the point of connection to existing facilities including existing watermains.

Work under this item shall include all Labour, Equipment and Material required to expeditiously expose existing utilities where a potential conflict may arise and require support and/ or protection. The Contractor is advised that payment under this item shall apply to specific locations noted on the Contract Drawings and exposures at all other locations will be subject to direction and approval by the Engineer.

Measurement and Basis for Payment

Measurement for payment will be in hours, rounded to the nearest half hour, and payment at the Contract hourly rate shall be full compensation for all Labour, Equipment and Materials required to expose the subject utility.

The Contractor is further advised that great care must be taken when excavating near utilities and that lost time due to damage of any utility as result of the Contractor's action or inaction will not be paid under this item.

80. Unshrinkable Fill

Scope of Work

Work under this provisional item shall be in accordance with OPSS 1359, 401 and as amended herein. The most stringent of the above specifications shall govern in case of conflict.

For backfill in areas where crossing pipes, utilities, and/ or structures will not permit compaction to the specified degree, an unshrinkable fill shall be used as directed by the Engineer.

The use of controlled density fill materials which will surround or cover existing utility plant or other facilities under the jurisdiction of a third party will be subject to review and acceptance in advance of controlled density fill placement which may conceal the subject facility or place it at risk of failure, due to loading or other incidental impacts.

The compressive strength of unshrinkable fill shall be not greater than 0.4 MPa at 28 days. The Contractor shall arrange sampling and testing of the controlled density fill to confirm the compressive strength of the material used. Material used by the Contractor that is greater than the specified maximum shall be removed at the Contractor's expense, including all related costs for restoration, reinstallation and protection of underground facilities impacted by the installation.

Measurement for Payment

Measurement shall be by volume in cubic metres for filling of neat excavation only.

Basis of Payment

Payment at the Contract price for the above item shall be full compensation for all Labour, Equipment and Material to do the work, including any related formwork, temporary steel plating and/ or shoring.

81. 15 MPA Concrete For Encasement And Utility Protection

The work under this item includes the excavation, supply, forming and placement of concrete for bedding, encasement and supports for utilities, sewers and watermains as directed by the Engineer.

Basis of Payment

Payment at the Contract Price for the above tender item shall include full compensation for all labour, equipment and material required to do the work.



**CITY OF GUELPH
SUPPLEMENTAL SPECIFICATIONS
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SPECIFICATIONS FOR CLEARING AND GRUBBING

Scope:

The work under this section shall comprise the supply of labour and equipment to clear and grub such areas as are shown on the drawings or as directed by the Engineer. The work shall also consist of the removal and disposal of windfalls, fallen branches, litter and debris including old fences and surface boulders.

Clearing operations:

Clearing shall consist of cutting of trees, brush and other vegetation within the areas to be cleared, and the disposal of timber, brush, windfalls and other surface litter.

All trees, shrubs and other vegetation as designated by the Engineer to be saved shall be carefully protected from danger of injury, during all construction operations. The Contractor may be required to cut only certain selected trees on certain areas, leaving the rest of the trees in the indicated areas unharmed.

Where possible, trees shall be felled towards the centre of the area to be cleared. Where trees cannot be felled without danger to traffic or injury to other trees, structures or property, they shall be cut in sections from the top down.

Burning of inflammable debris may be carried out provided all provincial and municipal statutes, by-laws and regulations are conformed to and all necessary permits and approvals are obtained.

In areas where burning is permitted, windfalls and other surface litter and all brush and timber which is not to be salvaged shall be piled in the centre of the cleared area and burned in such a manner as not to injure live trees. Where burning is performed alongside travelled roads it shall be performed in a manner which is safe and which will result in minimum discomfort to the travelling public.

The Contractor shall continually maintain sufficient force and equipment to prevent fires from spreading.

Any damage caused by the Contractor's operations to surrounding property shall be paid for by the Contractor.

In areas where burning is not permitted inflammable debris shall be disposed of off-site.

All timber cut under this Contract shall become the property of the Contractor and shall be hauled clear of the right-of-way before the final acceptance of the work by the Engineer.

Grubbing operations:

Grubbing shall consist of the removal and disposal of all stumps, roots, embedded logs and all debris from the areas designated to be grubbed, and shall be performed by the Contractor on the sites of excavations and embankments, and for any other highway requirements, as directed by the Engineer.

SPECIFICATIONS FOR CLEARING AND GRUBBING

The grubbed area shall, after removal of all debris, be levelled sufficiently to permit machine mowing. In no case shall any part or portion of the resultant debris from the grubbing operations be placed in or under any embankment.

The Contractor may be required to grub single or individual stumps, and to protect from danger of injury during this and all other construction operations the vegetation designated to be saved.

Clean-up of right-of-way:

The Contractor shall remove and dispose of all piled or surface boulders, regardless of size, old fences and other litter and debris, from the entire area of the right-of-way within the limits of the Contract, or as directed by the Engineer.

Compensation for such work shall be deemed to be included in the Contract price for "Clearing and Grubbing" and no additional payment will be made therefor.

Disposal of debris:

All debris resulting from clearing and grubbing and clean-up operations, except that which may be burned on site, shall be disposed of off site at locations arranged for by and at the sole expense of the Contractor.

Measurement and basis of payment:

All measurements shall be taken horizontally in hectares as staked or as instructed by the Engineer.

For single trees, rows of trees or hedges, areas shall be calculated in hectares by measuring from tip to tip of the longest branches. For single trees area shall be deemed to be that of a circle except that if provision is made on the tender for a unit price per tree.

Payment shall be made under this item for and at the Contract unit price per hectare as measured by the Engineer or his authorized representative, and shall be full compensation for all labour and equipment necessary to complete the work as specified and for all delays, re-handling, inconvenience and other costs occasioned by compliance with the applicable by-laws and statutes and their regulations.

Where the Contract calls for clearing and grubbing by lump sum, payment at the Contract lump sum price shall be compensation in full for:

All clearing and grubbing within the limits of the Contract required to facilitate work under the Contract.

The clean up of all surface boulders, old fences, litter and debris within the limits of the Contract.

The disposal off-site of all debris resulting from the foregoing operations.

SPECIFICATIONS FOR RECOVERABLE GRANULAR MATERIAL

Scope:

The work under this section shall comprise the supply of labour and equipment for the spreading and compaction of recoverable granular material from an existing roadway surface to be used as Granular "B" material.

Construction methods:

The Contractor shall excavate recoverable granular material from the existing roadway by methods and equipment satisfactory to the Engineer. The methods and equipment shall be such that the maximum of granular material is recovered without contamination. The recovered material shall be stockpiled if necessary, loaded and hauled, dumped, spread, and compacted in the manner specified for Granular "B" material per OPSS 1010. Location of stockpiles shall be subject to the Engineer's approval.

Measurement and basis of payment:

The volume of granular material relocated shall be determined by the Engineer using a method acceptable to the City and the Contractor taking into account that the volume relocated is included in quantities measured and paid for under Earth Excavation.

Payment will be made for recoverable granular material at the Contract unit price per cubic metre as measured by the Engineer and shall include the work required to stockpile, load, haul, spread and compact the relocated material on the site.

SPECIFICATIONS FOR WATER FOR COMPACTION OR DUST LAYING

Scope:

The work under this section shall comprise the supply of labour and equipment for the spreading and compaction of recoverable granular material from an existing roadway surface to be used as Granular "B" material.

Construction methods:

The Contractor shall excavate recoverable granular material from the existing roadway by methods and equipment satisfactory to the Engineer. The methods and equipment shall be such that the maximum of granular material is recovered without contamination. The recovered material shall be stockpiled if necessary, loaded and hauled, dumped, spread, and compacted in the manner specified for Granular "B" material per OPSS 1010. Location of stockpiles shall be subject to the Engineer's approval.

Measurement and basis of payment:

The volume of granular material relocated shall be determined by the Engineer using a method acceptable to the City and the Contractor taking into account that the volume relocated is included in quantities measured and paid for under Earth Excavation.

Payment will be made for recoverable granular material at the Contract unit price per cubic metre as measured by the Engineer and shall include the work required to stockpile, load, haul, spread and compact the relocated material on the site.

Scope:

The work under this section shall comprise the supply of labour, materials, and equipment to spread water as directed by the Engineer to aid compaction of materials to the specified degree of compaction, or reduce dust nuisance, or both.

Material:

Water shall not be taken from fire hydrants or the Corporation's Water Distribution System but may be purchased from the Corporation and loaded at the Waterworks Clair Tower on Clair Road. Water shall not be taken from the Speed or Eramosa Rivers, or tributary water courses.

Equipment:

Shall be acceptable to the Engineer, having a minimum capacity of 2250 litres and shall be capable of distributing water uniformly and with proper control.

Rate of application:

Shall be as determined by the Engineer or his authorized representative.

SPECIFICATIONS FOR WATER FOR COMPACTION OR DUST LAYING

Measurement:

Water will be measured in units of one thousand (1000) litres for that quantity used in the work by one of the following methods:

- a) The water tank and carrying vehicle shall be weighed empty and with a full tank of water. The net weight of water shall be converted to litres using a factor of 1.0 kilograms per litre.
- b) The water tank shall be measured and its volume computed in cubic metres. This volume shall be converted to litres using a factor of 1000 litres per cubic metre.
- c) A water metre of approved design.

Basis of payment:

Payment shall be made for the measured quantities of water at the contract unit price per thousand litres, which shall be compensation in full for the supply, transportation and application of water

scope:

The work under this item shall comprise the supply of labour, material and equipment for the breaking out and replacement of existing driveways, private walks, and curbs requiring restoration as a result of excavating or filling to the lines and levels indicated on the plans and cross-sections, or as directed by the Engineer.

The surface of the driveway shall be restored in such a manner as to give a smooth transition from the curb to the edge of the existing driveway.

Materials and methods of construction

All disturbed existing driveways, private walks, and curbs constructed on the City road allowance shall be restored to the following standards:

1. Existing driveways - gravel or crushed stone

Minimum of 200mm of compacted 19mm crusher run limestone if the original driveway was of crushed limestone, or a minimum of 200mm of compacted Granular "A" if the driveway was gravel.

2. Existing driveways - asphalt

Minimum of 200mm of compacted Granular "A" and 50mm of HL-3, Hot Mix, Hot Laid Asphaltic Concrete. Maximum size of course aggregate in HL-3 shall, however, be 9mm instead of 13mm.

3. Existing driveway - concrete

Minimum of 200mm of compacted Granular "A": and 180mm thick, 32 MPa concrete finished, cured, and surface sealed as detailed in current City Specifications for Sidewalks.

4. Existing private walks - concrete

Minimum of 75mm of compacted Granular "A" and 130mm thick, 32 MPa concrete finished, cured, and surface sealed as detailed in current City Specifications for Sidewalks.

5. Existing private curbs - concrete

Minimum of 150mm wide by 300mm deep, 32 MPa concrete finished, cured, and surface sealed, as detailed in current City Specifications for Curbs.

Measurement and basis of payment:

Shall be made under this item for and at the Contract unit price for each type of replacement as follows:

- | | | |
|--------------------------------------|---|--|
| 1. Gravel or crushed stone driveways | - | in square metres |
| 2. Asphalt driveways | - | including Granular "A" base in square metres |
| 3. Concrete driveways | - | in square metres |
| 4. Concrete private walks | - | in square metres |
| 5. Concrete private curbs | - | in metres |
| 6. Concrete private steps | - | in cubic metres based on neat lines |
| 7. Sawcutting | - | in linear metres |

SPECIFICATIONS FOR CATCHBASINS AND LATERALS

Scope:

The work under this section shall comprise the supply of all labour, equipment and materials as herein required for the supply and installation of catchbasins and their lateral connections. For the purpose of this specification the term "catchbasin" shall include ditch inlet catchbasins as well as single and double catchbasins.

Materials:

1. **Adjustment rings**
Shall be modular concrete sections manufactured by Moduloc Concrete Products (London) Ltd., under the trade name "Moduloc" or approved equal.
2. **Concrete**
Shall conform to and be placed in accordance with the requirements of City of Guelph Specifications for Ready Mixed Concrete, SS-27-SI.
3. **Catchbasin frames and grates**
Shall conform to the requirements of the Contract drawings and A.S.T.M. Designation A-48.
4. **Precast catchbasin components**
Shall conform to the requirements of the Contract drawings and OPSS 1351.
5. **Granular material**
For bedding and backfill shall be of the type specified in the Contract drawings and shall conform to the requirements of OPSS 1001 and 1010.
6. **Sewer pipe**
Shall conform to SS-100 Standard Specifications for Sewers.
7. **Mortar**
Shall be one part cement and three parts sand and shall meet the requirements of OPSS 1004, 1301 and 1302.

Construction:**1. Excavation and disposal**

Catchbasins and their laterals shall be excavated for in conformance to the requirements of the contract drawings. Excavation shall include the removal of earth, disintegrated rock, hard pan, boulders less than one cubic metre in volume, existing asphalt pavement and any other material requiring removal to construct the catchbasins and laterals. Solid rock and boulders one cubic metre or more in volume shall be removed and paid for under "Rock Excavation" or as extra work on a Time and Material Basis.

Excavated materials which cannot be incorporated into the work shall be disposed of offsite at locations arranged for by and at the sole expense of the Contractor.

Trench widths shall be kept to permissible minimums.

2. Precast catchbasin construction

SPECIFICATIONS FOR CATCHBASINS AND LATERALS

Precast catchbasins shall be constructed at locations as shown on the contract drawings or as directed by the Engineer.

The precast unit shall be set on a working foundation of 75mm minimum thickness of compacted Granular "A" or 19mm clear stone and shall be placed true to alignment and grade as set by the Engineer.

Any adjustment of the unit for plumb, alignment and grade shall be carried out by lifting the unit free of the excavation, levelling the base and replacing the unit to proper alignment and grade.

3. Cast-in-place catchbasin construction

Cast-in-place catchbasins shall be constructed as called for in the contract drawings and tender documents.

Concrete for the base slab shall be placed against undisturbed earth, however outside formwork shall be required for the walls of the structure. Adequate spreaders shall be used to hold the inner form rigidly in place.

Vibration shall be applied to the freshly placed concrete by hand or mechanical means to the satisfaction of the Engineer. Forms shall not be stripped for at least 48 hours after placing the concrete.

The work shall be protected from freezing, drying, winds, and running or surface water, for a minimum period of five days.

4. Backfill for catchbasins

Once the catchbasin is placed the excavation surrounding the unit shall be backfilled with acceptable material compacted to 95% of maximum dry density (A.S.T.M. Designation D698). Backfill shall be brought up simultaneously and equally on all sides of the structure and care shall be exercised to ensure the structure is not displaced. The material shall be placed in maximum loose depth lifts of 200mm and compacted by vibrating compaction equipment acceptable to the Engineer. The backfilling shall be up to the ground level as it existed before construct commenced, or where a road base is to be placed, to the road subgrade level.

5. Installation of frames and grates

Catchbasins shall be installed so that the top of the concrete section is at least 75mm but not more than 150mm below the bottom of the frame and grate. Moduloc adjustment rings shall be used to set the frame and grate at the required position and elevation.

Frames for grates shall be set on a full bed of mortar and shall match the finished grade and camber of the road surface and gutter.

Gratings for ditch inlets shall be installed and fastened down as indicated in the contract drawings.

SPECIFICATIONS FOR CATCHBASINS AND LATERALS

6. Construction of lateral sewers

Pipe placed in catchbasin walls for inlet or outlet connections shall extend through the wall a sufficient distance to allow for connections; shall be trimmed flush with the inside wall; and shall be securely and neatly grouted into place.

The line and grade of lateral sewers shall be as shown on the drawings or as provided by the Engineer. In general, lateral sewers shall be constructed at a 1% minimum grade. All requirements of SS-100 shall apply to this work.

7. Adjustment of catchbasins

Adjustment of catchbasins will apply where the top of the structure is to be lowered 50mm or less or is to be raised 300mm or less.

Prior to adjustment the existing frame and grate shall be carefully removed and salvaged. Once a catchbasin has been adjusted by adding or removing adjustment rings the salvaged frame and grate shall be set to the correct elevation on the adjusted structure as set out under "Installation of Frames and Grates".

When adjusting catchbasins, the contractor will be required to use modular sections manufactured by Moduloc concrete Products (London) Ltd., under the trade name "Moduloc" or approved equal. When securing the Moduloc sections and catchbasins, the Contractor will be required to apply Modulast beads (12mm diameter) in accordance with the manufacturer's recommendations.

All construction debris resulting from adjustment of catchbasins shall be removed from the contract site at the Contractor's expense.

8. Resetting catchbasins

Resetting catchbasins will apply where an existing catchbasin is to be salvaged and relocated to a new line and grade.

The Contractor shall excavate for, install and backfill the salvaged concrete unit as required for a new precast catchbasin and shall set the salvaged frame and grate as provided under "Installation of Frames and Grates".

All existing brickwork shall be removed from the salvaged concrete unit and new adjustment rings shall be used to set the frame and grate at the correct elevation.

All construction debris resulting from resetting catchbasins shall be removed from the contract site at the Contractor's expense.

Measurement and basis of payment:**1. Catchbasins**

Will be paid for on a unit price basis for each type called for in the Contract.

Payment at the contract unit price shall be full compensation for supplying all

SPECIFICATIONS FOR CATCHBASINS AND LATERALS

materials necessary for the complete installation of the catchbasin, including the frame and grate; for all excavation with the exception of rock excavation; for dewatering, sheathing and shoring when required and the disposal of surplus excavated materials; for the placing and compacting of granular bedding and suitable backfill; for the installation of the precast unit or for the placing of formwork and concrete; for the connection to the lateral sewer; for the placing of adjustment rings; for the placing of the full mortar bed, for the installation of the frame and grate and for all other work necessary to complete the structure in accordance with the contract requirements.

2. Lateral sewers

Will be paid for on the basis of metres of pipe placed, measured along the top of the pipe from the centre of the main to the centre of the catchbasin.

Payment at the contract unit price per metre shall be full compensation for supplying all materials necessary for the complete installation of the lateral sewers, for all excavation with the exception of rock excavation, for dewatering, sheathing and shoring when required and the disposal of surplus excavated materials, for the placing and compacting of granular bedding, for laying and jointing the pipe, for placing and compacting backfill material, for the connection to the sewer main or maintenance hole and for all other work necessary to install the lateral sewers in accordance with the contract requirements.

3. Adjusting catchbasins

Shall be paid for on a unit price basis for each catchbasin adjusted and such payment shall be full compensation for supplying all necessary materials, for removing and salvaging the existing frame and grate, for the removal of or the placing of adjustment rings, for placing of the full mortar bed, for the installation of the salvaged frame and grate and for all other work necessary to adjust the catchbasins in accordance with the contract requirements.

4. Resetting catchbasins

Shall be paid for on a unit price basis for each catchbasin reset and such payment shall be full compensation for supplying all necessary materials, for removing and salvaging the existing frame and grate, for removing and salvaging the concrete unit, for backfilling excavations with approved material and for all other work itemized herein before under "Catchbasins" in this Section.

The extension of catchbasin laterals when required will be paid for at the Contract unit price for laterals.

SPECIFICATIONS FOR ADJUSTMENTS TO
MAINTENANCE HOLES AND VALVE CHAMBERS

Scope:

The work under this section shall comprise the supply of all labour equipment and materials required to adjust the elevation of frames and covers for storm and sanitary maintenance holes and valve chambers and other similar structures, to exactly conform to the pavement grade and cross section as indicated in the drawings or as directed by the Engineer.

CONSTRUCTION:

Prior to adjustment the existing casting shall be carefully removed and salvaged.

The maintenance hole or valve chamber shall be adjusted to set the casting at the required elevation. The salvaged casting shall be set on a full bed of mortar and shall conform to the grade and camber of the road surface.

When raising castings the Contractor shall use modular concrete adjustment rings as manufactured by Moduloc Concrete Products (London) Ltd. under the trade name of "Moduloc" or approved equal. Mortar shall be one part cement and three parts sand and shall meet the requirements of City of Guelph Specifications for Sewers, SS-100. Steel shims or plastic shall be used to make an adequate support where castings are to be raised less than one full adjustment ring.

When securing the Moduloc sections on storm maintenance holes, the Contractor will be required to apply Modulast beads (12mm diameter) in accordance with the manufacturer's recommendations. Two beads of Modulast (12mm diameter) will be required on sanitary maintenance holes.

The Contractor shall note that the quality of mortar for maintenance hole and catchbasin adjustments will be rigorously inspected on this contract. Mortar shall be discarded when workability has so decreased it cannot be placed satisfactorily, or when it is evident that initial set has taken place. The addition of water and re-mixing will not be permitted.

Maintenance hole frames and covers shall be installed to exactly conform to the finished pavement grade and cross section. The following guidelines will be used by the Engineer when checking adjustments for acceptability:

A straight edge, 2.4 metres in length, will be centred on the maintenance hole cover, oriented parallel to the roadway, and placed on the pavement. The gap between the bottom of the straight edge and the centre of the maintenance hole cover will be measured to the nearest millimetre. This procedure will be repeated with the straight edge oriented transversely to the roadway. Both measurements will be recorded and averaged.

- d) If the gap is 10mm or less, the adjustment will be accepted.

SPECIFICATIONS FOR ADJUSTMENTS TO
MAINTENANCE HOLES AND VALVE CHAMBERS

- e) If the gap is 15mm or more, the adjustment will be rejected and the Contractor will be required to re-adjust the maintenance holes frame and grate at his own expense.
- f) If the average gap is 11mm to 14mm, the engineer will make a judgement call on the acceptability of the adjustment. If the adjustment is rejected, the Contractor will be required to re-adjust the maintenance hole frame and grate at his own expense.
- g) If the maintenance hole frame and grate are found to protrude above the pavement surface, the gaps between the ends of the straight edge and pavement surface will be measured and averaged in a manner similar to that above. If the protrusion is found to be 5mm or less, the adjustment will be accepted. If the protrusion is found to be 6mm or more, the adjustment will be rejected and the Contractor will be required to re-adjust the frame and grate at his own expense.

Additional maintenance hole steps, if required, shall be supplied and installed by the Contractor.

All construction debris resulting from this work shall be removed from the site at the Contractor's expense. Care shall be taken to ensure that no debris is dropped into maintenance holes and any material inadvertently dropped shall immediately be removed.

The sub-grade around the maintenance hole or valve chamber shall be thoroughly compacted and the excavation filled with Granular "A" compacted to 100% of maximum dry density (A.S.T.M. Designation D698) to the bottom of the frame flange. Above the flange it shall be filled with hot mix asphalt (HL-3) well compacted up to the level of the existing surface course.

Measurement and basis of payment:

a) Adjusting maintenance holes and valve chambers

This item shall apply where the top of the structure is to be adjusted, up or down, 300mm or less; where the adjustment entails the removal of brickwork only; and where the vertical length of new moduloc and/or coning section does not exceed 300mm.

Payment will be made on a unit price basis for each maintenance hole or valve chamber adjusted as called for in the tender and such payment shall be full compensation for supplying all necessary materials, for removing and salvaging the existing casting, for the removal of bricks, the placing of Modulo and/or coning sections, for installing steel shims, for placing the full mortar bed, for the installation of the salvaged casting, and for all other work necessary to complete the adjustment in accordance with the contract requirements.

SPECIFICATIONS FOR ADJUSTMENTS TO
MAINTENANCE HOLES AND VALVE CHAMBERS

b) Rebuilding maintenance holes and valve chambers

This item shall apply where the adjustment entails the removal of existing brickwork and defective maintenance hole sections as directed by the Engineer, and the installation of new precast maintenance hole components, and/or concrete collars and Moduloc; and where the vertical length of new maintenance hole construction exceeds 300mm.

Where payment is made on a vertical metre basis, measurement will be from the top of the existing maintenance hole section, which has been left in place to the top of the frame, and cover after adjustment. Payment will be made on either a vertical metre basis or a lump sum basis for each maintenance hole or valve chamber rebuilt and shall be full compensation for performing the work required under "Adjusting Maintenance holes and Valve Chambers" as well as for removal of existing sections if required and for installing new precast maintenance hole components. Unless otherwise specified in the Form of Tender, payment will be made for supplying new precast maintenance hole components under separate tender items.

SPECIFICATIONS FOR CURB AND GUTTER

Scope:

The work under this section shall comprise the supply of labour, materials and equipment for the construction of curb, or curb and gutter, including excavation and backfilling where required, as indicated in the contract drawings or as directed by the Engineer.

Materials:**1. Forms**

May be of wood or metal

- h) Wood forms shall be of 50mm nominal thickness, by 150mm nominal width dressed on all four sides, free of warp, and of sufficient strength to resist displacement during the placing and consolidation of the concrete.
- i) Curved forms shall be of 25mm nominal thickness, by 150mm nominal width dressed on all four sides.
- j) Metal forms shall be of approved sections and of such design as to permit secure fastening.
- k) All formwork shall be clean and treated with non-staining form release oil before concrete is placed against them, and so constructed as to prevent honeycombing.
- l) Placing of curb, or curb and gutter, by the extrusion method shall be permitted but all equipment and methods of construction shall be subject to the approval of the Engineer.

2. Concrete

City of Guelph Standard Specification SS-27 SI shall apply to all concrete supplied.

The proportions and qualities of cement, water, and aggregate shall conform to C.S.A. Specification A23.1-94 latest revision for "READY MIXED CONCRETE". All concrete supplied shall be ready mixed. The specified compressive strength shall be 32 MPa at 28 days.

The Engineer shall reserve the right to take whatever corrective action is needed if the concrete fails to meet the requirements of this specification or shows defects after placing.

The Contractor shall facilitate any needed investigations or inspection of the work.

The use of admixtures to prevent freezing or to accelerate setting of the concrete is prohibited.

3. Reinforcing steel

Reinforcing Steel shall conform to latest C.S.A. Specification G.30-18-M1992 for Structural Grade, Deformed, and Bars.

SPECIFICATIONS FOR CURB AND GUTTER

4. Joints

Expansion Joints shall be 12mm thick impregnated non-extruding fibre board conforming within the limits of the latest A.S.T.M. Specification covering this type of material, and shall be cut to the full cross section shape as detailed in the Standard Drawings.

Contraction Joints for curb or curb and gutter produced by the extrusion method shall consist of a saw cut in the concrete.

5. Curing compound

Curing Compound shall conform to the latest A.S.T.M. or OPSS 1315 Specifications for "Liquid Membrane Forming Compounds for Curing Concrete".

Pigmentation shall be white.

Construction methods**1. Excavation**

Shall be to the depths as shown on contract plans and profiles and latest revision of the Standard Drawings as specified for standard curb or standard curb and gutter.

Surplus excavated material not required for backfilling shall be disposed of as detailed in the contract or as directed by the Engineer.

2. Backfilling

Where backfilling is required to the underside of the curb or curb and gutter, the material used shall be as specified in Specification for Granular "A" and "B", and paid for under the same basis as the relevant specification.

Backfilling of the boulevard shall be carried out using selected excavated material. Boulevard grading shall leave a smooth transition between the curb and existing lawn, as indicated on typical road cross-sections.

3. Placing forms

Forms shall be well built, substantial, and unyielding, securely staked, braced and clamped to the required lines and grades.

4. Placing joints

Expansion Joints shall be placed vertically at intervals as indicated in latest revision of the Standard Drawings prior to placing concrete and shall under no circumstances be used as bulkheads unless they are backed up to the satisfaction of the Engineer. They shall not be placed in driveway curb cuts less than 5.5 metres in length.

When concrete curb or curb and gutter is placed by the extrusion method, contraction joints shall be formed by saw cutting the concrete within a sufficient time of placing of the curb or curb and gutter to prevent uncontrolled cracking.

SPECIFICATIONS FOR CURB AND GUTTER

The width of the joint shall be 3mm to 5mm and the depth 65mm minimum.

5. Placing reinforcement

Reinforcement shall be placed where detailed in the contract drawings.

No reinforcement will be required when curb and gutter is placed by the extrusion method.

6. Placing concrete

All concrete shall be placed under the following conditions:

- a) Each load shall be checked for air content.
- b) Slump tests shall be taken on the first load of concrete arriving on the job site and thereafter at the discretion of the Engineer.
- c) In surface damp forms accepted by the Engineer or his authorized representative.
- d) As near as possible to its final position.
- e) Maximum vertical drop from chutes shall be 1.0 metre.
- f) Evenly on both sides of joints so as to retain their vertical position.
- g) Forms shall be filled with an excess of concrete thoroughly spaded, compacted, and struck off to its required level in such a manner as to force the coarse aggregate below the surface of the mortar.
- h) Air temperature shall be 5.0° C and rising, and all necessary precautions shall be taken during cold weather to the satisfaction of the Engineer.
- i) No concrete shall be placed on frozen ground.
- j) Concrete shall have a temperature of not less than 10° C nor more than 38° C at the time of placing, and means acceptable to the Engineer shall be provided to maintain these limits for 72 hours after placing.
- k) Concrete not discharged and placed after 1.5 hours from the time of batching may be rejected per OPSS.MUNI 1350.07.05.01.03.

SPECIFICATIONS FOR CURB AND GUTTER

7. Form stripping and concrete finishing

The roadside form of the curb or curb and gutter may be stripped after initial set of the concrete has been achieved to facilitate finishing. Honeycombed or faulty sections shall be repaired to the satisfaction of the Engineer.

The roadside and upper surfaces shall be floated to a smooth uniform finish. The remaining formwork may be removed 24 hours after the concrete was placed. Traffic shall not be allowed to pass over the newly constructed curb or curb and gutter for a minimum of 3 days after the concrete has been placed. Plastering or rubbing down with a rich cement paste shall not be tolerated.

8. Contractor's stamp

The Contractor shall use a metal stamp, acceptable to the Engineer, bearing his name, and year of construction, to mark the top of the curb or curb and gutter at every 10th joint and at the beginning and end of the work.

9. Curing

All surfaces exposed to the elements shall be treated with the approved curing compound in strict accordance with the manufacturer's instructions immediately after finishing. If surfaces not requiring finishing are stripped and exposed to the elements prior to one week after placing, they shall be treated as above.

10. Faulty work

Any portion of the work not acceptable to the Engineer shall be broken out from joint to joint encompassing the work, and replaced to the specifications at no cost to the City.

Measurement and basis of payment:

Measurement of curb will be made in metres as measured in place along the top of the curb as detailed in Standard Drawings; for curb and gutter as measured in place along the gutter at the curb face as detailed in Standard Drawings.

Payment shall be based on the Contract unit price and the number of metres of concrete curb, or curb and gutter constructed and shall be compensation in full for all labour, equipment and material necessary to complete the work as specified. The work shall include all fine grading, dewatering, disposal of excess material, expansion joints, supply and placement of concrete of the required strength to the lines and grades as specified on the drawings including additional width at the back of curb where sidewalk is adjacent to curb, curing compound, finishing the concrete, supply and placement of reinforcing steel where specified or as directed by the Engineer, backfilling, curb, curb cuts for drive entrances and convenience ramps, compaction of acceptable backfill material, and all other construction necessary to complete the work as specified.

SPECIFICATIONS FOR SIDEWALKS

Scope:

The work under this section shall comprise the supply of labour, materials, and equipment for the construction of sidewalks as indicated in the contract drawings or as directed by the Engineer.

Materials:**1. Forms**

May be of wood or metal.

- a) Wood forms shall be of 50mm nominal thickness, by 150mm nominal width, dressed on all four sides, free of warp, and of sufficient strength to resist displacement during the placing and consolidation of the concrete.

Curved forms shall be of 25mm nominal thickness, by 150mm nominal width dressed on all four sides.

- b) Metal forms shall be of approved sections and of such design as to permit secure fastening.

All formwork shall be clean and treated with a non-staining mineral oil before concrete is placed against them.

2. Concrete

City of Guelph Standard Specification SS-27 SI shall apply to all concrete supplied.

The proportions and qualities of cement, water and aggregate shall conform to the C.S.A. Standard A23.1-94. All concrete supplied shall be ready mixed. The specified compressive strength shall be 32 MPa at 28 days.

The Engineer reserves the right to take whatever corrective action is needed if the concrete fails to meet the requirements of this specification or shows defects after placing. The Contractor shall facilitate any needed investigation or inspection of the work.

The use of admixtures to prevent freezing or to accelerate setting of the concrete is prohibited.

3. Bedding

Bedding material shall be Granular "A" meeting the requirements of OPSS 1010.

4. Expansion joints

Expansion Joints shall be 12mm thick asphalt impregnated, non-extruding, fibre-board, conforming within the limits of the latest A.S.T.M. Specification covering this type of material. They shall be cut to the full cross section shape as detailed in Standard Drawings. Expansion joints along curb face sidewalk shall be 6mm thick.

5. Curing compound

SPECIFICATIONS FOR SIDEWALKS

Curing Compound shall conform to the latest A.S.T.M. or OPSS 1315 Specification for "Liquid Membrane Forming Compounds For Curing Concrete". Pigmentation shall be white.

6. Contraction joints

Contraction joints shall consist of planes of weakness created by forming grooves, for the full width of the sidewalk, 3mm in width in the surface of the sidewalk. The depth of the grooves shall be equal to at least 20mm.

Construction methods**1. Excavation**

Excavation shall be to the depths as shown on contract plans and profiles and latest revision of Standard Drawings.

The bottom of the excavation shall be thoroughly consolidated to the satisfaction of the Engineer.

Surplus excavated material not required for backfilling shall be disposed of as detailed in the contract or as directed by the Engineer.

2. Backfilling

Where backfilling is required to the underside of the sidewalk, the material to be used shall be as determined by the Engineer. Backfill shall be compacted to the satisfaction of the Engineer.

3. Forms

Forms shall be well built, substantial, unyielding, securely staked, and braced to the required lines and grades.

4. Contraction joints

Contraction Joints shall be placed so that the sidewalk is divided transversely into lengths of not more than the width of the sidewalk. All edges shall be finished with a tool which produces a rounded edge and a smooth surface of not more than 50mm in width and a 5mm wide groove to the depth of 19mm.

Rounding of the longitudinal joints shall be done prior to the rounding of the transverse joints.

5. Expansion joints

Expansion Joints shall be placed vertically wherever the sidewalk abuts a curb or any rigid structure or wherever the placing of the concrete is suspended for more than 30 minutes as indicated on the Standard Drawings prior to placing of the concrete and shall be placed at every fourth sidewalk slab.

6. Placing concrete

All concrete shall be placed under the following conditions:

SPECIFICATIONS FOR SIDEWALKS

- a) Each load shall be checked for air content.
- b) Slump tests shall be taken on the first load of concrete arriving on the job site and thereafter at the discretion of the Engineer.
- c) In surface damp forms accepted by the Engineer or his authorized representative.
- d) As near as possible to its final position.
- e) Maximum vertical drop from chutes shall be 1 metre.
- f) Evenly on both sides of expansion joints so as to retain their vertical position.
- g) Forms shall be filled with an excess of concrete thoroughly spaded, compacted, and struck off to its required level in such a manner as to force the coarse aggregate below the surface of the mortar.
- h) Air temperature shall be 5.0° C and rising, and all necessary precautions shall be taken during cold weather to the satisfaction of the Engineer.
- i) No concrete shall be placed on frozen ground.
- j) Concrete shall have a temperature of not less than 10° C nor more than 38° C at the time of placing, and means acceptable to the Engineer shall be provided to maintain these limits for 72 hours after placing.
- k) Concrete not discharged and placed after 1.5 hours from the time of batching may be rejected per OPSS.MUNI 1350.07.05.01.03.

7. Finishing

The top surface of the sidewalk shall be broom finished. Prior to finishing (edging, jointing, floating, trowelling and brooming a slight hardening of the concrete is necessary before any of these operations can be begun. When the bleed-water sheen has evaporated and the concrete will sustain foot pressure with only about 5 mm indentation, the surface is ready for continued finishing operations.

8. Contractor's stamp

The Contractor shall use a metal stamp, acceptable to the Engineer bearing his name and year of construction to mark the top of the sidewalk at every 30th contraction joint, and at the beginning and end of the work.

9. Stripping forms

Forms may be removed after finishing and initial set of concrete has been attained, although the Contractor shall be held responsible for preventing vehicular traffic over the new sidewalk for a minimum period of 3 days after the concrete has been placed.

10. Curing

All surfaces exposed to the elements shall be treated with an approved curing compound in strict accordance with the manufacturer's instruction, immediately after finishing. If surfaces not requiring finishing are stripped and exposed to the elements prior to one week after placing, they shall be treated as above.

11. Faulty work

Any portion of the work not acceptable to the Engineer shall be broken out from contraction joint to contraction joint encompassing the work and replaced to

SPECIFICATIONS FOR SIDEWALKS

specification at no cost to the City.

Measurement and basis of payment:

Measurement will be made in square metres computed from the length and width of the area covered by concrete sidewalk to the limits shown on the drawings or designated by the Engineer.

Payment shall be based on the Contract unit price and number of square metres of concrete sidewalk of the required width and thickness and shall be compensation in full for all labour, equipment and material necessary to complete the work specified. The work shall include all fine grading and compaction of sub-grade material, dewatering, disposal of excess excavated material, forming and supply and placement of bedding material, expansion joints, supply and placement of concrete of the required strength to the lines and grades as specified on the drawings, curing compound, finishing the concrete, backfilling with acceptable material, compaction and surface grading and all other construction work necessary to complete the work as specified.

SPECIFICATIONS FOR GROUTED RIP-RAP

Scope:

The work under this section shall comprise the supply of labour, materials, and equipment as herein required for grouted rip rap as a protective covering of approved stone on earth bed.

Materials:

The quality of rock, field stones, or boulders, shall be approved by the Engineer. The size of the rock shall be 20 kilograms minimum.

Grout

Shall be composed of one part of Portland Cement and three parts fine aggregate.

Water, free from impurities, shall be added to these ingredients so as to provide suitable consistency to work with a mason's towel.

Excavation

The Contractor shall excavate, and fine grade to a uniform and even surface, the area to be rip-rapped, so as to provide adequate foundation upon which the bottom of the rip rap shall rest. Depressions shall be filled and thoroughly compacted.

Placing

Except to form a flat apron, the rip rap shall commence in a trench below the toe of the slope. Stones shall be placed to the required length, thickness and depth conforming to the lines given by the Engineer. They shall be set normal to the slope and placed so that the larger dimension is perpendicular to the face of the wall, unless such dimension is greater than the specified thickness of the wall.

The surface of the stones shall be liberally wetted before applying grout. Grout shall be placed from bottom to top and worked with suitable tools to fill all the voids completely. Open joints shall be filled with spalls. When the Contract requires the outer face of the stones to be exposed, excess grout shall be removed with a stiff brush. Curing methods acceptable to the Engineer shall be used.

Measurement and basis of payment:

Grouted rip rap shall be measured in place and computed into cubic metres.

Payment will be made at the Contract price per cubic metre and shall be compensation in full for supplying all labour, equipment and materials as herein required.

SPECIFICATIONS FOR TOPSOIL

Scope:

The work under this section shall comprise the supply of all labour and equipment as herein required to prepare the surfaces to receive the topsoil and to load, haul, spread and trim the topsoil, on such areas to be seeded and mulched or sodded as shown on the contract drawings or as directed by the Engineer.

Material:

Topsoil shall be fertile, loamy material, free from roots, vegetation, rubble and debris and containing not less than 4% organic matter for clay loams and not less than 2% organic matter for sandy loams to a maximum of 15% and capable of sustaining vigorous plant growth, free of subsoil contamination, roots and free from stones or clods over 25mm in greatest diameter and having a pH ranging from 6.0 to 7.5.

Topsoil may be obtained from:

- l) Material stripped by the Contractor from areas to be excavated or otherwise disturbed by the work and stockpiled adjacent to the work, or
- m) City owned stockpiles at various locations in the City. Information regarding the location of the stockpiles to be used on the contract may be obtained from the Engineer's Office at the time of tendering.
- n) Imported topsoil shall be free of contaminants that adversely affect plant growth. The Contractor shall be required to divulge the source of topsoil. The City will conduct Toxicity Characteristic Leaching Process (TCLP) analysis (es) as required (inorganic compounds, volatile organic compounds, herbicides, pesticides).
- o) The Contractor shall test all topsoil for Nitrogen, Phosphate, Potash and minor element values, soluble salt contents, organic matter, atrazine and pH value in order to determine the amount and type of fertilizer or additives to be applied for specific areas. The testing shall be the "Topsoil Package" as performed by SGS Agrifoods Laboratories, 1-503 Imperial Road North, Guelph Ontario, 1-800-265-7175 or approved equivalent. The Contractor shall be responsible to comply with the "Topsoil Package" testing recommendations for the addition of fertilizers to the topsoil.
- p) Use imported SOIL MIX for tree pits and shrub beds. Planting SOIL MIX to be 6 parts topsoil, 2 parts well-rotted weed-free manure, 1 part peat moss and 0.75kg superphosphate.

Soil amendments**Fertilizer:**

- .1 Conform to recommendations from soil testing agency with respect to improvement of tested topsoil and apply as specified for each condition.
 - .2 Industry accepted standard medium containing nitrogen, phosphorous, potassium and any other micro-nutrients suitable to the specific plant species or application or defined by the soil test.
-

SPECIFICATIONS FOR TOPSOIL

Peatmoss:

7. Derived from partially decomposed species of Sphagnum Mosses.
8. Elastic and homogeneous, brown in colour.
9. Free of wood and deleterious material which could prohibit growth.
10. Shredded particle minimum size: 5 mm.

Sand: washed coarse silica sand, medium to coarse textured.

Organic matter: such as rotted manure, hay, straw, bark residue or sawdust, as approved by the City.

Limestone:

1. Ground agricultural limestone.
2. Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

Bonemeal: Finely ground with a minimum analysis of 3% nitrogen and 20% phosphoric acid.

Construction methods:**Preparation of the surface**

All areas to be topsoiled shall be fine graded to the required lines and grades, allowing for a minimum depth of 150mm of topsoil. The surface shall be free of all vegetation and other debris and free of stones which would not be covered by the depth of topsoil specified and shall be loose to a depth of 25mm at the time of placing topsoil.

The Contractor shall perform such mowing, raking and picking up of debris and such discing, harrowing or other means of scarification as may be necessary to comply with this requirement and shall dispose of all debris off site.

Placing topsoil

The Contractor shall uniformly spread topsoil to a depth of not less than 150mm over the areas designated. All clods or lumps shall be pulverized and any roots, stones over 50mm in diameter, or foreign matter shall be raked up and removed as directed.

Measurement and basis of payment:

The area topsoiled will be measured in square metres on slopes within the boundaries shown on the drawing or designated by the Engineer. Payment for placing topsoil will be made at the contract unit price per square metre and shall be compensation in full for preparing the surfaces to receive the topsoil and for loading, hauling, spreading and trimming topsoil obtained from stockpiles located within the contract limits or elsewhere in the City.

SPECIFICATION FOR SEEDING AND MULCHING

Scope:

The work under this section will comprise supplying of all labour, equipment, and materials as herein required for seeding areas designated by the Engineer by hydraulic seeding and mulch cover method. Hydraulic mulch applications may be permitted at the discretion of the Engineer and shall comply with OPSS 804.

Materials:

All materials used in this work shall conform to OPSS 804.

Seeds

Only seeds harvested in the preceding season will be accepted. Grass seed shall meet the requirements of the Seeds Act. Grass seed mixture shall consist of the following;

- 52% creeping red fescue
- 28% Kentucky blue grass
- 12% perennial rye grass
- 5% red top grass
- 3% white Dutch clover

Preferred seeding mix for the upland restoration areas and open space (P.1 zone) as follows:

- .1 Areas shall be seeded in the spring or fall at 25 kg/1000 sq. m. to be applied with a nurse crop of annual ryegrass applied at 22 kg/1000 sq., ensure shredded compost a minimum depth of 25 mm is applied using "express blower supplemental seed injection system".

Early Succession Dry Prairie Meadow Mix	Sds/Lb	% of Mix
Arrow Leaved Aster (<i>Aster saggitifolius</i>)	700,000	2
Big Bluestem (<i>Andropogon gerardi</i>)	144,000	15
Black Eyed Susan (<i>Rudbeckia hirta</i>)	1,576,000	6
Canada Wild Rye (<i>Elymus canadensis</i>)	114,000	25
Foxglove/Beardtongue (<i>Penstemon digitalis</i>)	400,000	5
New England Aster (<i>Aster novae-angliae</i>)	1,100,000	5
Switchgrass (<i>Panicum virgatum</i>)	259,000	25
Virginia Wild Rye (<i>Elymus virginicus</i>)	73,000	15
Wild Bergamot (<i>Monarda fistulosa</i>)	1,272,500	2

- .2 Seeding Rate:

25 kg/hectare (22 lbs/acre) when drilled into a well-prepared site

- .3 Spot Application: 0.50 kg/100m² (1.10 lbs/1000 ft²)

Preferred seeding mix for the storm management ponds:

SPECIFICATION FOR SEEDING AND MULCHING

SWM Pond Mix Wet/Dry Mix	Sds/Lb	% of Mix
Black Eyed Susan (<i>Rudbeckia hirta</i>)	1,576,000	3
Canada Wild Rye (<i>Elymus canadensis</i>)	114,000	20
Fox Sedge (<i>Carex vulpinoidea</i>)	1,297,000	17
Indiangrass (<i>Sorghastrum nutans</i>)	175,000	15
New England Aster (<i>Aster novae-anglais</i>)	1,100,000	3
Spotted Joe Pye Weed (<i>Eupatorium maculatum</i>)	1,440,000	1
Switchgrass (<i>Panicum virgatum</i>)	259,000	20
Virginia Wild Rye (<i>Elymus virginicus</i>)	73,000	20
Wild Bergamot (<i>Monarda fistulosa</i>)	1,272,500	1

Fertilizer

Shall be kept dry, free-flowing, and not be allowed to form lumps.

Standard fertilizer shall be used and shall consist of 8-32-16 applied at the rate of 350kg/10,000m² unless otherwise approved by the Engineer.

Water

Shall be free from any impurities which would inhibit germination or otherwise adversely affect growth.

Water shall not be taken from fire hydrants or the Corporation's Water Distribution System but may be purchased from the Corporation and loaded at the Waterworks Clair Tower on Clair Road. Water shall not be taken from the Speed or Eramosa Rivers, or tributary water courses.

Asphalt emulsion

Asphalt emulsion to be used as an adhesive with the mulching material shall be specially refined petroleum asphalt emulsified in water containing no petroleum solvents or other components known to be toxic to plant life, and shall conform to OPSS 1103.

Mulching material

Shall be oat or wheat straw. Other vegetative material may be used on approval by the Engineer. All mulching material must be dry and on being processed through a mulch blower, shall form an evenly distributed mat. Straw shall be supplied in square bales and must be free of weeds and all other foreign material.

Construction methods:

Work in this section shall proceed only when in the opinion of the Engineer, weather and seasonal conditions are suitable. The areas to be seeded shall be fine graded and top soiled to uniform surface and loose to a depth of 25mm minimum at the time of seeding.

 SPECIFICATION FOR SEEDING AND MULCHING

No stones or other foreign material shall project more than 75mm above the general surface.

The prepared surface shall have to be approved by the Engineer before it is seeded or mulched.

Seeding

Grass seed, fertilizer, and nurse crop seed shall be thoroughly mixed and uniformly distributed by means of an approved hydraulic seeder over the area designated by the Engineer. The rate of application per hectare shall be:

Grass seed	100 kg
Fertilizer	350 kg
Nurse Crop Seed – Canada No. 1 Seed	
- Oats Grain	39 kg
- Rye Grain	63 kg
- Fall Wheat Grain	67 kg
Water	6,750 litres

The work shall be done only in calm weather and on ground free of frost, snow, ice or standing water.

The area seeded shall be mulched on the same day except in the case of seeding after straw mulching.

Mulching

An approved mulch blower will be used and the straw shall be at a right condition of moisture so that it can be processed without stoppage through the blower.

Average depth of straw over the area shall be 50mm, nowhere less than 25mm or more than 57mm, and the application shall be even and uniform.

Not less than 900 litres of asphalt emulsion per hectare shall be arranged into the airstream of the mulch blower in order to facilitate tying the mulch down.

Measurement and basis of payment:

The areas measured for payment shall include the 500mm overlap required at shoulders or adjoining existing vegetation or newly-laid sod. The area seeded and mulched will be measured in square metres on slopes within the boundaries designated by the Engineer.

Payment will be made for seeding and mulching at the contract unit price per square metre and shall be compensation in full for supplying all labour, equipment, and materials as herein required.

 SPECIFICATIONS FOR CHAIN LINK SECURITY FENCE AND GATES

Description:

This specification covers the requirements for the supply and erection of chain link security fence and gates.

Material:**Vinyl coated fencing fabric:**

Except as otherwise provided, steel wire fabric shall conform to the requirements of the current specification for Zinc-Coated Steel Chain Link Fence Fabric, CAN/CGSB 138.1-96.

The fabric shall be 1200, 1500 or 1800mm wide (as stated in the Engineering Drawings), with a uniform 50mm diamond pattern chain link mesh closed at the bottom edge by knuckling and at the top edge by twisting to form a barb.

The black vinyl coated wire used for the manufacture of the fence fabric shall be coated **before** weaving by thermally extruding or fusing the vinyl over the zinc coated steel core wire. The minimum thicknesses applicable to the coatings shall be:

1. The minimum nominal diameter of the finished vinyl coated galvanized steel wire will be 4.26mm.
2. The minimum nominal diameter of the steel, zinc coated galvanized **before** weaving wire shall be 3.5mm (No. 9 IWG).
3. The minimum vinyl coating thickness will be 0.380mm.

Posts and rails

All posts and rails shall be of galvanized steel pipe and shall conform to CAN/CGSB-138.2-96. All posts and rails shall be Type 1 and conform to the material requirements of ASTM 153, Schedule 40 and shall meet the requirements of TABLE 1. The galvanized coatings shall be applied by either electrolytic or hot-dip process and be electrostatically painted with two coats of Black Carboxyl Modified Vinyl Chloride/Vinyl Acetate UCAR paint.

TABLE 1			
	O.D. (mm)	I.D. (mm)	Mass per metre
Line Post	60.3	52.5	5.44 kg
Top and Brace Rails	43.0	39.3	3.02 kg
End, corner or straining post Gate post up to 3.0 metre single Gate post up to 6.0 metre double	88.9	77.9	11.27 kg

SPECIFICATIONS FOR CHAIN LINK SECURITY FENCE AND GATES

Gate post up to 4.5 metre single	114.3	102.3	16.06 kg
Gate post up to 9.0 metre double			

Tension wire

Top and bottom wires shall be 3.5mm (No. 9 IWG) galvanized steel wire with not less than 92 g/m² of zinc coating and the thermally extruded or fused black vinyl coating shall be not less than 0.380mm in thickness.

Fasteners or tie wires

Fasteners shall be 3.5mm diameter (No. 9 IWG) galvanized steel or aluminum wire or 1.5mm stainless steel, conforming to the requirements for fence fabric, except that galvanized steel or non-corrosive metal bands will be permitted for fastening the fabric to posts and gate frames. Fasteners or tie wires shall be black vinyl coated to match the entire system.

Stretcher bars and bands

Stretcher bars shall be 4.75mm x 19.05mm galvanized steel or heavier. Stretcher bar fastening bands shall be at least 3.15mm x 19.05mm galvanized steel, or 4.75mm x 19.05mm aluminum. Stretcher bars and fastening bands shall be black vinyl coated to match the entire system.

Gates

Gates shall be supplied in accordance with Standard Drawings in sizes defined as to the distance between the inside faces of the gate posts, as shown on the Engineering Drawings.

Gates shall be constructed from 42.85mm O.D. galvanized steel pipe frames and 33.35mm O.D. galvanized steel pipe braces, both conforming to the requirements for "Standard Weight" pipe, A.S.T.M. Specification Designation A120. All joints shall be electrically welded and hot-dip galvanized after welding, or otherwise treated by a procedure approved by the Engineer as providing equivalent protection. The galvanized coatings shall be applied by either electrolytic or hot dip process and be electrostatically painted with two coats of Black Carboxyl Modified Vinyl chloride/Vinyl Acetate UCAR Paint.

Gates shall be constructed with the fabric placed on the side of the fence as directed by the Engineer with the barbed edge at the top. The fabric and other components used on gates shall match the adjacent fence fabric and shall be subject to the same quality requirements.

All gates shall be supplied with galvanized malleable iron hinges, latch and latch catch and shall be capable of opening approximately 180 degrees. Double gates shall have a chain hook to hold gates open and a centre rest with drop bolt for the closed position. Gate latches shall be suitable for the use of padlocks which can be attached and operated from

 SPECIFICATIONS FOR CHAIN LINK SECURITY FENCE AND GATES

either side of the gate.

Gates shall be supplied completely assembled.

Fittings and hardware

All required fittings and hardware shall be of suitable aluminium alloy, steel, or malleable or ductile cast iron, galvanized in accordance with A.S.T.M. Specification, Designation A153 and electrostatically painted with two coats of Black Carboxyl Modified Vinyl Chloride/Vinyl **acetate ucar paint.**

Fittings and hardware shall be designed so as to fit or fasten to the posts in the proper manner without bending or distortion and shall be sound, free from defects and of adequate strength.

Zinc coating

Zinc coatings shall be smooth and continuous, shall adhere tenaciously to the base metal and shall be free from blisters, bare spots, projections or other defects not consistent with good galvanizing practice.

The weight of zinc coating shall meet the requirements of Table 2.

TABLE 2		
Minimum Requirements For Zinc Coating		
Component	Weight - gm./sq.m.	Preece Dips
Fabric and Wire	92	6
Posts and Rails	550	6
Frames and Braces	610	6
Cast Fittings	610	6
Other Fittings	610	6

Construction:

Grading

Prior to the erection of the chain link security fence, the Contractor shall remove any debris and correct minor ground undulations so as to obtain a smooth uniform gradient. The space between the surface of the ground and the bottom of the fabric shall not be less than 37mm and shall not exceed 75mm.

After fence erection, the Contractor shall clean and trim the site, replace sod disturbed by fencing operations, and restore the ground to a neat and satisfactory condition.

Posts

SPECIFICATIONS FOR CHAIN LINK SECURITY FENCE AND GATES

In determining the post spacing as shown on the plans, measurement will be made parallel to the slope of the ground. All posts shall be placed in a vertical position and set accurately to line and position as established by the Engineer.

Straining posts shall be installed at equal intervals not exceeding 150 metres where the distance is greater than 150 metres between end or corner posts. Additional straining posts shall be installed as directed by the Engineer where there are appreciable changes in vertical alignment. Changes in line horizontally where the angle or deflection is 20 degrees or more shall be considered as corners and corner posts shall be installed.

Posts in earth or concrete shall be set to the depth and dimensions shown in City of Guelph Standard detail SD-33. In such case, where the size of hole exceeds the minimum dimensions of the footings as shown on the Standard Drawings, the Contractor shall either place the footing against undisturbed soil or shall backfill the hole with suitable earth material compacted to a density of 95% of maximum dry density (A.S.T.M. Designated D 698) and then bore a hole to the required minimum dimensions.

Concrete Footings and Concrete Gate Rests

Concrete footings and gate rests shall be rough cast in the ground and domed above grade to shed the water.

Concrete shall conform to the requirements of City of Guelph Standard Specification SS-27 SI.

Fence fabric shall not be installed until the concrete footings have cured for a period of not less than 5 days.

Bracing

End and gate posts shall be braced to the nearest line post by means of a pipe brace placed in the centre and parallel to the ground to form a brace panel. Corner and straining posts shall be braced in the same manner but in two directions.

Pipe rails

Pipe rails shall be attached to the tops of the posts by means of waterproof caps which shall be fastened securely over the posts.

Tension wire

The bottom tension wire shall be stretched tight and securely fastened to end, corner, gate or straining posts with drop-forged turnbuckles and stretcher bar bands.

Fabric

The fabric shall be stretched taut and securely fastened to end, corner, gate and straining posts with steel stretcher bars and steel or aluminum stretcher bar bands. Steel aluminum stretcher bar bands shall be spaced at 300mm.

The fabric shall be securely fastened to the pipe rail and bottom tension wire with tie-wires at 450mm intervals and to the line posts at 300mm intervals. The tie-wires on the bottom

SPECIFICATIONS FOR CHAIN LINK SECURITY FENCE AND GATES

tension wire shall have not less than 2 twists.

The fabric shall be placed on the park/open space side of the posts unless otherwise directed by Engineer/Landscape Architect.

Gates

Both single and double gates shall be hung with the fastenings provided in conformity with Standard Drawings. Gates shall be hung approximately 37-75mm from the ground.

Damage to Vinyl and Zinc Coating

All abraded and damaged galvanized surfaces shall be cleaned and painted. Damaged areas shall be thoroughly wire brushed and all loose and cracked spelter coating removed, after which the cleaned area shall be painted with two coats of a zinc pigmented paint approved by the Engineer for this purpose. The cleaning of the damaged areas and the supply and application of paint shall be at the Contractor's expense.

Vinyl coatings showing signs of breaks, cracking, wrinkling or looseness may be rejected and replaced at the Contractor's expense.

Measurement for payment:**Chain Link Security Fence**

Measurement for chain link security fence shall be made in metres following the contour of the ground of the actual length of fence erected and shall include the length of brace panels and gate openings.

Measurement for end, corner, gate and straining posts shall be made for each post erected, but not line posts.

Gates

Measurement for gates shall be made of the actual number of openings in the fence for gates, regardless of the size and type of gate erected.

Basis of payment:**Chain link security fence**

Payment will be made at the contract price per metre for the supply and erection of the fence and line posts regardless of the nature of the material in which the posts are set. Such payment shall be full compensation for the preparation of the site, the disposal of debris, the construction of the concrete footings, the cutting of line posts where necessary, and the restoration of the site to a neat and satisfactory condition.

End, Corner, Gate and Straining Posts

Payment will be made at the contract price per post for the supply and erection of end, corner, gate and straining posts regardless of the nature of the material in which the posts are set. Such payment shall be full compensation for the supply and installation of braces,

SPECIFICATIONS FOR CHAIN LINK SECURITY FENCE AND GATES

the construction of the concrete footings and the cutting of posts where necessary.

Gates

Payment at the contract price per opening will be full compensation for the supply and erection of each size and type of gate together with the necessary fittings and hardware, and including the construction of the centre rest in the case of double gates.

SPECIFICATIONS FOR DEMOLITION AND REMOVAL OF STRUCTURES

Scope:

The work under this section shall comprise the supply of labour and equipment as herein required for the demolishing, salvaging, removing and disposing of the various items designated to be removed or partially removed under this contract and for the backfilling of the resulting trenches, holes and pits.

Removal operations:**1. Demolition**

Demolition shall be carried out in such a manner and with such equipment as not to disturb adjacent pavement, utilities or other works to be left in place and with such care as to leave undamaged, materials designated to be salvaged. Where a section of pavement, sidewalk, curb and gutter, or other structure is to be removed, the broken edges of the portions to be left in place shall where necessary be squared up and trimmed to the lines specified by the Engineer.

2. Disposal of Debris

All debris shall be disposed of offsite at locations arranged for by and at the sole expense of the Contractor.

3. Salvage

Catchbasin and maintenance hole castings removed during the course of the work, and any other material designated to be salvaged, shall be delivered to the City Yard on Municipal Street.

4. Excavation

Excavation required for the work to be carried out under this specification shall be performed in such a manner as to leave undisturbed, adjacent structures or other work to be left in place and to save where necessary, for purposes of backfill, the acceptable excavated materials. Where payment for the item to be removed is by the cubic metre, excavation shall be carried out so as to permit the measurement by the Engineer of the volume of concrete or masonry to be removed. Excavated material which is not required for the backfilling of the void resulting from the structure removal shall be used for embankment construction or disposed of offsite.

5. Backfilling and Trimming

After the removal or partial removal of the structure, where filling is required of the resulting trench, hole or pit, the Contractor shall backfill to the required grade using the excavated materials if suitable and imported materials as required and shall level and trim the site to provide slight contours and adequate drainage. Backfill material shall be placed in layers not exceeding 150mm and shall be compacted to 95% of the maximum dry density in the case of earth and 100% of the maximum dry density in the case of granular material.

SPECIFICATIONS FOR DEMOLITION AND REMOVAL OF STRUCTURES

Measurement for payment**1. Removal of Pavements**

The removal of pavements will be measured for payment in square metres in place. No deductions will be made from the computed areas for the spaces occupied by maintenance hole and catchbasin castings. The removal of concrete pavement and asphalt covered concrete pavement will be measured for payment whether on the roadway surface or within an excavation. The removal of asphalt pavement will be measured for payment only when the pavement forms the roadway surface. When asphalt is encountered elsewhere within an excavation, it will be paid for at the contract price for earth excavation. No payment other than at the contract price for earth excavation will be made for the removal of bituminous treated base, prime and surface treatments.

Payment shall be based on the Contract unit price and number of square metres of concrete sidewalk of the required width and thickness and shall be compensation in full for all labour, equipment and material necessary to complete the work specified. The work shall include all excavation, dewatering, disposal of excess excavated material, bedding, expansion joints, supply and placement of concrete of the required strength to the lines and grades as specified on the drawings, curing compound, finishing the concrete, backfilling with acceptable material, compaction and surface grading and all construction work necessary to complete the work as specified.

2. Removal of Sidewalks

The removal of concrete sidewalks and asphalt sidewalks will be measured in square metres in place.

No deductions will be made from the computed areas for the spaces occupied by maintenance hole castings or gratings, utility or traffic poles, or fire hydrants.

3. Removal of Curb and Gutter

The term curb and gutter shall be construed as meaning curb, gutter, combinations of curb and gutter, setbacks, bullnoses, and gutter outlets. Measurement for removal will be made horizontally in linear metres along the faces adjacent to the pavement. Payment will be made for the removal of either concrete curb and gutter or asphalt curb and gutter without further separation into types. No deduction will be made from the measured lengths for the spaces occupied by maintenance hole and catchbasin castings. Where the removal includes runs of curb and gutter which converge to form bullnoses, each run will be measured for payment and such measurement will be deemed to include the concrete fillet within the bullnose.

4. Removal of Maintenance Holes, Catchbasins and Ditch Inlets

Where maintenance holes, catchbasins and ditch inlets are to be removed in their entirety, payment will be made without separation into types for each unit removed.

SPECIFICATIONS FOR DEMOLITION AND REMOVAL OF STRUCTURES

5. Removal of Fences, Guide Rails and Guide Posts

Where fences, guide rails and guide posts are to be removed, measurement will be made horizontally in linear metres of the actual length of run of each type of installation removed.

6. Removal of Sewers

The removal of sewers will be measured horizontally in linear metres. There will be no deduction in length for the spaces occupied by intermediate maintenance holes, catchbasins or ditch inlets.

7. Removal of Concrete Structures, Culverts and Other Items

The removal of concrete structures, culverts and other items not previously referred to may be paid for by each, by lump sum, by the cubic metre or by such other method as the contract may call for. Where the contract calls for payment by the cubic metre, measurement will be made of the total volume of material making up the structure, portion of structure or group of structures designated for removal under the contract item including mortared masonry, concrete or material embedded in the concrete.

8. Imported Backfill Materials

Imported backfill material will be measured for payment in accordance with the specification for the material required and used.

9. Earth Excavation

Earth excavation in the course of demolition operations and subsequently wasted or used for backfill or embankment construction will not be measured for payment under this specification. When, however, such excavation overlaps excavation required for other work under the contract, then the overlapping excavation shall be paid for in accordance with the specification for such other work.

BASIS FOR PAYMENT**1. General**

Payment at the contract prices for the tender items covered by this specification shall be full compensation for demolition, for the disposal of debris, for salvage where specified, for earth excavation required for the demolition and for the subsequent disposition of the excavated material and for the backfilling of the resulting trenches, holes and pits except that imported backfill will be paid for separately in accordance with the specification for the material required and used.

2. Overlapping Removals

When it is necessary to remove a section of pavement, sidewalk, curb and gutter or similar item in order to remove a culvert, sewer or other structure lying beneath, payment will be made for each item removed in accordance with the specification for its removal.

3. Overlapping Excavation

SPECIFICATIONS FOR DEMOLITION AND REMOVAL OF STRUCTURES

When it is necessary to remove a section of pavement, sidewalk, curb and gutter or similar item in order to remove a culvert, sewer or other structure lying beneath, payment will be made for each item removed in accordance with the specification for its removal.

4. Overlapping Excavation

The volume of any excavation quantity measured for payment will include the volume within the established lines of the excavation, of pavement, sidewalk, curb and gutter, and any other structure or portion of structure removed in conjunction with the excavation except, however, it will not include the volume of pavement, sidewalk, curb and gutter and similar items which are removed from the surface but which do not overlie materials to be excavated directly beneath.

5. Rip-Rap

Where broken concrete or masonry is used for rip-rap construction, the placing of the rip-rap will be paid for separately under the appropriate tender item and will not be part of the work to be carried out under this specification.

6. Plugging Catchbasin Laterals

When the contract calls for the removal of catchbasins, catchbasin lateral sewers shall be plugged with concrete as directed by the Engineer except where it is proposed to connect a new catchbasin to the existing lateral. Such plugging of laterals shall be deemed to be incidental to catchbasin removal and no additional payment will be made therefor.

7. Cutting Pavement

When the Contractor is required to remove bituminous pavement under this contract, he shall carry out this work in such a manner as to leave undamaged the pavement which is to be left in place.

To ensure this result, he shall use power spades, power saws or other suitable means to cut the pavement along the limits required by the work or specified by the Engineer before commencing removal operations. Cutting of pavement as herein required shall be deemed to be incidental to bituminous pavement removal and no additional payment will be made therefor.

8. Traffic Islands

When the contract calls for the removal of traffic islands, the lump sum price for such removal shall include compensation in full for removing all concrete curbing, asphalt or concrete surfaces, concrete pole bases, and any other structures situated thereon and no additional payment will be made therefore.

9. Metal Railings

Compensation for removing metal railings and similar incidental hardware attached to concrete retaining walls, steps and other structures shall be deemed to be included in the contract price for removing such structures and no additional payment will be made therefor.

SPECIFICATIONS FOR READY MIXED CONCRETE

1. The Concrete supplier shall certify:
 - a) That their plant, equipment, and all materials to be used in the concrete comply with the requirements of the latest revision of C.S.A. Standard A23.1;
 - b) That the mix proportions selected will produce concrete of the specified performance, quality and yield;
 - c) That the strengths will comply with the requirements of Clause 4.4.6.7 of C.S.A. Standard A23.1.
 - d) That the aggregates to be used in the concrete mix meet the requirements of OPSS 1002.
 2.
 - a) The concrete supplier shall assume responsibility for the concrete mix proportions; however, he shall forward his proposed mix design to the owner prior to delivering concrete to the Contract.
 - b) The concrete supplier shall provide proof that his aggregate sources are on the M.T.O.'s current Concrete Aggregate Sources List and that his plant is certified by the Ready Mixed Concrete Association of Ontario.
 3. The requirements for concrete used in curbs, gutters, sidewalks, other slabs on grade, maintenance holes, catchbasins, pole bases and small retaining walls exposed to de-icing salts are as follows:
 - a) Type GU (10), Normal Portland Cement shall be used in the mix.
 - b) Specified Compressive Strength - 32 MPa at 28 days.
 - c) Minimum cementing materials content – per OPSS 1350.
 - d) Water/cement ratio - 0.45 maximum.
 - e) Nominal size of coarse aggregate - 20mm.
 - f) Slump at point of discharge - 80mm maximum.
 - g) Slump for slip forming applications - 30mm maximum.
 - h) Air entrainment - 6 1/2% \pm 1 1/2%.
 - i) Chemical admixtures – per OPSS 1350.
 - j) Supplementary cementing materials – per OPSS 1350.
 4. The requirements for concrete used as fill concrete, or as bedding encasement for sewers not exposed to freeze/thaw cycles are as follows:
 - a) Type GU (10) Normal Portland cement shall be used in the mix.
 - b) Specified compressive strength - 15 MPa at 28 days.
 - c) Minimum cement content – per OPSS 1350.
 - d) Water/cement ratio - 0.66 maximum.
 - e) Nominal size of coarse aggregate - 20mm.
-

SPECIFICATIONS FOR READY MIXED CONCRETE

- f) Slump at point of discharge - 100mm maximum.
 - g) Air entrainment - $5 \frac{1}{2}\% \pm 1 \frac{1}{2}\%$.
 - h) Chemical admixtures – per OPSS 1350.
5. The requirements for concrete used as encasement for utility ducts are as follows:
- a) Type GU (10) Normal Portland cement shall be used in the mix.
 - b) Specified compressive strength - 20 MPa at 28 days.
 - c) Minimum cement content – per OPSS 1350.
 - d) Water/cement ratio - 0.60 maximum.
 - e) Nominal size of coarse aggregate - 10mm.
 - f) Slump at point of discharge - 150mm maximum.
 - g) Air entrainment - $5 \frac{1}{2}\% \pm 1 \frac{1}{2}\%$.
 - h) Chemical admixtures – per OPSS 1350.
6. The requirements for concrete used as unshrinkable fill are per OPSS 1359.

SPECIFICATIONS FOR CONCRETE PAVERS

Scope:

The work under this section shall comprise the supply of all labour, equipment and materials for the construction of pavements using interlocking concrete pavers as indicated on the drawings or as directed by the Engineer.

Preparation for paving:

The sub grade shall be levelled and shaped to the lines and cross-section as indicated on the drawings or specified by the Engineer, and compacted to 95% of maximum dry density (A.S.T.M. Designation D.698).

Base material shall consist of 150mm of Granular "A" for sidewalks and 250mm Granular "A" for driveways compacted to 100% of maximum dry density and 40mm of sharp, mortar sand or limestone screenings for levelling bed.

Interlocking concrete pavers:

Interlocking Paving Stone shall be "Pavestone Plus Inc." Cobble 100 or approved equal.

Paving stones shall be 200mm x 100mm x 60mm. 80mm thickness for heavy vehicular applications.

Pavers shall be manufactured using no slump concrete with 6% air entrainment consisting of aggregates conforming to CSA A23.1 and type 10 Portland cement having a strength of 55 MPa. The design and dimensions of the pavers should be close to that indicated on the drawings; however, other designs will be acceptable provided the size and shape fit neatly into the area of application. The pavers shall be supplied in approved colours and laid to form a repeating pattern acceptable to the Engineer. The Contractor shall construct a mock-up of the pavement on site for the Engineer's approval and subsequent work shall match the approved laying sequence.

Installation of pavers:

Pavers shall be installed on the asphalt base to the layout indicated on the drawings or as otherwise directed by the Engineer.

Prior to placing the pavers, the Contractor shall lay a 40mm thick bed of sharp mortar sand or limestone screenings over the granular base. The Contractor shall then press the bricks into the sand bed, true to form and grade, and tap and mechanically vibrate them into place to set them in position. Joints shall be no more than 3.0mm in width, uniform and aligned accurately for the full extent of the paving surface.

Surface plane tolerance shall not exceed 2.0mm.

Clean, sharp, fine sand, free from all organic and deleterious substances shall be brushed into the joints and the pavement surface sprayed with water to consolidate the sand. This process shall be repeated until the joints are completely filled.

Pavers shall be accurately sawn where necessary to provide a continuous and uniform pattern. Cutting pavers with a hammer will not be permitted.

SPECIFICATIONS FOR CONCRETE PAVERS

Measurement and basis of payment:

Measurement will be made in square metres computed from the length and width of the area covered by concrete pavers to the limits shown on the drawings or designated by the Engineer.

Payment will be made at the contract unit price per square metre for each type of paver specified and shall be full compensation for all labour, equipment and material necessary to complete the work as specified.

The work shall include all earth excavation and grading as required, placing and compacting the granular bedding, placing the sand bed, setting the bricks and filling the joints, all in accordance with the contract requirements and manufacturer's recommendations.

SPECIFICATIONS FOR LAYOUT FOR CONTRACTOR

Scope:

The work under this item shall comprise the supply of labour, materials and equipment required to perform layout of all works listed in the Tender Form as shown on the contract drawings.

Contractor lay-out shall apply in accordance with the General Conditions of Contract GC 7.02.

Project Control

The Contract Administrator will provide a minimum of two control points and coordinates necessary to establish horizontal control at the project site. The Contractor will be responsible for establishing additional control points necessary for complete layout throughout the project.

The Contractor shall protect reference and lay-out points set by the Contract Administrator, and shall be responsible for the replacement of all hubs initially established by the Corporation. The City of Guelph will re-establish hubs and other layout points upon written request and at the expense of the Contractor.

Excavation And Grading

The Contractor will provide offset hubs at 10.0 metre intervals, on both sides of the right-of-way. The offset hubs will be accurate for the purposes of excavation and grading only. The offset hubs shall not be used for the setting of curb string line or the installation of maintenance holes and catch basins.

The Contractor will provide sufficient layout points to establish intersection radii for the purposes of excavation and grading.

Maintenance Holes And Catchbasins

The Contractor will provide one offset hub and one marker stake for each maintenance hole and catch basin. The hub will indicate an offset to the centreline of the grate. It will be the responsibility of the Contractor to determine any additional offsets required to ensure that the pre-manufactured structures are installed such that the final centreline of the grate is in accordance with the offset hubs. It will be the responsibility of the Contractor to take into account the tapered sections of catch basin maintenance holes and their respective offsets to the centre of the precast base. The Contractor shall measure the offset required for each structure delivered to the project site and submit a written account to the Contract Administrator before installation of any catch basin or maintenance hole.

The stations, offsets and final top of grate elevation for maintenance holes and catchbasins shall be set in accordance with the Contract Drawings.

Curb Layout

It will be the responsibility of the Contractor to provide layout of all curb. Curb shall be laid out using a combination of total station equipment, horizontal alignment and stations

SPECIFICATIONS FOR LAYOUT FOR CONTRACTOR

and offsets described on the Contract Drawings. The Contract Administrator will provide the Pavement Elevations Drawings(s) in digital and printed format. Other digital drawings will not be provided, nor will individual co-ordinates.

The Contractor will be responsible for installing two curb stakes at 10 metre intervals, both left and right of centreline. The first stake shall be a wooden hub set flush to the ground and marked with a nail. The other stake shall be a wooden marker stake indicating chainage and offset from the nail.

The Contractor is hereby advised that all curb stakes must be laid out a minimum of two (2) working days in advance of the curb construction. The City Survey Staff will confirm and verify the accuracy of the hubs at random intervals. It will be the Contractor's responsibility for the protection of the hubs prior to curb construction. The City of Guelph will not be held responsible for damaged hubs, nor the final accuracy at the time of curb construction.

Grade Sheets

It will be the responsibility of the Contractor to calculate grade sheets for both grading and curb construction. The Contract Administrator will provide Pavement Elevations Drawing(s) in digital and printed format. The Contractor shall provide three copies of the grade sheets to the Contract Administrator. One copy will reside with the Site Inspector, one copy with the City Survey Staff and one copy for the permanent construction file.

Curb grade sheets shall contain the following minimum information for each layout hub: chainage, offset, stake elevation, proposed grade, cut or fill.

Line Painting

The Contractor shall be responsible for pre-marking the lane widths and tapers as shown on the Contract Drawings.

The Contractor shall lay-out all other information necessary for the construction of the complete project in accordance with the Contract Drawings.

Payment

Payment on a lump sum basis for the above work shall be full compensation for all labour, equipment and material required to do the work. The item will be paid in increments proportionate to the value of the work completed relative to the total estimated value of the contract.

SPECIFICATIONS FOR PLANTING OF TREES

Tree protection zones**"Refer To Guelph Tree Technical Manual"**

The following is a chart showing minimum required distances for determining a Tree Protection Zone (TPZ) for City-owned trees located on a City Street, in parks and trees on private property. Some trees and some site conditions may require a larger TPZ.

Tree Protection Zones:

Trunk Diameter (DBH) ¹	Minimum Protection Distances Required ² City-owned and Private Trees	Minimum Protection Distances Required
<10 cm	1.2 m	Whichever of the two is greater: The drip line ⁴ or 1.2 m
10 ³ —29 cm	1.8 m	The drip line or 3.6 m
30—40 cm	2.4 m	The drip line or 4.8 m
41—50 cm	3.0 m	The drip line or 6.0 m
51—60 cm	3.6 m	The drip line or 7.2 m
61—70 cm	4.2 m	The drip line or 8.4 m
71—80 cm	4.8 m	The drip line or 9.6 m
81—90 cm	5.4 m	The drip line or 10.8 m
91—100 cm	6.0 m	The drip line or 12.0 m
>100 cm	6 cm protection for each 1 cm diameter or dripline plus 1 meter ⁶	12 cm protection for each 1 cm diameter or the drip line ⁵

¹Diameter at breast height (DBH) measurement of tree stem at 1.4 metres above the ground.

²Tree Protection Zone distances are to be measured from the outside edge of the tree base.

³Diameter (**10** cm) at which trees qualify for protection under the private tree by law.

⁴The drip line is defined as the area beneath the outer most branch tips of a tree.

⁵Converted from ISA Arborists' Certification Study Guide, general guideline for tree protection barriers of 1 foot of diameter from the stem for each inch of stem diameter.

⁶Or dripline plus 1 meter, whichever is greater

Within a TPZ there must be:

- no construction;
- no altering of grade by adding fill, excavating, trenching, scraping, dumping or disturbance of any kind.
- no storage of construction materials, equipment, soil, construction waste or debris.
- no disposal of any liquids e.g. concrete slush, gas, oil, paint.
- no movement of vehicles, equipment or pedestrians.
- no parking of vehicles or machinery.
- directional micro tunnelling and boring may be permitted within the limits of a TPZ.
- open face cuts outside a TPZ that are consistent with an approved plan and that

SPECIFICATIONS FOR PLANTING OF TREES

require root pruning, require the services of a qualified arborist or approved tree professional. An exploratory dig, either by hand or using a low water pressure hydro vac method, must be completed prior to commencing with open face cuts outside the TPZ.

The above mentioned requirements are for the area(s) designated as a TPZ. These requirements should also be implemented outside the TPZ in areas where tree roots are located. The roots of a tree can extend from the trunk to approximately 2-3 times the distance of the drip line.

Tree Protection Barriers

Tree protection shall be installed in accordance with the City's Tree Protection Policy and Specifications for Construction near Trees. Within a City road allowance where visibility is a consideration, 1.2m (4ft) high orange plastic web snow fencing on a 2"x 4" frame should be used

All supports and bracing used to safely secure the barrier should be located outside the TPZ. All supports and bracing should minimize damage to roots.

Where some fill or excavate must be temporarily located near a TPZ, a plywood barrier must be used to ensure no material enters the TPZ.

Root protection shall be installed where required in construction access locations in order to protect tree roots from compaction during construction. Root protection shall consist of a combination of filter fabric, clear crushed stone (half to three quarter inch diameter) placed in layer 15cm deep, and steel plating or other material, as approved by the Engineer.

Any area designated for stockpiling of excavated soil must be fenced with sediment control fencing. Sediment control fencing shall be installed in the locations as required. The sediment control fencing must be installed to Ontario Provincial Standards (OPSD 219.110) to the satisfaction of the Engineer. The sediment control fencing can be attached to the tree protection hoarding.

See SD 90a for Schematic detail.

Tree Protection Signage

A sign that is similar to the illustration SD 90c may be required to be mounted on all sides of a Tree Protection Barrier for trees protected by the Private Tree By law. The sign should be a minimum of 40cm x 60cm and made of white gator board or equivalent material.

Once all tree protection measures are in place, notify City for inspection.

Broken or damaged branches, roots and bark are to be remedied with timely treatments by a certified arborist.

TRUNCATED DOME DETECTABLE WARNING PLATES

Truncated dome detectable warning plates

Where specified on the contract drawings, Truncated Dome Detectable Warning Plates are to be installed on sidewalk ramps to warn visually impaired pedestrians that they are entering the roadway. All installations are to be completed in accordance with City Standard Drawings SD-4, SD-4A, SD-4B and SD-4C as applicable (which are all appended to these specifications) and in accordance with the following requirements:

- Plates are to be cast iron material with "Safety colour yellow" powder coat finish
- Plates are to be set back 150-200mm from back of curb and approximately 200mm from the edge (side) of curb ramp/sidewalk
- Plates are to be parallel with curb radius (ie. not necessarily perpendicular to direction of pedestrian travel). This may require the use of radial plates versus square plates on larger radii.
- A minimum of two 610mm x 610mm plates are to be used at any one sidewalk ramp
- Plates are available in 18" x 24" (457 x 610mm), 24" x 24" (610 x 610mm), and 24" x 30" (610 x 762 mm) 'square'. Radial plates are available in various radii, including 10', 15', 17.5', 20', 25', 30' and 35'. Careful consideration of radius selection is required as the plate radius must be close to the back of curb radius and not edge of pavement radius.

The following four manufacturers are approved suppliers of the cast iron warning plates:

East Jordan Iron Work**East Jordan, Michigan**

Ontario Branch:

159 Sugar Maple Road,
St. George, N N0E 1N0
Phone: 519-448-3395
Fax: 519-448-3393

Star Pipe Canada Inc.

1144 Industrial Road,
Cambridge, ON N3H 4W4
Toll Free: 1-888-893-7827
Phone: 519-650-1550
Fax: 519-650-1553

Neenah Foundry**Neenah, Wisconsin**

Ontario Representative:
Crozier/Ashleigh Suffron
1 Yonge Street, Suite 1801
Toronto, ON M5E 1W7
Phone: 1-866-624-9722

Bibby-Ste. Croix

Richard Lengyell
Ontario Sales Manager
1757 Burlington Street East
Hamilton, ON N3L 2Y6
Toll Free: 800-982-5681
Fax: 905-312-1434

Measurement for payment:

Measurement for payment made under this item shall be on an each basis for each plate installed as per specifications regardless of size/shape.

Basis of payment:

Payment at the contract unit price shall be full compensation for all labour, equipment and material required to do the work as specified herein.



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CITY OF GUELPH

STANDARD SPECIFICATIONS

FOR SEWERS

2020

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Section 1 – General**1.1 Region Of Waterloo And Area Municipal Supplemental Specification**

The work shall comply with Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services Part A, Part C, Part D and Part E (drawings only) except as amended or extended herein.

1.2 Plot Of Utilities Not Guaranteed

The Corporation assumes no responsibility for the completeness or correctness of the Plans with respect to existing underground utilities and structures and should the plots of such be found incorrect or incomplete the Contractor shall have no claim on that account.

1.3 Damage To Property, Buildings And Other Structures

If, in the opinion of the Engineer, the excavation for the sewer may cause damage to buildings or other structures adjacent to the work, the Engineer may direct that such buildings or other structures be underpinned or otherwise supported or protected, or that special sheathing be driven in such a manner and to such a depth as he deems necessary, or that only a short length of trench be opened at one time or that the trench be securely sheathed and braced on all sides and the permanent works be constructed in the same, and the trench backfilled before another opening is made. The Contractor shall at no expense to the Corporation except as specified, perform the work as directed, and the Contractor shall not be relieved of responsibility for any damage that may occur by reason of the Contractor's operations.

1.4 Protection Of Utilities From Damage

The Contractor shall at his own expense, and in a manner approved by the Engineer during the progress of the work, sustain in their place and protect from injury any and all water or gas mains, public or private sewers or drains, conduits, subways, steam and pneumatic pipes, sidewalks, service pipes, curbs, utility poles, cables and conduits and all other structures or property in the vicinity of this work whether over or underground, or which appear within the trench or tunnel, and he shall assume all costs and expenses for damages which may be occasioned by injury to any of them. The Contractor shall at all times

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have a sufficient quantity of timber and plank, chains, etc., on the site, and shall use the same as required for sheathing or sheet-piling and bracing the sides and ends of excavations, and for sustaining or supporting any and all structures that are endangered. If any damage should occur to such mains, sewers, pipes, poles, etc., during the course of the work or due to the work, the Contractor shall be fully responsible therefore and shall relieve the Corporation fully of any responsibility in the matter. The Contractor shall protect all water and service pipes from freezing. Should the Contractor fail to do so, the Engineer may protect such mains and service pipes or in the event of their having suffered injury, may immediately replace or repair them, charging the cost thereof to the Contractor. The Contractor will be held fully responsible for damages resulting from the freezing of such services.

1.5 Support Of Utilities And Mains

Where material is ordered by the Engineer to be left in place to support water and gas mains or services, public or private sewers or drains etc., which appear in or cross the trench, the Contractor shall be compensated for the material in accordance with the General Conditions. Where existing cast iron watermains are undermined or the pipe bedding is otherwise disturbed during the course of the work or due to the work, the existing watermain shall be removed, to a point one metre beyond the limit of such undermining on each side of the trench or excavation, and replaced with new watermain pipe. Compensation for the removal and replacement of such watermain sections will be made under contract items in the Schedule of Items and Prices or as extra work in accordance with the General Conditions.

1.6 Relocating And Rebuilding Existing Structures And Utilities

Should the location or position of any structure be such as, in the opinion of the Engineer, to require its removal, realignment or change, such work shall, subject to the provisions of the General Conditions, be without cost to the Contractor for the work of removal, realignment or change only, but such structures shall be stripped or uncovered or supported or sustained by the Contractor, at the Contractor's own expense before such removal or before and after such realignment or change, as constituting part of the Contract; and the Contractor shall not become entitled to claim any damage or extra compensation from or on account of the presence of such structure or on account of any delay due to removal or rearrangement of the same. The Contractor shall be entitled to such an extension of the time for the completion of

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the Contract as the Engineer shall decide is equivalent to the time that the work has been delayed by the removal, realignment or change of any such obstruction.

1.7 Maintaining Flow Of Sewers And Drains

The Contractor shall permanently provide for and maintain gas and water services and the flow of all sewers, drains, house or inlet connections, and all water courses which may be met with during the progress of the work. The Contractor shall not allow the contents of any sewer, drain or house or inlet connection to flow into the trench; and shall immediately remove from the proximity of the work all offensive matter using such precautions in so doing as may be directed by the Engineer. There shall be no measurement for payment for the work of this section.

1.8 Protection And Restoration - Railways

In the event of the sewer lying adjacent to, or crossing, any railway track or tracks, the Corporation will request the railway company affected to protect its tracks in any manner deemed necessary by it without expense to the Contractor. On the completion of such protective work on the part of the railway company, or on receipt of advice from it that such protective work is deemed unnecessary, the Contractor shall be permitted to enter upon the right-of-way in order to perform the work necessary for the carrying on of his contract and the Contractor shall assume all risk and responsibility in connection therewith.

Should there be a settlement of, or injury to, the tracks or other structures belonging to the said railways, as a consequence of the neglect or refusal of the Contractor to properly sheath the trench or otherwise support the ground through which the trench is excavated, or because of the inadequate, insufficient or otherwise unsuccessful method or means of support employed, the Engineer may authorize the railway to realign, regrade, resurface, and ballast such track or tracks and restore the same to the condition existing before the commencement of the work, or to similar condition, and the cost thereof shall be deducted from any monies due or to become due to the Contractor.

In the event that the sewer is constructed in open cut in order to cross the railway track, the Contractor shall give the Engineer sufficient notice in order to arrange with the railway to lift their track. The method of construction across the property shall be subject at all times and in all respects to the railway's approval. Upon completion of

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construction, the railway will re-lay the track lifted. The cost of lifting and re-laying the track shall be borne by the Corporation. This work will be carried out at times which are convenient to the railway affected, and the Contractor will not be allowed extra remuneration if this work is performed either at night or on Saturdays and Sundays or on Statutory holidays.

The presence of an Inspector employed by any railway company or commission shall not relieve the Contractor of responsibility. All accounts issued by the Railway Company for the costs of providing a Railway Construction Inspector will be borne by the Corporation.

The costs of any Flagging that may be required to control the operations of the railway as a result of the Contractor's operations will be borne by the Corporation.

1.9 Protection And Restoration - Road Allowances

Unless otherwise specified, all trenches, which encroach on the travelled portion including shoulders, of a gravel road or driveway shall be backfilled with the select excavated material and consolidated to within 600mm of the surface. The remaining 600mm shall be backfilled with 450mm of Granular "B" topped by 150mm of Granular "A" the full width of the cut. The surface must be left smooth and level and mounding will not be permitted.

The Contractor shall be responsible for maintaining the trench in good condition after backfilling until such time as the period of guaranteed maintenance has expired. The Contractor shall also be responsible for replacing all roadway culverts damaged by the Contractor's operations, cleaning and restoring all ditches to the satisfaction of the Engineer, cleaning of all roadway culverts and replacing, repairing and cleaning of all other structures damaged or disturbed by the Contractors operations.

Where an open cut is made in a paved road or paved driveway, the cut across the paved surface and shoulders, or from curb to curb as the case may be, shall be backfilled with the select excavated material and consolidated to within 700mm of the surface. The remaining 700mm shall be backfilled with 450mm of Granular "B" and 200mm of Granular "A" and finished with a 50mm temporary bituminous surface. This temporary patch shall be maintained in good repair by the Contractor until the final paving has been completed. The permanent pavement shall not be constructed until the authority of the Engineer has been obtained in order that the backfilling shall have been properly consolidated. Unless otherwise specified, the permanent and

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final paving of the cut on paved streets and paved driveways shall be done prior to the acceptance of the work, by a paving contractor approved by the Engineer at the Contractor's expense. This paving shall be carried out in accordance with Corporation's specifications for paved roads and shall be under the supervision of an Inspector of the Corporation. Reconstruction of all sidewalks, curbs, driveways, ditches, lawns, boulevards, rockeries, etc., shall be at the Contractor's expense. Should any defect in said permanent paving become manifest within the period of guarantee as a result of any defect in the workmanship or in materials used in the construction of the sewer or any of its appurtenances or connections, the Contractor will be required to repair such defects at the Contractor's own expense. The Engineer shall be sole judge in determining the extent and damage arising from such defect.

The pavement or sidewalk over any unauthorized excavations made by the Contractor in any roadway, driveway or sidewalk shall be permanently renewed at the Contractor's expense.

The above requirements as to temporary paving, permanent paving and as to repairing and relaying curbs, gutters and sidewalks shall apply to all trenches for services and to all other excavations as well as to sewer trenches.

1.10 Protection And Restoration - Easements

Where required in this Contract and where shown on the plans, the Corporation shall acquire the necessary easements for constructing the sewer across or under private property.

The Contractor shall not enter upon or occupy, with workers, tools machinery, or materials of any kind, the lands outside of the easements provided, except after written consent has been received by the Engineer from the proper parties. All rentals and damages for the use of private lands shall be paid by the Contractor.

Prior to the commencement of any construction within the boundaries of the easements, snow fences may be supplied by the Corporation in which case the fences will be erected and maintained by the Contractor, along the boundaries of the easements.

It is the intent of these specifications to ensure that all precautions are exercised by the Contractor during the progress of this work for the protection and preservation of all trees, shrubs, flowers, retaining walls, dams, bridges, and all other things which may be encountered during construction and that the easement is left in the same or better

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condition which existed prior to the commencement of construction.

Prior to the installation of sewers, the topsoil shall be stripped to its full depth and stockpiled by the Contractor, and on completion of the sewer installation the topsoil shall be replaced and regraded by the Contractor to its original depth and contour under the supervision of and subject to the approval of the Engineer.

Where regrading of topsoil is not deemed to be satisfactory due to frost or freezing weather, or any other condition, the Contractor will be required to regrade, re-rake or otherwise make good any unevenness or settlement when ground and weather conditions permit.

All fences, gates, or walls which are removed by the Contractor in order to provide access to or for construction of the works or any other purpose must be re-erected by the Contractor in their original positions, unless ordered otherwise, including provision of new footings for posts and stays similar to those existing.

1.11 Cleaning Of Maintenance Holes And Sewers

The Contractor shall be responsible for cleaning out sewers and maintenance holes when so directed by the Engineer. Should the Contractor fail to complete the clean out of the maintenance holes or sewers to the satisfaction of the Engineer within 24 hours of receipt of such an order from the Engineer in writing, the Corporation shall perform the clean out at the expense of the Contractor. In the event that the debris has caused a main block or the potential exists for a main block, the City will clean out the debris and back charge the Contractor at the discretion of the Engineer.

1.12 Stubs

All sewers not ending at a maintenance hole shall be plugged with a watertight plug supplied by the manufacturer for that purpose. On sewers too large to be plugged with a manufactured plug, the Contractor shall construct a watertight brick bulkhead satisfactory to the Engineer.

The cost of plugging the ends of stubs shall be included in the Contractor's tendered prices for sewers.

No stub shall be backfilled until the Engineer informs the Contractor that a survey crew has obtained all necessary ties and elevations on the stub. Should the Contractor backfill a stub without permission from the Engineer, the Contractor shall re-excavate and expose the stub at the Contractor's expense so that the survey crew can obtain the

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necessary information.

Section 2 - Materials**2.1 Approved And Alternative Pipe Materials**

The Contractor will not be permitted to "mix and match" pipe materials on a project. Once the Contractor has proposed and the Engineer has accepted the type and grade of material to be supplied for a particular pipe size and function, the contractor shall not use any other pipe material for such size and function anywhere on the project.

2.2 Corrugated Steel Pipe (Csp)

Corrugated Steel Pipe and Couplings shall conform to Ontario Provincial Standard Specification (OPSS) 1801. Corrugated Steel Pipe (CSP) may only be used for storm sewer mains outside of the road allowance. Fabricated tees and fittings supplied by the pipe manufacturer shall be used with CSP, 450mm to 1500mm.

2.3 Concrete

City of Guelph Specification SS-27-SI, CSA Standard A-23-1 and OPSS 900 shall apply to all concrete work under this contract.

2.4 Precast Maintenance Holes

Precast maintenance holes shall be manufactured to conform to the requirements of CSA A257.4 and A.S.T.M. Designation C478M. Wall thickness of sections, other than top sections of 1200mm diameter maintenance holes, shall conform to Wall "B" in A.S.T.M. Designation C76. The top section of 1200mm diameter maintenance holes shall be a minimum of 1200mm height, shall be tapered and the wall thickness at the top shall be 225mm minimum. Lifting holes shall be cast-in-place, and shall be diametrically opposite. Steps shall be cast-in-place.

Maintenance hole benching as per DGSSMS D.3.3.4.

Section 3 - Construction**3.1 Excavation****3.1.1 General**

Unless otherwise shown on the plans, specified or authorized all pipe sewers, house connections or drains shall be constructed in open trench.

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The contractor shall confine all excavations to the designated work area for this contract. The work area shall be confined to the road allowance and easements shown on the drawings. Any excavation beyond the designated work area shall be restored in accordance with the Engineers direction. In the absence of other direction from the Engineer, backfill of such excavation shall be compacted to 100% relative dry density to ASTM D698.

Where, in the opinion of the Engineer, conditions are not suitable for the use of trenching, excavating or other special machinery, the Contractor shall, upon the written order of the Engineer, carry out the work without the use of such machinery and no allowance will be made to the Contractor as a result of such restrictions.

Where the Engineer deems it necessary, for the protection of utilities, the Contractor shall excavate the trench with vertical walls with suitable shoring as per OHSA, and the Contractor shall not be entitled to any additional remuneration.

The breaking of frost shall be in a manner satisfactory to the Engineer. The breaking of frost by dropping a backhoe bucket from any height is not acceptable. Should the method of frost breaking adopted by the Contractor result in excessive noise, ground vibration or damage or possibility of damage to adjacent buildings or other structures, including mains or services, then the Contractor shall adopt a method which will eliminate these conditions and he shall not be entitled to any additional remuneration therefore.

3.1.2 Material To Be Excavated

Excavation shall include solid or disintegrated rock, shale, hardpan, clay, boulders, earth, rocks, or any other material of any nature which interferes with the construction work.

Where test borings are made of the ground adjacent to the line of work, the character of the soil and the approximate location of the test holes may be indicated on the plans. These borings are made to enable the works to be designed, and no responsibility is assumed by the Corporation for their exactness or completeness. Tenderers are expected to make such examination of the soil, as they may feel necessary in order to satisfy themselves as to the conditions to be encountered.

The Contractor will be required to assume all risks arising from or out of the nature of the materials to be excavated in order to accommodate the structures shown on the plans.

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3.1.3 Removal And Replacement Of Pavement And Other Surface Improvements

Existing concrete pavements, curbs, sidewalks or driveways removed in connection with construction shall be replaced to neatly sawed edges. Saw cuts shall be a minimum depth of 40 mm in concrete pavement or driveways and to a minimum depth of 25 mm in concrete sidewalk. If a saw cut in pavement falls within 1 metre of a construction joint, cold joint, expansion joint, or edge, the concrete shall be removed and replaced to the joint or edge.

Bituminous pavement removed in connection with construction shall be removed to clean vertical faces along straight lines.

3.2 Corrugated Steel Pipe

Corrugated steel pipes may only be used for storm sewer mains outside of the road allowance.

Section 4 - Field Testing, Acceptance For Maintenance Period And Final Acceptance**4.1 General**

Without in any way limiting the basis of acceptance under Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services Part A, Part C, Part D and Part E, the intention of this Section is to outline the procedures for field testing of the completed work, prior to acceptance for purposes of the maintenance period and Final Acceptance (prior to expiration of 2 year warranty period).

In order for the works to be accepted for the maintenance period, they must satisfactorily meet the requirements of the inspection and testing program outlined in this section and in the Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services Part A, Part C, Part D and Part E.

For Final Acceptance, the works must satisfactorily meet the requirements of the inspection and testing program outlined in this section and in the Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services Part A, Part C, Part D and Part E.

If the inspections identify defects or suspected defects additional field testing will be required to identify problems and potential solutions. The entire cost of this additional field testing shall be borne by the

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Contractor.

Only at the written direction of the Engineer, may any test be deferred. Notwithstanding any such deferral, the Engineer may later direct that the test be deferred prior to acceptance of the sewer.

4.2 CCTV Inspection

CCTV inspection shall be completed prior to acceptance for maintenance purposes and prior to Final Acceptance at the end of the maintenance period.

4.3 Leakage Tests For Gravity Sanitary Sewers And Forcemains**4.3.1 Exfiltration Test**

All exfiltration testing shall be done using the low pressure air testing method. Exfiltration testing with water shall only be used with the written approval of the Engineer.

4.3.2 Testing Forcemains

Leakage tests shall be performed in accordance with OPSS 412. Test pressure shall be

1035 kPa unless otherwise specified in the contract documents



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FOR WATERMAINS

2020

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Section 1 - General**1.1 Region Of Waterloo And Area Municipal Supplemental Specifications**

The work shall comply with **Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services Part A, Part C, Part D and Part E (drawings only)** except as amended or extended herein.

1.2 Plot Of Utilities Not Guaranteed

The Corporation assumes no responsibility for the completeness or correctness of the Plans with respect to existing underground utilities and structures and should the plots of such be found incorrect or incomplete the Contractor shall have no claim on that account.

1.3 Damage To Property, Buildings And Other Structures

If, in the opinion of the Engineer, the excavation for the watermain may cause damage to buildings or other structures adjacent to the work, the Engineer may direct that such buildings or other structures be underpinned or otherwise supported or protected, or that special sheathing be driven in such a manner and to such a depth as he deems necessary, or that only a short length of trench be opened at one time or that the trench be securely sheathed and braced on all sides and the permanent works be constructed in the same, and the trench backfilled before another opening is made. The Contractor shall at no expense to the Corporation except as specified, perform the work as directed, and he shall not be relieved of responsibility for any damage that may occur by reason of his operations.

1.4 Protection Of Utilities From Damage

The Contractor shall at his own expense, and in a manner approved by the Engineer during the progress of the work, sustain in their place and protect from injury any and all water or gas mains, public or private sewers or drains, conduits, subways, steam and pneumatic pipes, sidewalks, service pipes, curbs, utility poles and all other structures or property in the vicinity of this work whether over or underground, or which appear within the trench or tunnel, and he shall assume all costs and expenses for damages which may be occasioned by injury to any of them. He shall at all times have a sufficient quantity of timber and plank, chains, etc., on the site, and shall use the same as required for sheathing or sheet piling and bracing the sides and ends of excavations, and for sustaining or supporting any and all structures that are endangered. If any damage should occur to such mains, sewers, pipes, poles, etc., during the course of the work or due to the work, the Contractor shall be fully responsible therefor and shall relieve the Corporation fully of

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any responsibility in the matter. The Contractor shall protect all water and service pipes from freezing. Should he fail to do so, the Engineer may protect such mains and service pipes or in the event of their having suffered injury, may immediately replace or repair them, charging the cost thereof to the Contractor. The Contractor will be held fully responsible for damages resulting from the freezing of such services.

1.5 Support Of Utilities And Mains

Where material is ordered by the Engineer to be left in place to support water and gas mains or services, public or private sewers, or drains etc., which appear in or cross the trench, the Contractor shall be compensated for the material in accordance with the General Conditions. The Contractor shall supply shop drawings stamped by the Engineer for support. Where existing cast iron watermains are undermined or the pipe bedding is otherwise disturbed during the course of the work or due to the work, the existing watermain shall be removed, to a point one metre beyond the limit of such undermining on each side of the trench or excavation, and replaced with ductile iron watermain pipe. Compensation for the removal and replacement of such watermain sections will be made under contract items in the Schedule of Items and Prices or as extra work in accordance with the General Conditions.

1.6 Relocating And Rebuilding Existing Structures And Utilities

Should the location or position of any structure be such as, in the opinion of the Engineer, to require its removal, realignment or change, such work shall, subject to the provisions of the General Conditions, be without cost to the Contractor for the work of removal, realignment or change only, but such structures shall be stripped or uncovered or supported or sustained by the Contractor, at his own expense before such removal or before and after such realignment or change, as constituting part of the Contract; and the Contractor shall not become entitled to claim any damage or extra compensation from or on account of the presence of such structure or on account of any delay due to removal or rearrangement of the same. The Contractor shall be entitled to such an extension of the time for the completion of the Contract as the Engineer shall decide is equivalent to the time that the work has been delayed by the removal, realignment or change of any such obstruction.

1.7 Maintaining Flow Of Sewers And Drains

The Contractor shall, at his own expense, permanently provide for and maintain gas and water services and the flow of all sewers, drains, house or inlet connections, and all watercourses, which may be met with during the progress of the work. The Contractor shall not allow the contents of any sewer, drain or house or inlet connection to flow into the trench; and shall, at

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his own expense, immediately remove from the proximity of the work all offensive matter using such precautions in so doing as may be directed by the Engineer.

1.8 Protection And Restoration - Railways

In the event of the watermain lying adjacent to, or crossing, any railway track or tracks, the Corporation will request the railway company affected to protect its tracks in any manner deemed necessary by it without expense to the Contractor. On the completion of such protective work on the part of the railway company, or on receipt of advice from it that such protective work is deemed unnecessary, the Contractor shall be permitted to enter upon the right-of-way in order to perform the work necessary for the carrying on of his contract and he shall assume all risk and responsibility in connection therewith.

Should there be a settlement of, or injury to, the tracks or other structures belonging to the said railways, as a consequence of the neglect or refusal of the Contractor to properly sheath his trench or otherwise support the ground through which the trench is excavated, or because of the inadequate, insufficient or otherwise unsuccessful method or means of support employed, the Engineer may authorize the railway to realign, regrade, resurface, and ballast such track or tracks and restore the same to the condition existing before the commencement of the work, or to similar condition, and the cost thereof shall be deducted from any monies due or to become due to the Contractor.

In the event that the watermain is constructed in open cut in order to cross the railway track, the Contractor shall give the Engineer sufficient notice in order that he may arrange with the railway to lift their track. The method of construction across the property shall be subject at all times and in all respects to the railway's approval. Upon completion of construction, the railway will re-lay the track lifted. The cost of lifting and re-laying the track shall be borne by the Corporation. This work will be carried out at times which are convenient to the railway affected, and the Contractor will not be allowed extra remuneration if this work is performed either at night or on Saturdays and Sundays or on Statutory holidays.

The presence of an Inspector employed by any railway company or commission shall not relieve the Contractor of responsibility. All accounts issued by the railway company for the costs of providing a Railway Construction Inspector will be borne by the Corporation.

The costs of any Flagging that may be required to control the operations of the railway as a result of the Contractor's operations will be borne by the Corporation.

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1.9 Protection And Restoration - Road Allowances

During the performance of the work, it shall be the Contractor's responsibility to protect the public and interfere as little as possible with vehicular and pedestrian traffic, by the use of all necessary signs, barricades, fences, temporary walkways, watchmen, flags, and lanterns to the satisfaction of the Engineer.

The Contractor shall comply at all times with the Ministry of Transportation, Ontario (MTO) Traffic Control Manual for Roadway Work Operations which manual shall form part of this contract.

Existing traffic signs such as stop signs and speed limit signs are not to be removed by the Contractor. If it is necessary to have some of these signs temporarily removed during construction, then the Contractor shall give twenty-four (24) hours notice to the Engineer, who will in turn have the signs removed and replaced following construction, at no cost to the Contractor.

Unless otherwise specified, all trenches, which encroach on the travelled portion including shoulders, of a gravel road or driveway shall be backfilled with the excavated material and consolidated to within 600mm of the surface. The remaining 600mm shall be backfilled with 450mm of Granular "B" topped by 150mm of Granular "A" the full width of the cut. The surface must be left smooth and level and mounding will not be permitted.

The Contractor shall be responsible for maintaining the trench in good condition after backfilling until such time as the period of guaranteed maintenance has expired. He shall also be responsible for replacing all roadway culverts damaged by his operations, cleaning and restoring all ditches to the satisfaction of the Engineer, cleaning of all roadway culverts and replacing, repairing and cleaning of all other structures damaged or disturbed by his operations.

Where an open cut is made in a paved road or paved driveway, the cut across the paved surface and shoulders, or from curb to curb as the case may be, shall be backfilled with 450mm of Granular "B" and 200mm of Granular "A" and finished with a 50mm temporary bituminous surface. This temporary patch shall be maintained in good repair by the Contractor until the final paving has been completed. The permanent pavement shall not be constructed until the authority of the Engineer has been obtained in order that the backfilling shall have been properly consolidated. Unless otherwise specified, the permanent and final paving of the cut on paved streets and paved driveways shall be done prior to the acceptance of the work, by a paving contractor approved by the Engineer at the Contractor's expense. This paving shall be carried out in accordance with Corporation's specifications for paved roads and shall be under the supervision of an Inspector of the Corporation.

Reconstruction of all sidewalks, curbs, driveways, ditches, lawns, boulevards,

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rockeries, etc., shall be at the Contractor's expense. Should any defect in said permanent paving become manifest within the period of guarantee as a result of any defect in the workmanship or in materials used in the construction of the watermain or any of its appurtenances or connections, the Contractor will be required to repair such defects at his own expense. The Engineer shall be sole judge in determining the extent and damage arising from such defect.

The pavement or sidewalk over any unauthorized excavations made by the Contractor in any roadway, driveway or sidewalk shall be permanently renewed at the Contractor's expense.

The above requirements as to temporary paving, permanent paving and as to repairing and relaying curbs, gutters and sidewalks shall apply to all trenches for services and to all other excavations as well as to watermain trenches.

1.10 Protection And Restoration - Easements

Where required in this Contract and where shown on the plans, the Corporation shall acquire the necessary easements for constructing the watermain across or under private property.

The Contractor shall not enter upon or occupy, with workers, tools machinery, or materials of any kind, the lands outside of the easements provided, except after written consent has been received by the Engineer from the proper parties. All rentals and damages for the use of private lands shall be paid by the Contractor.

Prior to the commencement of any construction within the boundaries of the easements, snow fences may be supplied by the Corporation in which case the fences will be erected and maintained by the Contractor, along the boundaries of the easements.

It is the intent of these specifications to ensure that all precautions are exercised by the Contractor during the progress of this work for the protection and preservation of all trees, shrubs, flowers, retaining walls, dams, bridges, and all other things which may be encountered during construction and that the easement is left in the same or better condition which existed prior to the commencement of construction.

Prior to the installation of watermains, the topsoil shall be stripped to its full depth and stockpiled by the Contractor, and on completion of the watermain installation the topsoil shall be replaced and regraded by the Contractor to its original depth and contour under the supervision of and subject to the approval of the Engineer.

Where regrading of topsoil is not deemed to be satisfactory due to frost or freezing weather, or any other condition, the contractor will be required to

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regrade, re-rake or otherwise make good any unevenness or settlement when ground and weather conditions permit.

All fences, gates, or walls which are removed by the Contractor in order to provide access to or for construction of the works or any other purpose must be re-erected by the Contractor in their original positions, unless ordered otherwise, including provision of new footings for posts and stays similar to those existing.

1.11 Notification Of Watertakers

The Contractor, on approval of the Contract Administrator and City of Guelph Water Services Division, must make necessary arrangements to supply any sensitive water takers within the affected area with an alternate water supply as necessary for the duration of any water shutdown.

The Contract Administrator and City of Guelph Water Services Division shall approve the duration of any planned shutdown. For planned shutdowns longer than 8 hours, a temporary water distribution system approved by the Contract Administrator and City of Guelph Waterworks Division shall be provided by the Contractor.

1.12 Compliance With Ministry Of The Environment And Climate Change Regulations

All work that takes place on the City of Guelph's Water System will be conducted in accordance to the Safe Drinking Water Act, 2002 and all of its related Acts, Regulations and the Municipal Drinking Water Licence. Failure to complete all work in compliance with the above requirement may lead to termination of the contract between the City of Guelph and the third party and a refusal by the City of Guelph to pay the third party any outstanding costs.

The City of Guelph Water Services Division reserves the right, without loss, to stop work done by a third party on the drinking water system in the event that the drinking water system water quality is adversely affected, as defined in schedule 16 of the Drinking Water Systems Regulation 170/03.

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Section 2 – Materials**2.1 Material Specifications**

All pipe appurtenances and materials contacting the water supply shall conform to the latest revised applicable specifications of the American Waterworks Association (A.W.W.A.) and ANSI Standard NSF/60 or NSF/61. Evidence of conformance of materials and chemicals shall be made available to the owner.

All curb stops, main stops and unions 25mm to 50mm shall be No Lead.

2.2 Valves And Valve Boxes

Butterfly valves shall not be permitted, unless otherwise directed by the City Engineer.

One-piece plastic valve boxes (Mueller MVB Composite Valve Box or approved equal) shall also be permitted when used in conjunction with 100mm road leveller (Bibby VB717 or approved equal).

Valves shall open left (counter clockwise).

Gate valves should be Mueller, Clow or East Jordan Iron Works.

2.3 Hydrants

Hydrants shall conform to AWWA C502 and shall be McAvity Brigadier Style M-67 by Crane (Canada) Limited, East Jordan Iron Works 5CD250 HYD MJ-2AD WTRMSTR STZ, or Mueller Canada Valve Century.

Hydrants shall have two 63.5 mm (2-1/2") (C.S.A.B.-89-2-1954 or latest amendment) male hose connections and one 114.3 mm (4-1/2") pumper nozzle with a 100mm ULC approved Stortz connection. The front Stortz connection port shall face the street or access Road.

Hydrants shall open right (clockwise) and close left (counter clockwise).

Hydrants shall be painted Chrome Yellow and the port caps and bonnet shall be painted dark green (Multiguard 2500 self-priming enamel - Green 40004 as manufactured by Multiplex Chemicals Ltd. or approved equal). Stortz nozzles shall be painted black. The size of the adjacent watermain in inches shall be painted in black letters 200 mm high on the face of the hydrant barrel facing the street.

Hydrants shall have metal caps.

2.4 Blow-Offs

Blow-offs shall not be permitted.

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2.5 Plugs

Plugs for ductile iron pipe shall be cast iron bell and spigot (Tyton) style, conforming to AWWA C110 (ANSI A21.10).

Plugs for PVC pipe, 100mm to 300mm (4" to 12"), shall be injection moulded PVC meeting the requirements of 2.3.2 and equipped with a joint restraint device conforming to Uni-Bell PVC Pipe Association Standard UNI-B-13.

Plugs for PVC pipe, 350mm and larger, shall be cast iron mechanical joint conforming to AWWA C110 (ANSI A21.10), and equipped with a joint restraint device conforming to Uni-Bell PVC Pipe Association Standard UNI-B-13.

2.6 Service Connections**2.6.1 Corporation Stops**

Service connections to PVC mains shall be affected by using PVC moulded or fabricated tapped tees; service saddles shall be used only with the express permission of the Engineer.

Corporation stops (main stops) for 25mm copper services shall have compression connections (pack joints) and shall be fluorocarbon (Teflon) coated ball valves - Mueller B-25008, Ford FB1000 or approved equal.

Corporation stops for 38mm and 50mm copper services shall have inside iron pipe threaded outlet connection (female) and shall be fluorocarbon coated ball valves - Ford FB1600 or approved equal, plus appropriate service saddle and compression to outside IP thread adapter.

Tapped tees to be eliminated within 17 metres on in line valves, instead service saddles will be allowed to avoid unnecessary restraining methods.

2.6.2 Curb Stops

Curb stops for 25mm, 38mm and 50mm copper services shall have compression connections, and shall be fluorocarbon coated ball valves without drains - Ford B44-333 (-444, -666 and -777), Cambridge Brass "Century" E17402 (E17403, E17030 and E17040) or approved equal.

Curb boxes and stems for 25mm services shall have a 25mm upper section with extension from 1.7 metres and shall be Mueller A-726 with type 304 stainless steel rods and stainless steel cotter pins or approved equal. Curb boxes and stems for 38mm and 50mm services shall meet the above requirements except that the model shall be Mueller A-728 or approved equal.

2.6.3 Service Pipe

Unless otherwise specified, all service pipes for 25, 38 and 50mm services shall be of soft-copper Type K.

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Kinked, crushed or distorted tubing shall not be used. Solder type fittings shall not be used.

Unions for 25mm, 38mm and 50mm copper services shall have compression connections and shall be Emco "Successor" Series 17080, Mueller 110 Compression Connections, Ford Pack Joint Couplings or approved equal.

Only one union per service will be permitted and no pipe unions shall be installed under the road surface.

Copper service pipe shall be corrosion protected with zinc or magnesium anodes connected to the corporation stop equipped with a grounding tail nut.

2.7 Corrosion Protection

2.7.1 Cathodic Protection

Anodes and Petrolatum Tape Systems shall be installed on all valves, hydrants, fittings and specials and service pipe as set forth below:

Item To Be Protected	Anode Sizing	
	Zinc	Magnesium
Copper service pipe (25mm)	5.5 kg	14.5 kg
Copper service pipe (38mm & 50mm)	11	29
Hydrants	11	29
Valves (100mm to 250mm)	5.5	4.5
Valves (300mm and over)	11	29
Cast iron & plain ductile iron fittings and specials		
(100mm to 250mm)	5.5	14.5
(300mm and over)	11	29
Ductile iron "Hyprotec" coated fittings and specials when used on PVC watermain	5.5	14.5

Anodes shall be connected to valves, hydrants, fittings, joint restraints and specials using the "cadweld" method in accordance with the manufacturer's recommendations. Anodes shall be connected to grounding tail nuts on corporation stops to provide corrosion protection for service pipes.

2.7.2 Anodes

Packaged Zinc Anodes shall be 5.5 Kg castings, manufactured using a high purity zinc - 99.99% pure conforming to ASTM B-418-73 Type II. The zinc casting shall have a 3.2mm (0.125") diameter galvanized steel core wire throughout its length and shall be packaged in a cardboard or cloth container approximately 100mm in diameter.

The depolarizing material surrounding the zinc casting shall be composed of a gypsum/bentonite base material having an electrical resistivity less than 50

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ohm cm. wet.

An insulated copper (AWG #10/7 strand) wire, 2 metres minimum in length, shall be brazed to the end of the core wire.

Duratron Model DZP-550-12 zinc anodes meet the above requirements.

Packaged Magnesium Anodes shall be 14.5 Kg castings with a 3.2mm (0.125") diameter stainless steel core wire and shall be packaged in a cardboard or cloth container approximately 200mm in diameter.

The depolarizing material surrounding the magnesium casting shall be composed of a gypsum/sodium sulphate/bentonite mixture having an electrical resistivity less than 50 ohm cm. wet. An insulated copper (AWG #10/7 strand) wire, 2 metres minimum in length shall be brazed to the end of the core wire.

Duratron Systems Limited and Corrosion Service Company Limited presently manufacture anodes to the above requirements.

The packaged anode shall be placed in the trench a minimum of 1.0 metre from the material to be protected.

2.7.3 Petrolatum Tape Systems

Anti corrosion wrap shall be as supplied by Denso North America Inc. or Petro Coating Systems Ltd. Only material from one supplier exclusively shall be used on an installation. At no time shall materials from either system be utilized with the other.

Denso coating material shall consist of Denso paste or Denso priming Solution (for cold temperature application), Denso Profiling Mastic or Denso Mastic Blanket, and Denso LT Tape.

PP Series Primer Paste, PM Series Mastic, LT/ST/Ht Petroleum Tape, PVC 250 Overwrap Tape from Petro Coating Systems Ltd.

2.8 Tracer Wire

Tracer wire shall be 8 gauge TWU multistrand copper and shall be installed along all Non-Metallic pipe as close as possible to the pipe. The tracer wire shall be brought to the surface at all fire hydrants, looped twice around the hydrant barrel 100mm below finished grade and fastened by means of a washer to a breakaway flange bolt directly below the steamer port - as shown on the Detail Drawings. When Non-Metallic pipe is connected to an existing ductile iron watermain system, the tracer wire shall be connected to the ductile iron pipe, valve or fitting by the "cadweld" method.

2.9 Service Saddles

Service saddles shall be of stainless steel construction and shall have AWWA

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taper (CC) outlet thread. Service saddles shall be used on all taps larger than 25mm installed off ductile iron pipe and on all taps installed off PVC pipe where tapped tees cannot be used.

The following service saddles are approved for use with ductile iron pipe:

Cambridge Brass - Series 403 teck clamp

Cambridge Brass - Series 302 teck clamp

The following service saddles are approved for use with PVC pipe:

Cambridge Brass - Series 403 teck clamp

Cambridge Brass - Series 302 teck clamp

Robar Industries Ltd. - Series 2606

Ford - FS-303

2.10 Restraint Of Watermain Fittings

The work shall include the supply and installation of mechanical restrainers on both sides of all direct buried water valves and end caps/plugs for a minimum of 3 joints or 17m from the valve or end cap/plug.

The length of restraint shall be sufficient to allow for the excavation and removal of a portion of watermain on either side of the valve or end cap/plug and simultaneously maintain the watermain under maximum design pressure. Concrete thrust blocks at the capped end of a pipe run will **not** be acceptable for restraint.

In addition to thrust blocking, as detailed, restrained joints shall be provided on all pressurized mains in the following cases:

- a) Horizontal and vertical bends
- b) Reducers
- c) Plugs and caps
- d) Water valves
- e) The line side of hydrant valves
- f) The hydrant side of the hydrant tee
- g) Services 100mm in diameter and larger from the main to the property line
- h) Where explicitly shown on the drawings

For all watermains 350 mm diameter or larger, the restraint required beyond the valve or end cap/plug shall be calculated by the pipe manufacturer, certified by the pipe manufacturer's authorized representative and shall take into account the native soils, bedding, ground water conditions and all other factors required to restrain the valve against the maximum total design pressure of the watermain pipe acting on one side of the valve or end cap/plug. On completion of installation of watermains 350mm diameter or larger, the Contractor shall supply a Construction Report, prepared by the pipe manufacturer, that includes the following information.

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- Letter of Compliance
- Pipe design calculations
- Summary of fittings, method and length of restraint for each.

Joint restraints shall meet the requirements of ASTM 1674 performance specifications for Joint Restraint Devices. Provide corrosion protection at all joint restraints in accordance with Section 2.10 above.

Joint restraints for PVC pipe systems and fittings shall be serrated ring type as manufactured by UniFlange (Series 1300, 1350 & 1360), EBAA (Series 1600, 2500 & 2800) or Clow (Series 300 & 350) or wedge action type as manufactured by EBAA (Series 2000PV) or UniFlange (Series 1500).

Joint restraints for ductile iron pipe systems and fittings shall be wedge action as manufactured by EBAA (Megalug Series 1100), UniFlange (Series 1400 & 1450), Sigma (OneLok), Romac (RomaGrip) or approved equivalent.

Restrain all pipes and fittings within 6metres either side of bends.

2.11 Concrete

City of Guelph Specification SS-27, CSA Standard A-23-1 and OPSS 900 shall apply to all concrete work under this contract.

2.12 Exterior Bolts On Valves, Hydrants, Fittings And Couplings

All exterior bolts on valves, hydrants, fittings and couplings shall be FluoroKote #1 coated fasteners.

Section 3 – Construction

3.1 Excavation

3.1.1 General

Unless otherwise shown on the plans, specified, or authorized, all watermains and service pipes shall be constructed in open trench.

Where, in the opinion of the Engineer, conditions are not suitable for the use of trenching, excavating or other special machinery, the Contractor shall, upon the written order of the Engineer, carry out the work without the use of such machinery and no allowance will be made to the Contractor as a result of such restrictions.

Where the Engineer deems it necessary for the protection of utilities the Contractor shall excavate the trench with vertical walls using such trench boxes or sheathing and shoring as are necessary, and the Contractor shall not be entitled to any additional remuneration.

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The breaking of frost shall be in a manner satisfactory to the Engineer. The breaking of frost by dropping a backhoe bucket from any height is not acceptable. Should the method of frost breaking adopted by the Contractor result in excessive noise, ground vibration or damage or possibility of damage to adjacent buildings or other structures, including mains or services, then the Contractor shall adopt a method which will eliminate these conditions and he shall not be entitled to any additional remuneration therefor.

3.1.2 Material to be Excavated

Excavation shall include solid or disintegrated rock, shale, hardpan, clay, boulders, earth, rocks, or any other material of any nature, which interferes with the construction work.

Where test borings are made of the ground adjacent to the line or work, the character of the soil and the approximate location of the test holes may be indicated on the plans. These borings are made to enable the works to be designed, and no responsibility is assumed by the Corporation for their exactness or completeness. Tenderers are expected to make such examination of the soil as they may feel necessary in order to satisfy themselves as to the conditions to be encountered.

The Contractor will be required to assume all risks arising from or out of the nature of the materials to be excavated in order to accommodate the structures shown on the plans.

3.1.3 Removal and Replacement of Pavement and Other Surface Improvements:

Existing concrete pavements, curbs, sidewalks or driveways removed in connection with construction shall be replaced to neatly sawed edges. Saw cuts shall be a minimum depth of 40 mm in concrete pavement or driveways and to a minimum depth of 25 mm in concrete sidewalk. If a saw cut in pavement falls within 1 metre of a construction joint, cold joint, expansion joint, or edge, the concrete shall be removed and replaced to the joint or edge.

Bituminous pavement removed in connection with construction shall be removed to clean vertical faces along straight lines.

3.2 Chlorination Guidelines For Damaged Or Otherwise Compromised Watermains

For damaged or comprised watermains, Contract shall follow the latest edition of Watermain Disinfection Procedure, Ministry of the Environment and Climate Change, Safe Drinking Water Branch.

Damaged Watermain After Passing Partial or All Testing That Allows for Watermain to be Put into Service

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When a watermain is damaged after installation and has passed all or part of the appropriate testing, such as pressure test, swabbing, high chlorine and bacteria tests, the City of Guelph Waterworks Division reserves the right to have all the required testing initiated again and to the satisfaction of the City of Guelph's Waterworks Division after the repair or replacement of the damaged section of the watermain or service.

That all City of Guelph's water used in this process of the testing will be calculated along with the Waterworks Division costs and then billed directly to the party who will be responsible for the said costs that caused the damage to the watermain or service or any other part of the City of Guelph's water system.

When a new copper water service has been installed and is damaged during any form of work process the requirement shall be to install a new service complete from the watermain to the appropriate property line.

3.2.2 Miscellaneous

- Hydrant leads will be manually swabbed with chlorine swab.
- Sampling points shall be copper only. Copper sampling point will be provided with a shut-off valve and will be above ground to control the flow of water for testing. A minimum of 300 mm of copper pipe will be extended beyond the shut-off valve.
- Use only copper pipe or iron pipe or poly pipe for backflow connections.
- All tapping of watermains shall be performed by a designated Watermain Tapping Contractor approved by the City Engineer. All tappings shall be inspected by City of Guelph Water Services Division.



SS-300
CITY OF GUELPH
STANDARD SPECIFICATIONS
FOR
TRAFFIC-RELATED ITEMS
2020

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Section 1 Pavement Marking

1.1 General

This specification covers the requirements for the supply and application of pavement marking. All markings shall conform with the Ontario Traffic Manual Book 11 - Pavement, Hazard, and Delineation Markings and OPSS 710 Construction Specifications for Pavement Markings unless otherwise directed.

1.2 Quality

1.2.1 Quality of Pavement Marking

All organic solvent based traffic paint supplied by the Contractor shall meet the specifications outlined in Ontario Provincial Standard Specification 1712, as amended.

All field reacted polymeric pavement marking materials supplied by the Contractor shall meet the specifications outlined in Ontario Provincial Standard Specification 1714, as amended.

All water-borne traffic paint supplied by the Contractor shall meet the specifications outlined in Ontario Provincial Standard Specification 1716, as amended.

All thermoplastic pavement marking materials supplied by the Contractor shall meet the specifications outlined in Ontario Provincial Standard Specification 1713, as amended.

The Contractor shall be required to provide the Corporation with the following concerning the paint, field reacted polymeric pavement marking and thermoplastic pavement marking materials proposed for use prior to the commencement of work:

- Name of Manufacturer
- (b) Manufacturers product code number
- (c) A material sample and batch number shall be acquired at the Corporation's discretion at any time during the application.

Only traffic paint, field reacted polymeric pavement marking and thermoplastic pavement marking materials from manufacturers who have been approved by the Ministry of Transportation of Ontario and are listed on the Designated Sources of Material List shall be acceptable.

In the event that any of the paint, field reacted polymeric pavement marking or thermoplastic pavement marking materials used fails to meet the specifications, the

Contractor shall be liable for the total cost to remark those sections of roads where the substandard marking was applied.

1.2.2 Quality of Glass Beads

All reflectorized glass beads supplied by the Contractor under this Contract shall meet the specifications outlined in Ontario Provincial Standard Specification 1750, as amended.

The Contractor shall be required to provide the Corporation with the following concerning the glass beads proposed for use prior to the commencement of work:

- Name of Manufacturer
- (b) Manufacturers product code number
- (c) A material sample and batch number shall be acquired at the Corporation's discretion at any time during the application.

Only glass beads from manufacturers who have been approved by the Ministry of Transportation of Ontario and are listed on the Designated Sources of Material List shall be acceptable.

In the event that any of the glass beads used fails to meet the specifications, the Contractor shall be liable for the total cost to repaint those sections of roads where the substandard glass beads were applied.

1.3 Applications

1.3.1 Application of Pavement Marking

The Contractor is advised that all line painting requires two applications of paint. The Contractor should prepare their bid price accordingly.

Wet paint film thickness shall range from 0.35 mm to 0.40 mm. Dry paint film thickness shall range from 0.25 mm to 0.30 mm.

The width of all markings shall be as outlined in Ontario Traffic Manual Book 11, Pavement, Hazard and Delineation Markings. All stopbars are to be marked with a width of 45 cm. Where a double line is applied the space between the two lines shall be approximately 10 cm.

No thinners shall be mixed with the paint without specific approval of the Engineer.

Marking that require multiple passes to achieve the required width such as stop bars shall be capped/finished evenly at the centerline. Other markings such as railway crossing X's shall be capped/finished evenly at all ends of the markings.

Actual marking and spacing shall be in accordance with the Contract Drawings.

1.3.2 Application of Glass Beads

The rate of bead application for organic solvent based paint is to be 0.7 kg per litre of paint applied.

The rate of bead application for water borne paint is to be 0.8 kg per litre of paint applied.

Glass beads shall be applied in such a manner as to provide full coverage and good embedment over the entire width and length of the marking.

Glass beads shall be applied to uniformly cover the surface of the marking so that it shows the same colour and shape at night as it does during the day. Any markings improperly reflectorized shall be repainted at the Contractor's expense.

The Contractor shall supply and apply "drop on" glass beads for all markings, except parking stall markings, for work performed.

1.3.3 Application of Longitudinal Pavement Markings

The paint and glass beads shall be applied with a self-propelled lane line marking machine. The unit shall be capable of producing top quality marking with true edges free from waviness or variations. The unit shall have positive skip line mechanisms capable of variability of both line and skip distances. It shall spray at the full force required as soon as it is turned on and shall remain at a constant pressure to produce a uniform shade, free of variation.

Glass beads shall be applied by air propulsion and applied immediately on top of the painted line after application. The painted line must be totally and evenly covered with beads.

The lane line unit shall be equipped with at least three (3) paint guns (two on left side rigger and one at right side rigger for edge lines), two outboard riggers (for left and right side painting), bead bins and a pressurized glass bead system with dispensers to apply the reflective glass beads.

The lane line unit and cone truck shall be equipped with a full complement of lights for safety and night-time operation as per Ontario Traffic Manual Book 7 – Temporary Conditions.

The minimum number of vehicles required for all longitudinal paint application functions shall be a self-propelled pavement marking unit, and one "follow" truck to act as a safety warning vehicle. There shall at all times be a "follow" truck behind the line striping machine during pavement marking operations.

1.3.4 Application of Directional Arrows

Size and shape shall be in accordance with that used by the City of Guelph. No arrow shall be painted until specific instructions are received from the Engineer.

The Contractor shall be responsible for the stencil used to paint the arrows.

The Contractor shall ensure that the paint or field reacted polymeric marking material on each arrow is applied at the correct thickness in a uniform manner.

1.3.5 Application of Bicycle Markings

Bicycle markings include bicycle symbols, diamond symbols for reserved lanes and sharrow symbols. Size and shape of the symbols shall be in accordance with that used by the City of Guelph. No bicycle marking shall be painted until specific instructions are received from the Engineer. The Contractor shall be responsible for the stencil used to bicycle markings.

The Contractor shall ensure that the paint or field reacted polymeric marking material on each bicycle marking is applied at the correct thickness in a uniform manner.

1.3.6 Transverse Marking Application Equipment

The unit used to apply transverse marking shall meet or exceed the following specifications:

- Be relatively light, portable, fully self-contained and stand on a minimum of three (3) tires.
- Be capable of producing top quality marking with true edges free from waviness or variations from 76 mm to 150 mm wide.
- Be capable of simultaneous application of "drop-on" reflective glass beads (hand gun excluded).
- Have a minimum paint capacity of twenty-three (23) litres and a minimum bead capacity of 22.5 kg.
- Paint delivery to surface by means of a pneumatic system through a spray gun nozzle.
- Have hand gun attachment with a minimum of three (3) metres of the

appropriate hose(s).

1.3.7 Surface Preparation

The surface on which the pavement markings are to be placed shall be clean and dry. Pavement markings shall not be applied in damp conditions or if there is any evidence of surface moisture on the pavement, unless directed by the Engineer.

1.3.8 Weather Limitations

No markings shall be done when the temperature is below 10 degrees Celsius in the shade, nor during rainfall or fog, or until the pavement is perfectly dry. No markings shall be done if, in the opinion of the Engineer, the conditions are not conducive to top quality result.

1.4 Quality Assurance

The Engineer may perform random sampling at any time during paint application to assess line quality and to ensure adherence to specifications.

Line width, paint thickness, quality of edges, and uniformity in appearance will be assessed by the Engineer.

Glass bead distribution will be inspected for evenness in distribution, degree of embedment and retro reflectance.

Any marking improperly reflectorized shall be repainted at the Contractor's expense.

Retro reflectance values for newly applied pavement markings shall be taken in accordance to specifications as outlined in ASTM D6359-99.

1.5 Protection Of Work

The Contractor shall at all times ensure that the work zone and all freshly painted lines are suitably protected by conforming to the requirements outline in the Ontario Traffic Manual – Book 7 Temporary Conditions. This protection shall be left in place until the paint is dry and will not track and must be picked up by the Contractor within one half hour after the paint is dry.

All painting shall be performed in the same direction as the flow of traffic. No painting whatsoever shall be performed against the flow of traffic. Tracking of newly applied paint shall be removed by the Contractor at the Contractor's expense.

1.6 Temporary Markings

All temporary marking required in order to implement the Contractor's construction sequence shall be included in the Traffic Control item.

Temporary pavement markings must be maintained to be visible and reflective until the surface asphalt or permanent markings are placed. The Contractor is responsible to maintain temporary pavement markings at the Contractor's expense.

1.7 Pre-Marking

All labour, materials and equipment necessary for the layout and pre-marking of City roads shall be supplied by the Contractor. Pre-marking shall be required for all markings prior to painting. The Contractor shall obtain approval, from the Engineer, of the detour line markings and signing layout one week prior to commencing the work. All layout and painting shall conform to the latest issue of the Ontario Traffic Manual Book 11, Pavement, Hazard and Delineation Markings or as directed by the Engineer.

1.8 Clean-Up

The Contractor shall be responsible for the immediate cleaning up of the road allowance of all dirt, debris, excess paint and beads, empty bead bags and any other rubbish generated from the operation. In the event that the Contractor is required to clean or repair equipment which may involve the expulsion of paint not used for line painting the Contractor shall collect this paint in a plastic containing device and dispose of the paint in a proper manner. At no time is this paint to be disposed of in a catch basin, sewer or buried.

1.9 Records

It shall be the responsibility of the Contractor to keep accurate records of the quantities of paint and beads applied as well as the number of hours that were required for pre-marking. Records of day to day work shall be forwarded to the Corporation on a daily basis and must include the following information:

- (a) Application of Paint and Beads
 - (i) Specific location of where work was performed.
 - (ii) Number of litres of paint applied (white and yellow listed separately).
 - (iii) Quantity of glass beads supplied and applied.
 - (iv) Number of directional arrow painted (left and right arrows listed separately).
- (b) Premarking
 - (i) Number of hours of pre-marking

The daily records must be prepared in triplicate. Two (2) copies shall be supplied to the Corporation and one (1) copy retained by the Contractor. These records will be the only means used to determine the remuneration of which the Contractor is entitled.

1.10 Inspector And Inspector's Powers

All work shall be done to the satisfaction of the Engineer. Inspectors are required to be present at all times that the Contractor is working, to see that the provisions of the specifications are adhered to, especially with regard to quality of workmanship and materials and establishing quantities or paint used or the number of hours required to layout and pre-mark to their satisfaction.

1.11 Changes, Errors Or Omissions

Changes, errors or poor workmanship in pavement marking made by the Contractor, their agents, workmen or employees, either through carelessness or otherwise must be removed and corrected by the Contractor at their expense, within two (2) days of the error being made, or of the Contractor being advised of the error by the Engineer.

1.12 Payment

1.12.1 Painted Pavement Markings

The unit price bid identified in the schedule of unit prices shall be full compensation for the supply of all labour, equipment and material for the installation of two coats of painted pavement markings on the asphalt as shown on the contract drawings. Payment for painted pavement markings shall only be made for pavement markings installed in the final locations excluding gaps as shown on the contract drawings.

1.12.2 Field Reacted Polymeric Pavement Marking Materials

The unit price bid identified in the schedule of unit prices shall be full compensation for the supply of all labour, equipment and material for the installation of field reacted polymeric pavement marking materials as shown on the contract drawings. Payment for field reacted polymeric pavement markings shall only be made for pavement markings installed in the final locations excluding gaps as shown on the contract drawings.

1.12.3 Thermoplastic Pavement Marking Materials

The Contract **unit** price listed in the Form of Tender **bid identified in the schedule of unit prices** shall be full compensation for the supply of all labour, equipment and material for the installation of thermoplastic pavement marking materials as shown

on the contract drawings. Payment for thermoplastic pavement markings shall only be made for pavement markings installed in the final locations excluding gaps as shown on the contract drawings.

1.13 Pavement Marking Removal

This item shall consist of removing existing pavement markings from paved areas designated on the contract drawings or as required by the Engineer.

At no time shall black paint be used as an acceptable form of pavement marking removal.

The depth of removal shall be the minimum required to totally remove the existing pavement markings, to a normal depth, typically 3 mm. It is understood that the pavement marking removal process will leave some scarring. It is incumbent upon the Contractor to mitigate the degree of damage and scarring to the pavement.

If excessive damage results from the pavement marking removal operation, the Contractor shall repair, at their expense, said damage to the pavement, surface texture, sealant or appurtenances caused by the removal work by methods acceptable to the Engineer. The Contractor shall control the operation so that asphalt pavement is not damaged in any way to ensure that no pavement marking remains visible upon completion.

The unit price bid identified in the schedule of unit prices shall be full compensation for the supply of all labour, equipment and material for the removal of pavement markings as shown on the contract drawings.

Section 2 - Traffic Control Signs

2.1 General

The contractor shall reference this document and the Ontario Provisional Standard Specifications listed below to supply and install traffic control signs:

OPSS.2001 - Material Specifications for Metal Sign Blanks (June 1995)

The Contractor shall supply and install all traffic control signs shown on the contract drawings in accordance to the Ontario Traffic Manual, unless directed otherwise by City of Guelph staff. The Contractor shall return all surplus signs to the City of Guelph as directed by the Engineer.

2.2 Removal or Salvage of Traffic Control Signs

2.2.1 Removal of Traffic Control or Other Signs

The Contractor shall be responsible to remove traffic control or other signs as specified in the contract. The signs and associated posts, bases, and hardware will be removed and disposed of by the Contractor.

2.2.2 Salvage of Traffic Control or Other Signs

The Contractor shall be responsible to salvage signs as specified in the contract. The signs, posts, bases, and hardware shall be removed, disassembled and returned to the Operations Yard – 45 Municipal Street; in the same condition they were prior to the commencement of the project.

All signs must be removed from the posts prior to the removal of the posts and base. Care should be taken to prevent damage to any of the reflective sheeting. Any signs, posts, or bases damaged during removal or transportation will be replaced at the expense of the Contractor.

2.2.3 Salvage and Re-installation of Traffic Control or Other Signs

The Contractor shall be responsible to salvage and store traffic control signs or other signs to be re-installed by the contractor as specified in the contract. The Contractor shall remove the sign prior to removal of the post and base. The post and bases shall be returned to City of Guelph Operations Yard – 45 Municipal Street unless otherwise specified. Care should be taken to prevent damage to any of the reflective sheeting during storage.

Any signs, posts, or bases damaged during removal, storage, or transportation will be replaced at the expense of the Contractor.

2.3 Sign Position

The mounting height, offset and location shall be in accordance with the Ontario Traffic Manual Book 1, Appendix B "Sign Design Principles". Figure 5 is amended by amending the Stop Sign (Ra-1) installation height from 1.5-2.5m to 2.0m, unless otherwise directed by the Engineer. Ontario Traffic Manual Book 5, "Regulatory Signs" Figure 9 indicates sign positioning for Island Marker (Rb-25) and object marker (Wa-33) signs.

The Contractor shall leave 75mm of Telespar® post left exposed above the Ra-1, unless otherwise directed by the Engineer.

2.4 Sign Specifications

2.4.1 Retro-Reflective Sheeting

All traffic control signs must be retro-reflective to show the same colour, shape and message at night as they appear in daytime. All traffic control signs shall be fabricated using enclosed lens, encapsulated lens, or prismatic lens signs material in accordance to the American Society for Testing and Materials (ASTM) D4956 Standard Specification for Retro-reflective Sheeting for Traffic Control.

2.4.2 Sign Colour

All colours on traffic control signs must conform to the American Society for Testing and Materials (ASTM) D4956 Standard Specification for Retro-reflective Sheeting for Traffic Control.

2.4.3 Aluminum Substrate

All traffic control signs shall be fabricated using sheet aluminum. Sheet aluminum shall be nominal thickness of 2mm (0.082") flat sheet tension leveled, sign grade aluminum alloy 5052-H38, conforming to the requirements of ASTM B209M, Specification for Aluminum and Aluminum – Alloy Sheet and Plate.

The dimensions of the sign blank shall be within 1.5+/- mm of those specified and the finished sign shall be flat within the maximum allowable deflection of 0.005(D) where (D) is the maximum dimension of the sign blank in any direction. The manufacturer shall provide traffic control signs conforming in quality and accuracy of detail to the dimensional and tolerance requirements of the specifications. Where no tolerances are specified, the standard of workmanship shall be in accordance with normally accepted good practice.

Bolt and rivet holes shall conform in size, location and spacing to the dimension shown on SD-301.

2.4.4 Screening Ink

Ink used for silk screening must be designed for use on highways signs and recommended by the sheeting manufacturer. Inks shall be warranted effective for a period of time commensurate with warranted life of retro-reflective sheeting.

2.4.5 Manufacturer's Identification

All traffic control signs shall be clearly and permanently labeled (using durable, weather resistant material) or engraved with an identification coding. The coding

shall appear in characters 6-10mm high on the lower right back of the sign and shall be carried out in such a manner that the front face of the sign is not damaged. The manufacturer shall include the following information on the label:

Manufacturer's name

Month and year of manufacture

Brand of sheeting material

2.4.6 Sign Finish Quality

Traffic control sign sheeting material shall be correctly applied in accordance to the sheeting manufacturer's recommendations and industry accepted quality practices. The sheeting material must be applied so that it does not contain air pockets and the sheeting shall not have holes, tears, scrapes, compressed cells or patches. Any joints must be sealed in accordance to the sheeting manufacturer's recommendations. The sign fabricator must ensure the signs are adequately protected from damage during shipping.

Edges of all substrate material shall be de-burred to provide a smooth finished edge.

2.5 Mounting Posts

All traffic control signs shall be mounted on Telespar® galvanized tubing or approved alternate, except where co-usage of existing utility or traffic poles is possible.

The Telespar® anchor assembly shall be installed as per SD-305 Detail 'A'.

Traffic control signs mounted on Telespar® galvanized tubing or approved alternate shall be installed as per SD-305 Detail 'C'

Traffic control signs attached to utility poles shall be installed as per SD-306.

2.6 Payment

Payment as per the units in the Form of Tender for the installation of traffic control signs shall be full compensation for all labour, equipment and materials required to complete the work as specified.

Section 3 - Traffic Control Signals

The contractor shall reference this document, tables and the Ontario Provisional Standard Specifications as listed below to construct a traffic signal system. The Contract shall include the latest (most recent) edition of the Specification unless otherwise noted:

OPSS.MUNI 106 – General Specification for Electrical Work

OPSS 602 – Construction Specification for Installation of Electrical Chambers

OPSS 603 – Construction Specification for Installation of Ducts

OPSS 604 – Construction Specification for Installation of Cable

OPSS 609 – Construction Specification for Installation of Grounding

OPSS 610 – Construction Specification for Removal of Electrical Equipment and Materials

OPSS 614 – Construction Specification for Installation of Power Supply Equipment

OPSS 615 – Construction Specification for Erection of Poles

OPSS 616 – Construction Specification for Footings and Pads for Electrical Equipment

OPSS 617 – Construction Specification for Installation of Roadway Luminaires

OPSS 620 – Construction Specification for Traffic Signal Equipment and Electrical Traffic Control Devices

OPSS 624 – Construction Specification for Traffic Signal Interconnection Equipment

3.1 List Of Tables

A – Traffic Signal Installation – Approved Material List

B – Traffic Signal Installation Checklist

C – Traffic Signal Activation Policy

D – Contractor Traffic Signal Service Standard & Response Time

E – Contractor's Traffic Signal Equipment Return Checklist

3.2 Field Layout

The Contractor shall complete the installation of the traffic control signal as indicated on the Contract Drawing(s). The exact location of the traffic control signal plant including but not limited to:

- Pole base(s)
- Handwell(s)
- Traffic signal controller cabinet(s)
- Convenience ramp(s)
- Vehicle loop detector(s)
- Overhead vehicle/cyclist detector(s)
- Pedestrian and vehicle signal head(s)
- Pedestrian push button(s)
- Handhole direction(s)

Must be approved by City of Guelph – Traffic Signals staff prior to installation. Pole base layout will occur only when final grade, curb and sidewalk locations have been confirmed.

Any deviation from the Contract Drawing(s) must receive written approval from City of Guelph - Traffic Signals staff prior to any work commencing in the field.

Any traffic signal equipment installed which does not conform to SS-300 Sections 1-15 or SD 201-225 and SD 301-312 shall be replaced at full cost to the contractor.

The Contractor shall keep one set of traffic signal plan drawings on site solely for record keeping purposes. The Contractor shall record any deviations on the drawings as the work is performed. Deviations shall include changes, additions and deletions to the traffic signal plant. No additional payments will be made to the Contractor to provide these drawings.

3.3 Requirement of Police Officer for Traffic Control

The Contractor shall be required to provide continual, safe and legal operation of the traffic signals. In the event a traffic signal is required to be temporarily de-activated or placed into "flash" mode, the Contractor shall hire a City of Guelph police officer to direct traffic movements until the traffic signal is operating as desired. Traffic Signal staff must be notified in writing 24 hours prior to any signal be de-activated or placed into flash.

At no time shall anyone other than a police officer control the movements of traffic and pedestrians at a traffic signal.

3.4 Materials Provided By The Corporation

The City of Guelph will be the provider of the following materials:

- Traffic Signal Controller Cabinet(s)
- Radar/Video Detection Equipment

- Wireless Communication Equipment
- Accessible Pedestrian Push Buttons

Unless otherwise indicated in the Contract, the Contractor will be the supplier of all other materials required for the construction of a traffic control signal. Approved materials are noted in Table A "Traffic Signal Installation - Approved Material List".

3.5 Emergency Maintenance

Notwithstanding the Ownership of this equipment while in service, the Contractor shall respond as outlined Table D "Contractor Traffic Signal Service Standard and Response Time" to address any traffic signal deficiency.

The Corporation reserves the right to perform, or have performed, any emergency maintenance deemed required by any appropriate authority at the expense of the Contractor in the event of deficiency or malfunction.

3.6 Inspections

Throughout the project milestone inspections will be completed by City of Guelph Traffic Signals staff at key intervals listed below. It is the Contractor's responsibility to inform Traffic Signals staff a minimum of two (2) working days' notice in advance of work being completed that requires inspection.

1. Installation of conduit, prior to backfilling.
2. Installation of ground plates, prior to backfilling.
3. Pole foundations, prior to pouring concrete.
4. Cabinet or other pedestal pads with enclosed conduit, prior to pouring concrete.
5. Poles and mast arms, prior to installing wire.
6. Turn on (as per Traffic Signal Activation Policy), prior to turn on.

The contractor must submit a copy of Table "B" Traffic Signal Installation Checklist (pages 5 to 8) completed by the contractor at the time of requesting a final inspection.

Section 4 - Temporary Traffic Control Signals

4.1. General

In addition to the requirements of the OPSS outlined in Section 3, the following shall apply for the Corporation when installing a temporary traffic control signal.

4.2 Materials

The Contractor shall supply all material not identified in Section 3 to complete the installation. This will include but not be limited to poles, guys, anchors, aerial spans, junction boxes, conduit risers, span hangers, mast arms, signal heads, pedestrian heads, associated hardware and other aerial equipment. At no time will the Corporation provide any of the previously listed materials and equipment.

All material supplied, in accordance with this specification, will remain the property of the Contractor. City of Guelph – Traffic Signals staff reserves the right to reject used equipment deemed not suitable.

All signal heads used on a temporary traffic control signal shall have reflective backboards and approved LED displays.

4.3 Construction

The Contractor shall be responsible for the continual operation of the existing traffic signals within the Contract limits until such time temporary traffic signals are approved for activation.

Activation of the temporary traffic signal will not be approved until Table B "Traffic Signal Installation Checklist" is completed and all outstanding items have been addressed and noting Table C "Traffic Signal Activation Policy".

Wood poles shall be installed as shown on the Contract Drawing(s) and as confirmed by City of Guelph – Traffic Signals staff.

The Contractor shall use a messenger span of suitable gauge to support attached electrical conductors. The supply, installation and attachment of electrical conductors to the guy span, including suitable traffic signal cable, ground cable, power service cable and any other cables deemed necessary by the Engineer shall be as per OPSS 604.07.12.

The Contractor shall place as directed, portable temporary traffic signals to replace existing equipment deemed by the Engineer.

For the purpose of bidding, it shall be assumed that each temporary signal head installed on guy wires and any traffic or pedestrian signal head on a temporary stand shall be relocated twice, during the course of construction. A minimum of 4 metres of conductor cable is to be coiled at the signal head for relocation purposes.

The Contractor shall be required to remove the temporary signal installation upon completion of construction.

4.4 Payment

The lump sum bid price for this item shall be full compensation for all labour, material, equipment required to install, maintain and remove temporary traffic control signals.

Section 5 – Installation Of Handwells

5.1 General

In addition to the requirements of OPSS 602 "Construction Specification for Installation of Electrical Chambers", the following shall apply for the Corporation:

5.2 Materials

The Contractor shall supply all handwells as indicated in Table A "Traffic Signal Installation - Approved Material List".

5.3 Construction

The Contractor shall install each handwell as indicated on the Contract Drawing(s) or as directed by the Engineer so it is flush with the surrounding finished grade. Handwells shall be installed a minimum 0.5 metres from the nearest edge of sidewalk, unless otherwise directed by the Engineer.

The Contractor shall install all handwells as indicated in SD-209.

Any handwell damaged during the construction of the traffic signal system shall be replaced by the Contractor at no expense to the Corporation.

5.3.1 Verification of Existing Handwells

The Contractor may be required by the Engineer to investigate the location and verify the condition of existing handwells.

Any handwells that have been found below grade shall be temporarily protected from damage until remedial action is directed by the Engineer.

5.4 Payment

The unit price noted in the Form of Tender shall be paid as full compensation for all labour, equipment and material for the installation of handwells.

Section 6 – Installation Of Ducts

6.1 General

In addition to the requirements of OPSS 603 "Construction Specifications for the Installation of Ducts", the following shall apply for the Corporation:

6.2 Materials

The Contractor shall supply all ducts as indicated in Table A "Traffic Signal Installation – Approved Material List".

All ducts shall be rigid polyvinyl chloride conforming to CSA standard C22.2 No. 211.2, except where otherwise indicated. All couplings and bends shall also conform to the same standard as straight rigid ducts.

6.3 Construction

Ducts shall be installed as indicated on the Contract Drawing(s) unless otherwise indicated by the Engineer.

Duct installations are to be direct buried, unless otherwise indicated.

All underground ducts shall be installed with a desirable cover of 1000mm and an absolute minimum cover of 900mm. Roxol shall be inserted into the conduits prior to the application of expanding foam. Marker tape shall be placed above each duct trench as indicated by OPSS 603.05.09.

The Contractor shall install sufficient ducts of a suitable diameter on all wooden or concrete utility poles as to ensure the adequate protection of conductors.

All duct joints shall be made with the use of manufacturer approved couplings which permit a smooth joint between ducts. All joints shall be made waterproof by means of couplers and sealants. Ducts shall be brought into handwells at right angles to the walls of the handwell.

All ducts shall be verified to ensure they are free of debris, water, breakage or distortion under the supervision of the Engineer. Any ducts failing this test shall be repaired by the Contractor at no expense to the Corporation.

The terminations of all empty ducts shall be plugged with plastic plugs only.

All ducts shall be installed with a mule tape as indicated in Table A "Traffic Signal Installation – Approved Material List".

All backfilling shall be as outlined in SS-26 of this document.

6.3.1 Verification of Existing Duct

The Contractor may be required by the Engineer to investigate the location and verify the condition of any underground traffic signal plant, including duct, power supply points and facilities.

A sketch indicating the location, type, condition and content of any such plant shall be supplied by the Contractor to the satisfaction of the Engineer.

6.3.2 Repair of Underground Duct

The Contractor may be required to repair existing underground conduit found damaged.

The Contractor shall be required to identify the locations of these breaks and repair. The Contractor shall remove approximately one cubic metre of earth, remove all wire within the conduit, cut the pipe beyond the damaged portion, install couplings, replace wire and backfill/reinstate. Conduit joints shall be made with the use of manufacturer approved couplings which will permit a smooth joint between conduits. All joints shall be made waterproof by means of couplers and sealants.

All ducts used to replace damaged sections of ducts must be the same size as the existing ducts.

Where repairs are deemed necessary under the travelled portion of the road, they shall be carried out as per this section, with consideration being given to additional traffic control and road restoration.

6.4 Payment

The unit price noted in the Form of Tender shall be paid as full compensation for all labour, equipment and material for the installation of ducts.

Payment for items 6.3.1 and 6.3.2 shall be on a time and material basis.

Section 7 – Installation Of Traffic Signal Cable

7.1 General

In addition to the requirements of OPSS 604 "Construction Specification for Installation of Cable", the following shall apply for the Corporation:

7.2 Materials

The Contractor shall supply all wiring as indicated in Table A "Traffic Signal Installation – Approved Material List" and in the Contract Drawing(s) or as directed by the Engineer.

7.3 Construction

All wiring connections shall be completed as indicated in City of Guelph Standard Drawing SD-210 "Standard Typical Traffic Signal Wiring Details".

All wiring connections shall be twisted tight prior to applying an approved twist-on pressure connection.

All signal field terminations shall be clearly tagged by the Contractor with plastic marker plates and labelled with a permanent black marking pen. These tags will be securely tie wrapped to the cables and clearly labelled.

Traffic signal cables shall be identified with blue and red phasing tape as indicated in the Contract Drawing(s).

7.4 Payment

The lump sum price noted in the Form of Tender shall be paid as full compensation for all labour, equipment and material for the installation of traffic signal cable.

Cable required to connect the underground cable system to the pole mounted equipment (riser cable) shall be included in the price bid for the equipment.

Power service cables shall be paid as outlined in Section 10.4.

Section 8 – Installation Of Grounding

8.1 General

In addition to the requirements of OPSS 609 "Construction Specification for Installation of Grounding", the following shall apply for the Corporation:

8.2 Materials

The Contractor shall supply all grounding as indicated in Table A "Traffic Signal Installation – Approved Material List" and in the Contract Drawing(s) or as directed by the Engineer.

8.3 Construction

The Contractor shall install a ground rod or ground plate on each corner of the intersection, adjacent to the handwell, each of which will be connected to the field grounding system.

An RWU-90 green ground wire shall be connected to these ground rods or plates with a KA26 connection.

8.4 Payment

The unit price noted in the Form of Tender shall be paid as full compensation for all labour, equipment and material for the installation of grounding. The unit price bid will be paid for each ground rod or ground plate connected.

Section 9 – Removal Of Electrical Equipment

9.1 General

In addition to the requirements of OPSS 610 "Construction Specification for the Removal of Electrical Equipment and Materials", the following shall apply for the Corporation:

9.2 Materials

Materials shall be removed in a safe manner, ensuring not to endanger any member of the crew or public.

9.3 Construction

A representative of the Contractor and City of Guelph - Traffic Signal staff will complete Table E – "Contractor's Traffic Signal Equipment Return Checklist" prior to the removal of any electrical equipment. All equipment deemed salvageable shall be disassembled and delivered to the Operations Yard – 45 Municipal Street, where it shall be placed as directed by the Engineer.

All salvageable equipment shall be tagged or otherwise marked, indicating the date and location of removal and shall be complete with any mounting hardware included.

Removal of electrical equipment shall be completed in the following manner:

Traffic Signal Pole – Remove all traffic signal and pedestrian heads, mast arms, mast arm brackets, signs, pedestrian push buttons and any other attachments prior to the removal of the pole from the foundation.

Handwells – Remove handwells as indicated on the Contract Drawing(s). This may include the complete removal of the handwell or the removal of the ring and cover prior to backfilling the structure.

Pole Footings (Complete Removal) – Completely remove and dispose of concrete pole footings as directed by the Engineer.

Pole Footings (Partial Removal) – Partially remove the pole footing to a minimum of 0.3 metres from finished grade as directed by the Engineer.

Traffic Signal Controller – Remove the traffic signal controller at the direction of the Engineer.

Concrete Mounting Pads – Completely remove and dispose of the concrete mounting pad for traffic signal controllers as directed by the Engineer.

Power Supply Equipment – Remove and dispose of all power supply equipment, including riser ducts and junction boxes as directed by the Engineer.

9.4 Payment

The Contractor shall be responsible to supply all labour, equipment and material required to completely remove all traffic signal equipment. Payment for this item will be at the lump sum price as specified in the Form of Tender and shall include disposal of all unsalvageable material or equipment, delivery of reusable equipment to the Operations Yard and site restoration.

Section 10 – Installation Of Power Supply Equipment

10.1 General

In addition to the requirements of OPSS 614 "Construction Specification for the Removal of Power Supply Equipment", the following shall apply for the Corporation:

10.2 Materials

The Contractor shall be required to supply all equipment and material required to ready the installation for connection to Guelph Hydro facilities as per SD-221 and SD-221a.

The cable from the point of supply to the controller cabinet shall be:

1 x #8 1 x #8 RWU90 Black

1 x #8 RWU90 White

1 x #6 RWU90 Green

An additional #6 RWU90 Green cable shall be installed from the point of supply to the nearest handwell, bypassing the controller cabinet. The cable shall conform to all applicable ESA standards.

10.3 Construction

The Contractor shall install a pole mounted combination panel or combination panel within an enclosed pedestal as indicated on the Contract Drawing(s).

At locations with decorative street lighting, a photoelectric controller shall be installed as per OPSS 614.07.06 and as indicated in the Contract Drawing(s).

It is the responsibility of the Contractor to make arrangements with the Engineer and Guelph Hydro representative at least one (1) week prior to installing any services to existing Guelph Hydro plant.

10.3.1 ESA Inspection

The Contractor shall be required to make arrangements for inspection by the Electrical Safety Authority (ESA) prior to the signals being energized. Any cost associated with this inspection shall be the responsibility of the Contractor.

The Contractor shall ensure the ESA Final Acceptance Certificate is forwarded to Guelph Hydro and the City of Guelph – Traffic Signals staff.

10.4 Payment

The unit price noted in the form of Tender shall be paid as full compensation for all labour, equipment and material, including power service cable for the installation of power supply equipment. The bid price shall include all labour equipment and material required to install, connect, splice and otherwise complete the electrical requirements of the Contract.

Quantities for all other multi-conductor cable shall be calculated from conduit quantities installed and measured in the field.

Section 11 – Installation Of Traffic Signal Poles

11.1 General

In addition to the requirements of OPSS 615 “Construction Specification for Pole Erection”, the following shall apply for the Corporation:

11.2 Materials

The Contractor shall supply sectional steel traffic signal poles and accessories as indicated in Table A “Traffic Signal Installation – Approved Material List”.

11.3 Construction

All poles shall be installed as specified on City of Guelph Standard Drawing SD-213, SD-213a, SD-213b, SD-214, SD-214a or SD-215 "Typical Traffic Signal Pole". Where poles are perforated or cut for any reason they shall be treated with a zinc rich compound and fitted with rubber grommets.

For sectional steel poles 5.64 metres or more in assembled height, three self-tapping or impact inserted pins shall be put in the overlap of all sections below the signal bracket so they are spaced equally around the pole.

Taping of joints as instructed. Sample of taping method available for review upon request prior to pre-turn on inspection.

11.4 Payment

The Contractor shall be responsible to supply all labour, equipment and material required to install the traffic signal poles. Payment for this item will be at the unit price as specified in the Form of Tender.

Section 12 – Footings & Pads For Electrical Equipment

12.1 General

In addition to the requirements of OPSS 616 "Construction Specification for Footings and Pads for Electrical Equipment", the following shall apply for the Corporation:

12.2 Materials

The Contractor shall supply a cylindrical Sonotube concrete footing complete with anchor bolts and nuts required for base mounting of pole, type and size as indicated on the Contract Drawing(s), or as directed by the Engineer.

The Contractor shall supply and install rigid PVC conduit in all pole bases as per City of Guelph Standard Drawing SD-201, SD-201a, SD-201b, SD-201c and/or SD-204.

12.3 Construction

12.3.1 Installation of Pole Footings

The Contractor shall install all material and labour necessary to undertake the excavation, forming and placing of concrete, backfilling to the top of the proposed sub-grade elevation, and compacting to 95% Standard Proctor, acceptable on-site material.

The top of the concrete footing shall be established at grade level and shall be determined and checked by the Engineer prior to pouring. The footing shall be level to ensure the pole remains level. The Contractor shall remove all excess material from the concrete form after the pole footing has cured.

Bidders are advised that efforts will be made to locate footings as far away from existing utilities as possible; however, the Contractor may be required to locate these footings immediately adjacent to utilities. No additional compensation shall be paid for exposing these utilities or for employing less efficient methods or excavation including hand digging.

All anchors shall be placed at right angles to the curb lines of the intersecting streets.

12.3.2 Installation of Traffic Signal Controller Pad

The Contractor shall install a concrete traffic signal controller pad of 25MPa Ready Mix concrete complete with ground rods or ground plates. The Contractor shall remove all excess material from the concrete controller pad after the pad has cured.

The Contractor shall be responsible to supply and install the cabinet anchor bolts in the base so they are compatible with the proposed traffic signal controller.

The location of the traffic signal controller shall be marked out in the field by City of Guelph – Traffic Signal staff.

12.4 Payment

The Contractor shall be responsible to supply all labour, equipment and materials required to install the traffic signal pole and traffic signal controller pad. Payment for this item will be at the unit price as specified in the Form of Tender.

Section 13 – Installation Of Roadway Lighting

13.1 General

In addition to the requirements of OPSS 617 "Construction Specification for Installation of Roadway Luminaires", the following shall apply for the Corporation:

13.2 Materials

The Contractor shall be supplied roadway lighting by Guelph Hydro as indicated on the Contract Drawing(s) or as directed by the Engineer.

13.3 Construction

The Contractor shall install roadway lighting as indicated on the Contract Drawing(s), Guelph Hydro standard or as directed by the Engineer.

The Contractor shall ensure all roadway lighting is functioning as required by Guelph Hydro.

13.4 Payment

The Contractor shall be responsible to supply all labour, equipment and materials required to install roadway lighting. Payment for this item will be at the unit price as specified in the Form of Tender.

Section 14 – Installation Of Traffic Signal Equipment

14.1 General

In addition to the requirement of OPSS 620 "Construction Specification for Traffic Signal Equipment and Electrical Traffic Control Devices", the following shall apply for the Corporation:

14.2 Materials

14.2.1 Traffic Signal Mast Arms & Signal Heads

The Contractor shall supply single member mast arms, including double bracket attachments and all necessary plate and U-Bolt clamps as outlined in SD 212, SD 217 and SD 219, as indicated in Table A "Traffic Signal Installation – Approved Material List".

The Contractor shall supply minimum 38mm x 300mm aluminum pipe brackets where signal heads are face or side mounted on a signal pole.

All mast arm mounting plates and back brackets shall be appropriate for the pole at the mounting point, such that proper fit and alignment are achieved.

All mast arms shall be manufactured such that the signal head attachment fitting is level when the arm is installed on a pole which is truly vertical and plumb.

Mast arm attachment bolts shall be a minimum 19mm in diameter medium carbon steel quenched and tempered in accordance with specification "SAE J429 – Grade 5", and be marked accordingly.

Under no circumstances shall threaded rod be considered acceptable as a fastening device for the installation of signal mast arms.

All steel equipment shall be hot dipped galvanized.

All hand hole bolts, pole plate bolts and pushbutton bolts shall be Anti - Seize.

Cushion hangers or plumbizer attachments are to be used only when directed by the Engineer.

14.2.2 Pedestrian Signal Attachments & Pedestrian Signal Heads

The Contractor shall supply all materials required for pedestrian arms as outlined within the Form of Tender in those locations as noted on the Contract Drawing.

These arms shall be a minimum 38mm x 460mm aluminium pipe brackets, complete with pole shoes and all other accessories required to complete the installation.

Where mast arms are drilled or cut for any reason, they shall be treated with a zinc rich compound and fitted with rubber grommets.

Upper and lower nuts in signal heads and pedestrian heads shall be Anti - Seize.

The location of the pedestrian mast arms will be determined in the field by City of Guelph – Traffic Signal staff to suit field conditions prior to installation.

14.2.3 Traffic Controller

The Contractor shall be provided the traffic controller by the Corporation. The Contractor shall supply all material required to attach the traffic controller to the mounting pad as indicated in SD-204.

14.2.4 Traffic Actuation Equipment

Pedestrian Push Buttons & Signs

The Contractor shall supply pedestrian push buttons as indicated in Table A – “Traffic Signal Installation – Approved Material List”.

Where Accessible Pedestrian Signals are installed, the City shall supply the accessible pedestrian push buttons, already programmed and clearly identified for installation location. The Contractor shall be responsible for the installation and wiring connections of the accessible pedestrian push buttons only.

The Contractor shall supply “Pedestrian Pushbutton symbol signs” (Ra-12) as outlined in Ontario Traffic Manual (OTM) Book 5 and “Pedestrian Information Sign” as outlined in SD-302, only where Accessible Pedestrian Signals are not installed.

Vehicle Loop & Run Wires

The Contractor shall supply vehicle loops and run wires as indicated in Table A – “Traffic Signal Installation – Approved Material List”.

All loops sealed at a temperature of less than 5°C shall be sealed with Chemque Q-Seal 290W only.

Radar/Video Detection

The Contractor shall be supplied the mounting hardware, wire and radar/video detection by the Corporation. The Contractor shall install the radar/video detectors as indicated on the Contract Drawing(s). The Contractor shall also be responsible for aiming/adjusting the detectors as required in conjunction with City of Guelph who will configure the detectors.

Fire Pre-Emption System

The Contractor shall supply the pre-emption head(s) as indicated in Table A – “Traffic Signal Installation – Approved Material List”.

14.3 Construction

14.3.1 Traffic Signal Mast Arms & Signal Heads

The Contractor shall install traffic signal mast arms and signal heads as indicated on the Contract Drawing(s).

Prior to activation, all signal heads shall be completely covered with an opaque material.

All signal heads shall provide a minimum clearance of 5.0 metres from the top of the final road surface to the bottom of the traffic signal backboard.

All mast arms are to be thoroughly tightened to reduce the likelihood of shifting due to wind conditions.

14.3.2 Pedestrian Signal Attachments & Pedestrian Signal Heads

The Contractor shall install pedestrian signal attachments and signal heads as indicated on the Contract Drawing(s).

Upper and

Prior to activation, all pedestrian heads shall be completely covered such that they do not face any existing roadway crossing.

14.3.3 Traffic Controller Cabinet

The Contractor shall be required to complete all documentation as per the City of Guelph "Traffic Signal Installation Checklist".

The Contractor will be responsible to pick up the traffic signal controller cabinet from the Public Works Department yard and deliver it to the site for installation. Testing and verifying the operation of this unit to the satisfaction of City of Guelph – Traffic Signal staff shall be the responsibility of the Contractor prior to field installation. The traffic signal timer, Malfunction Management Unit (MMU) and power supply will not be provided to the Contractor until the necessary power is available in the field for the operation of the controller cabinet.

The Contractor is responsible for comprehensive testing of the final connections and field wiring as well as the MMU. These tests shall be performed by the Contractor in the presence of the City of Guelph – Traffic Signal staff.

A City of Guelph Police Officer shall be present to control movements of traffic and pedestrians during the traffic signal activation. All costs and scheduling for this service is the responsibility of the Contractor.

The Contractor shall apply Foam Seal to the conduits entering the Traffic Controller Cabinet.

Activation of the traffic signal will not be approved until Table B "Traffic Signal Installation Checklist" is completed and all outstanding items have been addressed and noting Table C "Traffic Signal Activation Policy".

14.3.4 Traffic Actuation Equipment

Pedestrian Push Buttons & Signs

Each pedestrian push button shall be placed on the poles as indicated on the Contract Drawing and SD 212 or as directed by City of Guelph – Traffic Signal staff.

Vehicle Loop & Run Wires

Loops and run wires shall be installed by the Contractor in compliance with City of Guelph Standard Drawing SD-206 and OPSD 2520.01 "Loop Detector Installation Details" in the dimensions indicated on the Traffic Signal plan. In all cases, the Contractor shall arrange an on-site meeting with the City of Guelph – Traffic Signal staff to determine exact locations.

Saw cutting for loop wire slots in the pavement shall be done in straight lines with saw cut widths and depths for slots set to the dimensions shown on City of Guelph Standard Drawing SD-206 "Typical Quadruple Loop". The saw shall be equipped with a depth gauge and horizontal guide to assure proper depth and alignment of the slot. The blade used for the saw cut shall provide a clean well-defined saw cut without damage to the adjacent area. Corner cutting for slots shall be extended only far enough past each corner point to obtain the full depth of the slot.

Any saw cut across a crack or uneven pavement must be treated as per Detail "C" within SD-206 "Typical Quadruple Loop". The loop wire is to be placed in a 13mm conduit across the crack or uneven pavement. City of Guelph – Traffic Signal Staff shall determine the location(s) where 13mm conduit is required.

The Contractor shall install loop wires and detector cables and place the required sealant on the same day that saw cuts are cut in the road surface. No traffic is to be allowed over the area until the installation is complete and the sealant has hardened in accordance with the manufacturer's instructions.

The Contractor under the supervision of City of Guelph – Traffic Signal staff measure and record the DC wire resistance and leakage resistance with a "Megger". If the loop resistance measures between 1 and 5 ohms and leakage resistance measures 10 megaohms, complete the filling of slot with approved detector loop sealant so that run-off will not collect in the slot. A dry cement powder shall be applied over the sealant to minimize tracking. If high DC resistance (5 ohms or more) or less than 10 megaohms of leakage resistance occurs, the complete loop wire must be replaced.

The run wires shall be directed to the nearest handwell then to the nearest signal pole to the loops via the signal conduit. Belden 8720 lead in cable shall run from the signal pole to the traffic controller. The path of the run wire shall be as indicated on the drawing or as specified by the Engineer. Under no circumstance are any joints or splices to be made in a handwell. All joints or splices are to be made within the traffic signal pole.

All run wires shall run individually to be connected in the controller and provide proper inductance for amplifier requirements.

The run wires between the loops and controller shall be protected by buried conduit, or where they cross the travelled portions of the roadway shall be inserted in a saw cut and sealed as described above.

Loop detector amplifiers shall be set in accordance with the direction of City of Guelph – Traffic Signal staff.

Both the loop and run wire terminations shall be clearly tagged by the Contractor with plastic marker plates and labelled with a permanent marking pen as manufactured by Panduit Corporation or an approved equivalent. These tags will be securely tie wrapped to the cables and clearly labelled.

Radar/Video Detection

The Contractor shall install the radar/video detection mounting bracket at a desirable height of 9.5-10.0 metres. At locations where this mounting height cannot be achieved, the mounting height will be determined by City of Guelph – Traffic Signal staff.

The Contractor shall aim each detector(s) for the approach required, however final aiming of the detector(s) will be performed by of Guelph – Traffic Signal staff.

Fire Pre-Emption System

The Contractor shall supply and install all equipment as indicated in the Contract Drawing(s).

Each fire pre-emption head shall be tested for correct operation in the presence of City of Guelph – Traffic signal staff prior to activation of the traffic signal.

14.4 Payment

The Contractor shall be responsible to supply all labour, equipment and materials required to install traffic signal equipment. Payment for this item will be at the unit price as specified in the Form of Tender.

Section 15 – Installation Of Traffic Signal Interconnection Equipment**15.1 General**

In addition to the requirements of OPSS 624 “Construction Specification for Traffic Signal Interconnection Equipment”, the following shall apply for the Corporation.

15.2 Material

The Contractor shall supply interconnection cable or supply and install detectable mule tape as specified in Table A “Traffic Signal Installation - Approved Material List”.

15.3 Construction

The Contractor shall leave a minimum of 1 metre of interconnect cable coiled within each handwell.

All final connections at the traffic signal cabinet will be made by the Corporation. The Contractor shall leave sufficient cable for the final controller connections to be made at each controller.

15.4 Payment

The Contractor shall be responsible to supply all labour, equipment and materials required to install interconnection equipment. Payment for this item will be at the unit price as specified in the Form of Tender.

Section 16- Tables

Table A- Traffic Signal Installation: Approved Materials List

Item	Description	Make	Model No.
Traffic Signal Poles	1.5m aluminum straight round pole	Sentinel Pole & Traffic Equipment Ltd.	P85-550-AB190
	4.0m poles complete with base – steel sectional	Pole Fab Inc.	SS45R712B-C/W#5 base TB16R712B-C/W#6 base
		AMG Metals Inc	SSP 54-3.6B
	5.3m poles complete with base – steel sectional	Pole Fab Inc.	SS35R712B-C/W #5 base TB16R712B-C/W #6 base
		AMG Metals Inc	SSP 53-5.5B
	7.0m poles complete with base – steel sectional	Pole Fab Inc.	SS25R712B-C/W#5 base TB16R712B-C/W #6 base
		AMG Metals Inc	SSP 52-7.0B
	8.7m poles complete with base – steel sectional	Pole Fab Inc.	PF15S172B-2P-53GA INS – C/W #5 base TB16R712B-C/W #6 base
		AMG Metals Inc	SSP 51-8.7B
	10.5m poles complete with base – steel sectional	Pole Fab Inc.	TB16R712B-C/W #6 base
AMG Metals Inc.		SSP 61 – 10.5B	
Pole Base Anchors	Pole base anchor for 1.5m aluminum straight round pole	Sentinel Pole & Traffic Equipment Ltd.	¾-2B-190
	Pole base anchor – 1-1/4 inch DRG-2FS, 279mm x 279mm x 457mm (11" x 11" x 18") – no loctite	NCA/Acrow-Richmond	354-07-1015
		AMG Metals Inc	AMG 395 BCDx457-32-S
	Pole base anchor – 1-1/4 inch DRG-2FS, 318mm x 318mm x 457mm (12.5" x 12.5" x 18") – no loctite	NCA/Acrow-Richmond	354-07-1091
AMG Metals Inc		AMG 450 BCDx457-32-S	
Signal Head Brackets	Double bracket assembly	Fortran Traffic Systems Limited	AB-0137-3 AB-0137-4
		Sentinel Pole & Traffic Equipment Ltd.	VSF - 358 VSF - 458

Note: Any deviation from the items indicated in Table "A": "Traffic Signal Installation – Approved Material List" requires submission and approval of Shop Drawings prior to installation in the field

The Corporation of the City of Guelph
Operations Department

Table A- Traffic Signal Installation: Approved Materials List

Item	Description	Make	Model No.	
LED units for Traffic Signal Heads and Pedestrian Signal Heads	300mm and 200mm traffic signal modules and pedestrian signal modules (international symbol type) that meet latest ITE specification as published in the <i>Equipment and Materials Standards of the Institute of Transportation Engineers</i>			
Traffic Signal Heads	Yellow polycarbonate signal head, with yellow back, complete with stainless steel reinforcing plates in the top and bottom sections with cowl visors. Yellow polycarbonate backboard with a 3" (76mm) reflective strip around perimeter using 40-91 Diamond Grade Yellow reflective tape. Include approved LED units. 30cm RED, 20cm AMBER, 20cm GREEN	Econolite	Head: CPS36TY2NNCONNNNV	
		Fortran Traffic Systems Limited	P1LH409 – head BSP1344R - backboard	
	30cm RED, 20cm AMBER, 20cm GREEN, 30cm BI-MODAL ARROW	Econolite	Head: CPS47TY2NNCONNNNV	
		Fortran Traffic Systems Limited	Head: P5LE409 Backboard: BSP5444R	
	30cm RED, 30cm AMBER, 30cm GREEN	Econolite	Head: TPS31TY2NNCONNNNV	
		Fortran Traffic Systems Limited	Head: P3LH409 Backboard: BSP3344R	
	30cm RED, 30cm AMBER, 30cm GREEN, 30cm BI-MODAL ARROW	Econolite	TPS41TY2NNCONNNNV	
		Fortran Traffic Systems Limited	Head:P3LE409 Backboard:BSP3444R	
	Pedestrian Signal Heads	Single section yellow polycarbonate pedestrian head. Complete with yellow polycarbonate visor and 30cm round or square bimodal walk/don't walk LED unit.	Econolite	PPSFYYSNVNS
			Fortran Traffic Systems Limited	P3L6640

Note: Any deviation from the items indicated in Table "A": "Traffic Signal Installation – Approved Material List" requires submission and approval of Shop Drawings prior to installation in the field

The Corporation of the City of Guelph
Operations Department

Table A- Traffic Signal Installation: Approved Materials List

Item	Description	Make	Model No.
Pedestrian Head Pole Plates	Pole plates – unpainted	Fortran Traffic Systems Limited	PLA380
		Tacel Limited	MHAL100
Countdown Pedestrian Signal Heads	Double section yellow polycarbonate pedestrian head. Complete with yellow polycarbonate visor and 30cm round or square bimodal walk/don't walk LED unit and square LED countdown unit	Econolite	PPQMYSPNVNS
		Fortran Traffic Systems Limited	P4LO640
		Innovative Traffic Solutions Inc.	AMPPB82B799
		Tacel Limited	SPPECYC
Pedestrian Head Street Elbows	Street Elbows – unpainted	Fortran Traffic Systems Limited	ELB004
Traffic Signal Mast Arms	1.2 metre	Power-Lite	TR-4SMA
	1.8 metre	Power-Lite	TR-6SMA
	2.44 metre	Power-Lite	TR-8SMA
	3.05 metre	Power-Lite	TR-10SMA
	3.66 metre	Power-Lite	TR-12SMA
	4.57 metre	Power-Lite	TR-15SMA
	5.48 metre	Power-Lite	TR-18SMA
	6.1 metre	Power-Lite	TR-20SMA
Traffic Signal Mast Arm Pole Plates	Refer to SD 217 and 217a		
Pedestrian Push Button Assembly	Rectangular 2 bolt push button	Campbell Company	4 EVR 120 Rectangular
Power Supplies	Intersection with no street lighting, 70A main breaker	Square D	QO2L70RB
	Intersection with street lighting, combination panel with 100A main breaker	Square D	CQO18M100RB100
Power Supply Enclosure	Unpainted stainless steel enclosure	Sentinel Pole & Traffic Equipment Ltd.	TCL 100-4
Power Supply Breakers	30A One Pole branch breaker for traffic and street lighting	Square D	QO130
Traffic Signal Cable	12 conductor	IMSA polyethylene insulated, polyvinyl chloride jacketed	Specification No.19-1C 2001
	7 conductor		
	4 conductor		
	Ground cable	#6 RWU-90	

Note: Any deviation from the items indicated in Table "A": "Traffic Signal Installation – Approved Material List" requires submission and approval of Shop Drawings prior to installation in the field

The Corporation of the City of Guelph
Operations Department

Table A- Traffic Signal Installation: Approved Materials List

Item	Description	Make	Model No.
	Pedestrian pushbutton Loop lead-in-Belden cable	Beldn cable	8720
	Loop detector wire	#14 RWU90	
	Pre-emption cable	#138 cable	3M
	Power service cable	#8 14 AWG Black & White	
Ground Rods	19mm x 3048mm (¾" x 10')	Hydel Enterprises Inc.	3410G
Ground Plates	Galvanized	Hydel Enterprises Inc.	1016.GPGC
Ground Lug	Connection to Ground Rod/Plate	Burndy	GRC-3426
Handwells	330mm x 610mm x 457mm box with open base	Synertech	S1324B18FA
		Quazite	PT1324BA18
	432mm x 762mm x 457mm box with open base	Synertech	S1730B18FA
		Quazite	PT1730BA18
	610mm x 914mm x 457mm box with open base	Synertech	S2436B18AA
		Quazite	PT2436BA18
Handwell covers	Cover for 330mm x 610mm box c/w "Traffic" logo	Synertech	S1324HBBOA01
		Quazite	PT1324HA0046
	Cover for 432mm x 762mm box c/w "Traffic" logo	Synertech	S1730HBBOA01
		Quazite	PT1730HA0046
	Cover for 610mm x 914mm box c/w "Traffic" logo	Synertech	S2436HBBOA01
		Quazite	PT2436HA0046
Underground conduit	100mm (4") conduit	Rigid PVC conduit, elbows and fittings shall meet CSA No. 22.2, No 211.2 – M1984 (R2003)	"Scepter" Rigid PVC conduit or equal
	76mm (3") conduit		
	50mm (2") conduit		
	25mm (1") conduit		
	Underground Directional Bore	SDR13.5, 1000 series	High density polyethylene
Connection boxes	152mm x 152mm (6" x 6")	Scepter box	
	203mm x 203mm (8" x 8")		
	305mm x 305mm (12" x 12")		
Backer rod	Extruded close cell 13mm diameter polyethylene foam		
Loop Detector Sealant	Summer sealant	Chemque	Q-Seal 290S
	Winter sealant		Q-Seal 290W
	Summer sealant	3M	DLS 5000
Field Wiring Tags		Panduit	MP 175-C

Note: Any deviation from the items indicated in Table "A": "Traffic Signal Installation – Approved Material List" requires submission and approval of Shop Drawings prior to installation in the field

The Corporation of the City of Guelph
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Table A- Traffic Signal Installation: Approved Materials List

Item	Description	Make	Model No.
Fish Cord	5/8" Mule Tape		
Fire Pre-emption Equipment	Opticom Detector	Global Traffic Technologies	721
	Fire Pre-Emption Discriminator Card	Global Traffic Technologies	452
Rectangle Rapid Flashing Beacon	Bi-directional configuration, solar APS SC315 system with audible push-button	Carmanah	
	AB-9407- Dual RRFB Solar with audible push-button	JSF	
	Tapco Dual RRFB 55W 48aH Solar w/ XAV	Tapco	TAPCORRFBSOLXAV

Note: Any deviation from the items indicated in Table "A": "Traffic Signal Installation – Approved Material List" requires submission and approval of Shop Drawings prior to installation in the field

TABLE B -Traffic Signal Installation Checklist

2. Traffic Signal Controller Cabinet (to be completed by City of Guelph electrical staff)

- | | NEMA TS1 | NEMA TS2 Type 1 | NEMA TS2 Type 2 |
|---|------------------------------|-----------------|-----------------------------|
| 1) Cabinet type (circle) | | | |
| 2) Orientation of movements consistent with "blue line" drawings and timing plans | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 3) Conflict flash function operates as required | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 4) Signal timer unit on/off switch operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 5) Signal flash switch operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 6) GFI power receptacle breaker switch operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 7) Controller power supply breaker switch operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 8) Vehicle detector door switches operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 9) Vehicle detector door switches match phases | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 10) Pedestrian detector door switches operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 11) Pedestrian detector door switches match phases | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 12) Pre-emption door switches operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 13) Front/side panel output connections secured | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |

Police Door

- | | | | |
|---|------------------------------|--|-----------------------------|
| 14) Police door opens, closes and locks properly | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 15) Police door sealing casket in place | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 16) Police door auto-flash switch operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 17) Police door signals on/off switch operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 18) Police door manual/auto timing operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |
| 19) Police cord switch operational | Yes <input type="checkbox"/> | | No <input type="checkbox"/> |

TABLE B-Traffic Signal Installation Checklist

2. Traffic Signal Controller Cabinet (continued)

Document Pouch

- 20) Document pouch properly attached to door Yes No
- 21) Loop chart included in document pouch Yes No
- 22) Cabinet "blue line" drawings in document pouch Yes No
- 23) Maintenance log book included in document pouch Yes No
- 24) Conflict monitor test verification sheets in doc. pouch Yes No
- 25) Timing plans included in document pouch Yes No
- 26) Traffic Signal Plan included in document pouch Yes No

Load Switches

- 27) All load switches installed and operational Yes No
- 28) Number of load switches _____

Conflict Monitor

- 29) Manufacturer: _____ Serial #: _____
- 30) Jumper card match "blue line" drawing Yes No
- 31) All cables secure Yes No
- 32) Monitor senses conflict Yes No
- 33) Time and date correct N/A Yes No

Vehicle Detectors

- 34) All applicable detectors installed and operational Yes No
- 35) Number of vehicle detectors _____

TABLE B- Traffic Signal Installation Checklist

Signal Plant Inspection - Pre turn-on checklist (to be completed by City of Guelph and contractor)

Date of Inspection: _____ Time: _____

City of Guelph Inspector: _____

Contractor: _____

Contractor's Representative: _____

- | | | |
|---|------------------------------|-----------------------------|
| 1) Copy of ESA inspection provided to City | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 2) Were supplemental agreements or change orders required for the signal work | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 3) Have these changes been documented on field dwgs | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 4) Equipment installed is consistent with that shown on the signal drawing | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

Controller Cabinet

- | | | |
|--|------------------------------|-----------------------------|
| 5) Traffic signal controller installed at location as shown on the signal plan | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 6) Cabinet base free from honey combing | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 7) Cabinet pad installed at the correct height | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 8) The cabinet to base connection secured and sealed | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 9) Conduit in the cabinet extend at least 5cm above pad | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 10) Correct number of spare conduits supplied | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 11) Spare conduits terminated and capped | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 12) All conduits sealed with foam seal in the cabinet | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 13) Cable runs and wiring secure | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 14) All cables are identified in the cabinet | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

TABLE B- Traffic Signal Installation Checklist

Signal Plant Inspection - Pre turn-on checklist Continued (to be completed by City of Guelph and contractor)

- | | | |
|---|------------------------------|-----------------------------|
| 15) Wiring is neat and orderly | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 16) The cabinet grounded as per electrical specification | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 17) Lugs on the field signal wires and tagged per phase | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 18) Service neutral connection secured in cabinet | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 19) Service ground connection secured in cabinet | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 20) Power connection secured in cabinet | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 21) Transient suppressor for service line installed correctly | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

Signal Installation Grounding

- | | | |
|---|------------------------------|-----------------------------|
| 22) Grounding at each location as shown on the sig. plan | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 23) Ground lug connection used to attach bonding wire to grounding electrodes | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 24) Bonding network for all poles connected back to service ground | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

Handwells

- | | | |
|---|------------------------------|-----------------------------|
| 25) All lids stamped "Traffic" | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 26) Cover secured to handwell (all bolts installed) | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 27) All handwells flush with surrounding grade | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 28) All handwells installed as shown on the signal plan | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

Conduit

- | | | |
|---|------------------------------|-----------------------------|
| 29) All conduit Rigid PVC meeting CSA specification | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 30) Pull rope installed in all conduits | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 31) Size of conduit used is consistent with the signal plan | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 32) Restoration of trench in compliance with specification | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

TABLE B- Traffic Signal Installation Checklist
Signal Plant Inspection - Pre turn-on checklist Continued (to be completed by City of Guelph and contractor)

- 33) Depth of conduit in compliance with SD-222 Yes No
- 34) All unused conduit capped Yes No

Signal Poles, Signal Heads and Pole Bases

- 35) All signal pole bases correct size cage Yes No
- 36) All signal pole bases at correct elevation Yes No
- 37) All signal pole bases pinned Yes No
- 38) All signal heads clearly visible Yes No
- 39) No cables touching our signal equipment Yes No
- 40) Vehicle signal heads consistent with material list Yes No
- 41) Pedestrian signal heads consistent with material list Yes No
- 42) Reflective tape on backboards Yes No
- 43) Mast arms correctly installed Yes No
- 44) Correct strapping of conduit on wooden/cement poles Yes No

Miscellaneous

- 45) All signal and pedestrians indications assigned correct Yes No
- 46) All applicable vehicle detectors operational Yes No
- 47) All push button detectors operational Yes No
- 48) All signage related to traffic signal installed Yes No
- 49) Provisions for pavement markings to be installed prior to activation Yes No
- 50) Pre-emption wires secured, connected and verified Yes No
- 51) Loops sealed as per specification Yes No

The Corporation of the City of Guelph
Operations Department

TABLE B- Traffic Signal Installation Checklist
Signal Plant Inspection - Pre turn-on checklist Continued (to be completed by City of Guelph and contractor)

52) Wiring connections in pole handholes labeled Yes No

53) Fire Pre-emption installed and working as desired Yes No

Comments

Item #	Comment

Checked By: _____

Date: _____

Table C- Traffic Signal Activation Policy

Policy Statement

The traffic signal controller will not be given approval for turn-on until all hardware is installed and wiring within the traffic signal controller cabinet is completed and operational.

Procedure

Two (2) working days' notice is given to Traffic Signal staff to complete a pre-turn on inspection.

The inspection shall be conducted by a representative of the City of Guelph Operations Department – Traffic Signal staff with the builder of the traffic signal. The inspection will ensure all (a detailed checklist is provided in Table "B"):

- Vehicle and pedestrian signal indications are operational
- Vehicle detector loops are operational
- Pedestrian push buttons are operational
- Signage associated with the traffic signal is installed

Only after a sign-off is completed from City of Guelph traffic signal staff shall the contractor arrange for a pay-duty police officer to complete the signal turn-on. Deficiencies shall be repaired prior to the turn-on of the signal.

Pavement markings (crosswalks and stop bars) are to be installed just prior to the signal turn-on. If road surface conditions do not permit for pavement markings, "Stop Here On Red Signal" (Rb-78) signs shall be installed on each approach. These signs are the responsibility of the Contractor.

A representative of the City of Guelph traffic signal staff shall be present to oversee the traffic signal activation. A police officer will control all traffic movements within the intersection during the activation period.

The log book (titled "Traffic Signal Inspection & Maintenance Record) shall be signed by both City staff and the contractor upon turn-on.

Traffic signal turn-ons are not permitted on Fridays (or if Friday is a holiday, the Thursday preceding a holiday Friday.)

Table D- Contractor Traffic Signal Service Standard and Response Time

Condition	Response
Traffic/Pedestrian and Audible Signals	
One or more traffic signals blank	2 hours
Traffic signal head showing more than 1 colour	2 hours
Red signal inoperative	2 hours
Amber signal inoperative	2 hours
Green signal inoperative	2 hours
Arrow signal inoperative	2 hours
Walk signal inoperative	2 hours
Don't Walk signal inoperative	2 hours
Traffic signal head alignment is incorrect creating safety hazard	2 hours
Pedestrian pushbutton inoperative	2 hours
Primary signal head misaligned – not a safety hazard	24 hours
Secondary signal head misaligned – not a safety hazard	24 hours
Pedestrian signal head misaligned – not a safety hazard	24 hours
Primary signal head obstructed	24 hours
Secondary signal head obstructed	24 hours
Pedestrian signal head obstructed	24 hours
Fire Pre-emption inoperative	24 hours
Traffic signal head or backboard is damaged – not a safety hazard	1 week
Handwells	
Handwell damaged - potential safety hazard	2 hours
Handwell missing or loose lid. High or low pedestrian volume	2 hours
Handwell damaged – not a safety hazard	1 week
Service Panel	
Service panel – potential safety hazard	2 hours
Service panel door not secure	24 hours
Service panel damaged – not a safety hazard	1 week
Overhead Conductors and Support Cables	
Overhead conductors or support cables – potential safety hazard	2 hours
Overhead conductors or support cable damaged – not a safety hazard	24 hours
Signals in flash - red/red or amber/red	City staff
Signals not changing “stuck”	City staff
Traffic signal cycling without vehicle or pedestrian actuation	City staff
Audible signal not operating	City staff
Audible signal at incorrect alignment	City staff

The Corporation of the City of Guelph
Operations Department

Table E- Contractor’s Traffic Signal Equipment Return Check

Location _____ Date _____

The contractor is required to remove all signal poles, mast arms, signal heads, signs, pedestrian push buttons and any other signal equipment prior to the removal of the pole from the pole base. The salvageable equipment shall be tagged and returned to the Operations Department Yard (45 Municipal Street).

24-hour notice given for equipment return to the Operations & Transit Yard
Yes ___ No ___

Controller cabinet return Yes ___ No ___ N/A _____

Equipment	Size	Number to be Returned	Number Returned
Sectional Pole	10.5 metre		
	7.1 metre		
	4.0 metre		
Signal Head	3 section		
	4 section		
	5 section		
Special Signal Heads			
Mast Arm	6.1 metre		
	5.48 metre		
	4.57 metre		
	3.66 metre		
	3.05 metre		
	2.44 metre		
	1.8 metre		
1.2 metre			
Mast Arm Brackets			
Pedestrian Heads			
Pedestrian Push Buttons			
Fire Pre-emption Heads			
Handwells	330mm X 610mm		
	432mm X 762 mm		
	610mm X 910mm		
Traffic Regulatory Signs			
Traffic Warning Signs			
Traffic Information Signs			
Street Name Signs			

Table F- Contractor's Traffic Signal Equipment Return Check

Field Inspection

Date _____

Signature Contractor _____

Signature City _____

Equipment Return

Date _____

Signature Contractor _____

Signature City _____



STANDARD DRAWINGS FOR CONSTRUCTION PROJECTS

2020

City of Guelph

Standard Drawings for Construction Projects Index

Section 1 Sidewalks/ Curb & Gutter/ Concrete Pavers	
Drawing Numbers	Description
1-1	Bus Stop Pad Layout – Revised Feb/12
1-2	Concrete Sidewalk – Revised Jan/10
1-4, 1-4a, 1-4b & 1-4c	Truncated Dome Detectable Warning Plates (4 sheets) - February 2015
1-37	Raised Median (Asphalt Surfaced) – Revised Feb/05
1-37 Modified	Raised Median (With concrete Pavers) – Revised Jan/11
1-71a	Channel Liner (for Watercourses) – Revised Feb/05
1-71b	Precast Channel Liner (for Watercourses) – Revised Feb/05
1-83	Concrete Paving Stone Installation – Revised Feb/05
Section 2 Maintenance holes/ Catchbasins/ Vaults	
Drawing Numbers	Description
2-7	Precast Maintenance Holes Tee for Concrete Pipe – Revised Mar/07
2-9	Manhole Safety Platform (1200mm Diameter Circ. Stack) – Revised Feb/05
2-15	Rear Yard Catchbasin Frame & Grate – Revised Feb/05
2-16	Riveted Grating for Ditch Inlet Catchbasin – Revised Feb/05
2-41	Standard Drop Structure for Maintenance Holes – Revised Jan/10
2-42	Special Drop Structure for Maintenance Holes – Revised Jan/10
2-58	900mm (Heavy Duty) Maintenance Hole Cover and Frame – Revised Feb/05
2-59	Frame, Grill and Cover Plate for 1700mm x 1125mm x 1125mm Plate Utility Vault – Revised Feb/05
2-59 Modified	Frame, Grill and Cover Plate for 1700mm x 1125mm Plate Utility Vault (Modified) – Revised Feb/05
2-61	Semi-Precast Maintenance Hole (825mm to 2700mm) – Revised Jan/10
2-67	2400mm Diameter Precast Maintenance Hole – Revised Jan/10
2-70	Internal Grate for Concrete Pipes 1050mm & Over – Revised Feb/05
2-70 Modified	Internal Grate for 675mm Diameter Storm Outlet – Revised Feb/05
2-70 Modified	Internal Grate for Concrete Pipe 855mm x 1345mm – Revised Feb/05

Section 3 - Pipes: Storm/ Sanitary/ Drains	
Drawing Numbers	Description
3-21	Service Connections for New Developments and Unserviced Lot – Revised 02/2020
3-29	Standard Bedding for Sewers and Watermains – Revised Feb/17
3-55	Sewer and Watermain Laterals – Revised Feb/14
3-56	Sewer and Watermain Laterals for Semi-Detached Lots Rev: Feb/14
3-75	Sump Pump Detail – Pumping to Storm – Revised Feb/05
3-76	Sump Pump Detail – Pumping to Storm (Alternate) – Revised Feb/05
3-77	Sump Pump Detail – Pumping to Grade – Revised Feb/05
3-78	Connection of Foundation – Drain to Storm Drainage Piping – Revised Feb/05
3-79	Driveway Area Drain, Gravity Drainage – Revised Feb/05
3-81	Drainage of Window Wells – Revised Feb/05
Section 4 - Waterworks	
Drawing numbers	Description
4-22a & 4-22b	Backflow Preventer Detail Variations 1 & 2 – Revised Feb/13
4-23	Ice Rink Chamber and Connection Detail – Jan/10
4-24	Valve Box Installation (100 to 300 Dia. Watermain) – Revised Feb/05
4-25	Hydrant Installation – Revised Jan/15
4-25a	Private Hydrant Installation – Revised Jan/15
4-25b	Combined Hydrant & Water Service Installation to Commercial Properties Deleted 02/2020
4-26	Sampling Station – January 2018
4-27	Thrust Blocking for Watermains – Revised Feb/05
4-28	Standard Blow-Offs – Revised Jan/15
4-54a	Tracer Wire Details for PVC Watermains – Revised Jan/15
4-54b	Service connection Details for PVC Watermains – Revised Jan/15
4-88	Watermain Swab Exit – 300m I.D. (Detail) – Revised Feb/05
4-88a	Watermain at Cul-De-Sac – Revised Feb/05
4-91	Valve Installation on or Connection to Existing Watermain – Jan/07

Section 5 - Road section	
Drawing numbers	Description
5-45	Construction Entrance Mud Mat Detail for City Road Access - February 2017
5-45a	Construction Entrance Mud Mat Detail for Rural Road Access - February 2017
5-46	Pavement Widening Detail – Revised Feb/05
5-48	Typical Cross Sections for 10m & 8.8m Roads (20m R.O.W.) – Revised Dec/11
5-48a	Typical Cross Section for 8.4m Road (18m R.O.W.) – Rev Dec/11
5-48b	Typical Cross Section for 8.4m Road (17m R.O.W.) – Jan/16
5-49	Typical Cross Section for 15M Road (30m R.O.W.) – Revised Dec./11
5-49a	Typical Cross Section for 16m Road (30m R.O.W.) – (Bicycle Routes) – Revised Dec/11
5-49b	Typical Cross Section for 12m Collector - (26m R.O.W.)- Rev Dec/11
5-49bb	Typical Cross Section for 12m Collector (26m R.O.W.)
5-49c	Typical Cross Section for 9m Collector (26m R.O.W.) at Greenway – Revised Dec/11
5-50	Typical Cross Section for Industrial Subdivision Roads (0.95m Ditch) – Revised Dec/11
5-50a	Typical Cross Section for Industrial Subdivision Roads (8.6m wide – asphalt (36.5m R.O.W.) – Revised Dec/11
5-50b	Industrial Subdivision Road – 8.6m wide – asphalt (36.5m R.O.W – Revised Jan/10
5-62	Typical Grading Section – 10m & 8.8m Roads – (20m R.O.W) – Revised Jan/10
5-62a	Half section grading section – 8.4m road – 18m r.o.w – revised Jan/10
5-63	Typical grading section – 15m roads – (30m r.o.w.) – rev. Jan/10
5-63a	Typical grading section – modified for bicycle routes – revised Jan/10
5-63b	Grading sections – 11m roads – (26m r.o.w.) – revised Jan/10
5-68	Typical cross section & grading section (16.5m r.o.w.) – revised jan/10
5-72	Typical grading section for 30m industrial roads – revised Jan/10

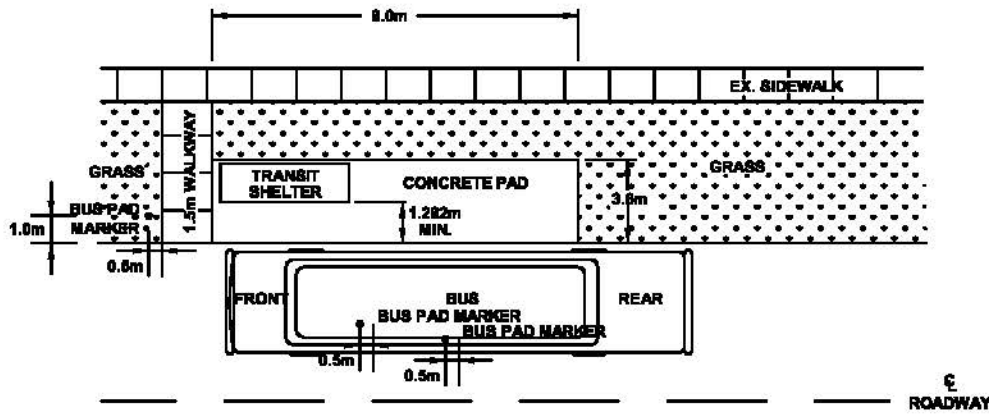
Section 6 - Landscape/ erosion control	
Drawing numbers	Description
6-30	Sodding of Slopes – Revised Feb/05
6-74b	Heavy Duty Silt Fence – Revised Feb/05
6-84	Erosion and Sediment Control – Revised Feb/05
6-87a	City Standard Trail Barrier Gate – REVISED 02/20
6-87b	Security Barrel Pin Details – Revised Feb/12
6-90a	Tree Protection Zone Fence Detail – DELETED 02/2020
6-90b	Tree Planting on Public Boulevard – DELETED 02/2020
6-90c	Tree Protection Zone Information Signage Detail – DELETED 02/2020
Section 7- Culverts	
Drawing numbers	Description
7-31	Bedding & Backfilling for C.S.P. Culverts – Revised Jan/08
7-40	Corrugated Steel Pipe End Section Details – Revised Feb/05
Section 8 - Guardrail/ bollards/ fence/ signs	
Drawing numbers	Description
8-32	Dead End Sign & Barricade Detail – Revised Jan/11
8-32a	Dead End Sign & Barricade Detail (4 Lane Arterial Road)– Rev. Jan/11
8-33	Chain Link Security Fence – Revised Feb/05
8-34	Pedestrian Walkway – Revised Jan/15
8-35	Standard Highway & Farm Fence Details – Revised Feb/05
8-86a & 8-86b	Pedestrian Guard – Revised Feb/05
8-89	Removable Bollard Detail – Revised Feb/05
Section 9 - Traffic	
Drawing numbers	Description
9-201	Concrete Foundation for Traffic Control Signal Poles – R-3 09/03/09
9-201a	Concrete Foundation for Power Pedestals – 13/02/22
9-201b	Concrete Foundation for Pedestrian Push Button Pole – 13/12/09
9-201c	Concrete Foundation for Solar Flashing 40 km/h School Zone Signs - 13/12/11
9-201d	Concrete Mounting Pad for Traffic Controller Cabinet and Power Pedestals – new January 2019
9-204	Concrete Mounting Pad for Traffic Controller Cabinet – Revised 02/2020
9-205	Anchorage Assembly & Installation – R-3 13/01/22
9-206	Typical Quadruple Loop – R-1 07/11/21
9-206a	Loop Identification Detail – R-1 08/11/25

Section 9 - Traffic continued	
Drawing numbers	Description
9-206b	Typical Quadruple Loop – For Bicycles - 12/01/19
9-207	Loop Lead In Installation Detail – R-2 08/11/25
9-209	Traffic Handwell – R-3 08/11/25
9-210	Standard Typical Traffic Signal Wiring Details – Revised 02/2020
9-211	Standard Typical Traffic Control Signal Schematic Wiring Diagram – R-2 13/01/25
9-212	Standard typical traffic signal equipment mounting detail – Revised 02/20
9-213	Typical traffic signal pole (4.0m) ss25r712b steel sectional used for mounting pedestrian heads – Revised 02/2020
9-213a	Aluminum Pole for Pedestrian Push Buttons - 13/12/09
9-213b	Typical Traffic Signal Pole (5.3m) Steel Sectional - R-1-17/04/10
9-214	Typical Traffic Signal Pole (7.01m) SS25R712B Steel Sectional – R-2 17/04/10
9-214a	Typical Traffic Signal Pole (8.75m) Steel Sectional – R-1-17/04/10
9-215	Typical Traffic Signal Pole (10.5m) TB16R712B Steel Sectional – R-2 12/01/19
9-216	Typical Base Mounted Pole Placed in Slopes – R-2 07/11/21
9-217	Aluminum Single Member Traffic Signal Mast Arm Attachment Details – 06/02/01
9-217a	Aluminum Single Member Traffic Signal Mast Arm Mounting Details - 07/01/05
9-218	Traffic Signal Head Vertical Bracket Mounting Detail – R-2 07/11/22
9-219	Typical Traffic Signal Head Mounting Detail – R-2 07/12/05
9-220a	Typical Traffic Signal Head Mounting Detail (Double Arm Bracket) – R1 17/10/18
9-221	General Arrangement Standard: Intersection Traffic Signal Lights and Street Lighting Supply – R-4 17/10/17
9-221a	Detail Standard: Intersection Traffic Signal Lights and Street Lighting Supply – R-3 14/11/24
9-222	Rigid PVC Conduit Bank and Profile for Traffic Signs - 07/01/05

Section 9 - Traffic continued	
Drawing numbers	Description
9-223	Typical Traffic Conduit Layout For Signalized Intersections - Revised 02/2020
9-224	Reflective Marking Tape Signal Head Detail – R-1 09/11/25
9-225	Standard Typical Solar Flashing 40 km/h School Zone Signage Detail - 13/12/11
9-226	Pole Mounted Traffic Signal Controller Cabinet Installation - Revised 02/2020
9-301	Sign Blanks (4 pages) – 11/01/13
9-302	Pedestrian Crossing Instruction Sign – 11/01/13
9-303	Name Sign – 11/01/13
9-304	Oversize Street Poppy Design Street Name Sign – R-1 13/01/25
9-305	Telespar Installation Detail - R-1 14/01/29
9-306	Sign Mounting Brackets – 11/01/13
9-307	Mobility Device Loading Zone -14/12/02
9-308	Kiss N' Ride Zone – 14/12/02
9-309	Commercial Vehicle Parking -14/12/02
9-310	Yield Here To Pedestrians -14/12/02
9-311	City of Guelph Speed Limit -14/12/02
9-312	For Enforcement Call -14/12/02
9-313	Street Name Sign – January 2018
9-401	Pavement Marking Detail - Bicycle w/Diamond and Bicycle w/ Sharrow - February 2015
9-402	Pavement Marking Detail – Ladder Crosswalk – January 2018
9-403	Pavement Marking Detail – Yield to Pedestrian Line – January 2018
9-404	Pavement Marking Detail – Separated Crossride (2.3m width) – new February 2019
9-405	Speed Cushion Design – new Nov. 26 th , 2019

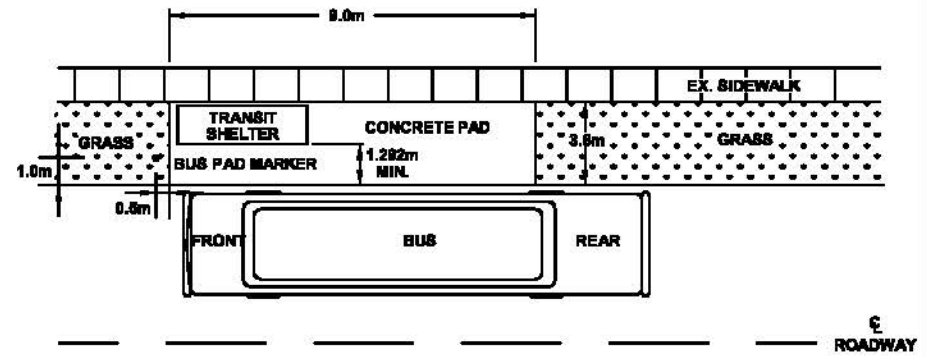


**SECTION 1:
SIDEWALKS
CURBS & GUTTERS
CONCRETE PAVERS**



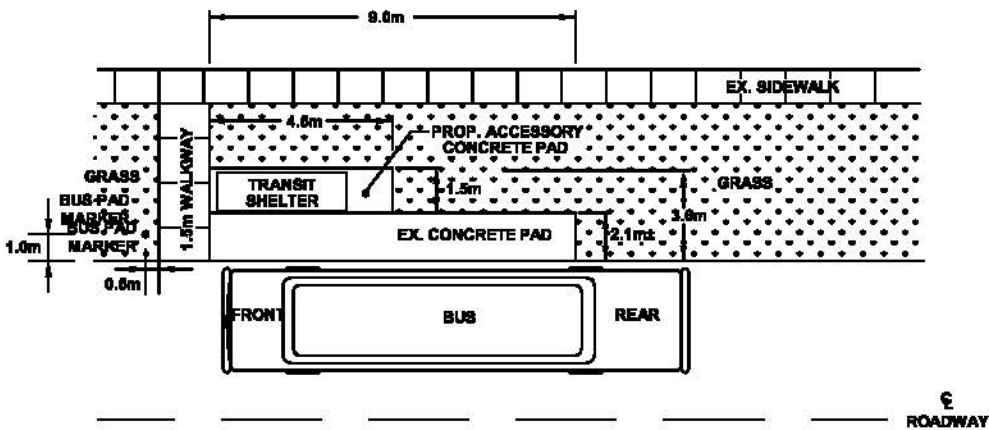
STANDARD BUS STOP WITH TRANSIT SHELTER AND WALKWAY

FIGURE 1



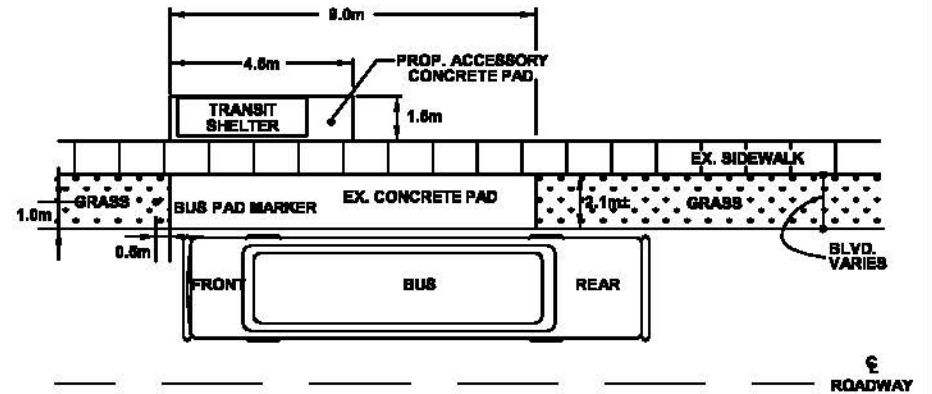
ACCESSORY CONCRETE PAD WITH TRANSIT SHELTER OPPOSITE SIDE OF EXISTING SIDEWALK

FIGURE 2



ACCESSORY CONCRETE PAD WITH TRANSIT SHELTER ABUTTING EXISTING CONCRETE PAD

FIGURE 3



STANDARD BUS STOP WITH TRANSIT SHELTER

FIGURE 4

- NOTES:
 1. SHELTERS REQUIRE HYDRO CONNECTION.
 2. CONCRETE AS PER SS-27.
 3. SAW-CUT CONSTRUCTION JOINTS.

CITY OF GUELPH STANDARD DRAWING

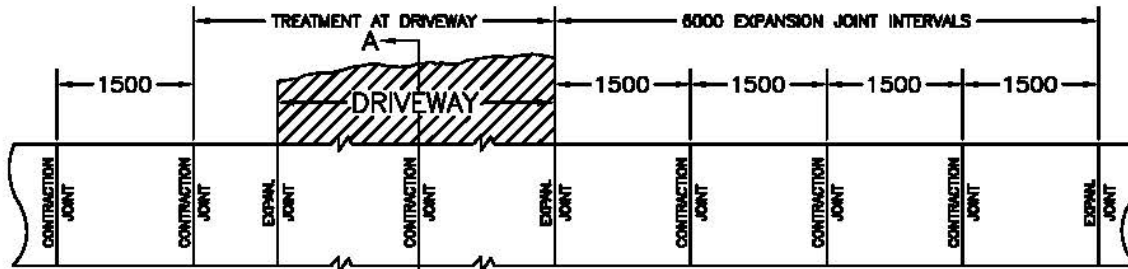
BUS STOP PAD WITH TRANSIT SHELTER LAYOUT

DATE DRAWN: JAN/10	REV. No.: R-2
DESCRIPTION: REVIEWED FEB/2012	
REV. DATE: FEB/2012	REV. BY.: G.F./C.M.C.
APPROVED BY:	
CITY ENGINEER	

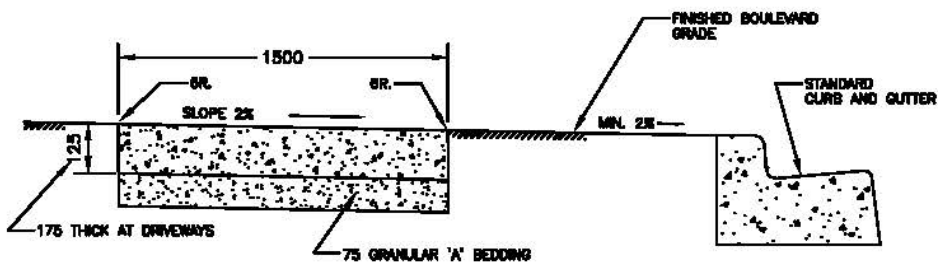
City of Guelph
Making a Difference

ENGINEERING

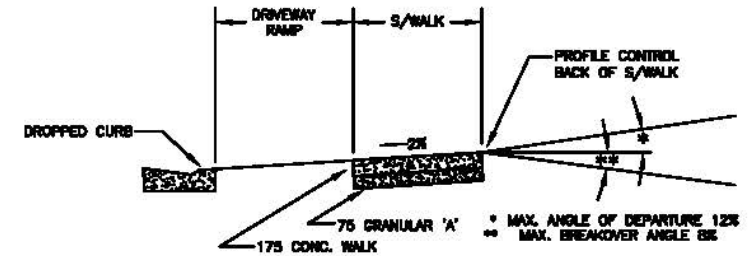
1 - 1



PLAN VIEW



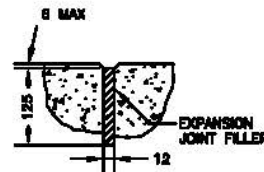
STANDARD SECTION



SECTION A - A

NOTES:

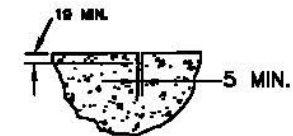
1. THE CONTRACTOR SHALL USE A METAL STAMP, ACCEPTABLE TO THE ENGINEER, BEARING HIS NAME AND YEAR OF CONSTRUCTION TO MARK THE TOP OF THE SIDEWALK AT THE BEGINNING AND END OF THE WORK AS DIRECTED IN FIELD.
2. DRIVEWAY RAMP BETWEEN CURB AND SIDEWALK SHALL HAVE 2%min. AND 10%max. GRADE. WHEN STEEPER GRADE IS INDICATED, SIDEWALK CROSS FALL SHALL BE INCREASED OR SIDEWALK LOWERED AT DRIVEWAYS AS DIRECTED BY THE ENGINEER.
3. SIDEWALK THICKNESS
 - RESIDENTIAL DRIVEWAY 175mm
 - COMMERCIAL, INDUSTRIAL 175mm
4. CONTRACTION JOINTS TO BE SAW-CUT AND NOT TROWELLED.



EXPANSION JOINT DETAIL

NOTES:

ALL CONTRACTION JOINTS SAW-CUT (TYPICAL)



CONTRACTION JOINT DETAIL

CITY OF GUELPH STANDARD DRAWING

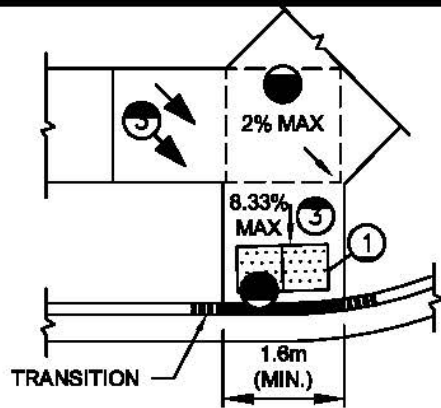
CONCRETE SIDEWALK

DATE DRAWN : -	REV. No. : R-7
DESCRIPTION : REVIEWED JAN/2010	
REV. DATE : JAN/10	REV. BY. : G.F./C.M.C.
APPROVED BY:	
CITY ENGINEER	

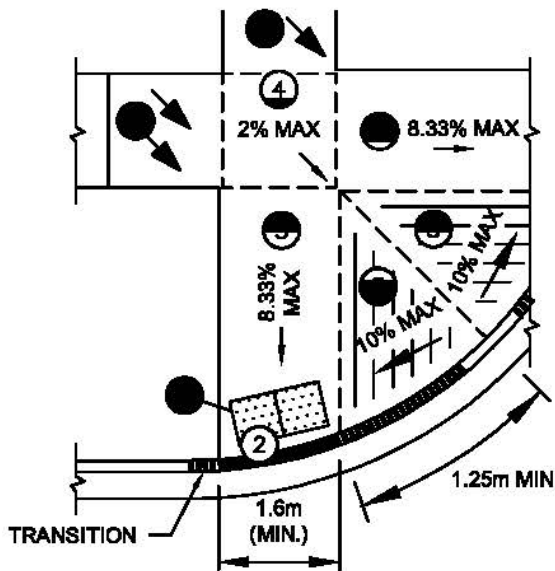


ENGINEERING

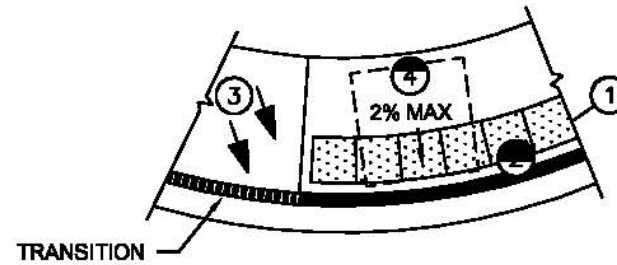
1 - 2



PREFERRED TREATMENT WITH SEPARATE LANDING AREAS
(SEE SD - 4A)



ALTERNATE SIDEWALK RAMP - SEPARATE RAMPS WITH COMMON LANDING AREAS
(SEE SD - 4B)



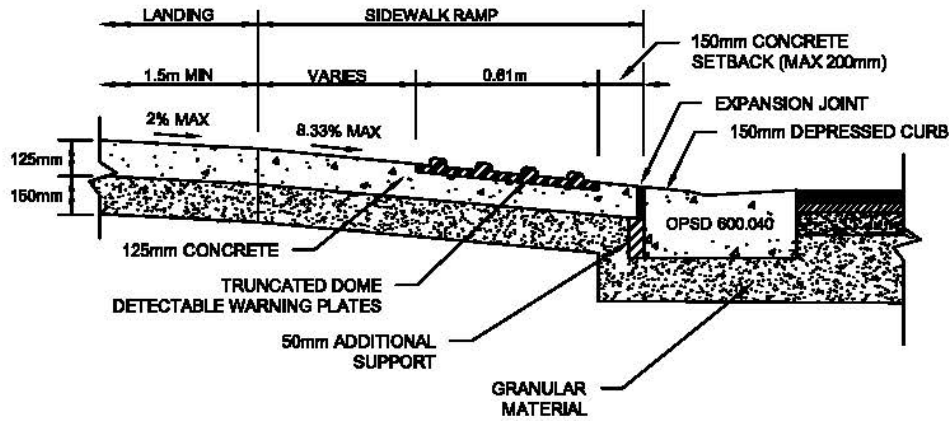
ALTERNATE SIDEWALK RAMP TREATMENT - COMMON RAMP
(SEE SD - 4C)

———— CONCRETE CURB IS DEPRESSED
 ■■■■■ CONCRETE CURB IS IN TRANSITION

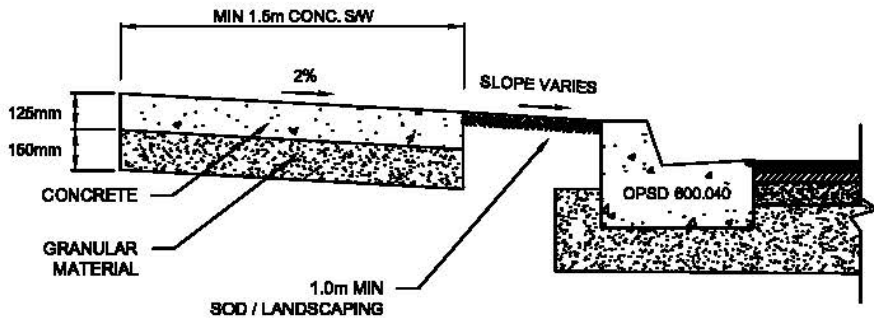
NOTES:

1. ALL TRUNCATED DOME DETECTABLE WARNING PLATE DESIGNS ARE TO BE FINALIZED BY THE PLATE MANUFACTURER. (610mm x 610mm SQUARE OR RADIAL PLATES TO MATCH CURB RADIUS). NUMBER OF WARNING PLATES TO MATCH WIDTH OF PROJECTED SIDEWALK OR TRAIL (For example, 1.8m sidewalk to have 3 plates)
2. TRUNCATED DOME PLATES ARE TO BE PLACED 150mm OFFSET FROM BACK OF CURB (200mm MAXIMUM). MINIMUM 150mm CONCRETE REQUIRED FROM OUTER EDGE OF PLATE ASSEMBLY TO THE EDGE OF SIDEWALK.
3. RAMPS ARE TO BE SLOPED BETWEEN 2% AND 6% DESIRABLE (8.33% MAXIMUM).
4. LANDING AREAS ARE 1.5m X 1.5m MINIMUM AND ARE SLOPED TO A MAXIMUM OF 2%.
5. CONCRETE FLARES ARE SLOPED TO A MAXIMUM OF 10%.
6. TRANSITION TO BE 1.5m PREFERRED OR 0.7m MINIMUM.

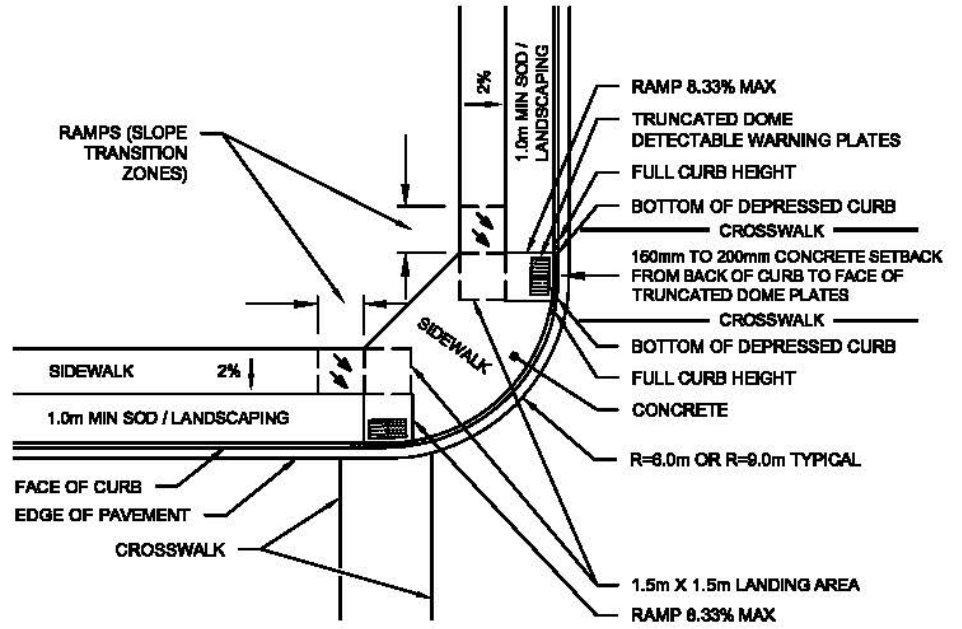
CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: Feb/15	REV. No.:	 Guelph <small>Making a Difference</small>	
TRUNCATED DOME DETECTABLE WARNING PLATES		DESCRIPTION:			ENGINEERING
		REV. DATE:	REV. BY.: A.J./C.M.C.		
		APPROVED BY:		1 - 4	
		CITY ENGINEER			



CROSS SECTION OF COMBINED SIDEWALK AND CURB AND GUTTER AT SIDEWALK RAMP




CROSS SECTION OF SIDEWALK, BOULEVARD, CURB AND GUTTER

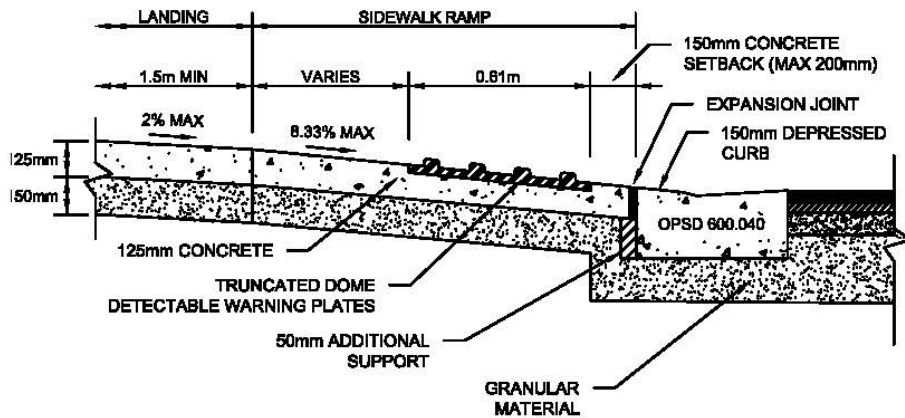


PLAN VIEW

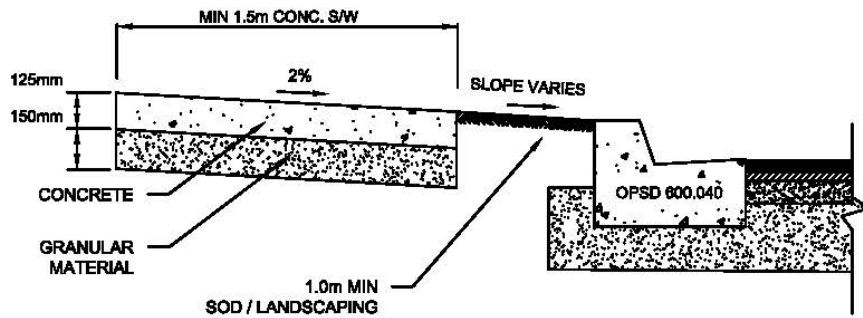
NOTE:

1. FOR TRUNCATED DOME DETECTABLE WARNING PLATE PLACEMENT IN CONCRETE SIDEWALK RAMPS, REFER TO SD-4.

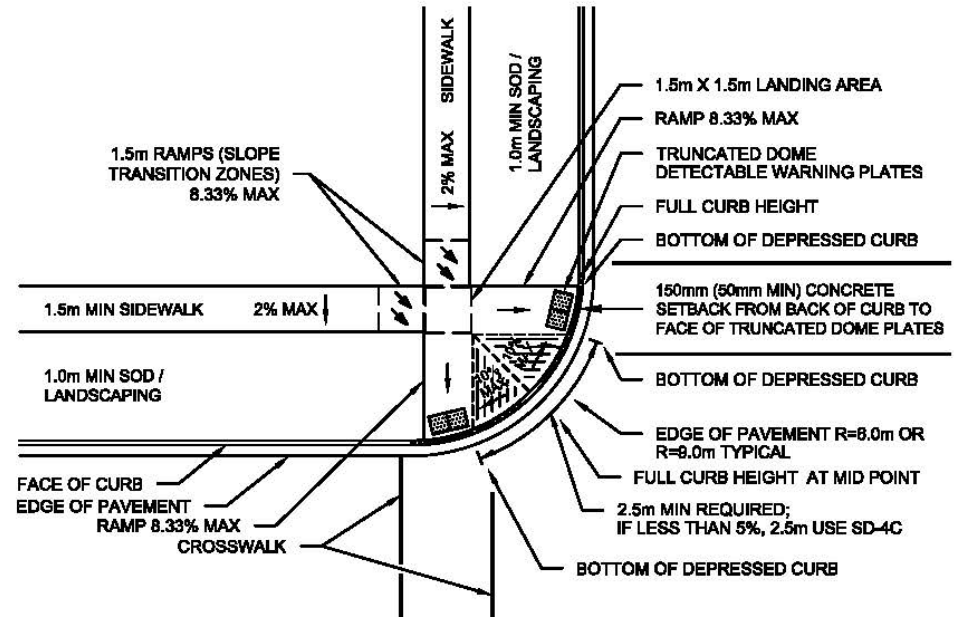
CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : Feb/15	REV. No. :	 Guelph <small>Making a Difference</small>
PREFERRED SIDEWALK RAMP - SEPARATE LANDING AREAS		DESCRIPTION :		
		REV. DATE :	REV. BY. : A.J./C.M.C.	1 - 4A
		APPROVED BY:		
		CITY ENGINEER		



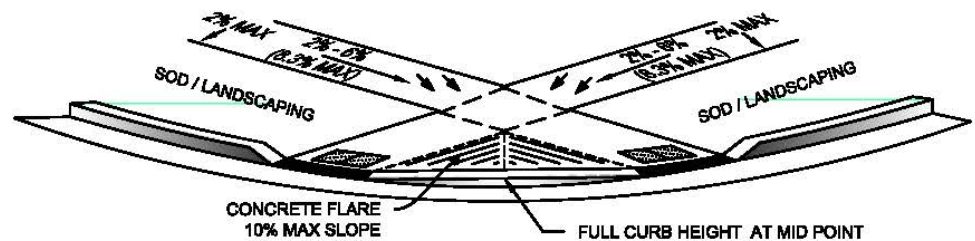
CROSS SECTION OF COMBINED SIDEWALK AND CURB AND GUTTER AT SIDEWALK RAMP



CROSS SECTION OF SIDEWALK, BOULEVARD, CURB AND GUTTER




PLAN VIEW

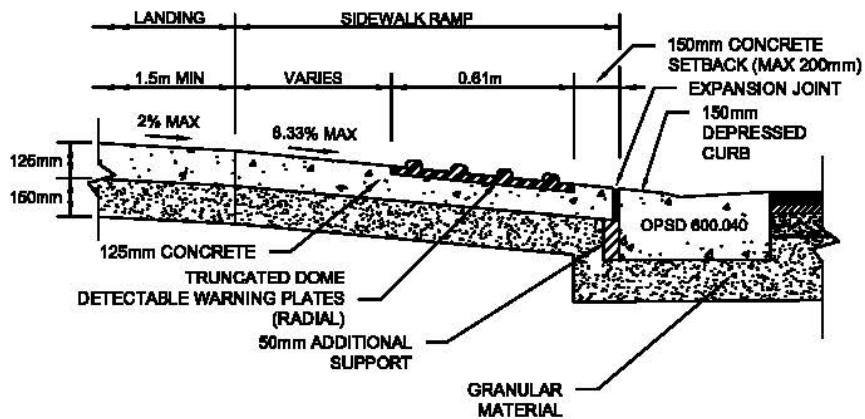


FRONT VIEW

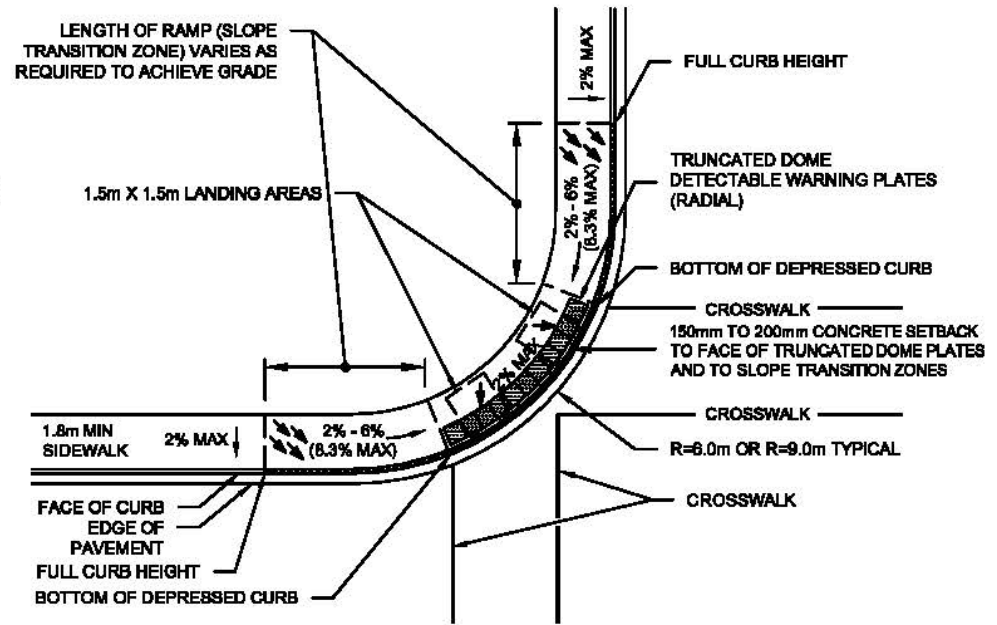
NOTE;

1. FOR TRUNCATED DOME DETECTABLE WARNING PLATE PLACEMENT IN CONCRETE SIDEWALK RAMPS, REFER TO SD-4B.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : Feb/15	REV. No. :	 ENGINEERING
ALTERNATIVE SIDEWALK RAMP - SEPARATE RAMPS WITH COMMON LANDING AREA		DESCRIPTION :	REV. BY : A.J./C.M.C.	
		REV. DATE :	APPROVED BY :	1 - 4B
			CITY ENGINEER	



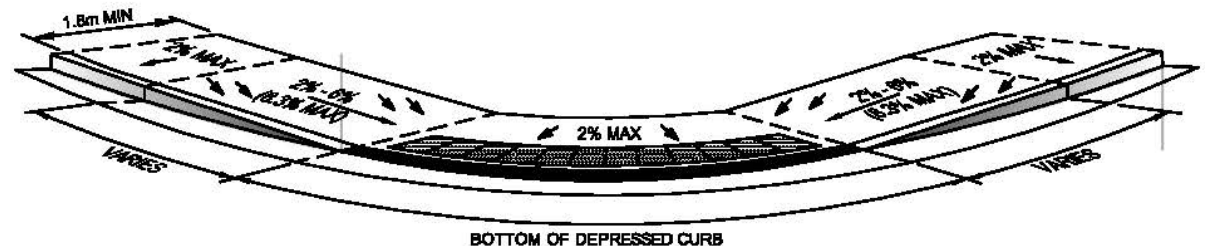
CROSS SECTION OF COMBINED SIDEWALK AND CURB AND GUTTER AT SIDEWALK RAMP




PLAN VIEW

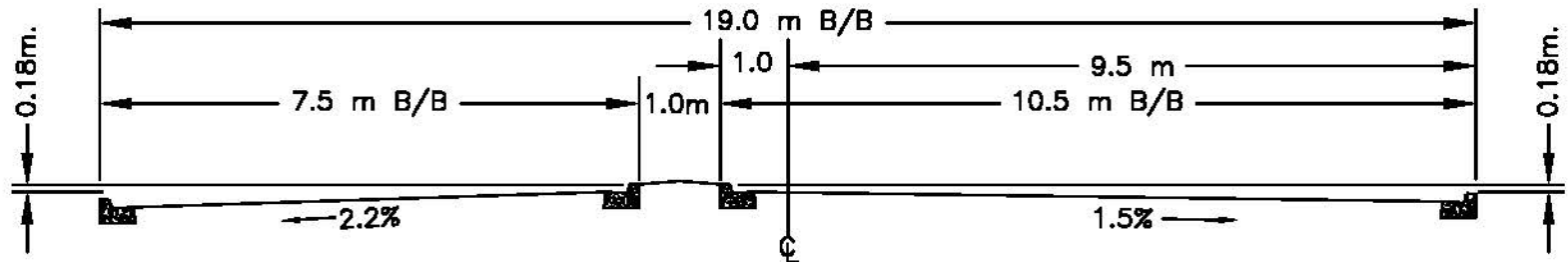
NOTES:

1. FOR TRUNCATED DOME DETECTABLE WARNING PLATE PLACEMENT IN CONCRETE SIDEWALK RAMPS, REFER TO SD-4.
2. BOTTOM OF DEPRESSED CURB SHOULD LINE UP WITH BACK EDGE OF SIDEWALK ON THE OPPOSITE SIDE OF THE STREET IN BOTH DIRECTIONS WHERE APPLICABLE.



FRONT VIEW

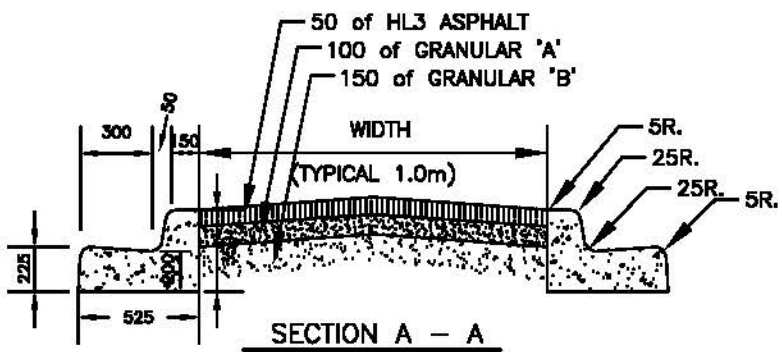
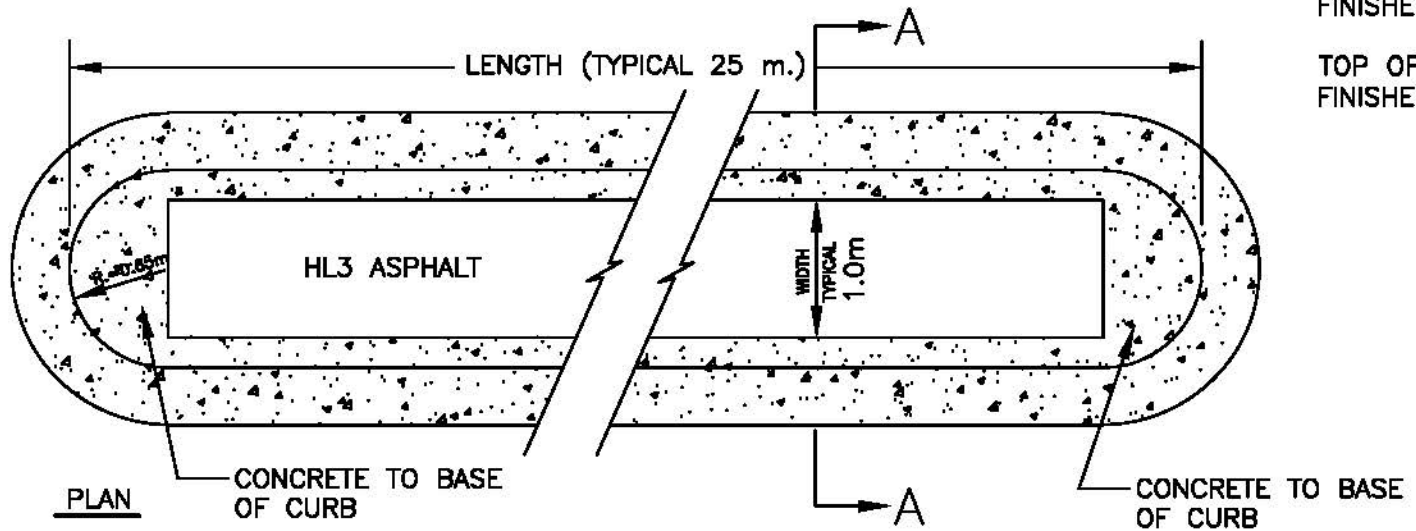
CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : Feb/15	REV. No. :	 Guelph <small>Making a Difference</small>
ALTERNATIVE SIDEWALK RAMP - COMMON RAMP		DESCRIPTION :		
		REV. DATE :	REV. BY. : A.J.J.C.M.C.	1 - 4C
		APPROVED BY:		
		CITY ENGINEER		



TYPICAL ROAD SECTION AT INTERSECTIONS WITH MEDIAN

TOP OF MEDIAN CURB IS 0.17 m ABOVE FINISHED ϕ ROAD GRADE

TOP OF ROADSIDE CURB IS 0.01 m BELOW FINISHED ϕ ROAD GRADE



CITY OF GUELPH STANDARD DRAWING

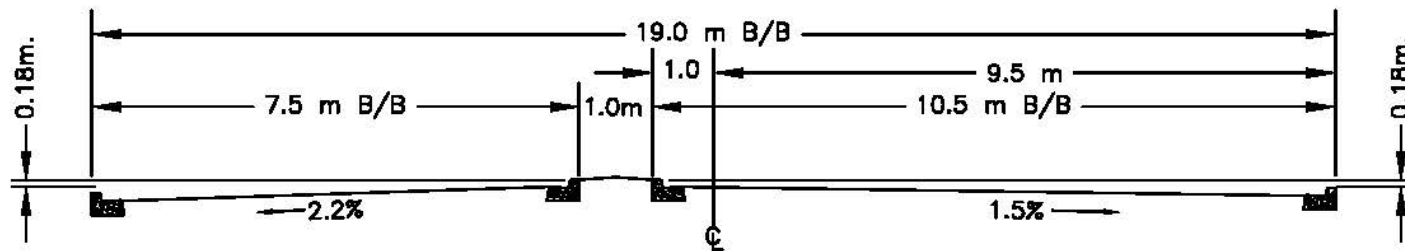
**RAISED MEDIAN
(ASPHALT SURFACED)**

DATE DRAWN: -	REV. No.: R-4
DESCRIPTION: REVIEWED FEB/2005	
REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.
APPROVED BY: CITY ENGINEER	

City of Guelph
Making a Difference

ENGINEERING

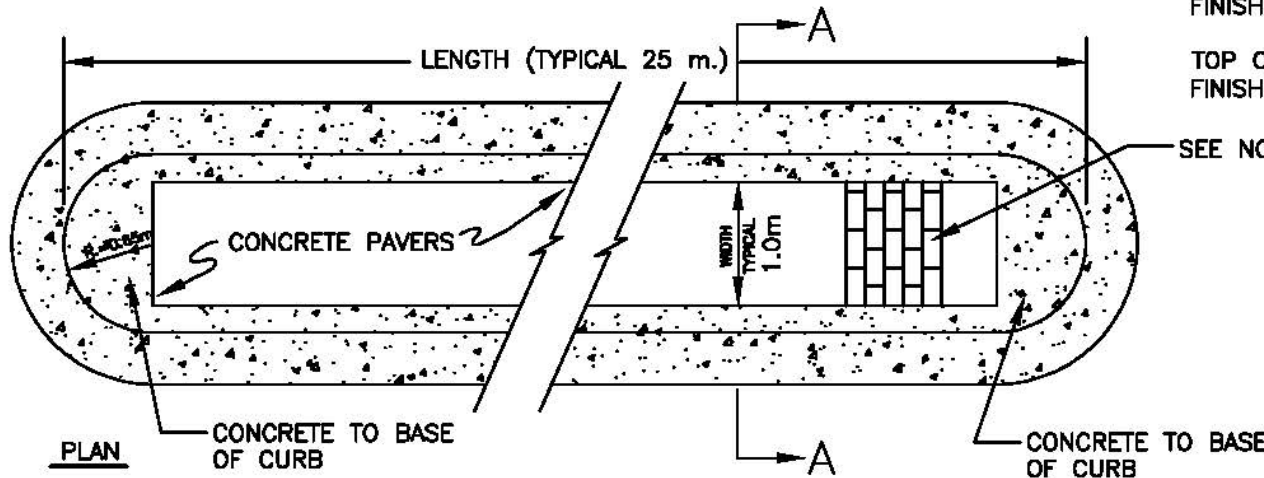
1 - 37



TYPICAL ROAD SECTION AT INTERSECTIONS WITH MEDIAN

TOP OF MEDIAN CURB IS 0.17 m ABOVE FINISHED \varnothing ROAD GRADE

TOP OF ROADSIDE CURB IS 0.01 m BELOW FINISHED \varnothing ROAD GRADE

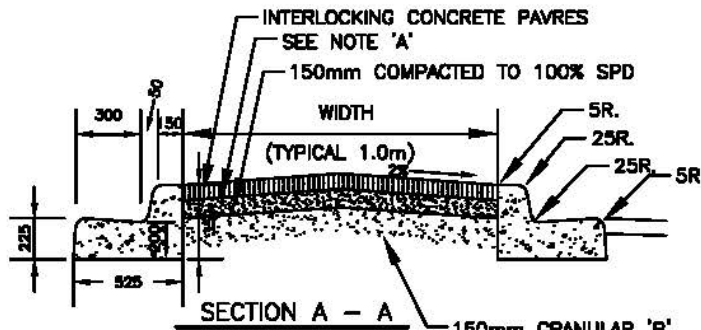


SEE NOTE 'B'

PLAN

CONCRETE TO BASE OF CURB

CONCRETE TO BASE OF CURB




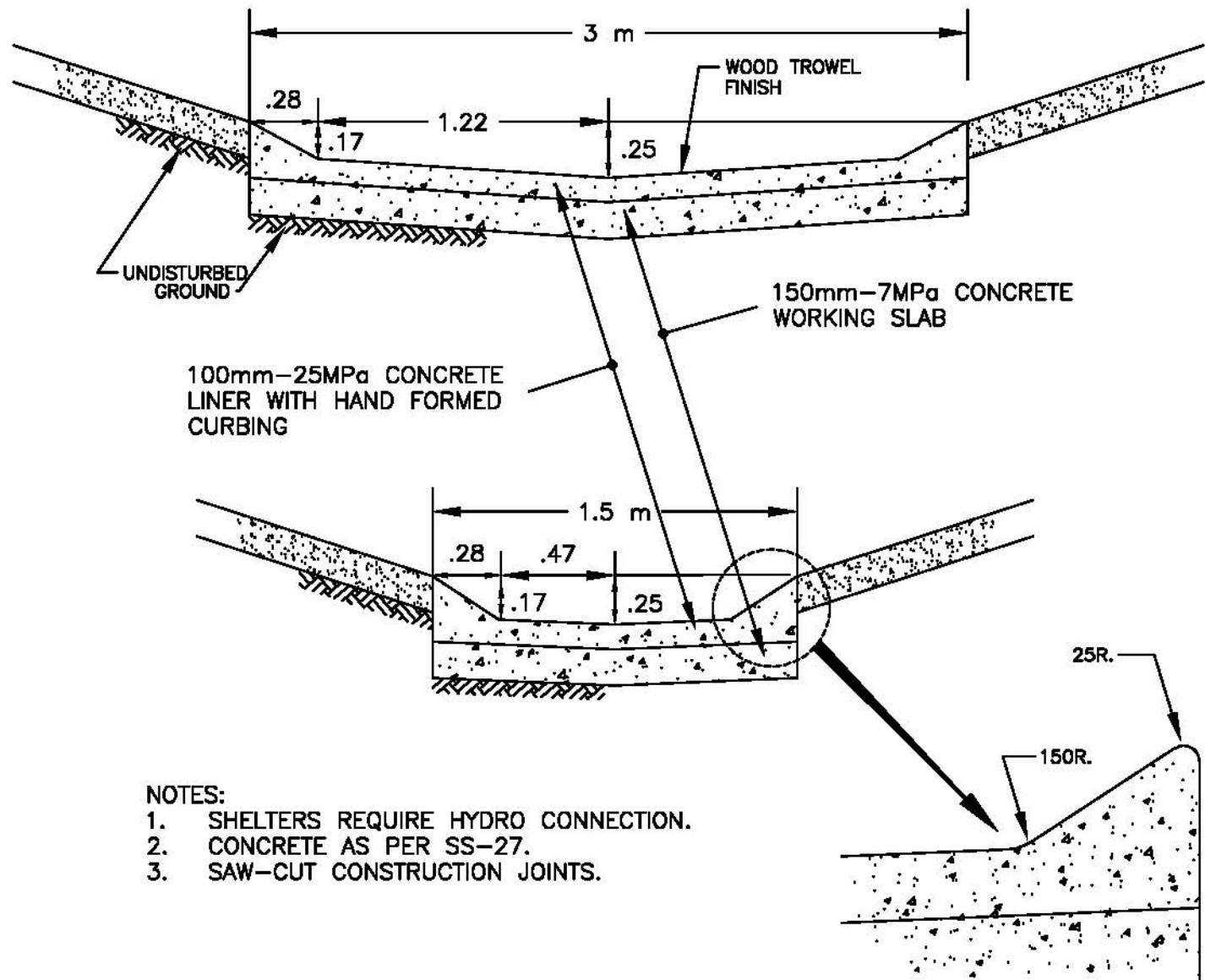
TYPICAL SECTION OF MEDIAN NTS

NOTE 'A':
40mm MAXIMUM LIMESTONE SCREENING OR SHARP MORTAR SAND FOR LEVELLING BED.

NOTE 'B':
INTERLOCKING CONCRETE PAVERS INSTALLED PERPENDICULAR TO THE DIRECTION OF TRAFFIC FLOW.


COLOUR - NATURAL GREY MIX OR RED AS SPECIFIED BY THE ENGINEER.

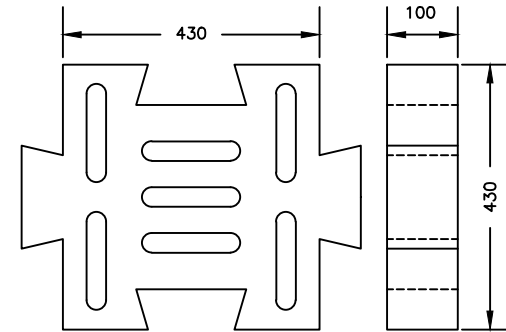
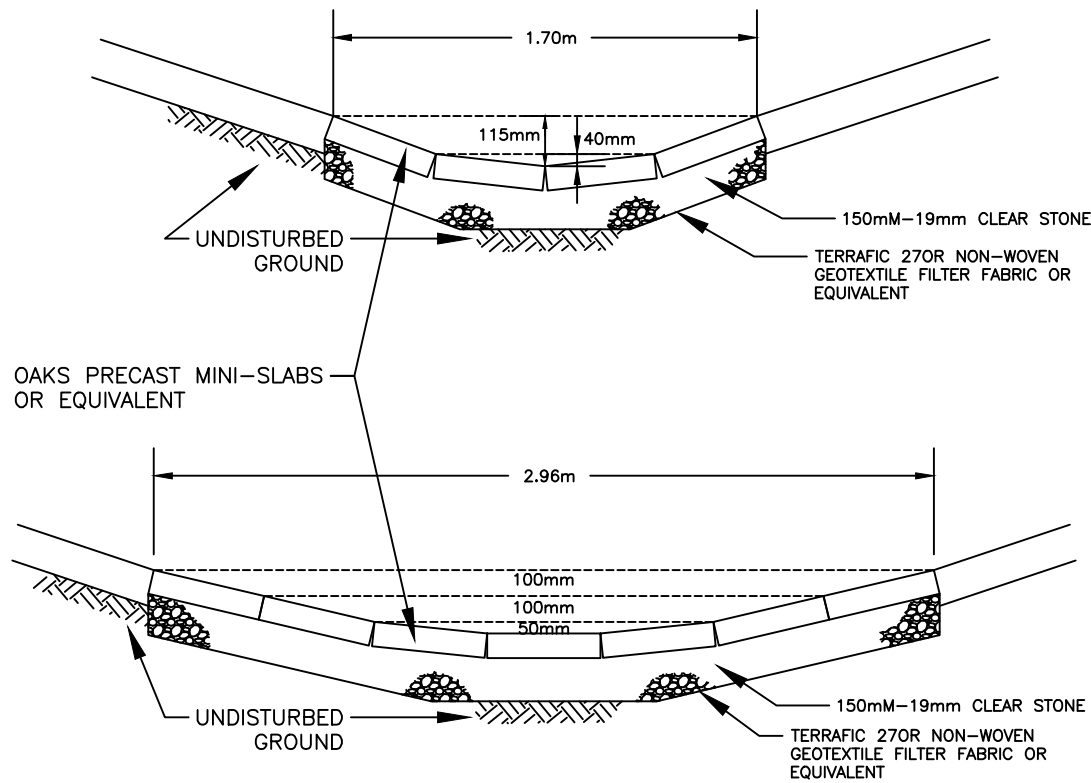
CITY OF GUELPH STANDARD DRAWING RAISED MEDIAN (WITH CONCRETE PAVERS)	DATE DRAWN: MAR/82	REV. No.: R-9	 <small>Making a Difference</small>
	DESCRIPTION: REVIEWED JAN/2011		
	REV. DATE: JAN/11	REV. BY.: G.F./C.M.C.	1 - 37 MODIFIED
	APPROVED BY: CITY ENGINEER		




NOTES:

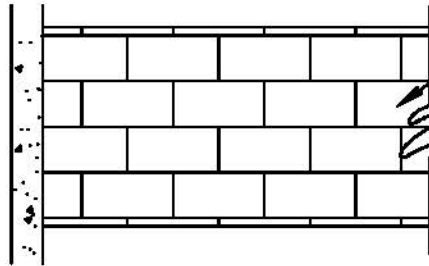
1. SHELTERS REQUIRE HYDRO CONNECTION.
2. CONCRETE AS PER SS-27.
3. SAW-CUT CONSTRUCTION JOINTS.

<p>CITY OF GUELPH STANDARD DRAWING</p> <p>CHANNEL LINER DETAILS</p> <p>FOR CITY OF GUELPH</p> <p>WATERCOURSES</p>	DATE DRAWN: MAR/88	REV. No.: R-3	 <p>ENGINEERING</p>
	DESCRIPTION: REVIEWED FEB/2005		
	REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.	
	APPROVED BY: CITY ENGINEER		<p>1 - 71a</p>



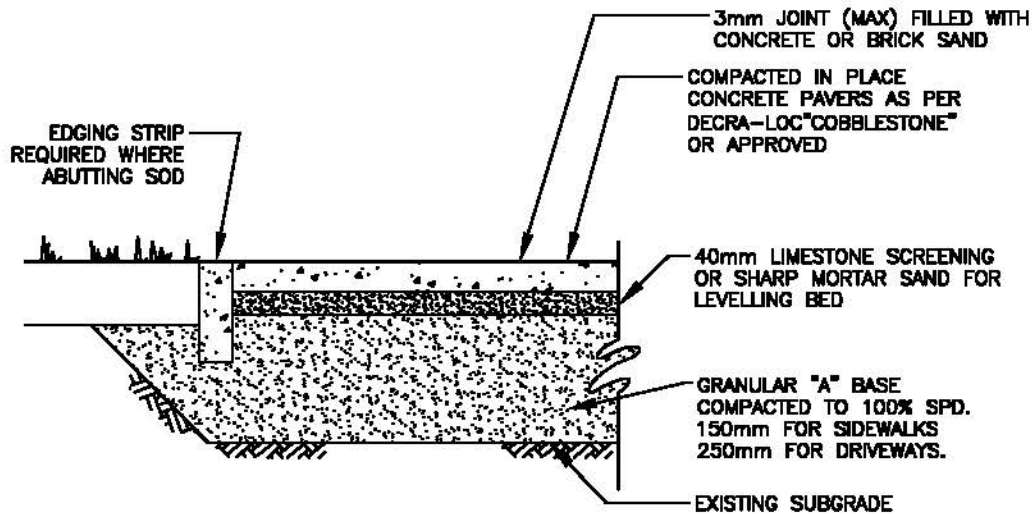
MATERIAL: PRECAST CONCRETE
 DIMENSIONS: 430mm x 430mm x 100mm THICK
 WIEGHT: 34.5 kg. (76 lbs)
 GROUND COVERAGE: 185m² (2 ft²)
 CONCRETE STRENGTH: 55 MPa (8000 psi)
 BUNDLE SIZE: 24 PIECE BUNDLES (NO PALLETS)

CITY OF GUELPH STANDARD DRAWING PRECAST CHANNEL LINER FOR CITY OF GUELPH WATERCOURSES	DATE DRAWN : FEB/89	REV. No. : R-3	 <small>Making a Difference</small>
	DESCRIPTION : REVIEWED FEB/2005		
	REV. DATE : FEB/05	REV. BY. : G.F./M.E.C.	1 - 71b
	APPROVED BY: _____		



CONCRETE UNIT PAVERS SHALL BE INSTALLED IN RUNNING BOND PATTERN. (SEE NOTE 2)


PLAN



SECTION

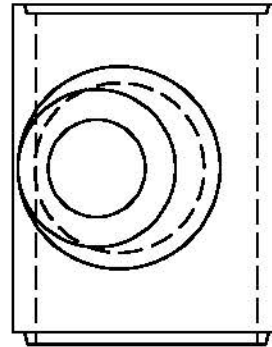
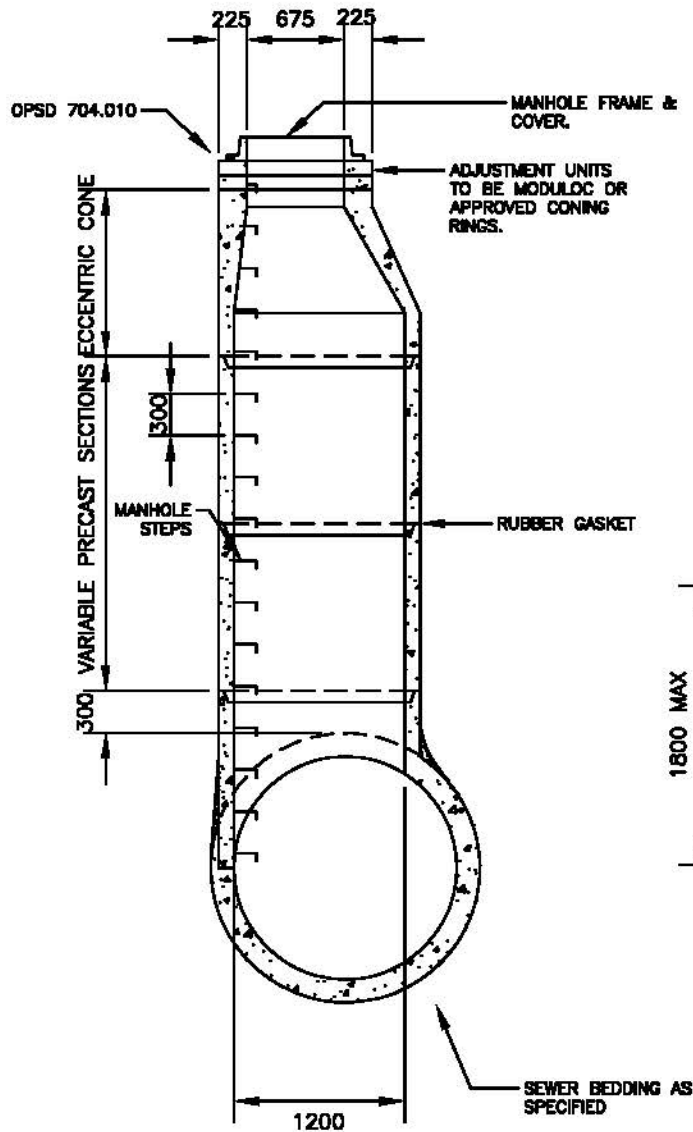
NOTES:

1. MATERIALS FOR CONCRETE UNIT PAVERS SHALL CONFORM TO THE LATEST CSA STANDARDS FOR PORTLAND CEMENT AND AGGREGATES.
2. PAVERS SHALL BE INSTALLED PERPENDICULAR TO THE DIRECTION OF TRAFFIC FLOW IN BOULEVARDS AND RAISED ISLAND MEDIANS.
3. COLOURS FOR PAVERS: NATURAL, GREY MIX OR RED WHERE SPECIFIED BY THE ENGINEER
4. PAVING STONE THICKNESS:
60mm FOR SIDEWALKS AND MEDIANS
80mm FOR DRIVEWAYS

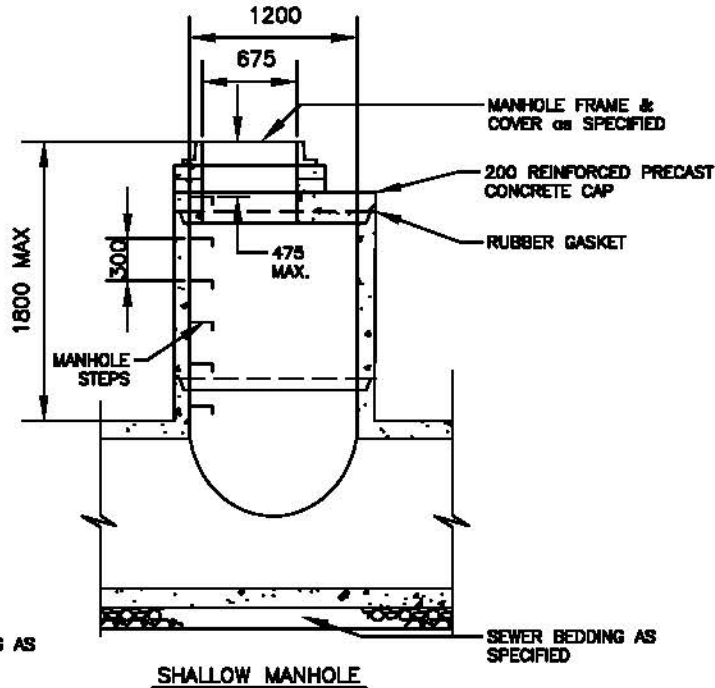
CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No.: R-3	 ENGINEERING
CONCRETE PAVING STONE INSTALLATION		DESCRIPTION: REVIEWED FEB/2005		
		REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.	
		APPROVED BY: _____ CITY ENGINEER		
				1 - 83



**SECTION 2:
MANHOLES
CATCHBASINS
VAULTS**



PLAN

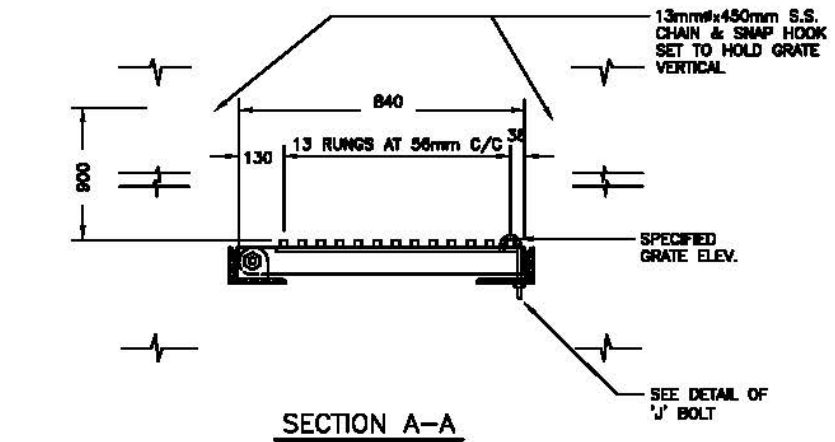
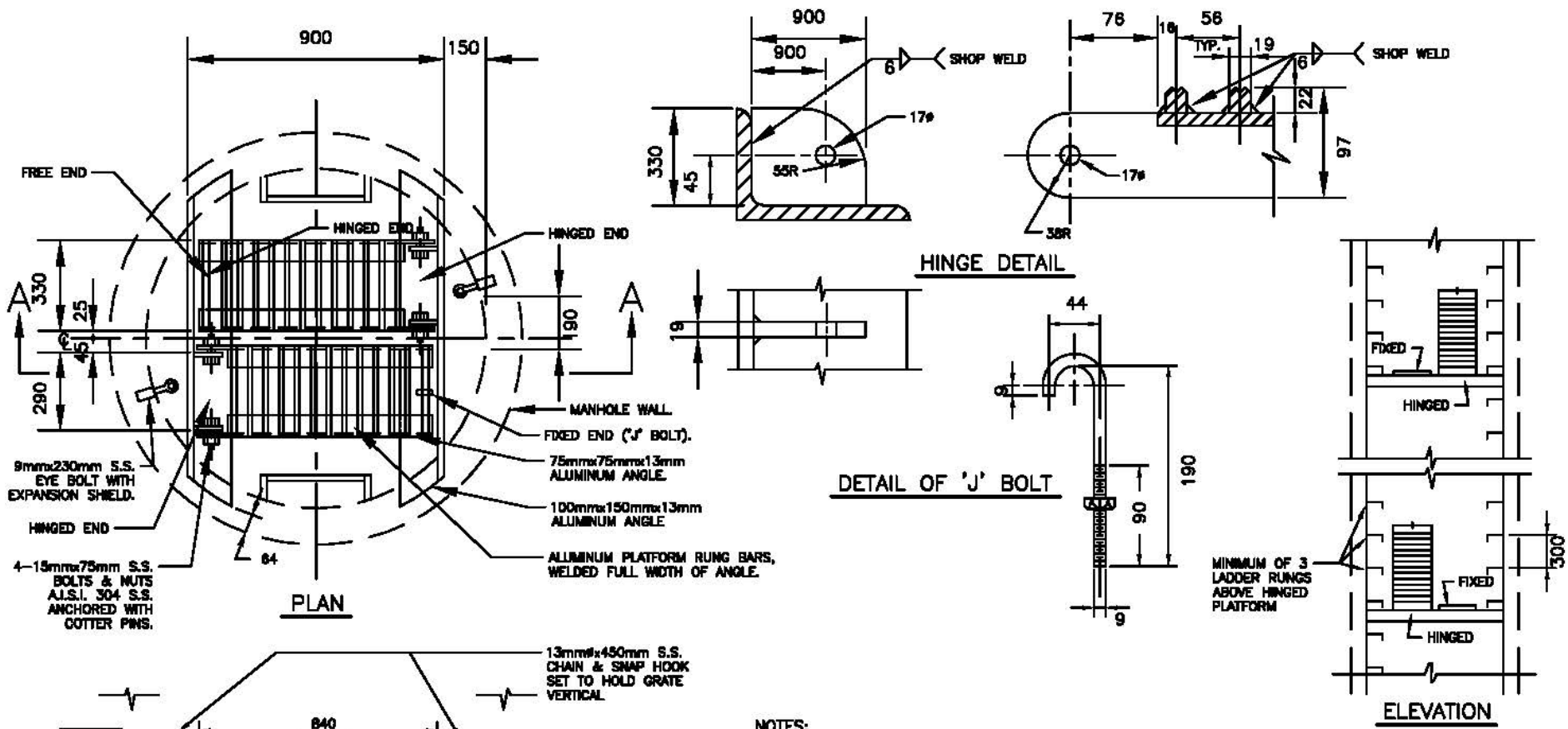


SHALLOW MANHOLE

NOTES:

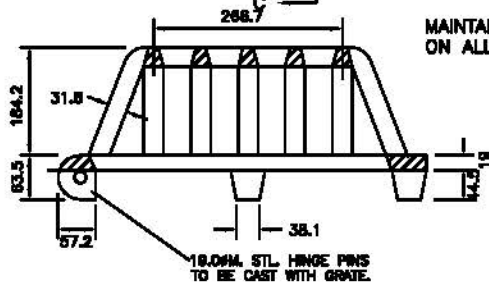
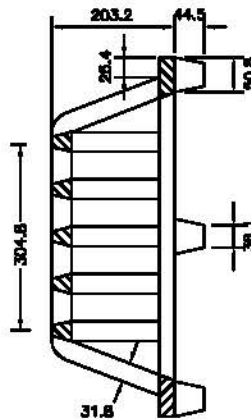
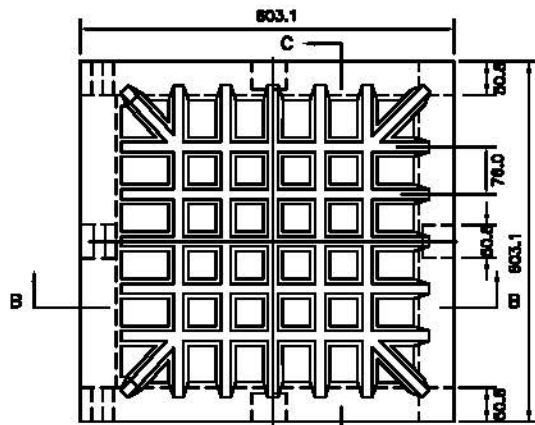
1. PRECAST MANHOLE SECTIONS SHALL BE EQUAL TO A.S.T.M. SPECIFICATIONS C-478.
2. FIRST STEP TO BE 475 MAX. BELOW TOP OF FRAME. LAST STEP TO BE 300 ABOVE BENCHING OR 600 MAX. ABOVE INVERT.
-STEPS TO BE INSTALLED ON THE ROADSIDE WALL OF THE STRUCTURE.
3. ALL JOINTS AND LIFTING HOLES IN MANHOLE TO BE COMPLETELY FILLED IN WITH A 3:1 MORTAR MIX AND POINTED BEFORE BACKFILLING.
4. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : -	REV. No. : R-5	 ENGINEERING
PRECAST MANHOLE TEE FOR CONCRETE PIPE FROM 1050mm AND LARGER MAIN		DESCRIPTION : REVIEWED FEB/2007		
		REV. DATE : MAR/07	REV. BY. : G.F.	2 - 7
		APPROVED BY: CITY ENGINEER		



- NOTES:
1. ALUMINUM TO BE APPROVED ALLOY.
 2. AT ALL POINTS WHERE ALUMINUM AND CONCRETE SURFACES COME INTO CONTACT (END OF BASE ANGLE), ALUMINUM SURFACES TO BE COATED WITH 2 COATS OF STATIC ASPHALT PAINT.
 3. MANHOLE DEPTH BETWEEN 5m & 10m, GRATE TO BE PLACED AT MID POINT. MANHOLE DEPTH BETWEEN 10m & 15m, GRATE TO BE PLACED AT THIRD POINT. PLATFORMS ARE REQUIRED BY LAW FOR MANHOLE DEPTHS GREATER THAN 5m.
 4. ALL 100mm x 150mm x 13mm ALUMINUM ANGLE SUPPORTS TO BE INSTALLED DURING PRE-CASTING OF MANHOLE SECTIONS.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No.: R-5	
MANHOLE SAFETY PLATFORM 1200 DIAMETER CIRCULAR STACK		DESCRIPTION: REVIEWED FEB/2005		
		REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.	ENGINEERING
		APPROVED BY: CITY ENGINEER		2 - 9

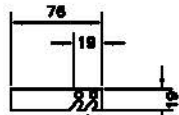


MAINTAIN THIS ANGLE ON ALL SIDES

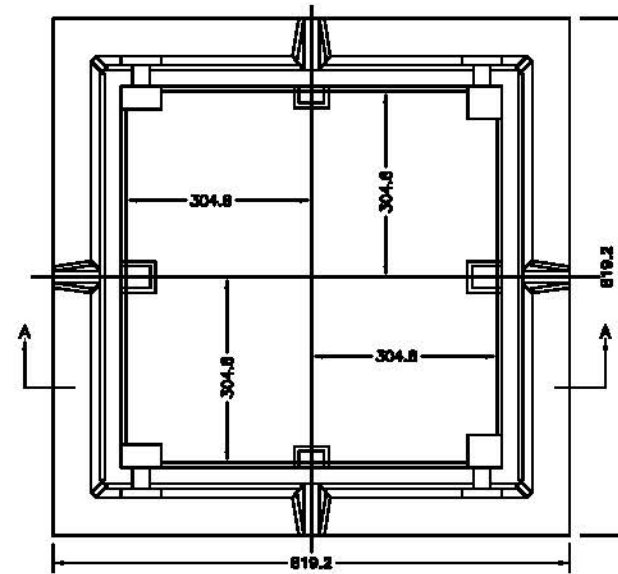
SECTION C-C

SECTION B-B

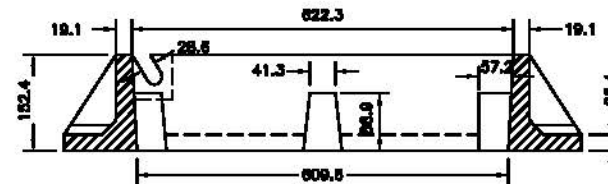
GRATE



HINGE PIN



FRAME



SECTION A-A

NOTES:

1. ALLOWABLE TOLERANCES:
 DIMENSIONS 300mm OR LESS $\pm 2\%$
 DIMENSIONS OVER 300mm UP TO AND INCLUDING 900mm $\pm 2\%$
2. THE INITIALS OR MARK OF THE MANUFACTURER ARE TO BE DISTINCTLY CAST IN RAISED LETTERS ON BOTH FRAME AND GRATE.
3. STEEL FOR HINGE PINS TO BE AS PER A.S.T.M. DESIGNATION A-7 OR EQUIVALENT.

CITY OF GUELPH STANDARD DRAWING

REAR YARD CATCH BASIN
FRAME AND GRATE

DATE DRAWN: - REV. No.: R-3

DESCRIPTION: REVIEWED FEB/2005

REV. DATE: FEB/05 REV. BY.: G.F./M.E.C.

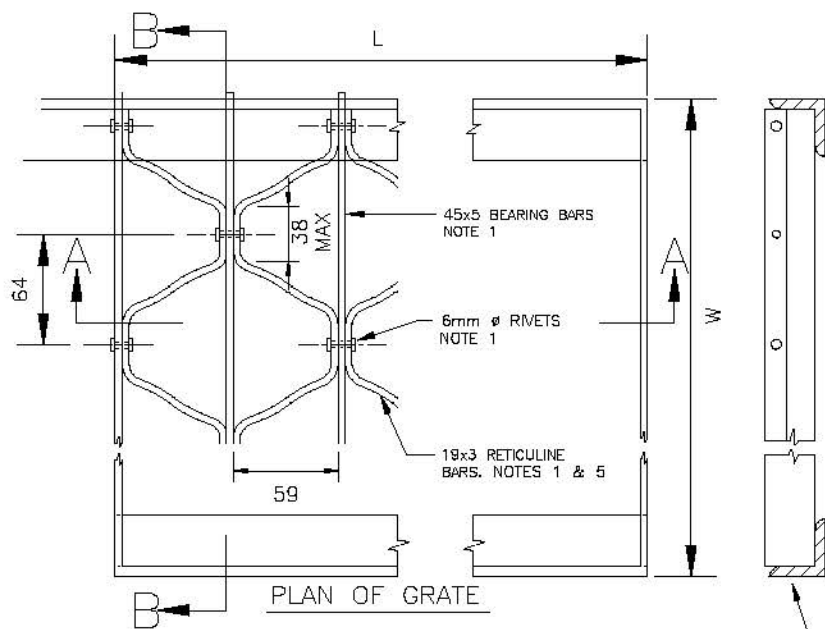
APPROVED BY:

CITY ENGINEER

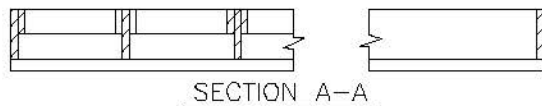


ENGINEERING

2 - 15

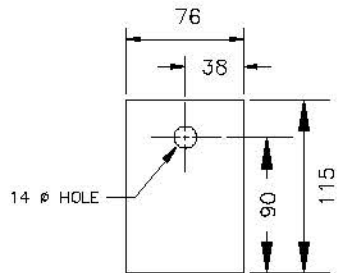


PLAN OF GRATE



SECTION A-A

SECTION B-B



OFFSET WASHER DETAIL

GRATING TYPE	GRATING SIZE	
	LENGTH	WIDTH
A	765	770
B	1340	770

NOTES:

- MATERIALS:
 - BEARING BARS - WELDING QUALITY STEEL HAVING THE MINIMUM TENSILE STRENGTH OF SAE-1015
 - RETICULINE BARS - WELDING QUALITY STEEL HAVING THE MINIMUM TENSILE STRENGTH OF SAE-1010
 - RIVETS - FLAT HEAD TO SAE-1015
- FINISH:

ALL SURFACES SHALL BE PAINTED WITH ONE SHOP COAT OF ASPHALT OR TAR BASE PAINT, HAVING A MINIMUM SOFTENING POINT OF 71°C.
- TOLERANCES:

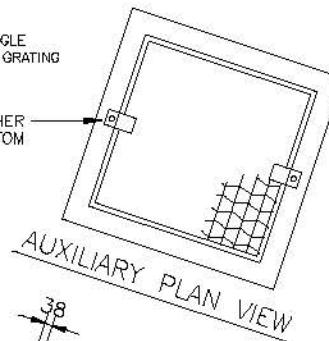
TOLERANCES SHALL BE AS SHOWN IN THE STANDARD SPECIFICATION FOR METAL GRATING AND METAL GRATING THREAD OF THE METAL GRATING INSTITUTE. ALLOWABLE TOLERANCES FOR DIMENSIONS ±2.0%.
- STANDARD METAL GRATING INSTITUTE MARKING: RF-37-5.
- RETICULINE BARS MAY BE CRIMPED OR STRAIGHT. MAXIMUM LENGTH OF THE RETICULINE BAR PARALLEL TO THE BEARING BAR IS 38mm AT EACH RIVET.
- WELDING:

END BEARING BARS TO BE WELDED TO ANGLE BAR ALONG BOTH LEGS WITH 5mm FILLET WELD.
- FASTENER:

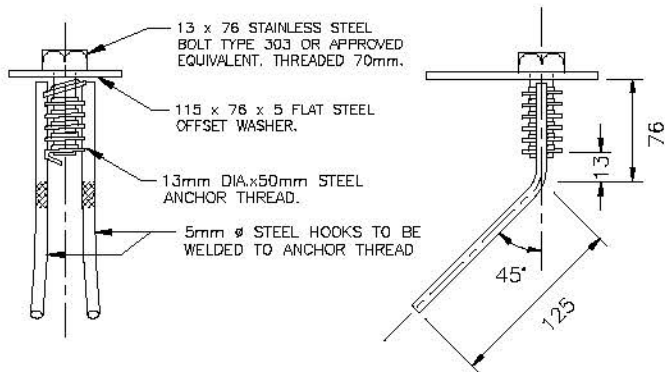
AFTER MANUFACTURE, ASSEMBLY (EXCEPT BOLT) SHALL BE HOT-DIPPED GALVANIZED TO A.S.T.M.-A153-61. SCREW ONLY TO RECEIVE A LIBERAL COATING OF WHITE NON-STAINING GREASE.

50x50x6 ANGLE WELDED TO GRATING

OFFSET WASHER TOP & BOTTOM



AUXILIARY PLAN VIEW



DITCH INLET CROSS-SECTION

CITY OF GUELPH STANDARD DRAWING

RIVETED GRATING FOR DITCH INLET CATCH BASIN

DATE DRAWN: - REV. No.: R-3

DESCRIPTION: REVIEWED FEB/2005

REV. DATE: FEB/05 REV. BY.: G.F./M.E.C.

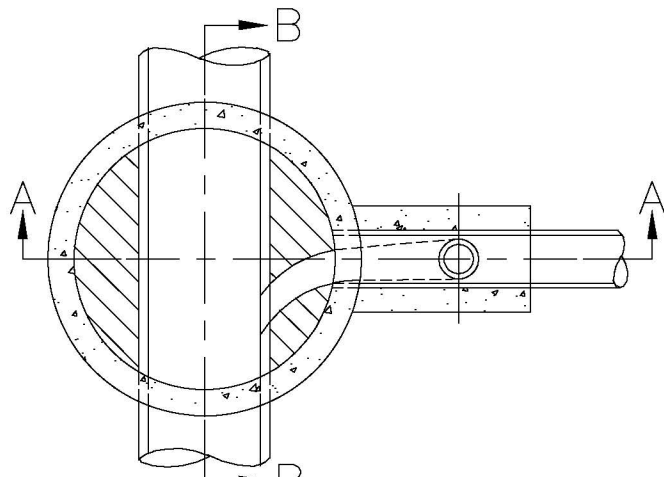
APPROVED BY:

CITY ENGINEER



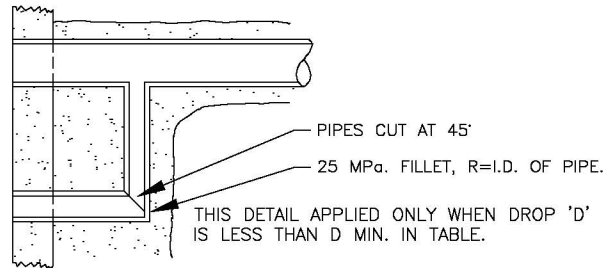
ENGINEERING

2 - 16



WHEN SIZE OF DROP PIPE EXCEEDS 900, A FORMED OR PRECAST 90° BEND WILL BE USED INSTEAD OF 2-1/8 BENDS AS DETAILED ON DRAWINGS.
 WHEN MINIMUM OF 0.762m IS USED. USE A 90° ELBOW INSTEAD OF 2-1/8 BENDS.

SIZE OF DROP PIPE	'D' MIN.	'L' MIN.
200-250	750	600
300-450	900	600
525	975	650
600	1075	700
675	1175	750
750	1275	800
825	1375	850
900	1475	900



THIS DETAIL APPLIED ONLY WHEN DROP 'D' IS LESS THAN D MIN. IN TABLE.

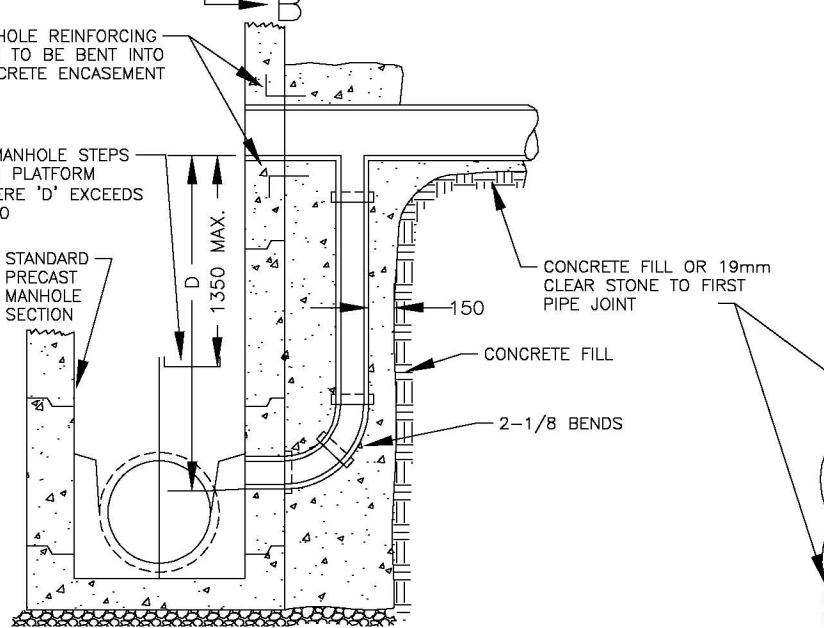
NOTES:

1. DROP PIPE TO BE ONE PIPE SIZE SMALLER THAN INLET PIPE.
2. DROP PIPE OBVERT TO BE LEVEL WITH OUTLET PIPE OBVERT.
3. DROP PIPE TO BLEND WITH FLOW.
4. ALL CONCRETE IN DROP STRUCTURE TO BE READ IN CONJUNCTION WITH SS-27 (3).
5. MINIMUM DIMENSIONS BASED ON USE OF STANDARD FITTINGS AS PER LATEST INFORMATION BY SUPPLIERS.
6. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURERS PERMISSIBLE VARIATIONS.

MANHOLE REINFORCING WIRE TO BE BENT INTO CONCRETE ENCASEMENT

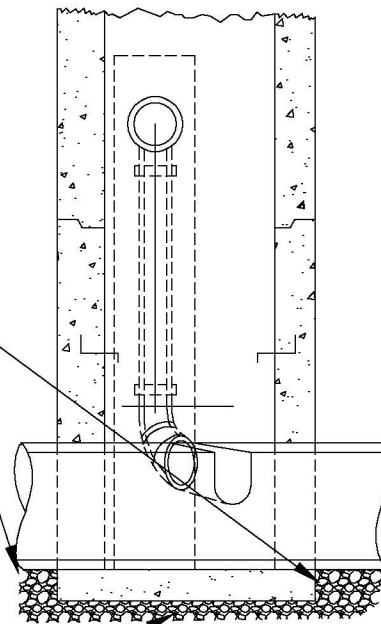
2 MANHOLE STEPS FOR PLATFORM WHERE 'D' EXCEEDS 1800

STANDARD PRECAST MANHOLE SECTION



SECTION A-A

19mm CRUSHED STONE LEVELING COURSE IF REQUIRED



SECTION B-B

CITY OF GUELPH STANDARD DRAWING

STANDARD DROP STRUCTURES FOR MANHOLES

DATE DRAWN: - REV. No.: R-2

DESCRIPTION: REVIEWED JAN/2010

REV. DATE: JAN/10 REV. BY.: G.F./C.M.C.

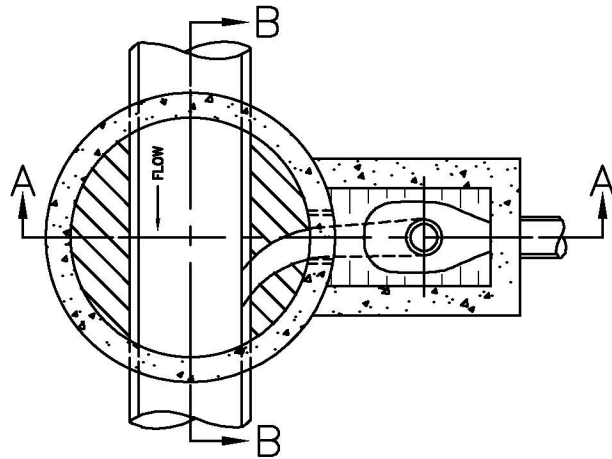
APPROVED BY:

CITY ENGINEER

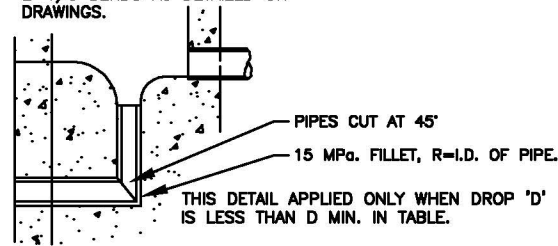


ENGINEERING

2 - 41



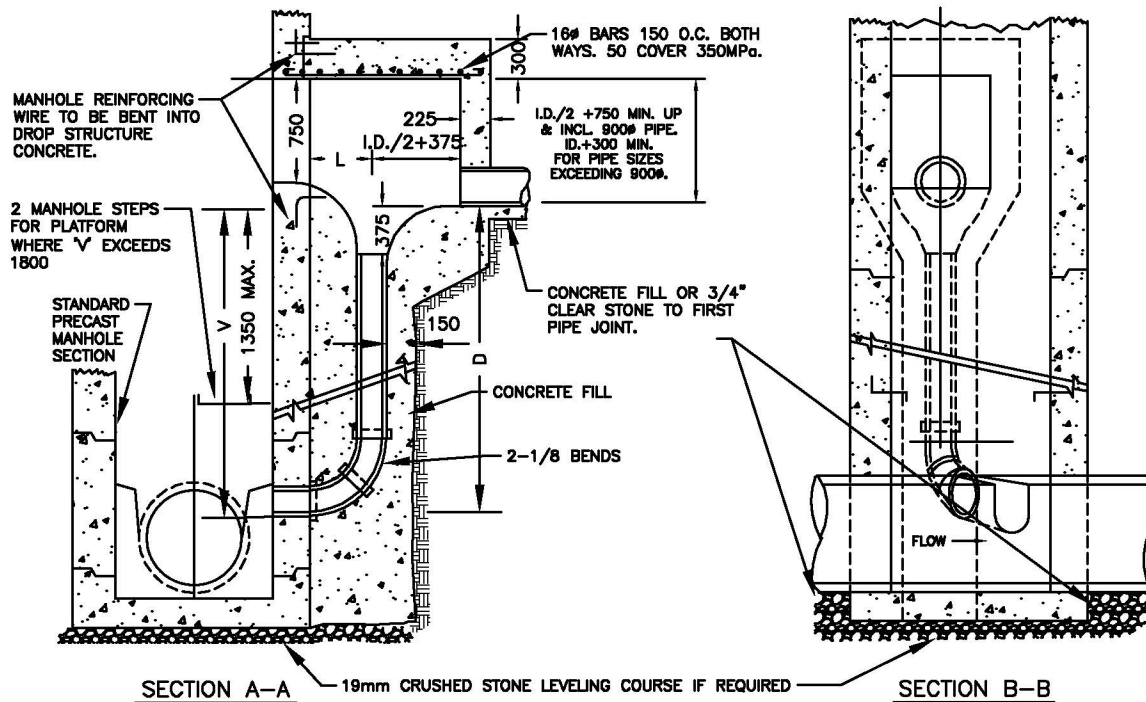
WHEN SIZE OF DROP PIPE EXCEEDS 900, A FORMED OR PRECAST 90° BEND WILL BE USED INSTEAD OF 2-1/8 BENDS AS DETAILED ON DRAWINGS.



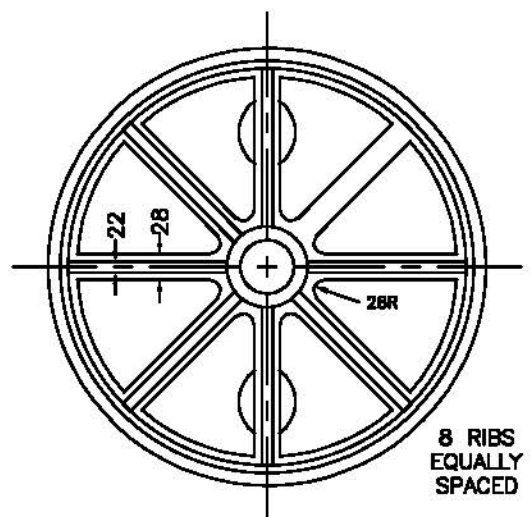
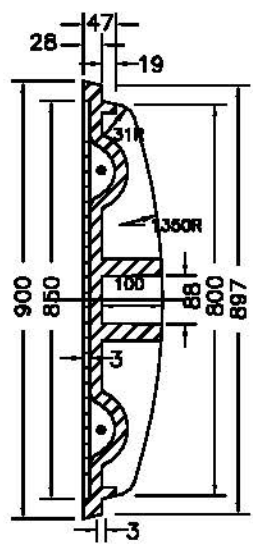
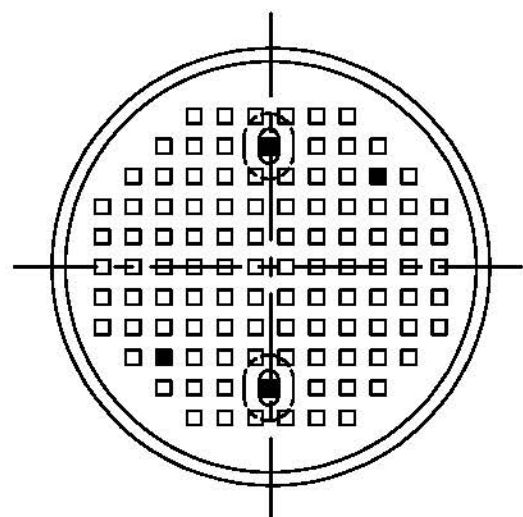
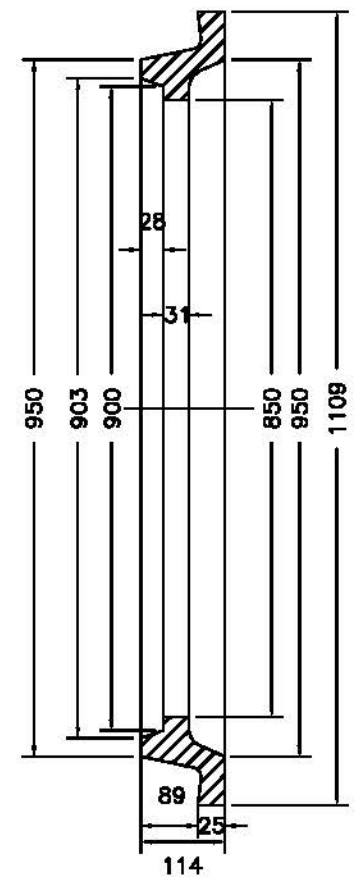
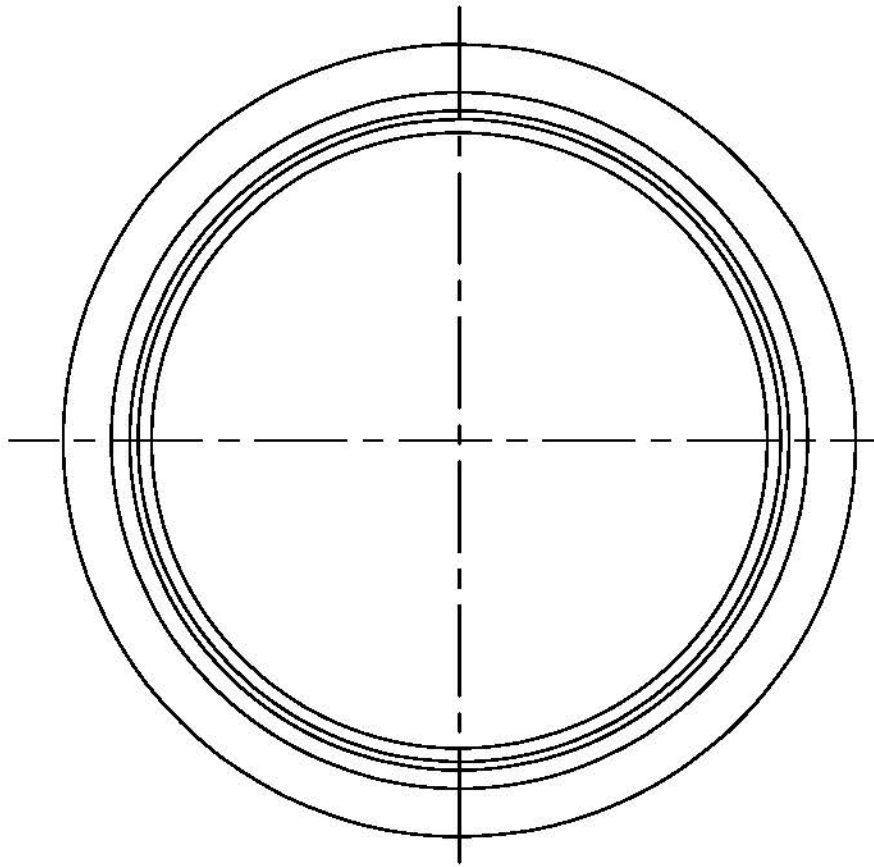
SIZE OF DROP PIPE	'D' MIN.	'L' MIN.
200-450	1125	600
525	1200	650
600	1300	700
675	1400	750
750	1500	800
825	1600	850
900	1700	900

NOTES:

1. DROP PIPE TO BE ONE PIPE SIZE SMALLER THAN INLET PIPE.
2. DROP PIPE OBVERT TO BE LEVEL WITH OUTLET PIPE OBVERT.
3. DROP PIPE TO BLEND WITH FLOW.
4. ALL CONCRETE IN DROP STRUCTURE TO BE READ IN CONJUNCTION WITH SS-27 (3).
5. MINIMUM DIMENSIONS BASED ON USE OF STANDARD FITTINGS AS PER LATEST INFORMATION BY SUPPLIERS.
6. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURERS PERMISSIBLE VARIATIONS.



<p>CITY OF GUELPH STANDARD DRAWING</p> <p>SPECIAL DROP STRUCTURES FOR MANHOLES</p>	DATE DRAWN: -	REV. No.: R-2	
	DESCRIPTION: REVIEWED JAN/2010		
	REV. DATE: JAN/10	REV. BY.: G.F./C.M.C.	<p>2 - 42</p>
	APPROVED BY:		



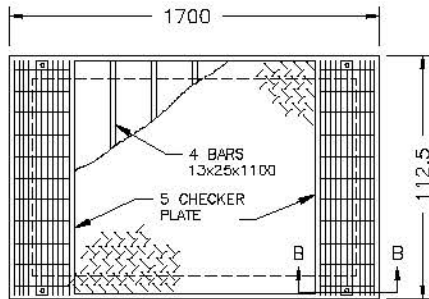
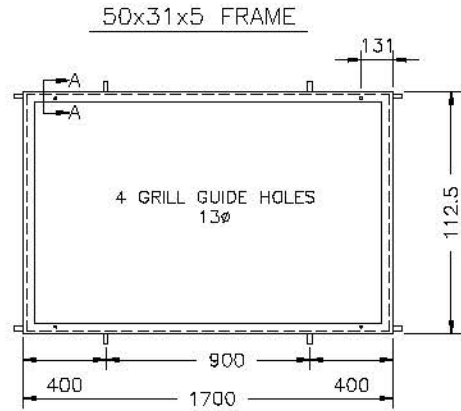
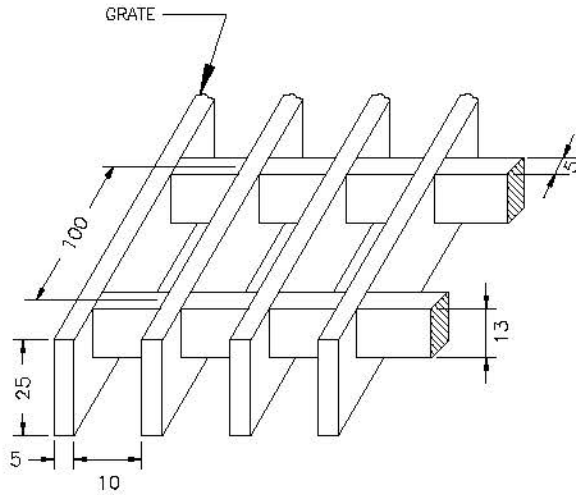
- NOTES:
 1. ORDER BY H.M.36 WITH 2 LIFTING PINS.
 2. TOTAL WEIGHT APPROXIMATELY 318 kg.

CITY OF GUELPH STANDARD DRAWING

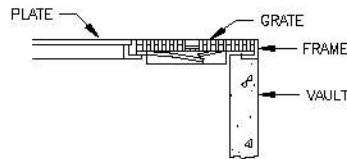
**900mm (HEAVY DUTY)
 MANHOLE COVER & FRAME**

DATE DRAWN: -	REV. No.: R-2
DESCRIPTION: REVIEWED FEB/2005	
REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.
APPROVED BY: CITY ENGINEER	

ENGINEERING
2 - 58

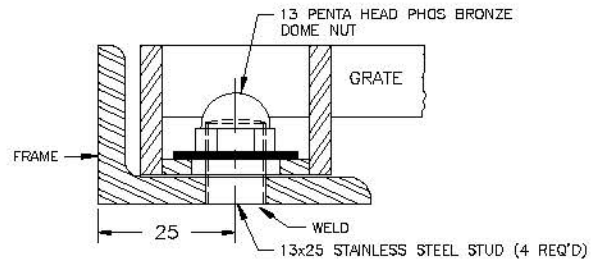


SECTION B-B



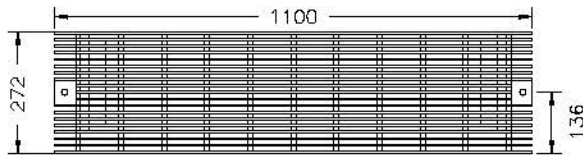
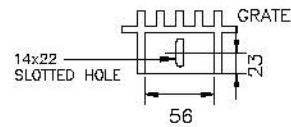
CLOSE MESH X-BAR GRATING
(2 REQ'D)

GRATING FASTENER DETAIL

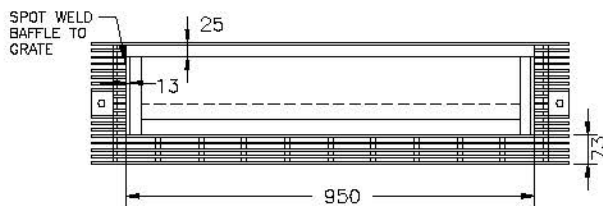


SECTION A-A

(SHOWING GRATING LOCK DOWN ARRANGEMENT)



TOP VIEW



BOTTOM VIEW

NOTES:

1. PLATE TO BE HOT ROLLED STEEL WITH A 4-WAY RAISED DIAMOND PATTERN ON SURFACE.
2. PLATE AND GRATING TO BE FINISHED HOT DIPPED GALVANIZED AS PER A.S.T.M. A-123.

CITY OF GUELPH STANDARD DRAWING

**FRAME GRILL & COVER PLATE
FOR 1700mm x 1125mm PLATE
UTILITY VAULT**

DATE DRAWN: - REV. No.: R-2

DESCRIPTION: REVIEWED FEB/2005

REV. DATE: FEB/05 REV. BY.: G.F./M.E.C.

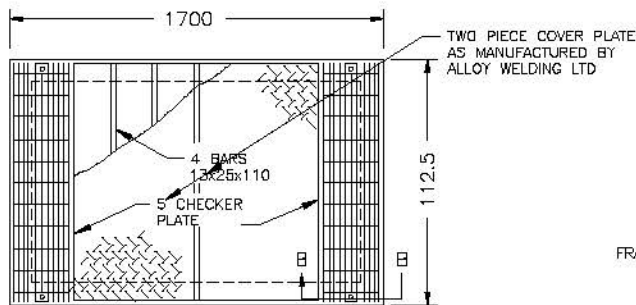
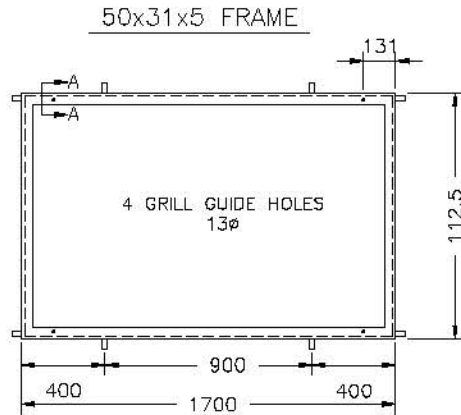
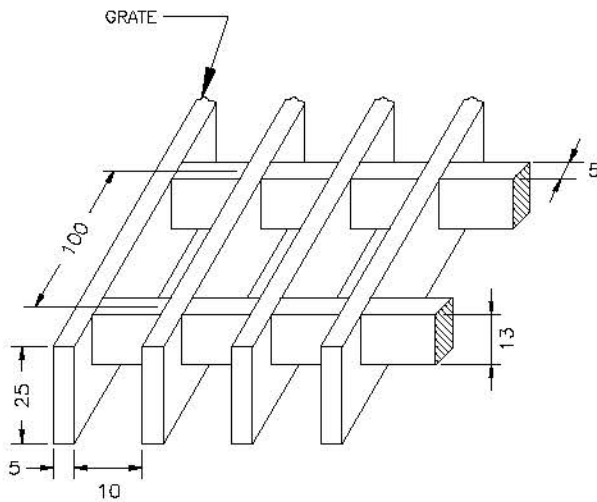
APPROVED BY:

CITY ENGINEER

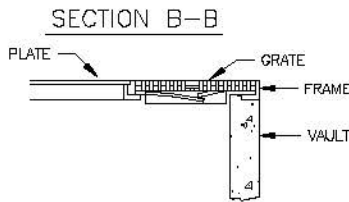
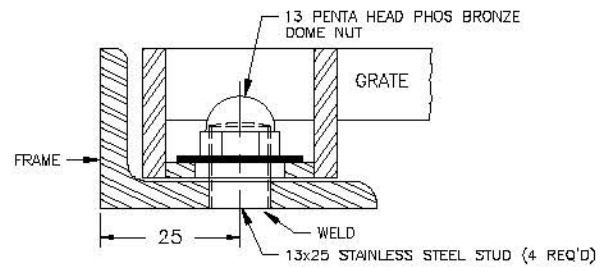


ENGINEERING

2 - 59

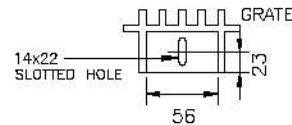


GRATING FASTENER DETAIL

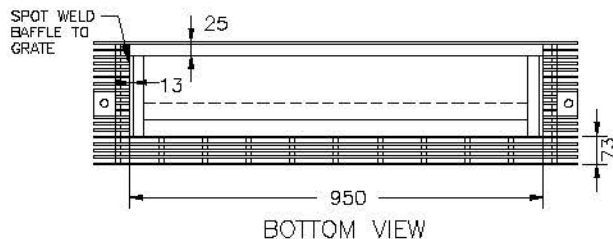
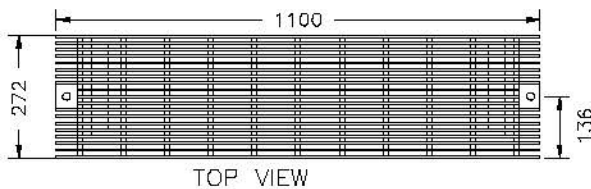


SECTION A-A

(SHOWING GRATING LOCK DOWN ARRANGEMENT)



**CLOSE MESH X-BAR GRATING
(2 REQ'D)**



NOTES:

1. PLATE TO BE HOT ROLLED STEEL WITH A 4-WAY RAISED DIAMOND PATTERN ON SURFACE.
2. PLATE AND GRATING TO BE FINISHED HOT DIPPED GALVANIZED AS PER A.S.T.M. A-123.

CITY OF GUELPH STANDARD DRAWING

**FRAME GRILL & COVER PLATE
FOR 1700mm x 1125mm PLATE
UTILITY VAULT**

DATE DRAWN: - REV. No.: R-2

DESCRIPTION: REVIEWED FEB/2005

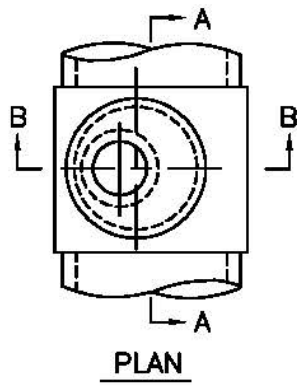
REV. DATE: FEB/05 REV. BY.: G.F./M.E.C.

APPROVED BY: CITY ENGINEER

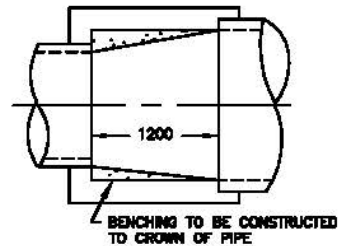


ENGINEERING

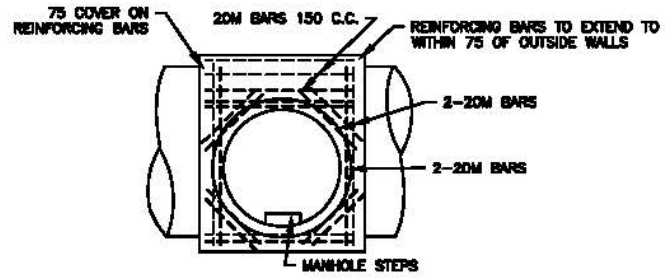
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MODIFIED**



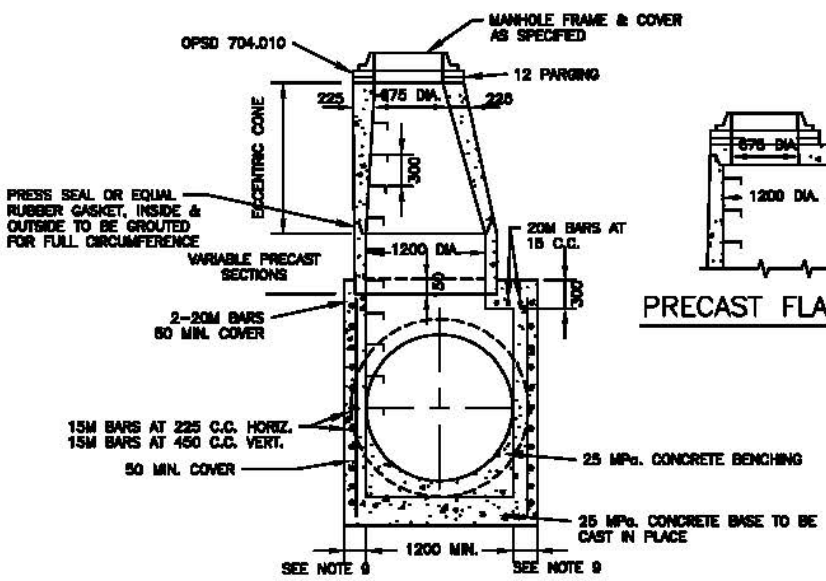
PLAN



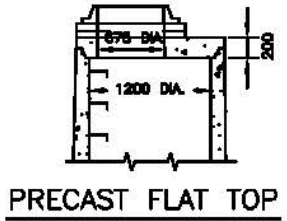
SECTION D-D
(FOR INCREASE IN PIPE SIZES)



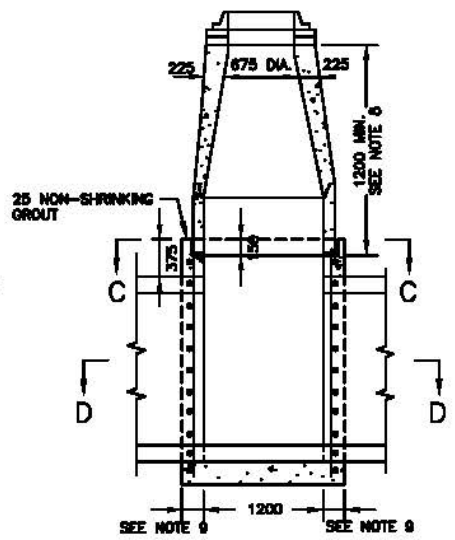
SECTION C-C



SECTION B-B



PRECAST FLAT TOP

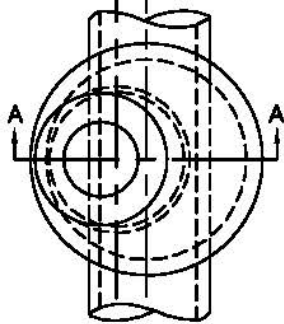


SECTION A-A

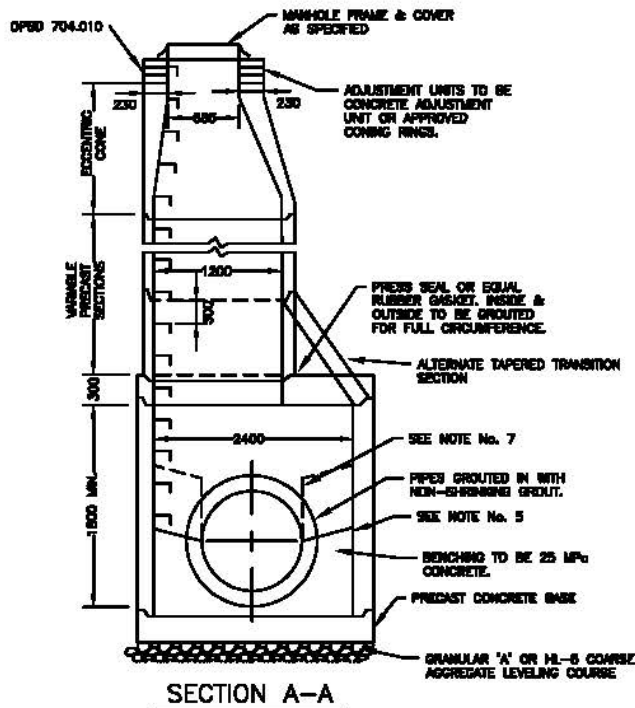
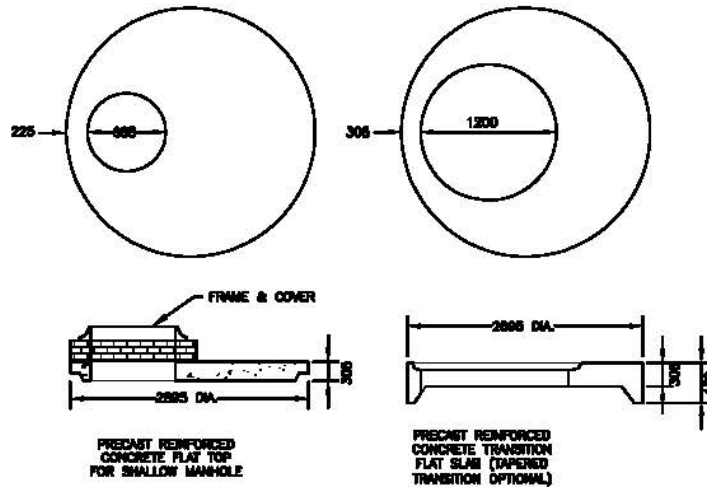
- NOTES:
1. FOR CAST-IN-PLACE BASE, CONCRETE TO BE 32 MPa AT 28 DAYS.
 2. PRECAST MANHOLE SECTIONS SHALL BE EQUAL TO A.S.T.M. SPECIFICATIONS C-478.
 3. STEPS: FIRST STEP TO BE 475 mm MAX. BELOW FRAME. LAST STEP TO BE 300 mm ABOVE BENCHING OR 600 mm ABOVE INVERT. STEPS TO BE INSTALLED ON THE ROAD SIDE WALL OF THE STRUCTURE.
 4. PARING MIX ON ALL BRICKWORK TO BE 1:3 MORTAR MIX AND APPLIED 12 mm THICK.
 5. OPENING IN BASE FOR PRECAST MANHOLE SECTION TO BE NOT LARGER THAN O.D. OF SECTION PLUS 25 mm. TWELVE MILLIMETRE (12 mm.) SPACE TO BE FILLED WITH HOT BITUMINOUS SEALER.
 6. ALL JOINTS AND LIFTING HOLES IN MANHOLE SECTIONS TO BE COMPLETELY FILLED WITH A 1:3 MORTAR MIX AND PAINTED BEFORE BACKFILLING.
 7. PIPES ENTERING PRECAST SECTIONS ON MANHOLE MUST NOT ENTER AT JOINTS.
 8. PRECAST FLAT TOP TO BE USED WHEN TOTAL HEIGHT OF PRECAST SECTION IS LESS THAN 1200 mm.
 9. WALLS: 225 mm FOR MANHOLES 4500 mm OR LESS. 300 mm FOR MANHOLES OVER 4500 mm.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No.: R-4	 ENGINEERING
SEMI - PRECAST MANHOLE 825mm TO 2700mm		DESCRIPTION: REVIEWED JAN/2010	REV. DATE: JAN/10	
		APPROVED BY:		2 - 61
			CITY ENGINEER	

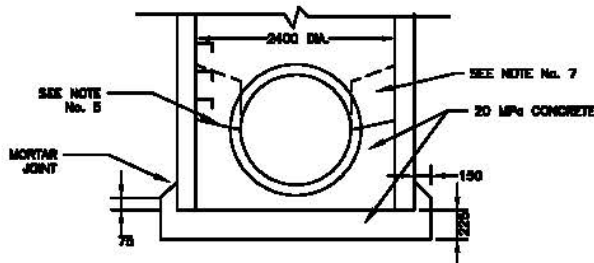
☉ CHIMNEY ☉ MANHOLE



PLAN



SECTION A-A



OPTIONAL CAST IN PLACE BASE

NOTES:

1. FOR CAST-IN-PLACE BASE, CONCRETE TO BE:
 A) 32 MPa AT 28 DAYS.
 B) AIR ENTRAINMENT 6.5%±.5%
 C) SPECIFIED SLUMP 50mm MIN. AND 100mm MAX.
2. PRECAST MAINTENANCE HOLE SECTIONS SHALL BE EQUAL TO A.S.T.M. SPECIFICATIONS C-478.
3. STEPS: FIRST STEP TO BE 475 mm MAX. BELOW TOP OF FRAME. LAST STEP TO BE 300 mm ABOVE BENCHING OR 800 mm MAX. ABOVE INVERT.
 - STEPS TO BE INSTALLED ON THE ROADSIDE WALL OF THE STRUCTURE.
4. PARING MIX ON ALL BRICKWORK TO BE 1:3 MORTAR MIX AND APPLIED 12 mm THICK. THEN COATED WITH 2 COATS OF BITUMEN.
5. TOP OF BENCHING TO BE SLOPED NO GREATER THAN 4:1 (HORIZONTAL TO VERTICAL) NOR LESS THAN 8:1 (HORIZONTAL TO VERTICAL)
6. ALL LIFTING HOLES IN MAINTENANCE HOLE SECTIONS TO BE COMPLETELY FILLED IN WITH A 1:3 MORTAR MIX AND PAINTED BEFORE BACKFILLING.
7. WHERE USED OR APPLICABLE TO STORM SEWER BENCHING SHALL BE TO CROWN.
8. SEE SD-29 FOR PIPE BENDING MATERIAL FOR CAST-IN-PLACE MAINTENANCE HOLE BASE CONSTRUCTION WITH RIGID PIPES. THE FIRST LENGTHS OF PIPE IN AND OUT OF THE MAINTENANCE HOLE ARE TO HAVE CLASS 'A' BEDDING (SEE OPSD 802.03 AND OPSD 1005.01)

CITY OF GUELPH STANDARD DRAWING

**PRECAST MANHOLE
2400mm DIA.**

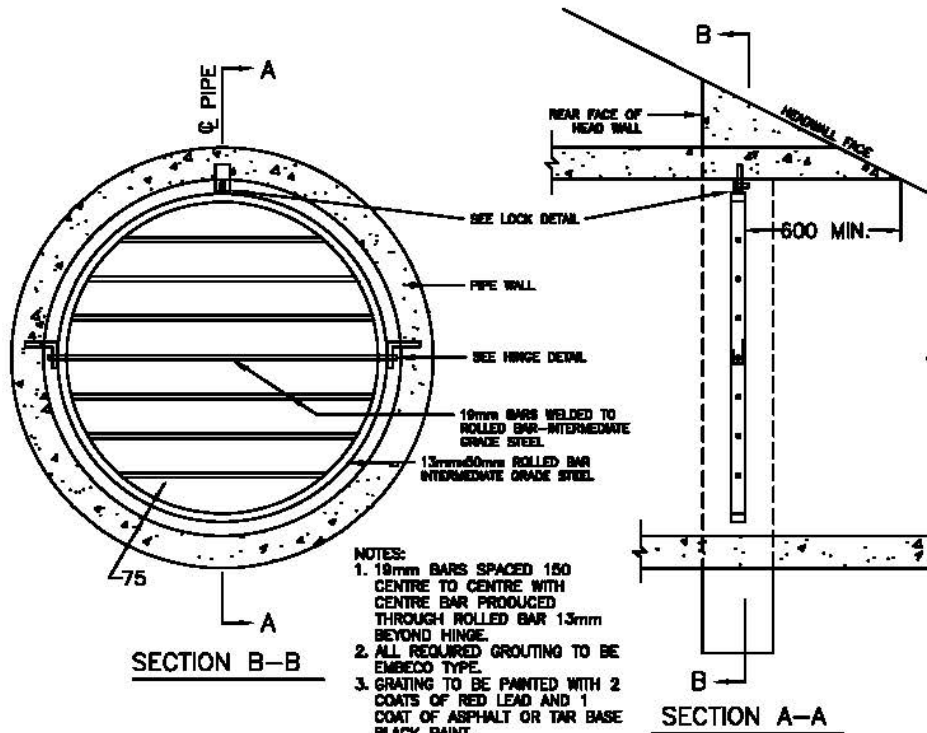
DATE DRAWN: - REV. No.: R-4
 DESCRIPTION: REVIEWED JAN/2010
 REV. DATE: JAN/10 REV. BY.: G.F./C.M.C.
 APPROVED BY:



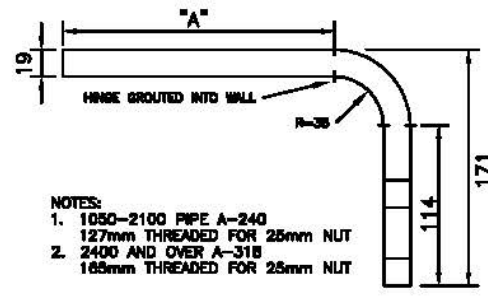
ENGINEERING

2 - 67

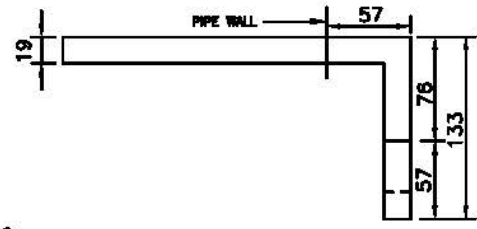
CITY ENGINEER



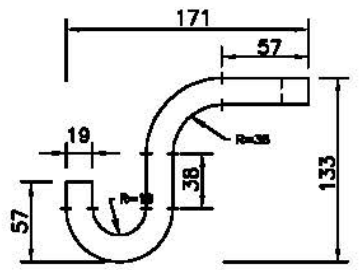
- NOTES:
1. 10mm BARS SPACED 150 CENTRE TO CENTRE WITH CENTRE BAR PRODUCED THROUGH ROLLED BAR 13mm BEYOND HINGE.
 2. ALL REQUIRED GROUTING TO BE EMBECO TYPE.
 3. GRATING TO BE PAINTED WITH 2 COATS OF RED LEAD AND 1 COAT OF ASPHALT OR TAR BASE BLACK PAINT.



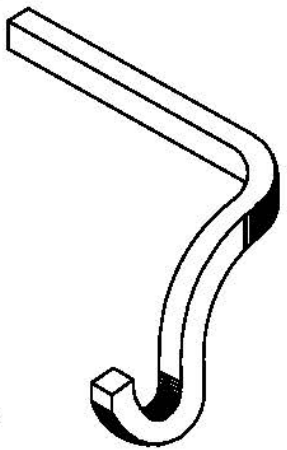
- NOTES:
1. 1050-2100 PIPE A-240
127mm THREADED FOR 25mm NUT
 2. 2400 AND OVER A-318
165mm THREADED FOR 25mm NUT



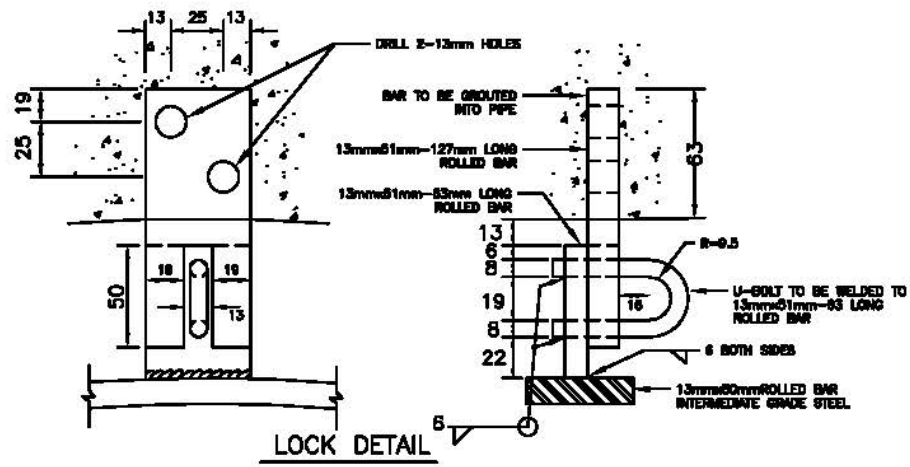
NOTE:
FOR PIPES 2400 AND OVER, GRATE BARS INCREASED TO 25mm DIA. THREE VERTICAL 25mm BARS TO SPAN THE THREE CENTRAL HORIZONTAL BARS AT 0.6m INTERVALS.



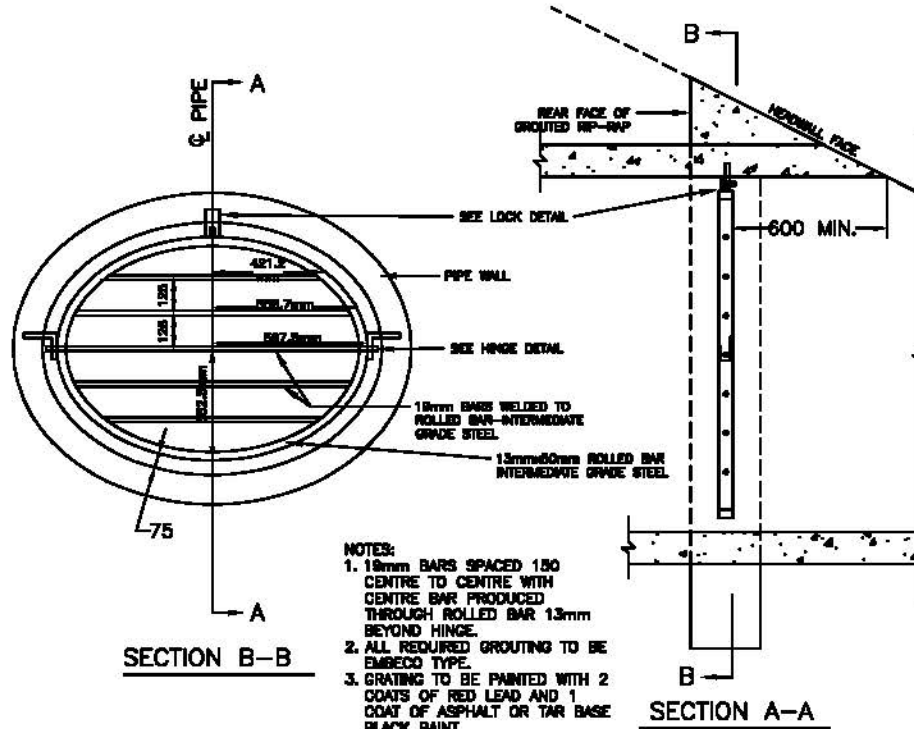
- NOTES:
1. IF GRATE HINGE IS INSTALLED PRIOR TO BACK FILLING, HINGE SHALL BE BOLTED TO OUTSIDE OF WALL AND GROUTED.
 2. ONE RIGHT AND ONE LEFT ANGLE SO BOTH HOOKS FACE OPEN END OF PIPE.
 3. HINGE TO BE 19mm SQUARE INTERMEDIATE GRADE STEEL.



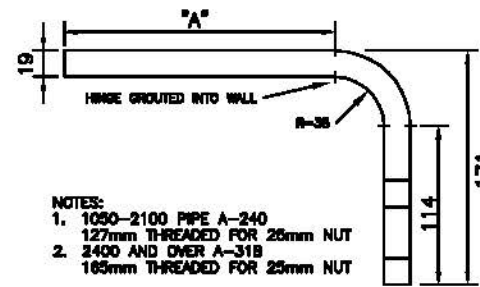
ISOMETRIC VIEW OF HINGE



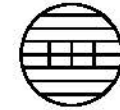
CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No.: R-2	 ENGINEERING
INTERNAL GRATE FOR CONCRETE PIPE 1050mm DIA. AND LARGER		DESCRIPTION: REVIEWED FEB/2005		
		REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.	2 - 70
APPROVED BY:		CITY ENGINEER		



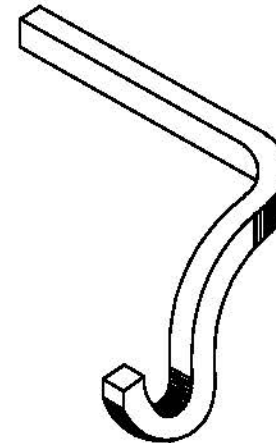
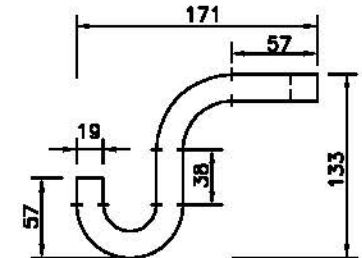
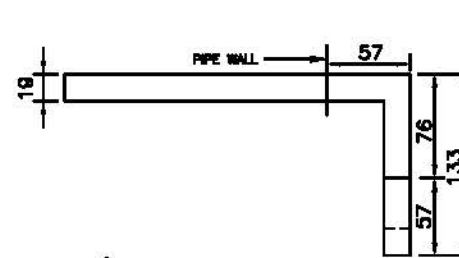
- NOTES:
1. 19mm BARS SPACED 150 CENTRE TO CENTRE WITH CENTRE BAR PRODUCED THROUGH ROLLED BAR 13mm BEYOND HINGE.
 2. ALL REQUIRED GROUTING TO BE EMBECCO TYPE.
 3. GRATING TO BE PAINTED WITH 2 COATS OF RED LEAD AND 1 COAT OF ASPHALT OR TAR BASE BLACK PAINT.



- NOTES:
1. 1050-2100 PIPE A-240 127mm THREADED FOR 25mm NUT
 2. 2400 AND OVER A-31B 165mm THREADED FOR 25mm NUT

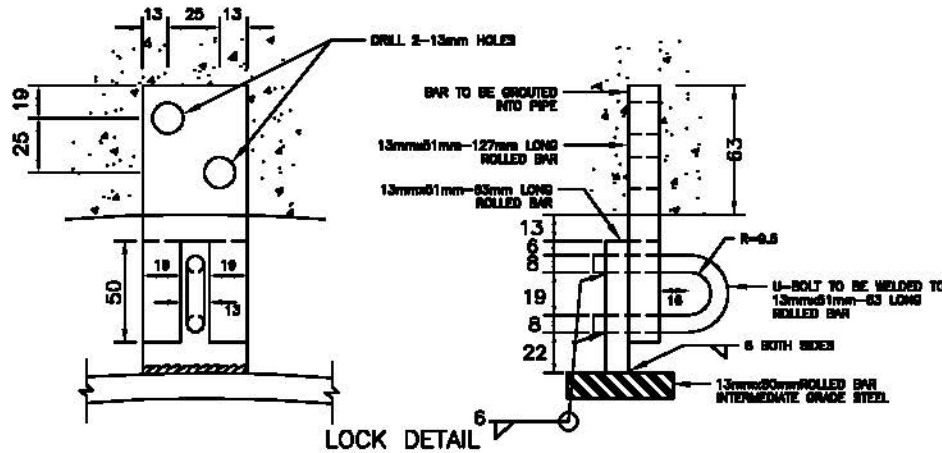


- NOTE:
- FOR PIPES 2400 AND OVER, GRATE BARS INCREASED TO 25mm DIA. THREE VERTICAL 25mm BARS TO SPAN THE THREE CENTRAL HORIZONTAL BARS AT 0.6m INTERVALS.




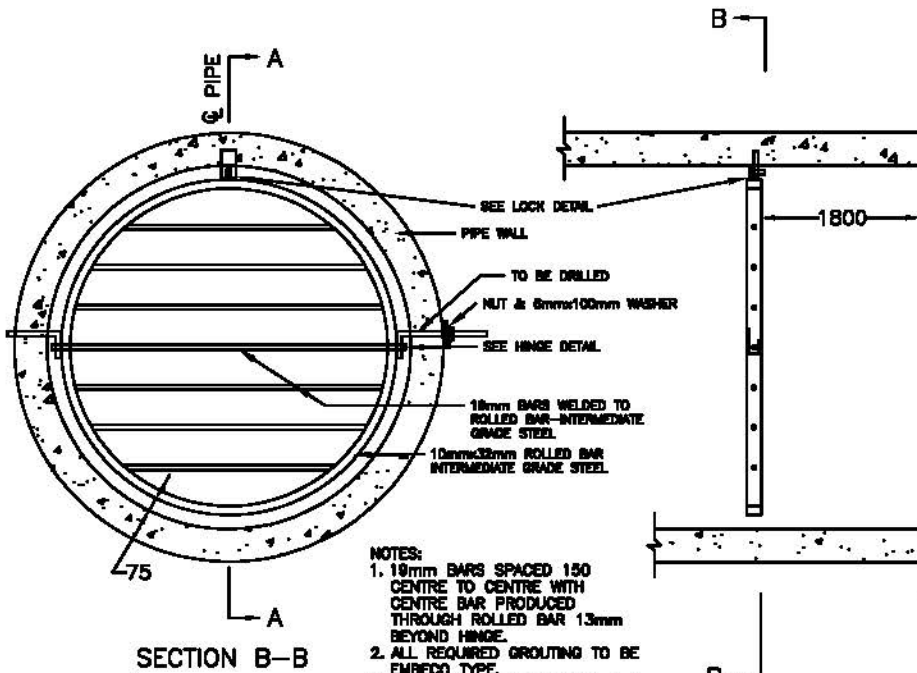
ISOMETRIC VIEW OF HINGE

- NOTES:
1. IF GRATE HINGE IS INSTALLED PRIOR TO BACK FILLING, HINGE SHALL BE BOLTED TO OUTSIDE OF WALL AND GROUTED.
 2. ONE RIGHT AND ONE LEFT ANGLE SO BOTH HOOKS FACE OPEN END OF PIPE.
 3. HINGE TO BE 19mm SQUARE INTERMEDIATE GRATE STEEL.

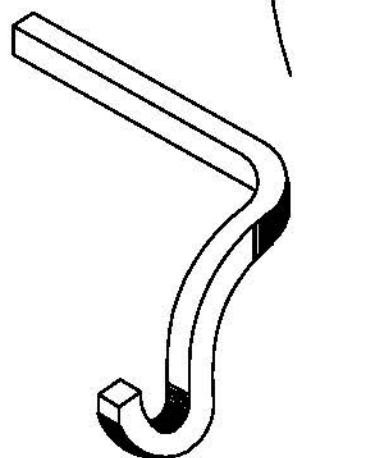
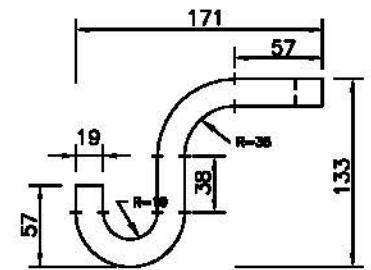
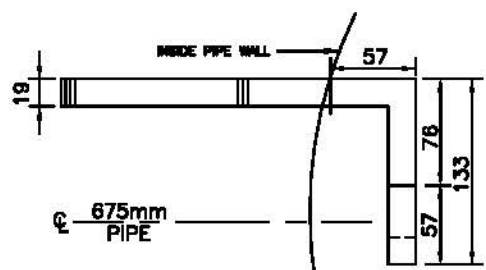
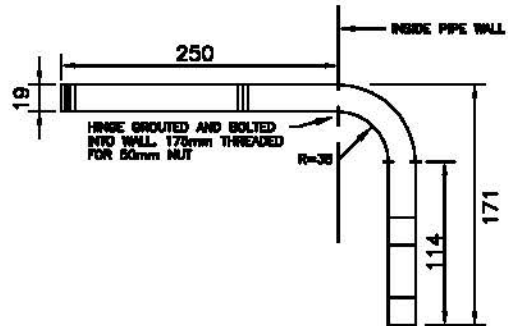


LOCK DETAIL

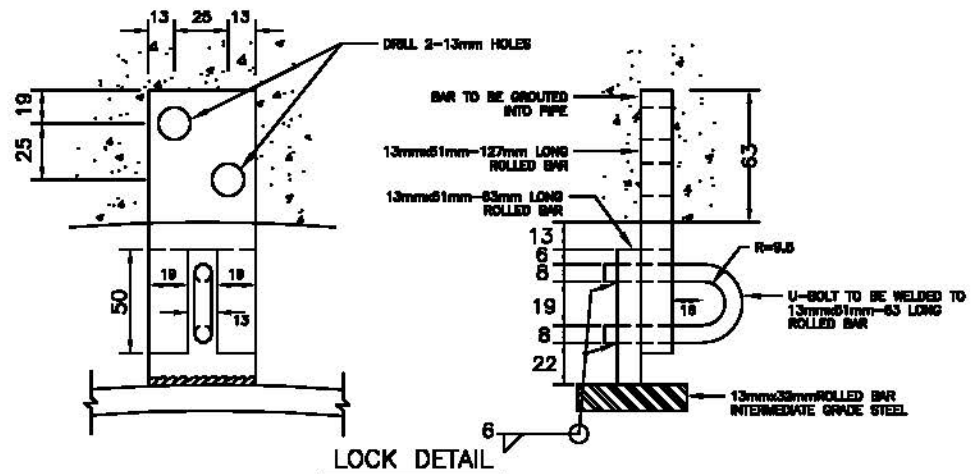
CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No.: R-2	 <small>Making a Difference</small>
INTERNAL GRATE FOR CONCRETE PIPE 855mm x 1345mm HE		DESCRIPTION: REVIEWED FEB/2005		
		REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.	ENGINEERING
		APPROVED BY:		2 - 70 MODIFIED
			CITY ENGINEER	



- NOTES:
 1. 18mm BARS SPACED 150 CENTRE TO CENTRE WITH CENTRE BAR PRODUCED THROUGH ROLLED BAR 13mm BEYOND HINGE.
 2. ALL REQUIRED GROUTING TO BE EMBEDO TYPE.
 3. GRATING TO BE PAINTED WITH 2 COATS OF RED LEAD AND 1 COAT OF ASPHALT OR TAR BASE BLACK PAINT.



- NOTES:
 1. IF GRATE HINGE IS INSTALLED PRIOR TO BACK FILLING, HINGE SHALL BE BOLTED TO OUTSIDE OF WALL AND GROUTED.
 2. ONE RIGHT AND ONE LEFT ANGLE SO BOTH HOOKS FACE OPEN END OF PIPE.
 3. HINGE TO BE 19mm SQUARE INTERMEDIATE GRADE STEEL

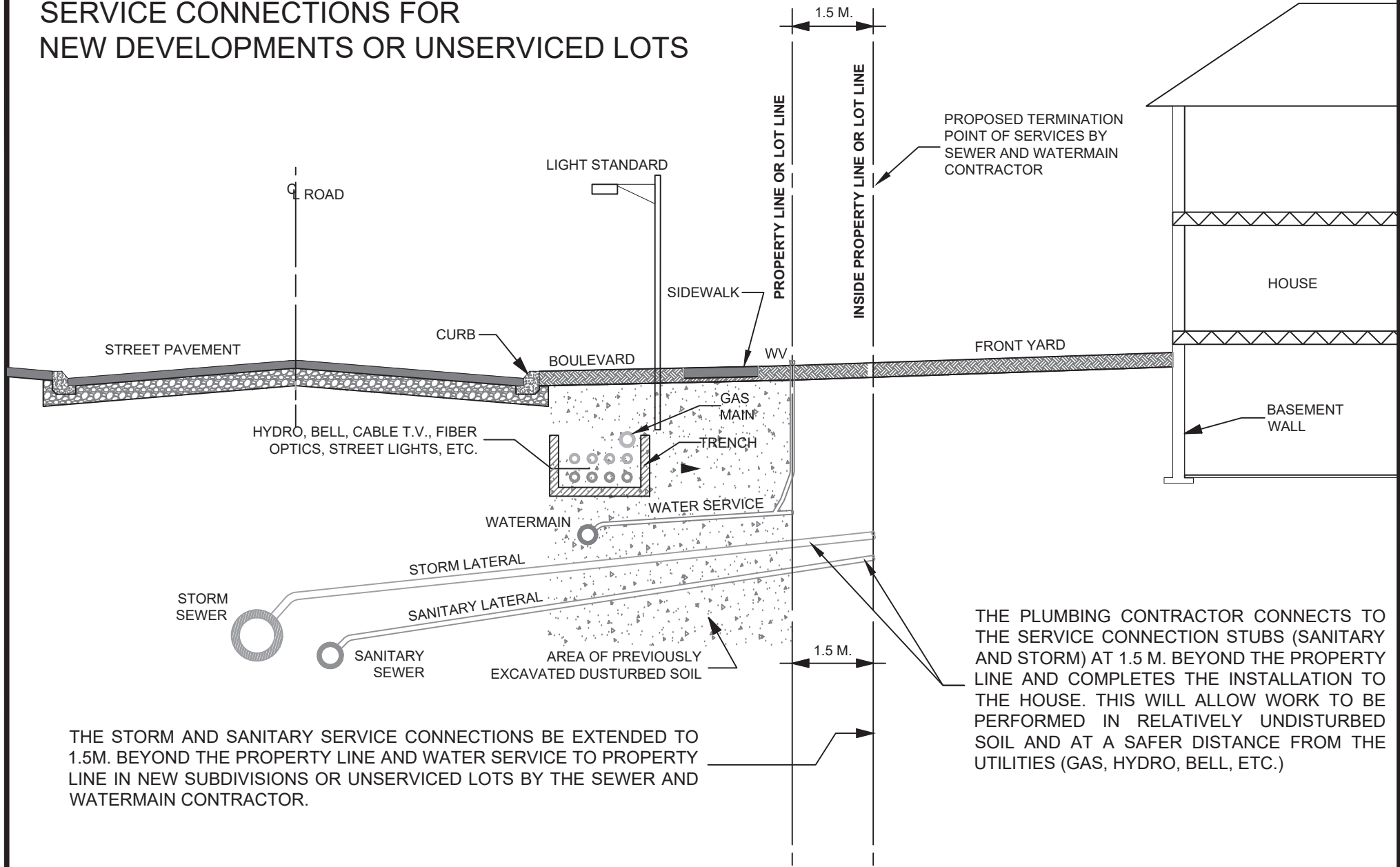


CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : -	REV. No. : R-2	 Guelph <small>Making a Difference</small>
INTERNAL GRATE FOR CONCRETE PIPE 675mm DIA. STORM OUTLET		DESCRIPTION : REVIEWED FEB/2005		
		REV. DATE : FEB/05	REV. BY. : G.F./M.E.C.	2 - 70 MODIFIED
		APPROVED BY: CITY ENGINEER		



**SECTION 3:
PIPES
STORM
SANITARY
DRAINS**

SERVICE CONNECTIONS FOR NEW DEVELOPMENTS OR UNSERVICED LOTS



CITY OF GUELPH STANDARD DRAWING

SERVICE CONNECTIONS FOR NEW DEVELOPMENTS AND UNSERVICED LOTS

DATE DRAWN : Feb. 2017

REV. No. : R-2

DESCRIPTION : N.T.S.

REV. DATE : Feb. 2020

REV. BY. : I.U./J.B.

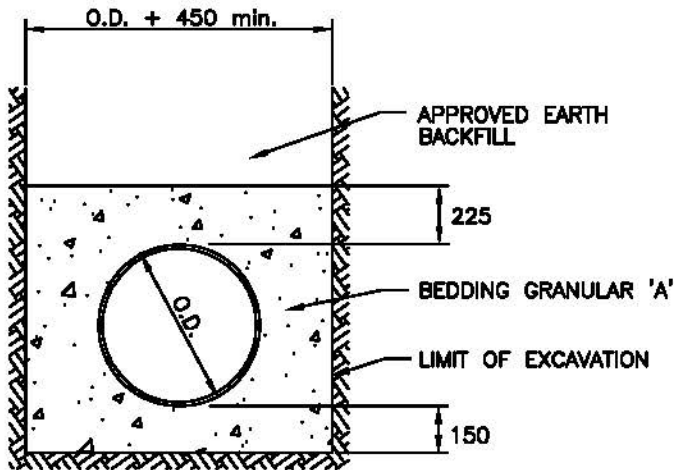
APPROVED BY :

CITY ENGINEER



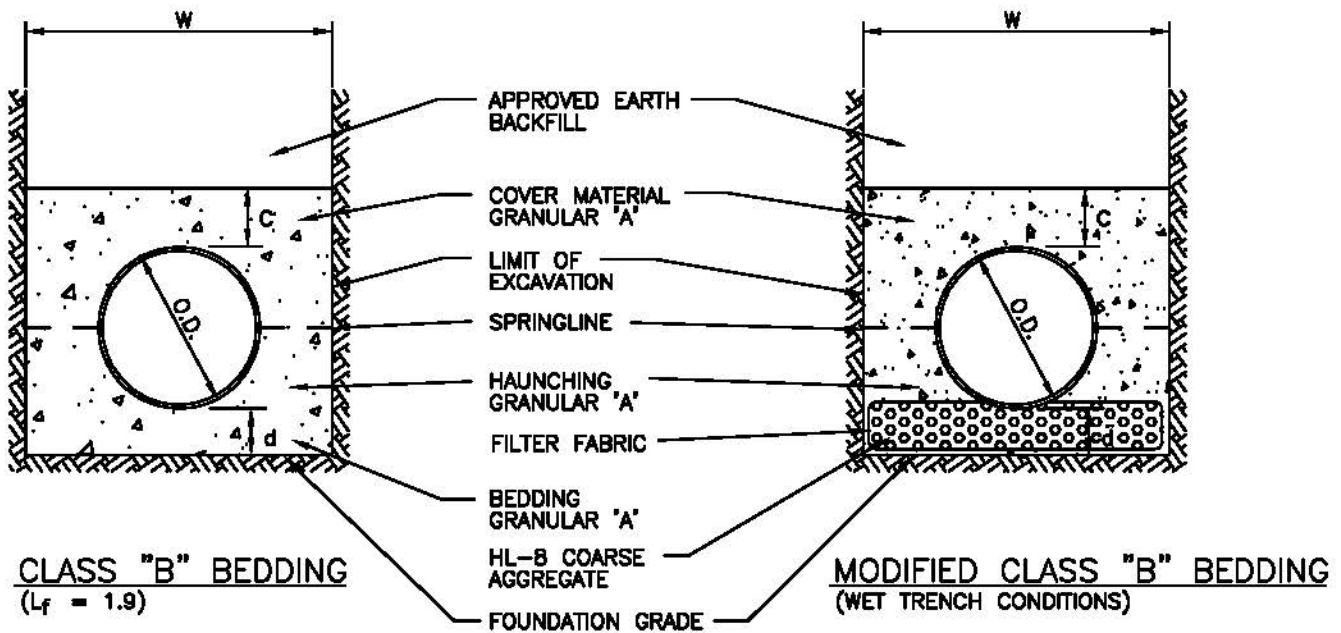
ENGINEERING

3 - 21



NOMINAL PIPE INSIDE DIAMETER D (mm)	MINIMUM TRENCH WIDTH W (mm)	MINIMUM BEDDING BELOW d (mm)	MINIMUM COVER OVER PIPE C (mm)
RIGID PIPE			
675 or less	1125	150	225
750 to 1500	O.D. + 600	225	225
1650 & over	O.D. + 800	300	225
FLEXIBLE PIPE			
675 or less	1125	150	300
675 to 1200	O.D. + 800	150	300
1200 to 1650	O.D. + 800	225	400
1650 & over	O.D. + 1000	225	500

WATERMAIN BEDDING



**BEDDING FOR RIGID AND FLEXIBLE
PIPE SEWERS**

NOTES:

- O.D. = OUTSIDE DIAMETER OF BELL END OF PIPE.
- STONE SIZE WITHIN 300mm OF PIPE SURFACE SHALL NOT EXCEED 75mm.
- IN ROCK TRENCHES, BEDDING DEPTH (d) BELOW WATERMAINS AND SEWER PIPES SHALL BE INCREASED TO 300mm.
- FOR PURPOSE OF CONTRACT SPECIFICATIONS BEDDING INCLUDES HAUNCHING & COVER MATERIAL.
- IN WET TRENCH CONDITIONS HL-8 COARSE AGGREGATE MAY BE USED TO INVERT OF PIPE. THE BEDDING BELOW INVERT SHALL BE WRAPPED IN FILTER FABRIC (TERRAFIX 270 R OR APPROVED EQUAL) WHERE DIRECTED BY THE ENGINEER.

CITY OF GUELPH STANDARD DRAWING

**STANDARD BEDDING FOR
SEWERS AND WATERMAINS**

DATE DRAWN: - REV. No.: R-6

DESCRIPTION: REVIEWED FEB/2017

REV. DATE: FEB/17 REV. BY.: J.D.K./C.M.C.

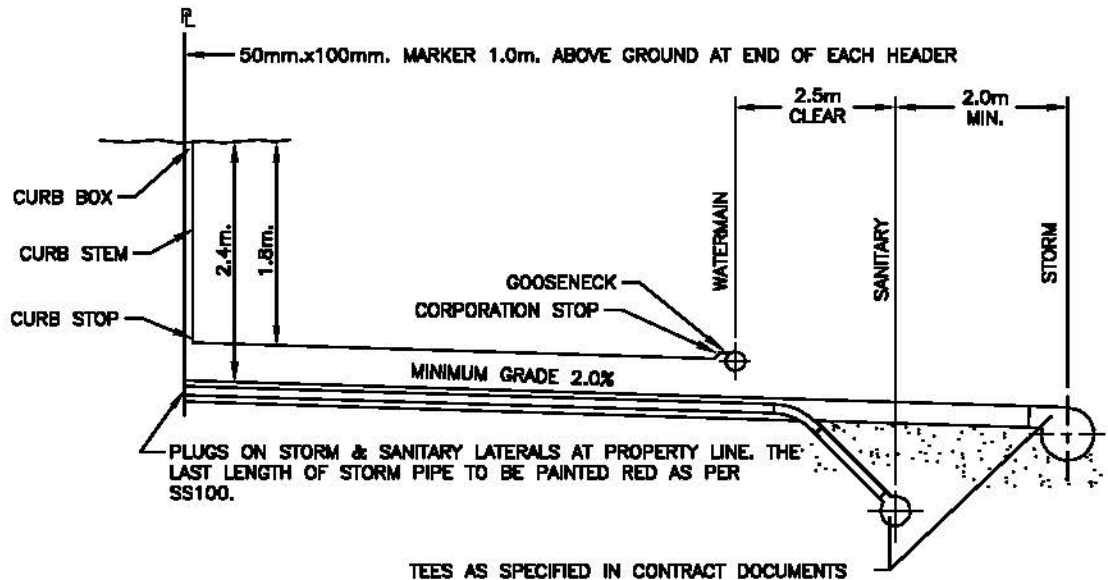
APPROVED BY:

CITY ENGINEER

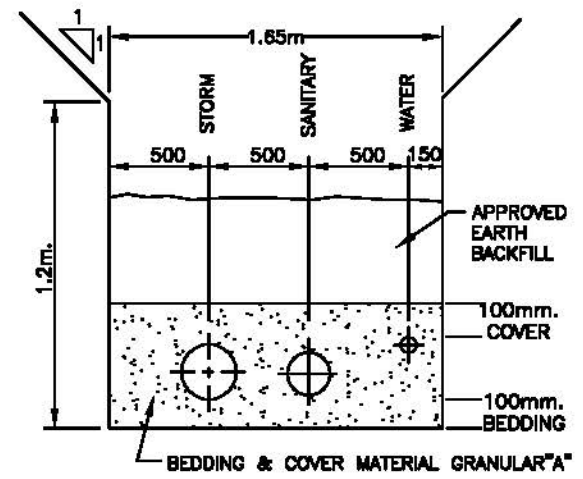


ENGINEERING

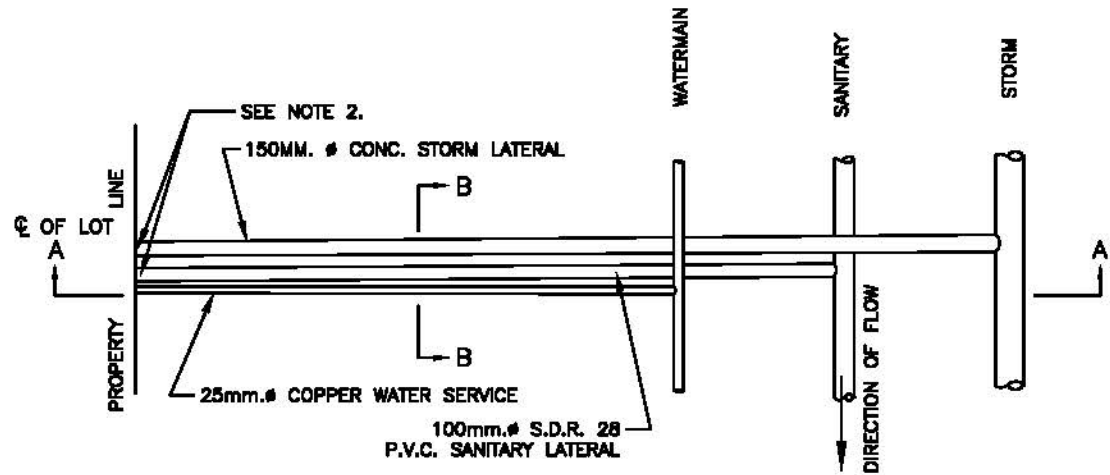
3 - 29



SECTION A-A

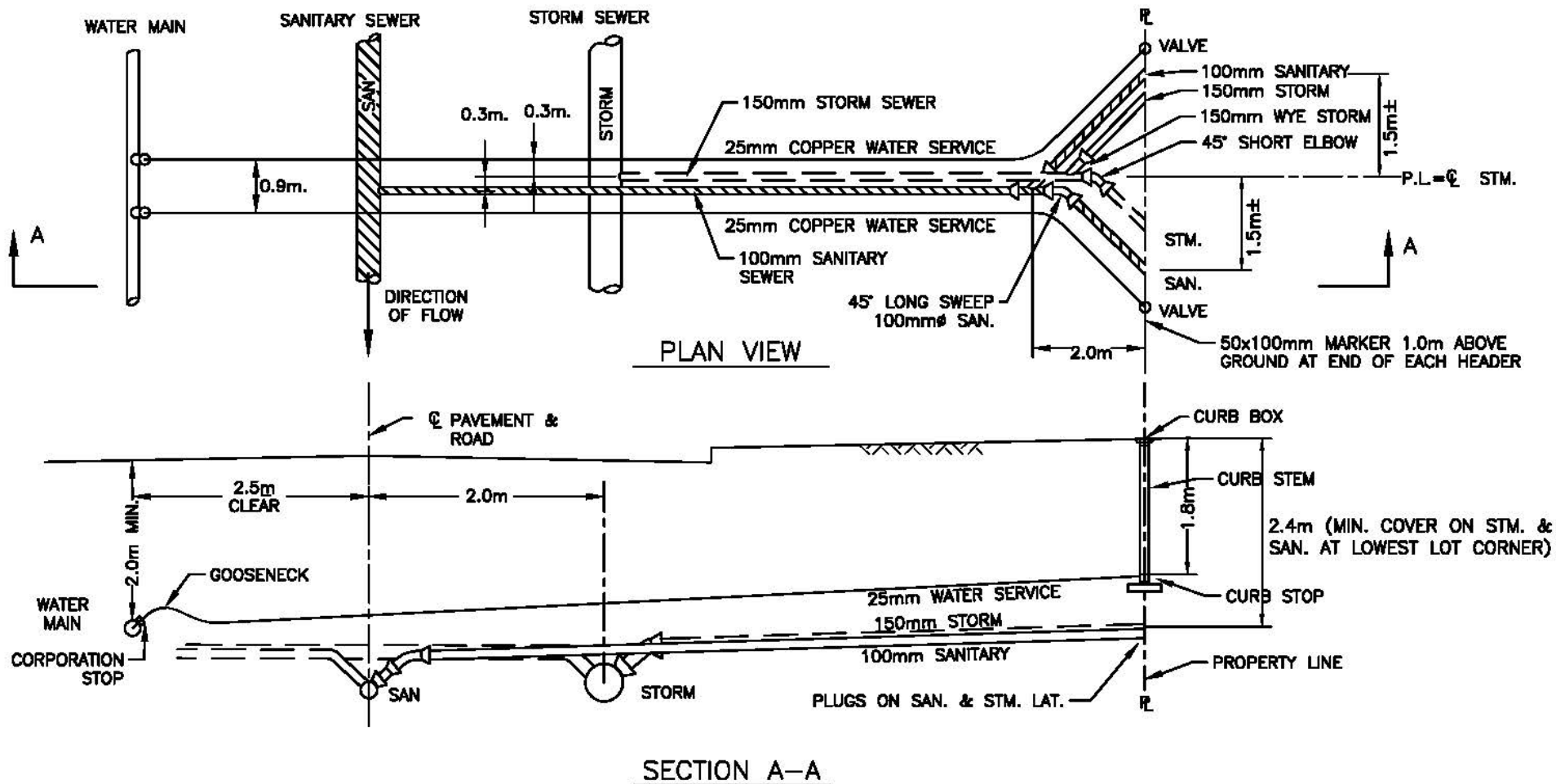


SECTION B-B

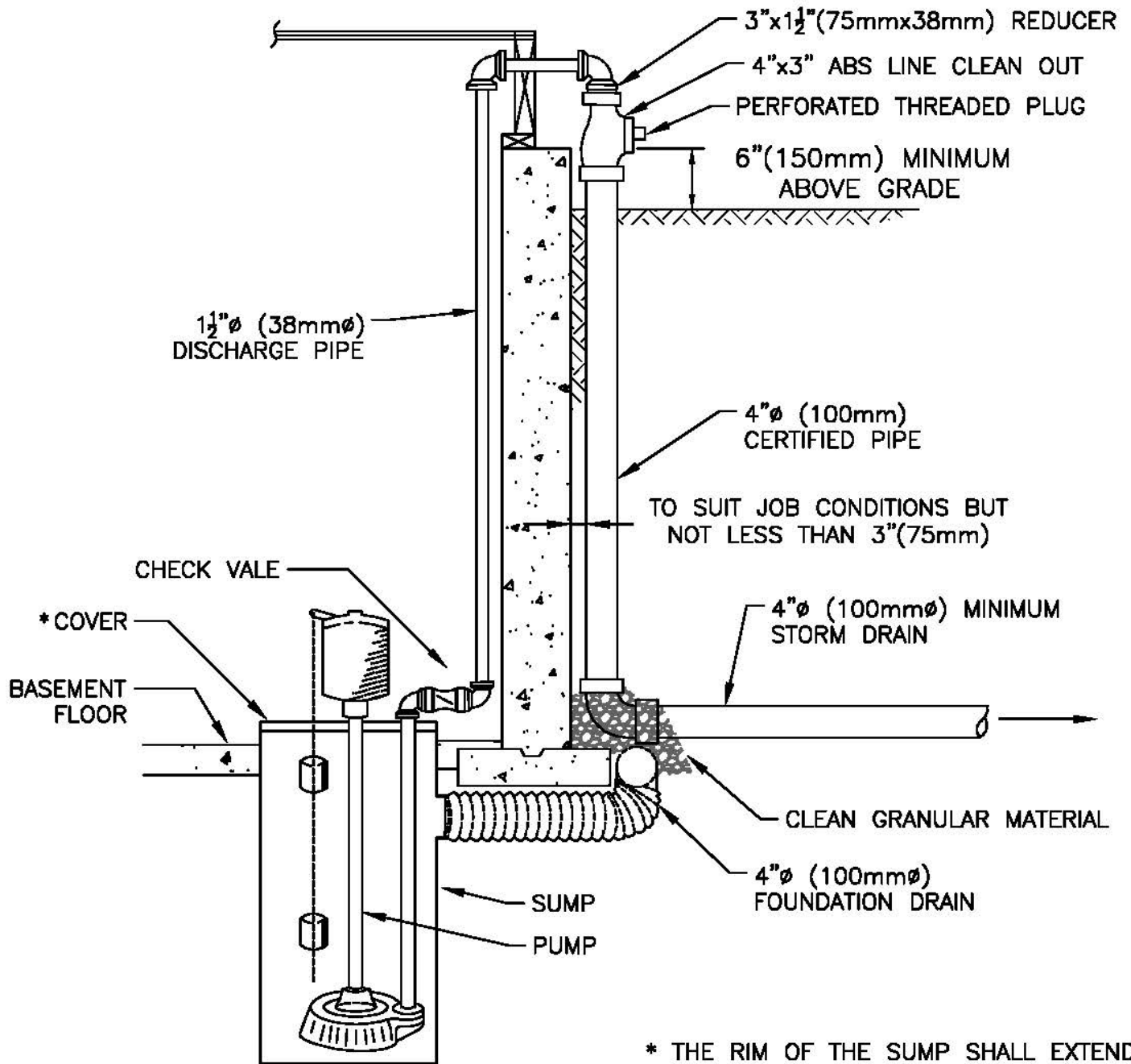


- NOTES:
1. STONE SIZE WITHIN 300m OF PIPE SURFACE SHALL NOT EXCEED 75mm.
 2. THE LAST SEWER SERVICE PIPE EXTENDING UP TO OR JUST PAST THE PROPERTY LINE SHALL BE AT LEAST 1.0 metre IN LENGTH.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : -	REV. No. : R-7	 Guelph <small>Making a Difference</small>
<h1>SEWER & WATERMAIN LATERALS</h1>		DESCRIPTION : REVIEWED JAN/2014		
		REV. DATE : FEB/14	REV. BY. : G.F./C.M.C.	<h2>3 - 55</h2>
		APPROVED BY:		



CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No.: R-7	 ENGINEERING
SEWER & WATERMAIN LATERALS FOR SEMI-DETACHED LOTS		DESCRIPTION: REVIEWED JAN/2014		
		REV. DATE: FEB/14	REV. BY.: G.F./C.M.C.	3 - 56
APPROVED BY:		CITY ENGINEER		



* THE RIM OF THE SUMP SHALL EXTEND A MIN. OF 1 1/2" (38mm) ABOVE FLOOR.

SECTION

CITY OF GUELPH STANDARD DRAWING

**SUMP PUMP DETAIL
PUMPING TO STORM**

DATE DRAWN: MAR/94
REV. No.: R-2

DESCRIPTION: REVIEWED FEB/2005

REV. DATE: FEB/05
REV. BY.: G.F./M.E.C.

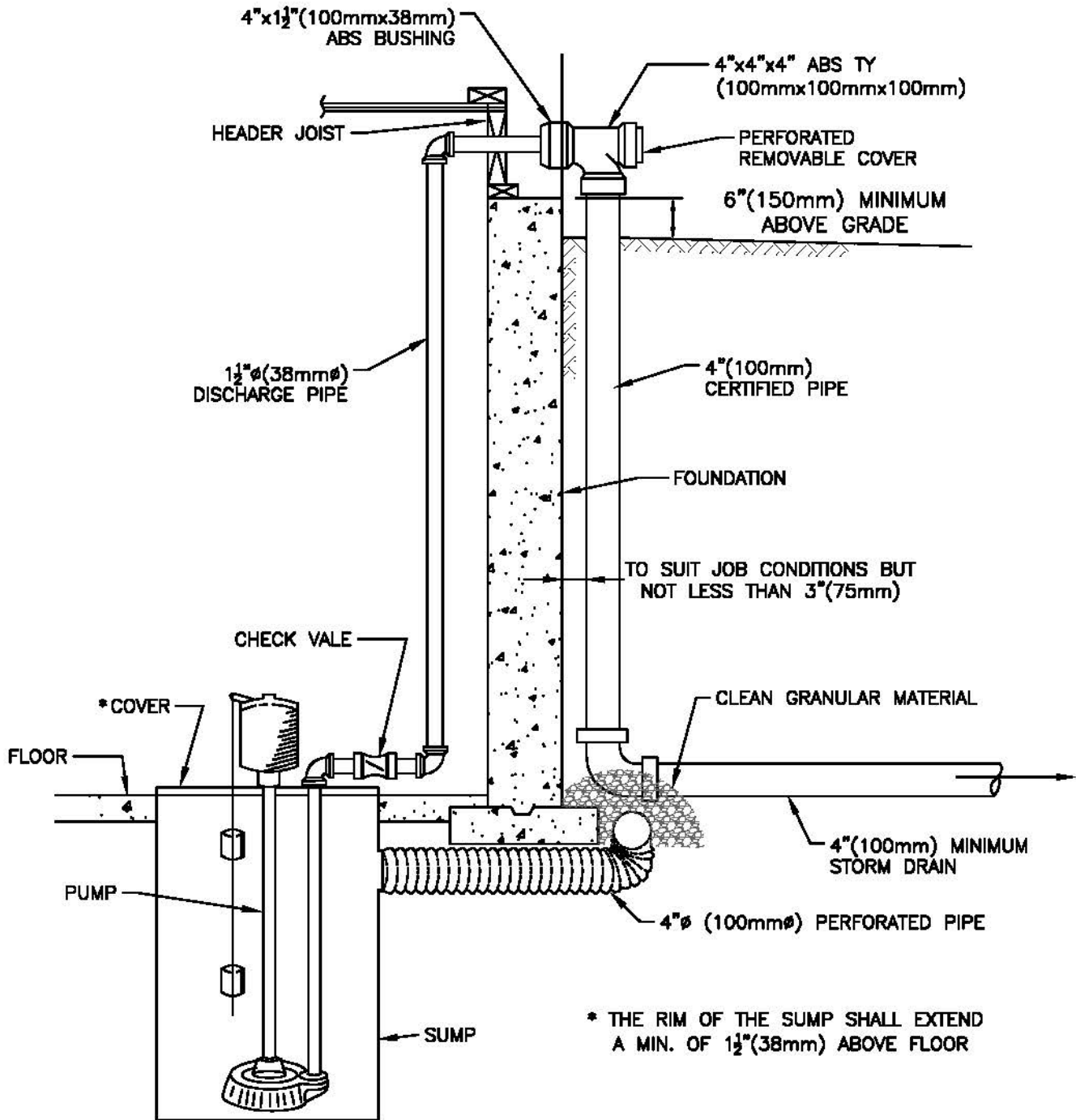
APPROVED BY:

CITY ENGINEER



ENGINEERING

3 - 75



CITY OF GUELPH STANDARD DRAWING

**SUMP PUMP DETAIL
PUMPING TO STORM
(ALTERNATIVE TO SD-75)**

DATE DRAWN: MAR/84
REV. No.: R-2

DESCRIPTION:
REVIEWED FEB/2005

REV. DATE: FEB/05
REV. BY.: G.F./M.E.C.

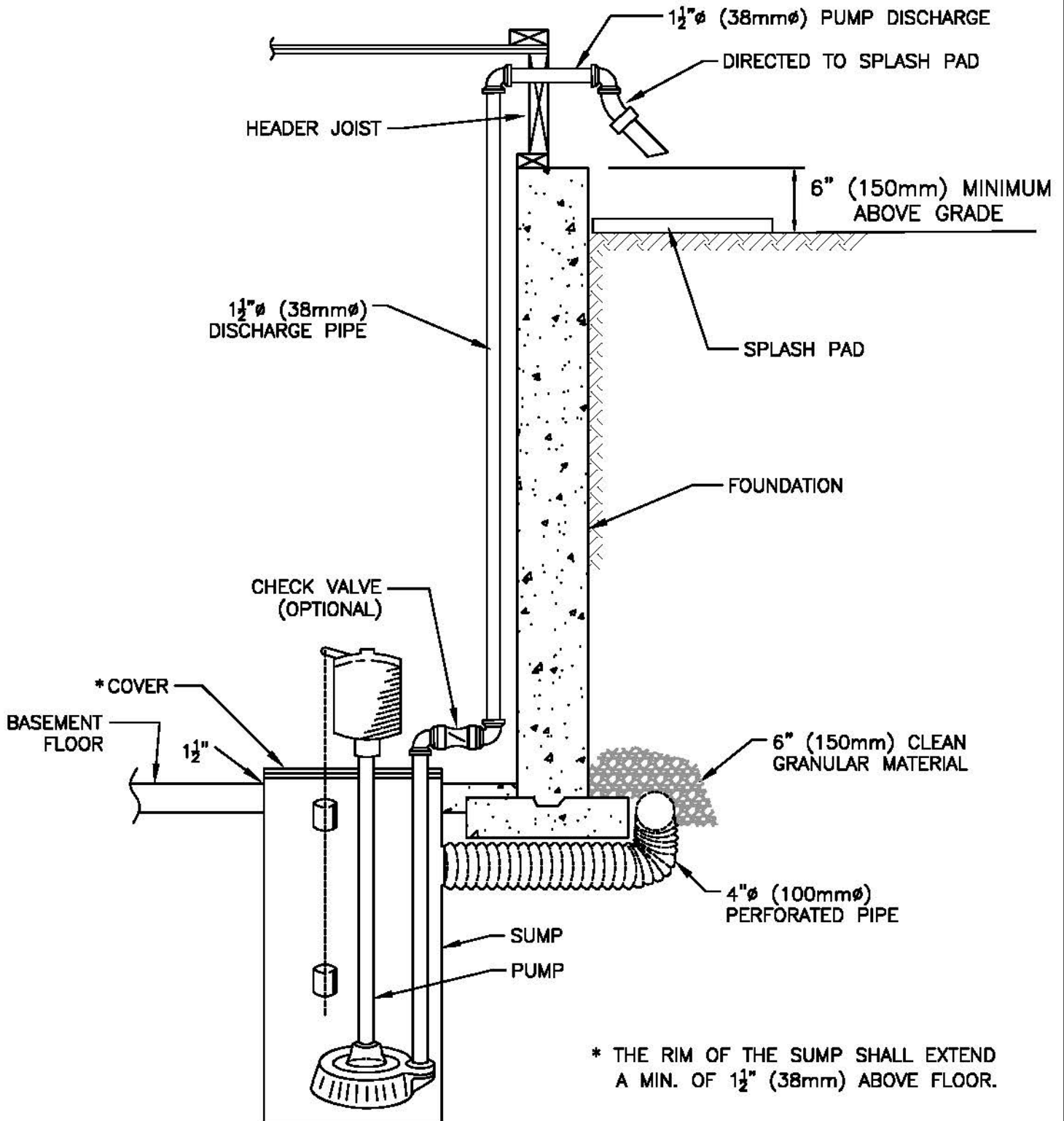
APPROVED BY:

CITY ENGINEER



ENGINEERING

3 - 76



CITY OF GUELPH STANDARD DRAWING

SUMP PUMP DETAIL PUMPING TO GRADE

DATE DRAWN : MAR/94
REV. No. : R-2

DESCRIPTION :
REVIEWED FEB/2005

REV. DATE : FEB/05
REV. BY. : G.F./M.E.C.

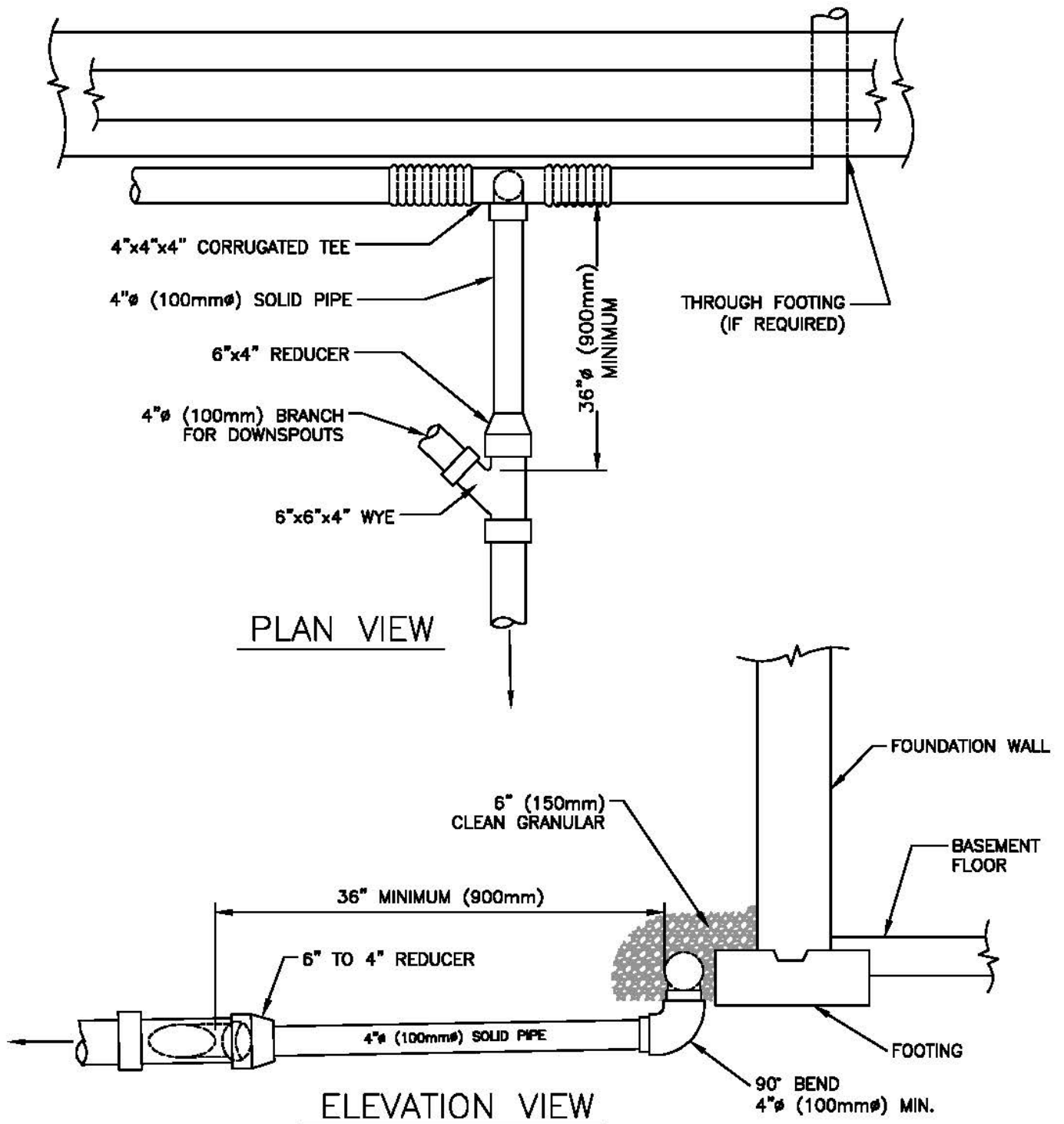
APPROVED BY:

CITY ENGINEER



ENGINEERING

3 - 77



CITY OF GUELPH STANDARD DRAWING

DATE DRAWN: MAR/94 REV. No.: R-2



DESCRIPTION: REVIEWED FEB/2005

REV. DATE: FEB/05 REV. BY.: G.F./M.E.C.

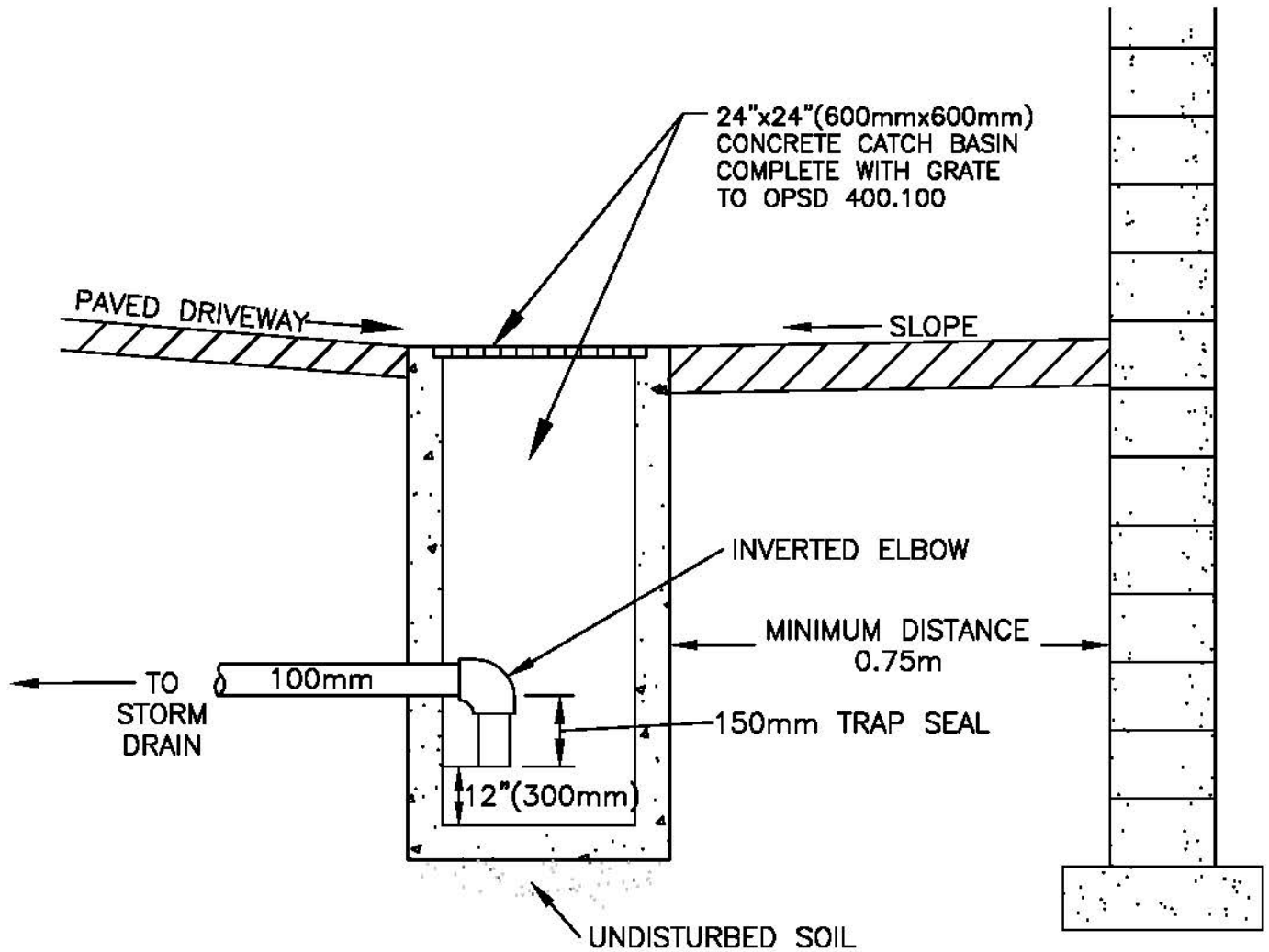
ENGINEERING

APPROVED BY:

3 - 78

CITY ENGINEER

CONNECTION OF FOUNDATION DRAIN TO STORM DRAINAGE PIPING



CITY OF GUELPH STANDARD DRAWING

**DRIVEWAY AREA DRAIN
GRAVITY DRAINAGE**

DATE DRAWN :
MAR/94

REV. No. :
R-2

DESCRIPTION :
REVIEWED FEB/2005

REV. DATE :
FEB/05

REV. BY. :
G.F./M.E.C.

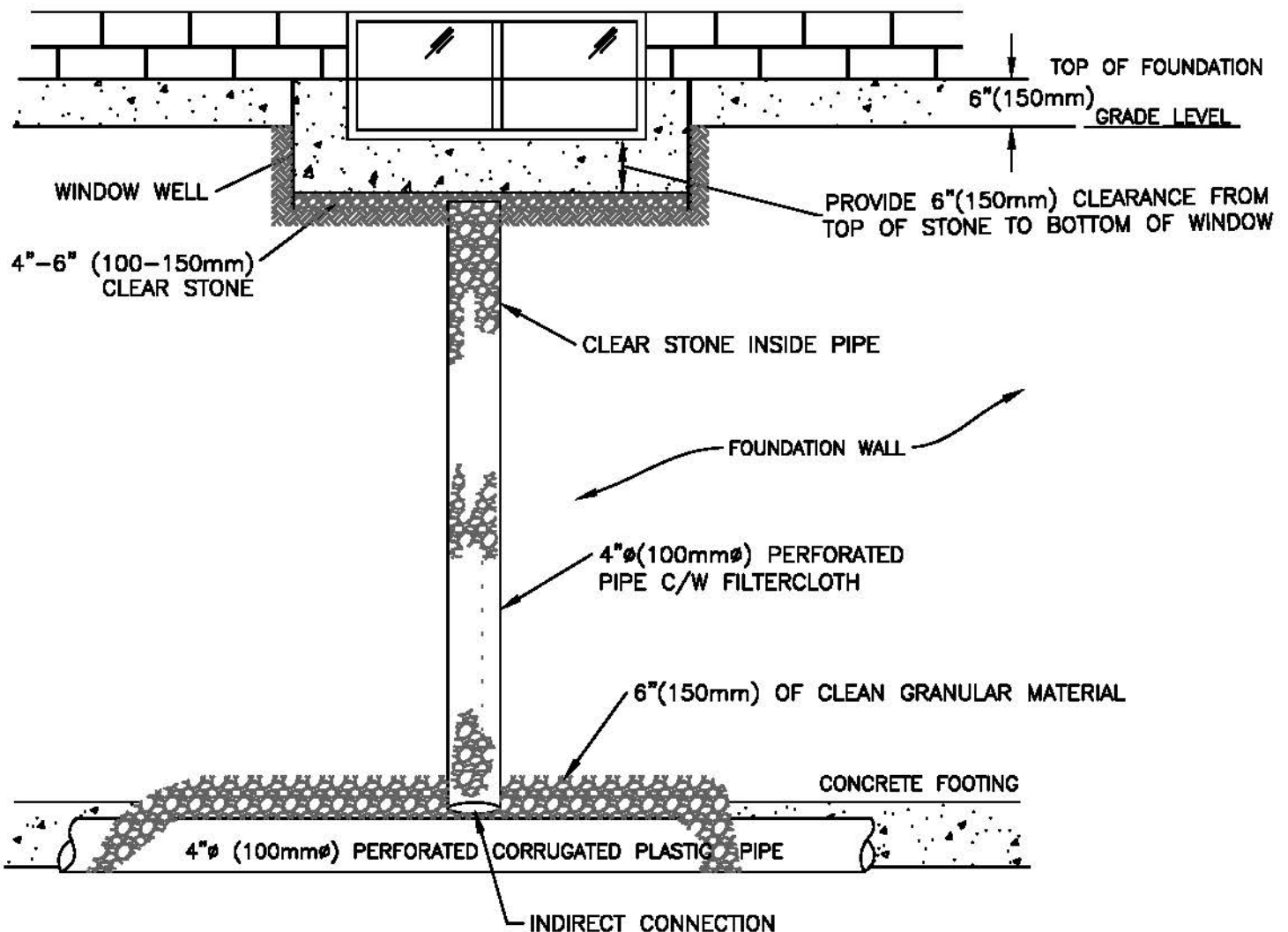
APPROVED BY:

CITY ENGINEER



ENGINEERING

3 - 79



CITY OF GUELPH STANDARD DRAWING

DRAINAGE OF WINDOW WELLS

DATE DRAWN : MAR/94
REV. No. : R-2

DESCRIPTION :
REVIEWED FEB/2005

REV. DATE : FEB/05
REV. BY. : G.F./M.E.C.

APPROVED BY:

CITY ENGINEER

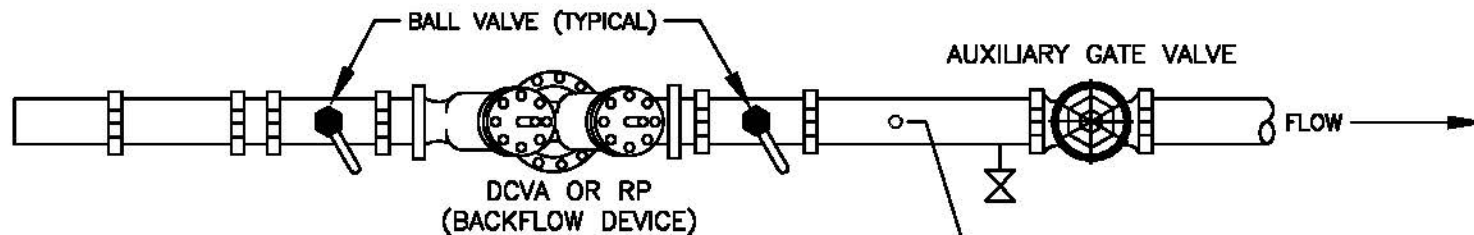


ENGINEERING

3 - 81



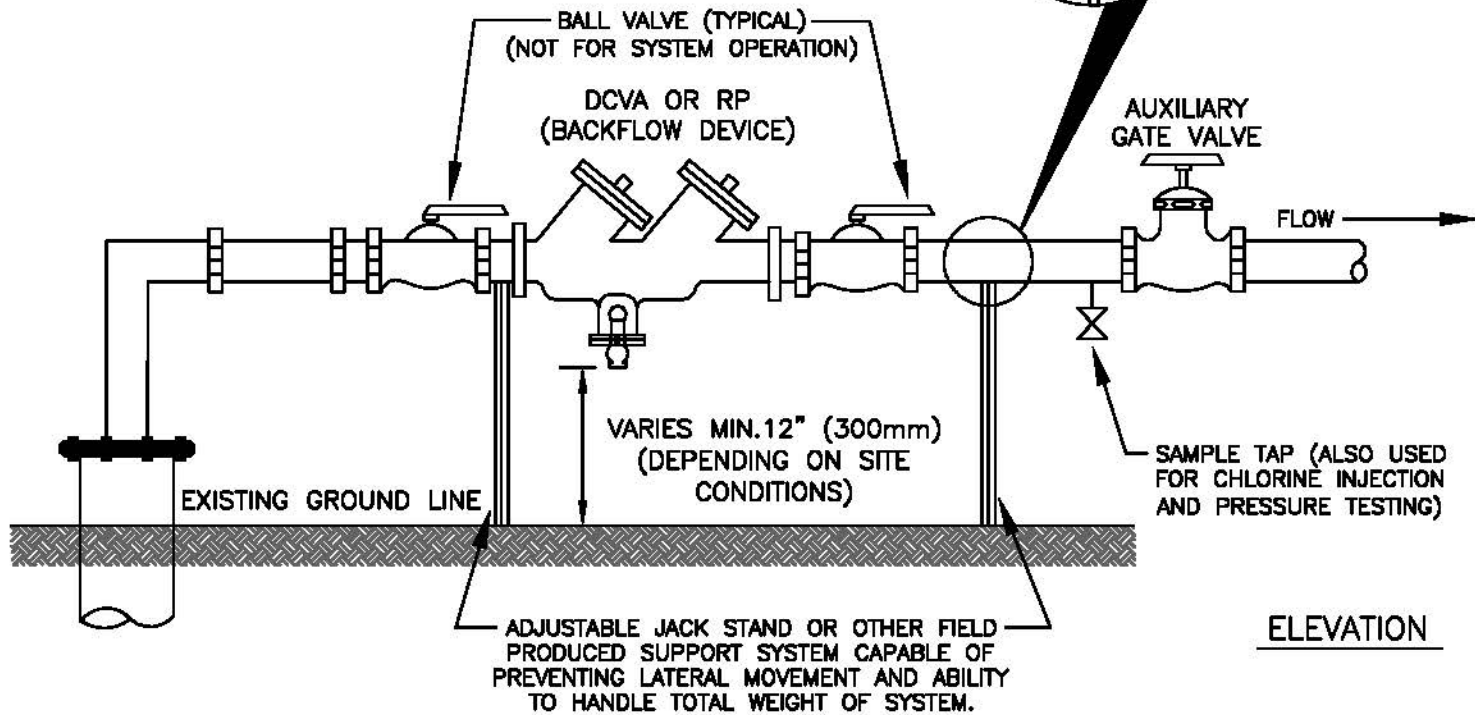
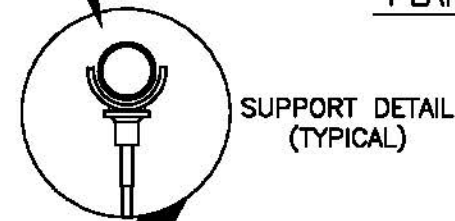
SECTION 4: WATERWORKS




PLAN

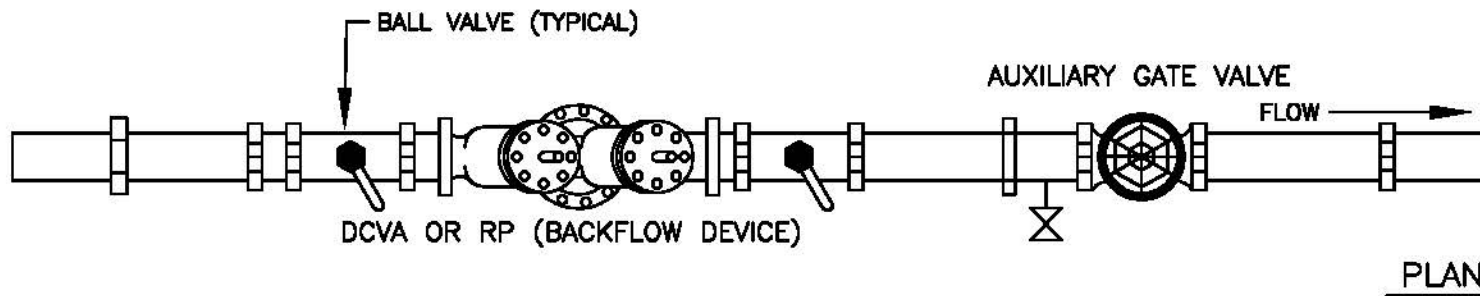
RECOMMENDED ASSEMBLY:

1. FLUSH LINE BEFORE CONNECTING ASSEMBLY.
2. ATTACH BACKFLOW CONFIGURATION WITH ACCEPTABLE SUPPORT SYSTEM.



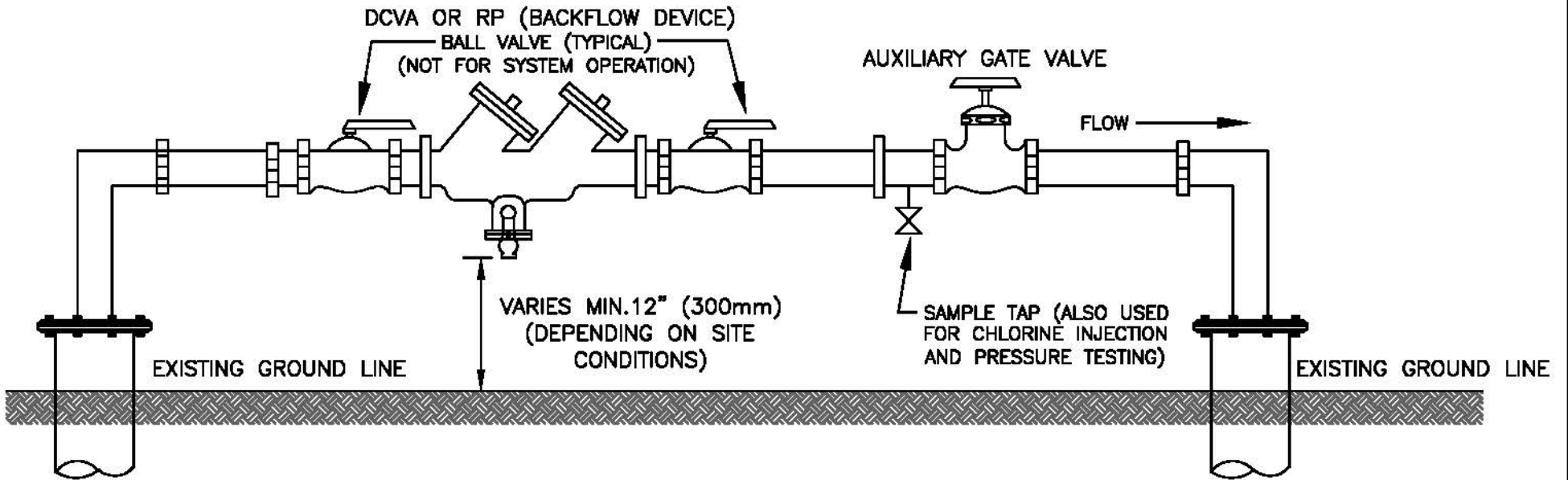
ELEVATION


CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : Feb. 2013	REV. No. : R-	 <small>Making a Difference</small>
BACKFLOW PREVENTER DETAIL VARIATION 1		DESCRIPTION : REVIEWED:		
		REV. DATE : FEB/13	REV. BY. : G.F./C.M.C.	ENGINEERING
		APPROVED BY: CITY ENGINEER		4 - 22A



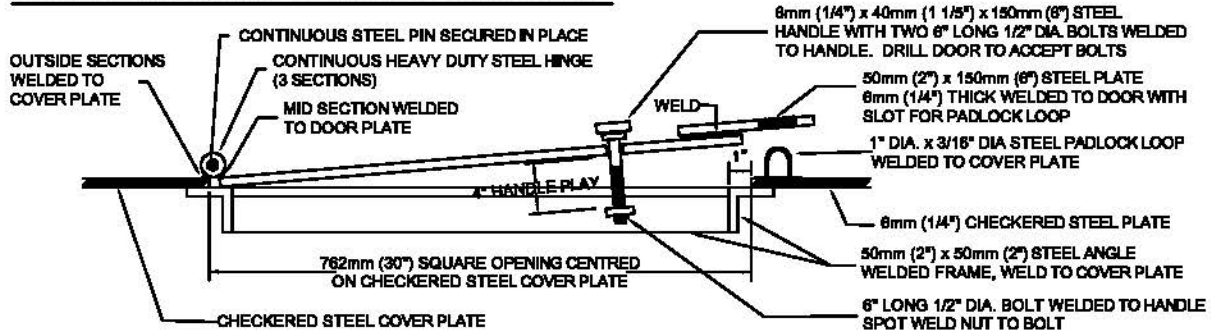
RECOMMENDED ASSEMBLY:

1. FLUSH LINE BEFORE CONNECTING ASSEMBLY.
2. ATTACH BACKFLOW CONFIGURATION WITH ACCEPTABLE SUPPORT SYSTEM.
3. NO ADDITIONAL SUPPORT REQUIRED WHEN PIPING RE-ENTERS THE GROUND.

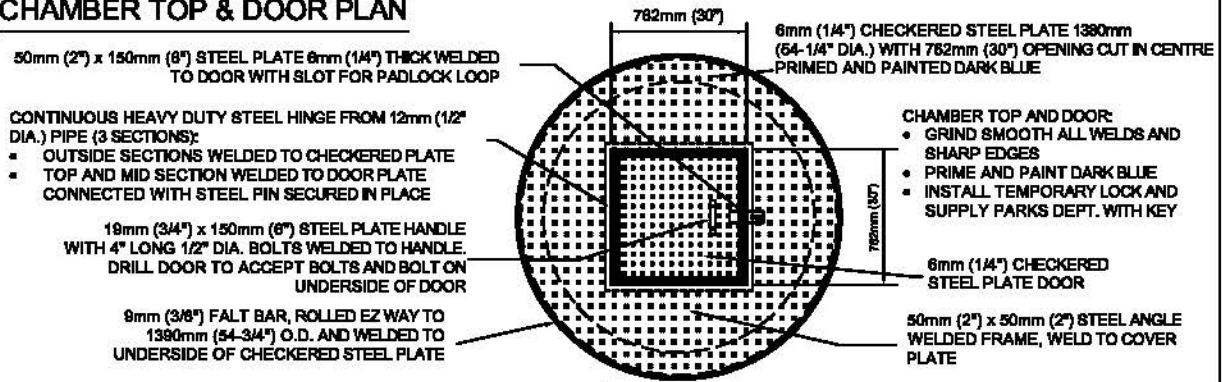


CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: Feb. 2013	REV. No.: R-	 Guelph <small>Making a Difference</small>
BACKFLOW PREVENTER DETAIL VARIATION 2		DESCRIPTION: REVIEWED:	REV. BY.: G.F./C.M.C.	
		REV. DATE: FEB/13	APPROVED BY:	4 - 22B
		CITY ENGINEER		

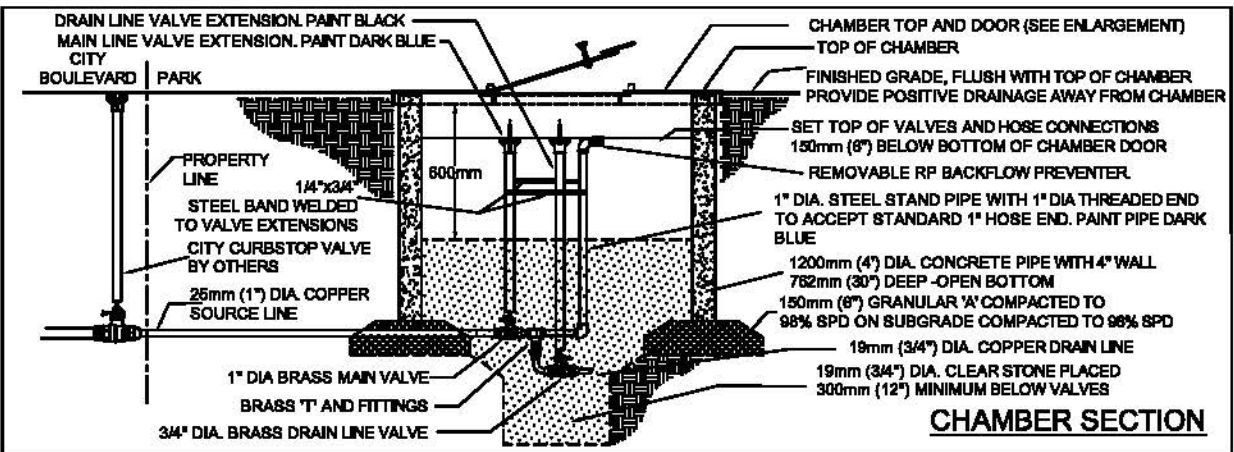
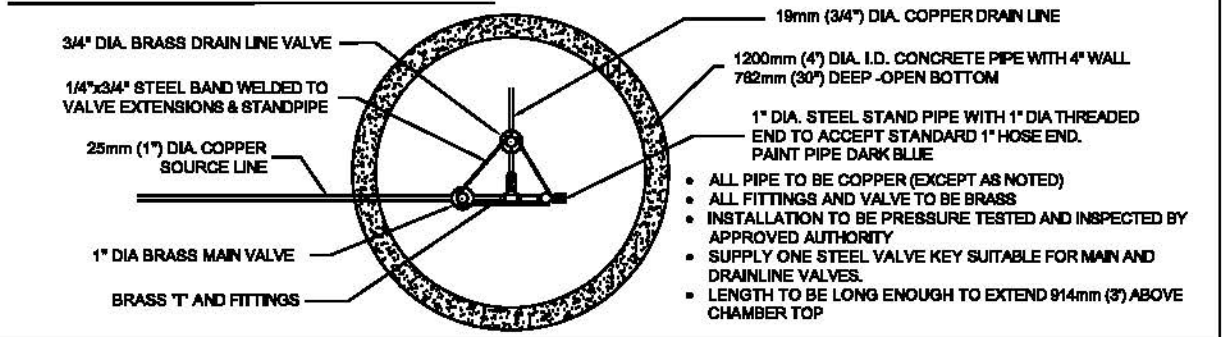
CHAMBER DOOR SECTION ENLARGEMENT



CHAMBER TOP & DOOR PLAN



CHAMBER PLAN (TOP NOT SHOWN)



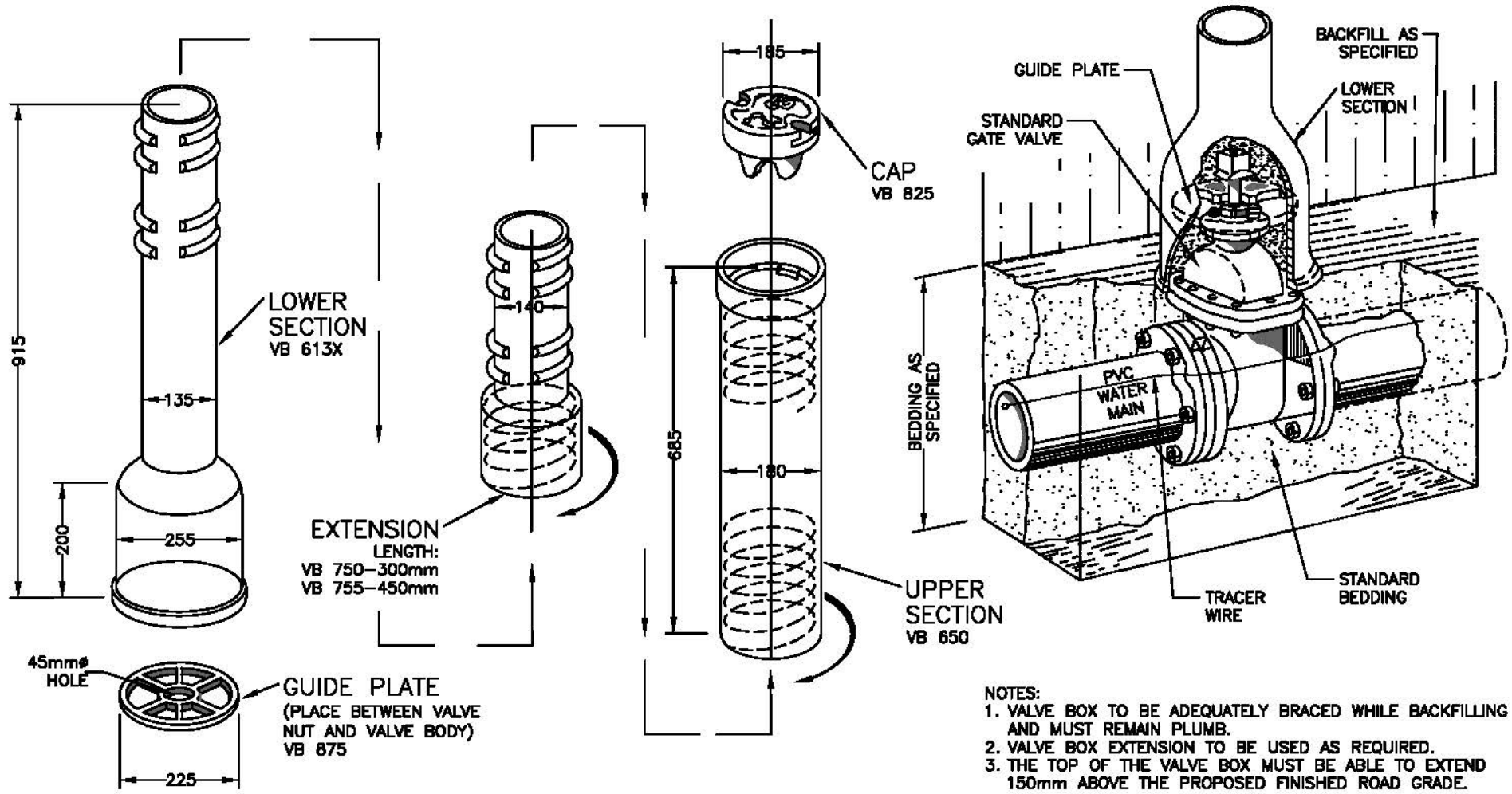
CITY OF GUELPH STANDARD DRAWING

ICE RINK CHAMBER AND CONNECTION DETAIL

DATE DRAWN: JAN/10	REV. No.: -
DESCRIPTION: REVIEWED	JAN/2010
REV. DATE: -	REV. BY: G.F./C.M.C.
APPROVED BY:	
CITY ENGINEER	

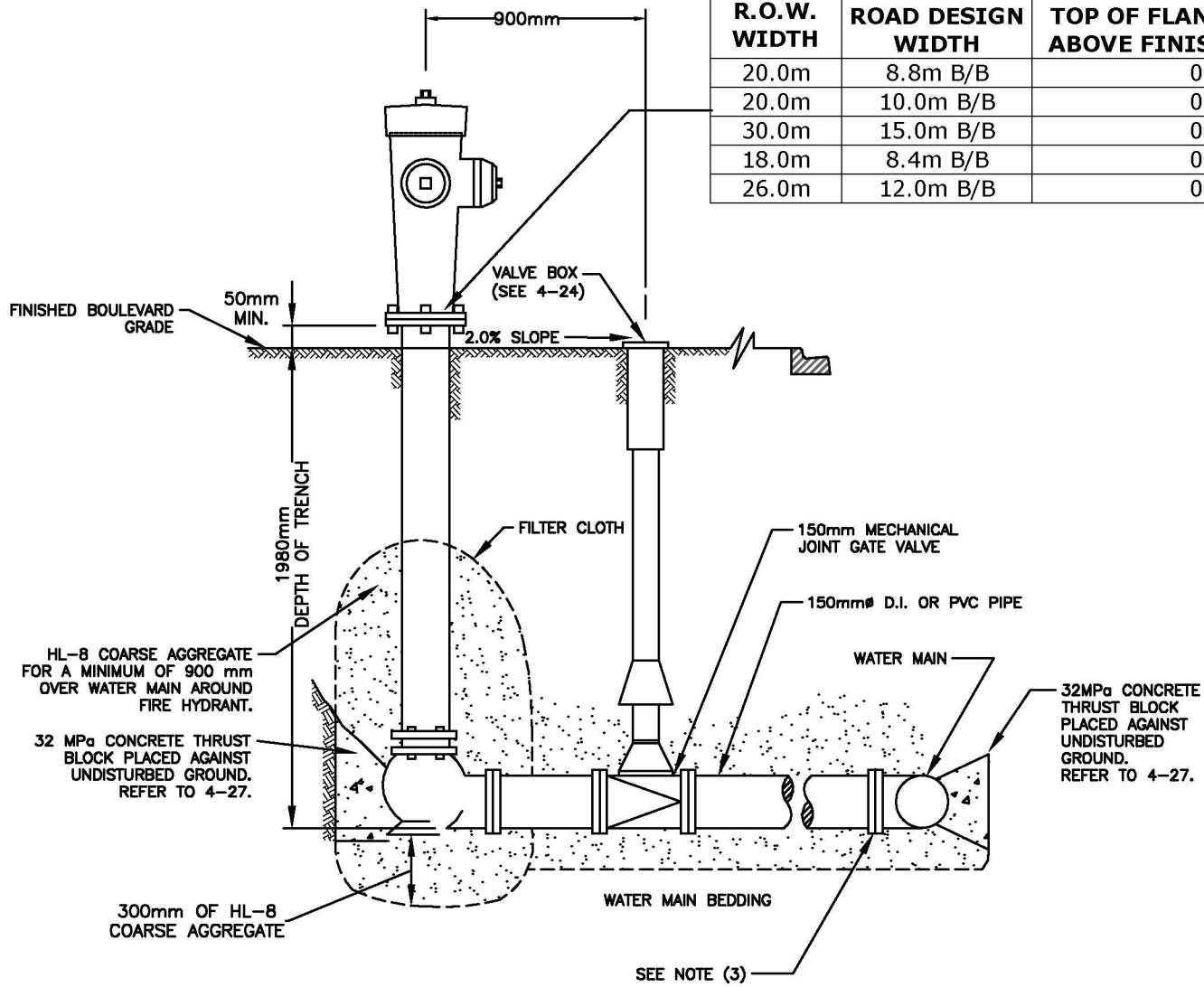


4 - 23



CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: MAR/96	REV. No.: R-2	
VALVE BOX INSTALLATION 100 TO 300 DIA. WATERMANS		DESCRIPTION: REVIEWED FEB/2005		
		REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.	ENGINEERING
		APPROVED BY: CITY ENGINEER		4 - 24

RESIDENTIAL SUBDIVISIONS ONLY			
R.O.W. WIDTH	ROAD DESIGN WIDTH	TOP OF FLANGE ELEVATION ABOVE FINISHED ROAD C/L	HYDRANT TO STREET LINE
20.0m	8.8m B/B	0.180	4.0m
20.0m	10.0m B/B	0.160	3.6m
30.0m	15.0m B/B	0.125	5.0m
18.0m	8.4m B/B	0.180	3.3m
26.0m	12.0m B/B	0.165	4.5m



- NOTES:
1. HYDRANT SHALL HAVE ONE 114.3mm (4½") FRONT PUMPER PORT IN ADDITION TO TWO 63.5mm (2½") SIDE POINTS.
 2. HYDRANTS SHALL OPEN RIGHT (CLOCKWISE) AND CLOSE LEFT (COUNTER CLOCKWISE).
 3. PVC MOULDED OR D.I. MECH. JOINT TEES 150mm & 200mm PVC MAINS; D.I. MECH. JOINT TEES ON 250mm & LARGER MAINS
 4. DEPTH OF TRENCH SHALL BE 1900mm, BARREL LENGTH SHALL SUPPLIED ACCORDINGLY.
 5. POLYETHYLENE BOND BREAKER TO BE USED BETWEEN CONCRETE AND FITTING.
 6. FRONT PUMPER PORT TO FACE STREET OR ACCESS ROAD.
 7. SEE 4-54A & 4-54B FOR TRACER WIRE DETAILS.
 8. WHEN PVC PIPES ARE USED, RESTRAINED JOINTS SHALL BE PROVIDED ON THE LINE SIDE OF THE HYDRANT VALVE AS WELL AS THE HYDRANT SIDE OF THE HYDRANT TEE.
 9. REFER TO REGION OF WATERLOO DGSSMS FOR REQUIRED PETROLATUM TAPE SYSTEM.

CITY OF GUELPH STANDARD DRAWING HYDRANT INSTALLATION	DATE DRAWN : -	REV. No. : R-5	
	DESCRIPTION : REVIEWED JAN/2015		
	REV. DATE : JAN/15	REV. BY. : G.F./C.M.C.	ENGINEERING 4 - 25a
	APPROVED BY:		
CITY ENGINEER			

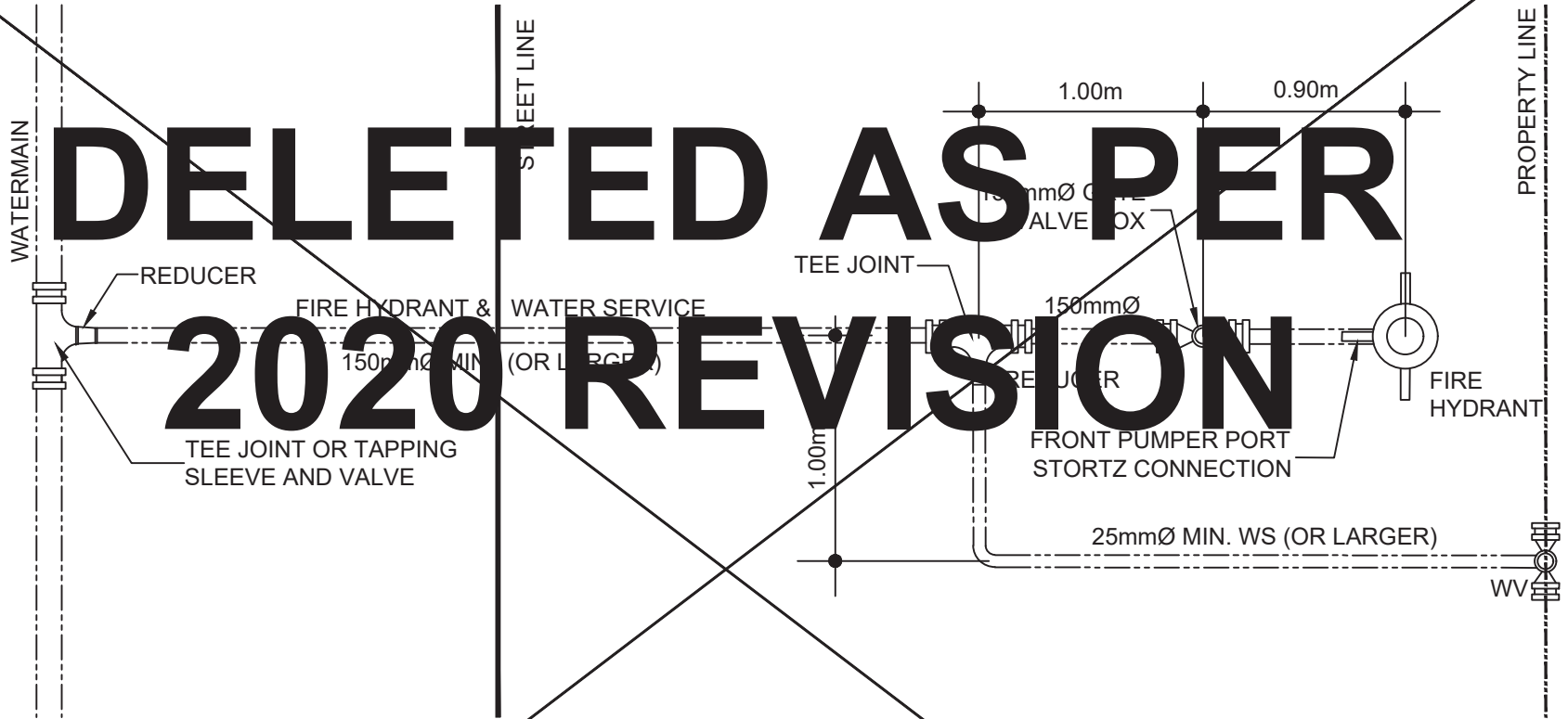
STREET LINE

STREET LINE

PROPERTY LINE


DELETED AS PER

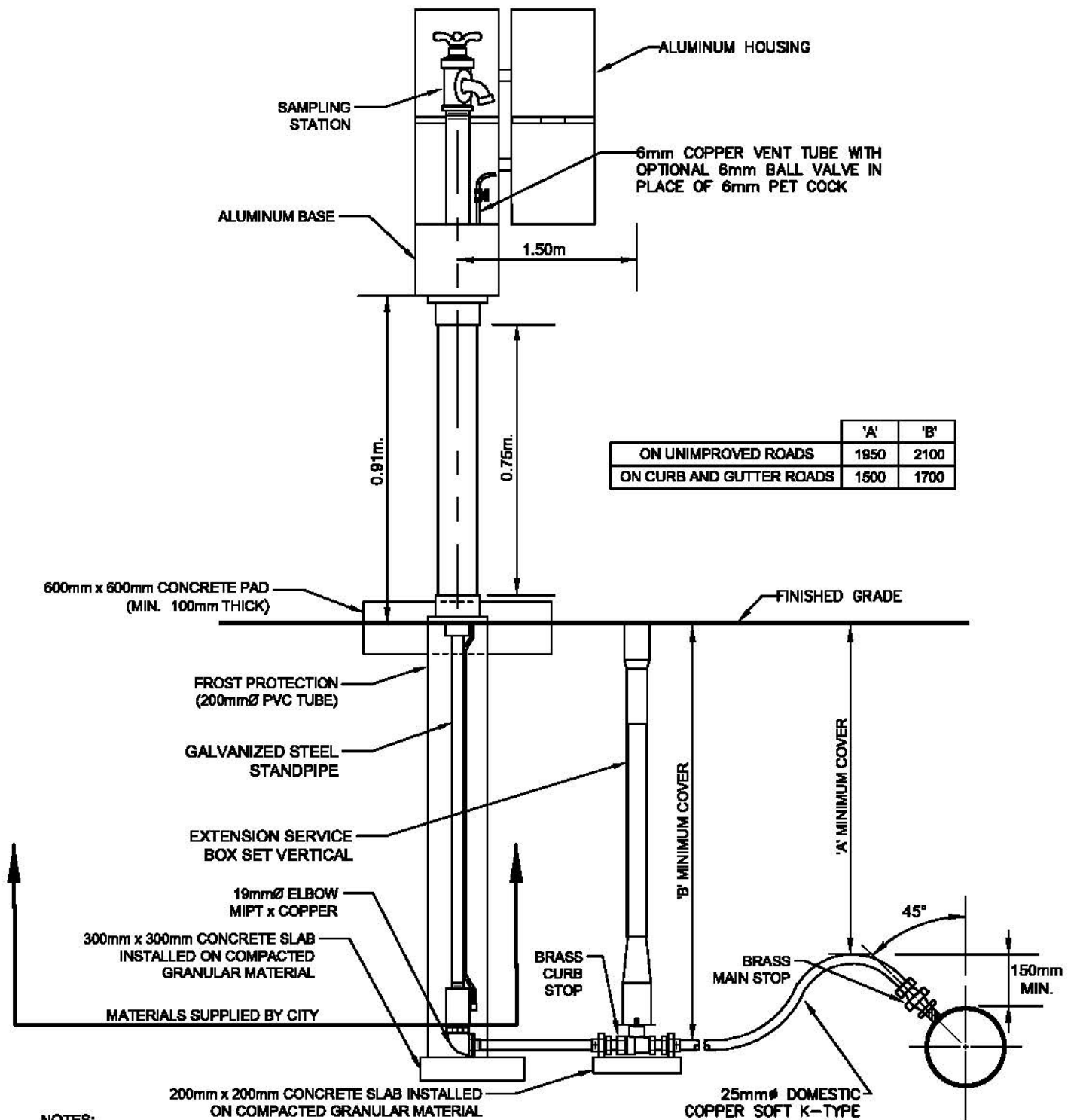
2020 REVISION



NOTES:

1. HYDRANT SHALL HAVE ONE 114.3mm (4 1/2") FRONT PUMPER PORT IN ADDITION TO TWO 63.5mm (2 1/2") SIDE POINTS.
2. HYDRANTS SHALL OPEN RIGHT (CLOCKWISE) AND CLOSE LEFT (COUNTER CLOCKWISE).
3. THE HYDRANT SHALL BE PAINTED YELLOW WITH PORTS, AND STORTZ NOZZLES PAINTED MEDIUM GREEN.
4. PVC MOULDED OR D.I. MECH. JOINT TEES ON 150mmØ & 200mmØ PVC MAINS. D.I. MECH JOINT TEES ON 250mm OR LARGER
5. DEPTH OF TRENCH SHALL BE 1900mm, BARREL LENGTH SHALL BE SUPPLIED ACCORDINGLY.
6. POLYETHYLENE BOND BREAKER TO BE USED BETWEEN CONCRETE AND FITTINGS.
7. FRONT PUMPER PORT TO FACE STREET OR ACCESS ROAD.
8. SEE SD 54 A & B FOR TRACER WIRE DETAILS.
9. REFER TO REGION OF WATERLOO DGSSMS FOR REQUIRED PETROLATUM TAPE SYSTEMS.
10. 90° BEND REQUIRED FOR LATERALS 100mmØ AND GREATER.

CITY OF GUELPH STANDARD DRAWING	DATE DRAWN : Feb. 2017	REV. No. :	 Guelph <small>Making a Difference</small>
	DESCRIPTION : N.T.S.		
	REV. DATE :	REV. BY. : I.U./C.M.C.	4 - 25b
	APPROVED BY:		
COMBINED HYDRANT & WATER SERVICE INSTALLATION TO COMMERCIAL PROPERTIES		CITY ENGINEER	



NOTES:

1. SAMPLING STATIONS SHALL BE FURNISHED WITH A 19mm FIP INLET AND A (19mm HOSE OR UNTHREADED) NOZZLE.
2. ALL STATIONS SHALL BE ENCLOSED IN A LOCKABLE, NON-REMOVABLE ALUMINUM-CAST HOUSING.
3. WHEN OPENED, THE STATION SHALL REQUIRE NO KEY FOR OPERATION AND THE WATER WILL FLOW IN ALL BRASS WATERWAY.
4. ALL WORKING PARTS WILL ALSO BE OF BRASS AND BE REMOVABLE FROM ABOVE GROUND WITH NO DIGGING. EXTERIOR PIPING SHALL BE GALVANIZED STEEL (BRASS PIPE ALSO AVAILABLE).
5. A COPPER VENT TUBE WILL ENABLE EACH STATION TO BE PUMPED FREE OF STANDING WATER TO PREVENT FREEZING AND TO MINIMIZE BACTERIA GROWTH.
6. ECLIPSE #88-SS, STAINLESS STEEL SAMPLING STATION SUPPLIED BY CITY FOR CONTRACTOR INSTALLATION. BALANCE OF MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR.

CITY OF GUELPH STANDARD DRAWING

SAMPLING STATION
NOT TO SCALE

DATE DRAWN : DEC/17 REV. No. :

DESCRIPTION :
REVIEWED DEC/17

REV. DATE : REV. BY. :
A.V./C.M.C.

APPROVED BY:

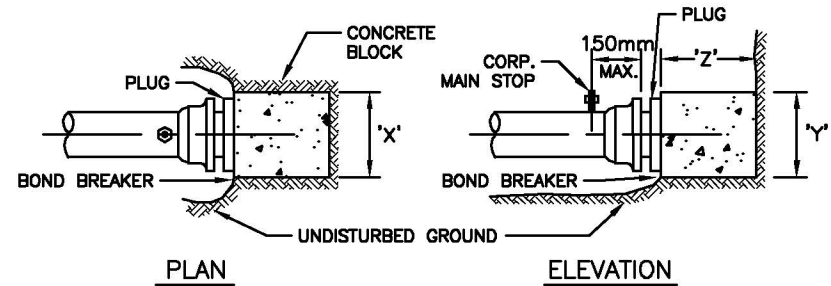
CITY ENGINEER



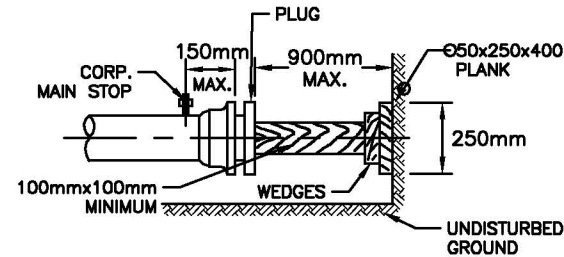
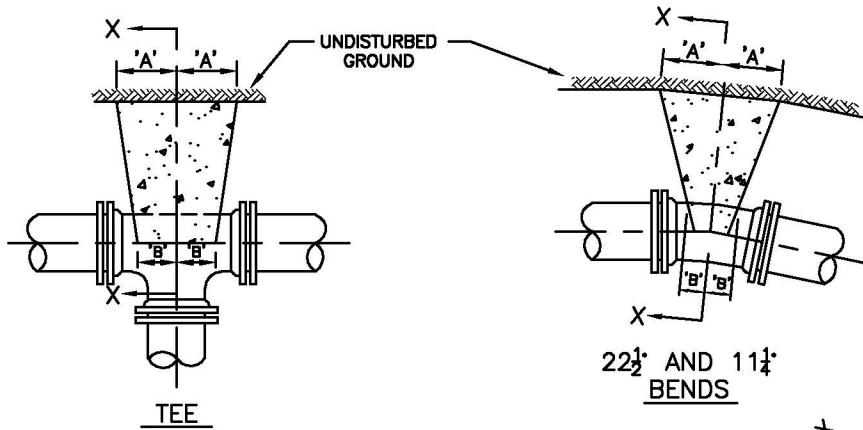
ENGINEERING

4 - 26

SIZE OF PIPE	MINIMUM DIMENSIONS															
	TEE				90° BEND				45° BEND				22½° & 11¼° BENDS			
	'A'	'B'	'C'	'D'	'C'	'D'	'E'	'A'	'B'	'C'	'D'	'A'	'B'	'C'	'D'	
100	150	63	375	75	375	75	225	150	75	375	75	150	75	375	75	
150	150	75	450	75	450	75	300	225	75	450	75	150	75	450	75	
200	200	125	550	75	550	100	350	225	100	550	100	225	100	550	100	
250	250	175	600	75	600	125	400	300	125	600	125	300	125	600	125	
300	300	225	750	75	750	150	450	375	150	750	150	375	150	750	150	
400	450	300	825	75	975	150	600	500	225	825	150	500	225	825	150	

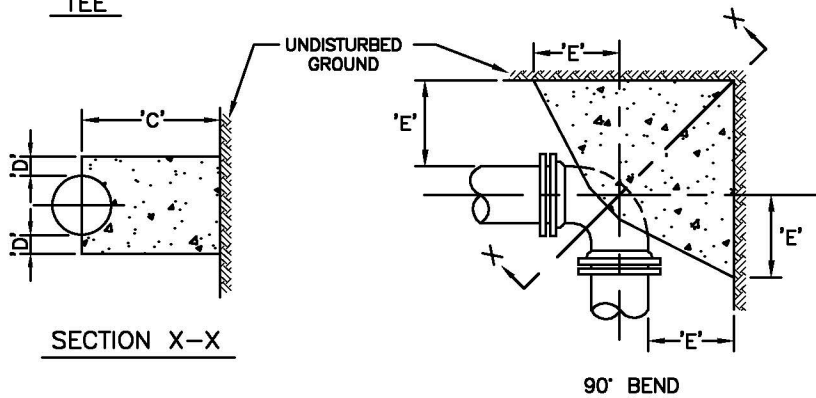


PERMANENT BLOCKING




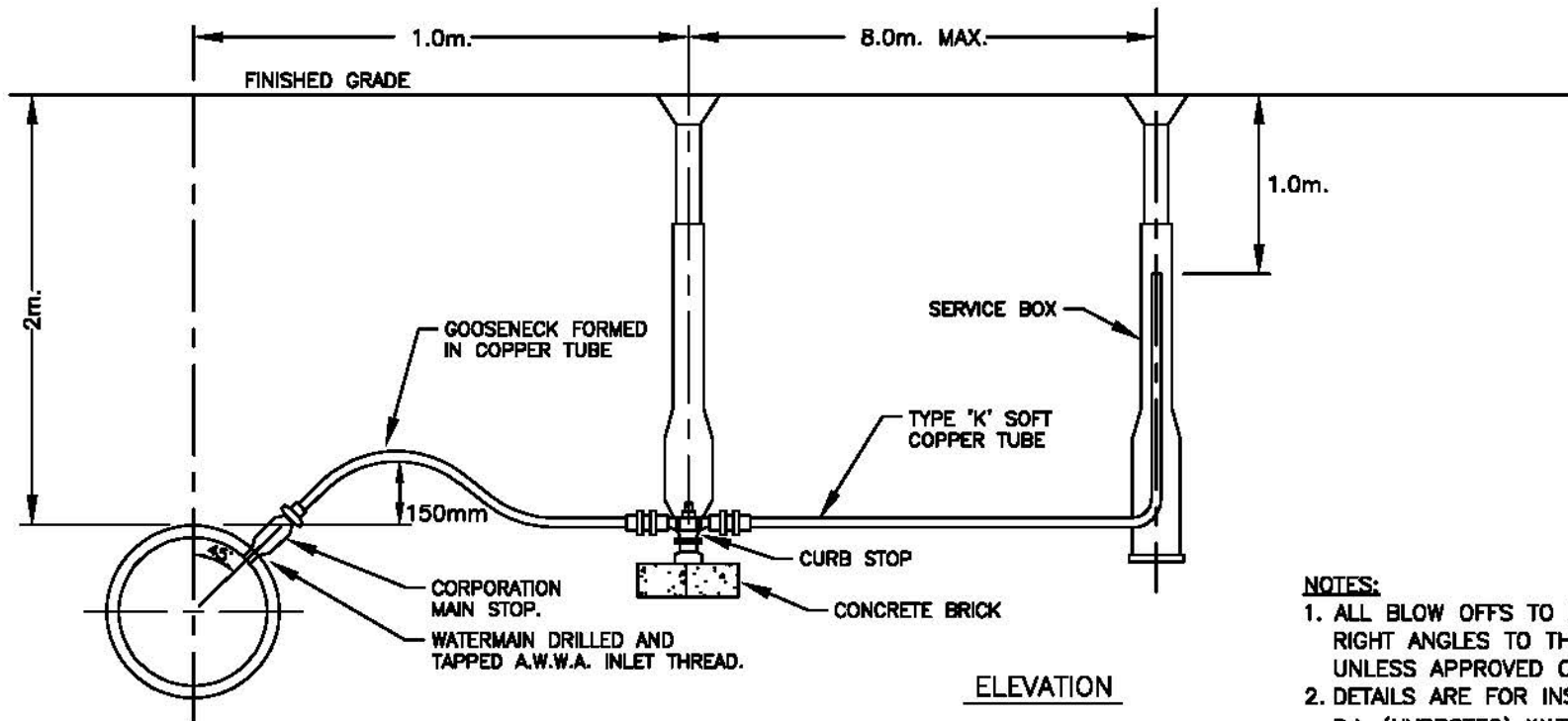
TEMPORARY PLUG BLOCKING 100mm TO 300mm WATERMAIN

MINIMUM DIMENSIONS				
SIZE OF PIPE	'X'	'Y'	'Z'	
100	300	300	450	
150	450	400	450	
200	600	400	600	
250	750	500	750	
300	900	600	900	
400	1200	900	1200	

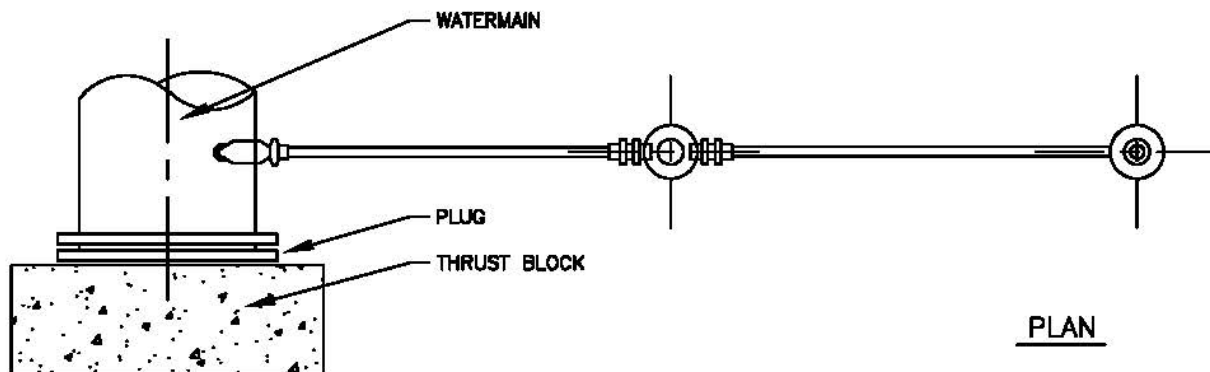


- NOTES:
1. ALL CONCRETE TO BE 32MPa AT 28 DAYS.
 2. ALL CONCRETE TO BE PLACED AGAINST UNDISTURBED GROUND.
 3. DO NOT USE FOR BLOCKING WHERE WATER MAIN TEST PRESSURE EXCEEDS 1MPa OR IN UNSTABLE SOIL CONDITIONS.
 4. POLYETHYLENE BOND BREAKER TO BE USED BETWEEN CONCRETE AND FITTINGS.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN :	REV. No. :	
<h1>THRUST BLOCKING FOR WATERMANS</h1>		-	R-2	
		DESCRIPTION :		ENGINEERING
		REVIEWED FEB/2005		
		REV. DATE :	REV. BY. :	
FEB/05	G.F./M.E.C.			<h2>4 - 27</h2>
APPROVED BY:				
CITY ENGINEER				




ELEVATION

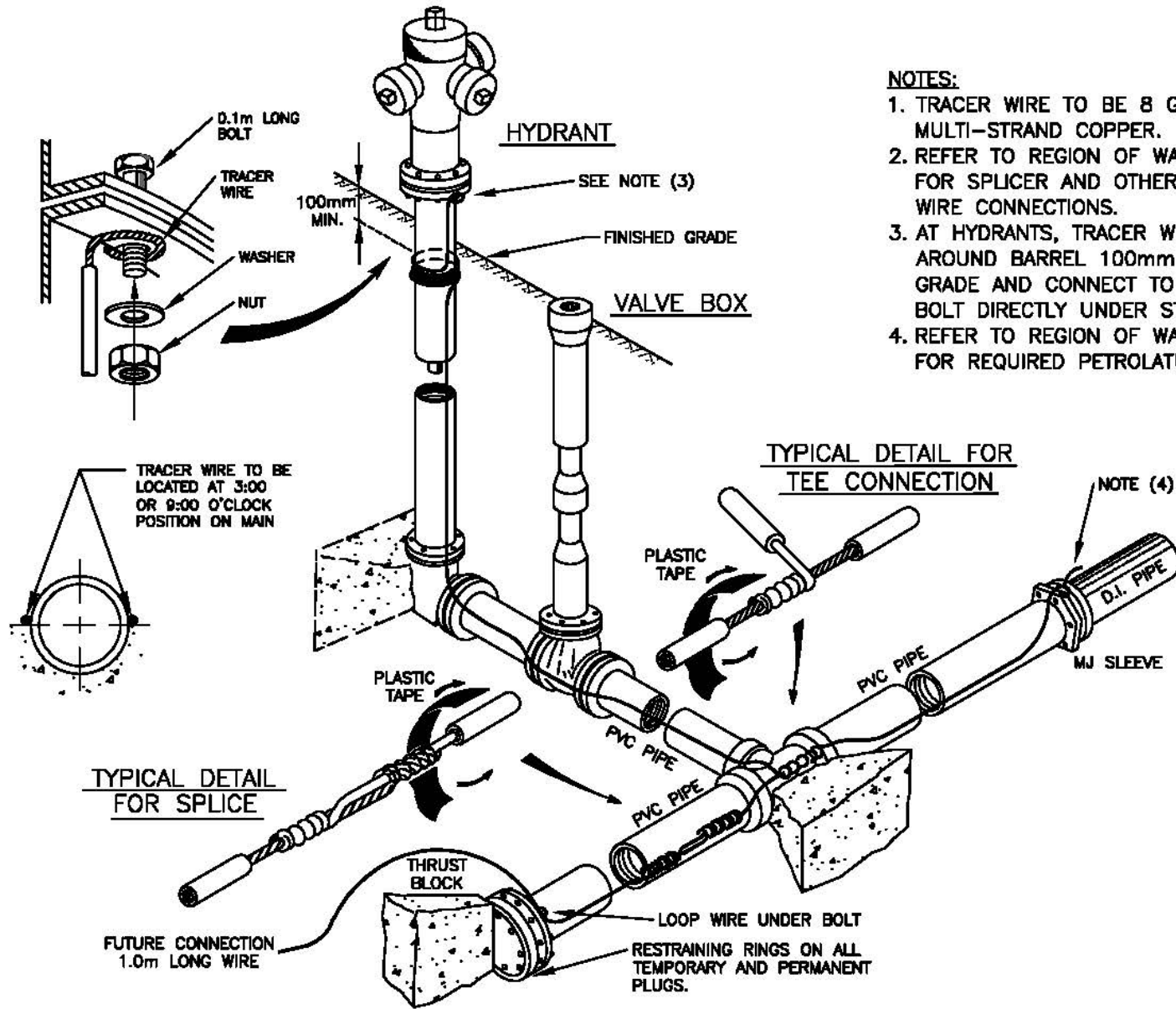


PLAN

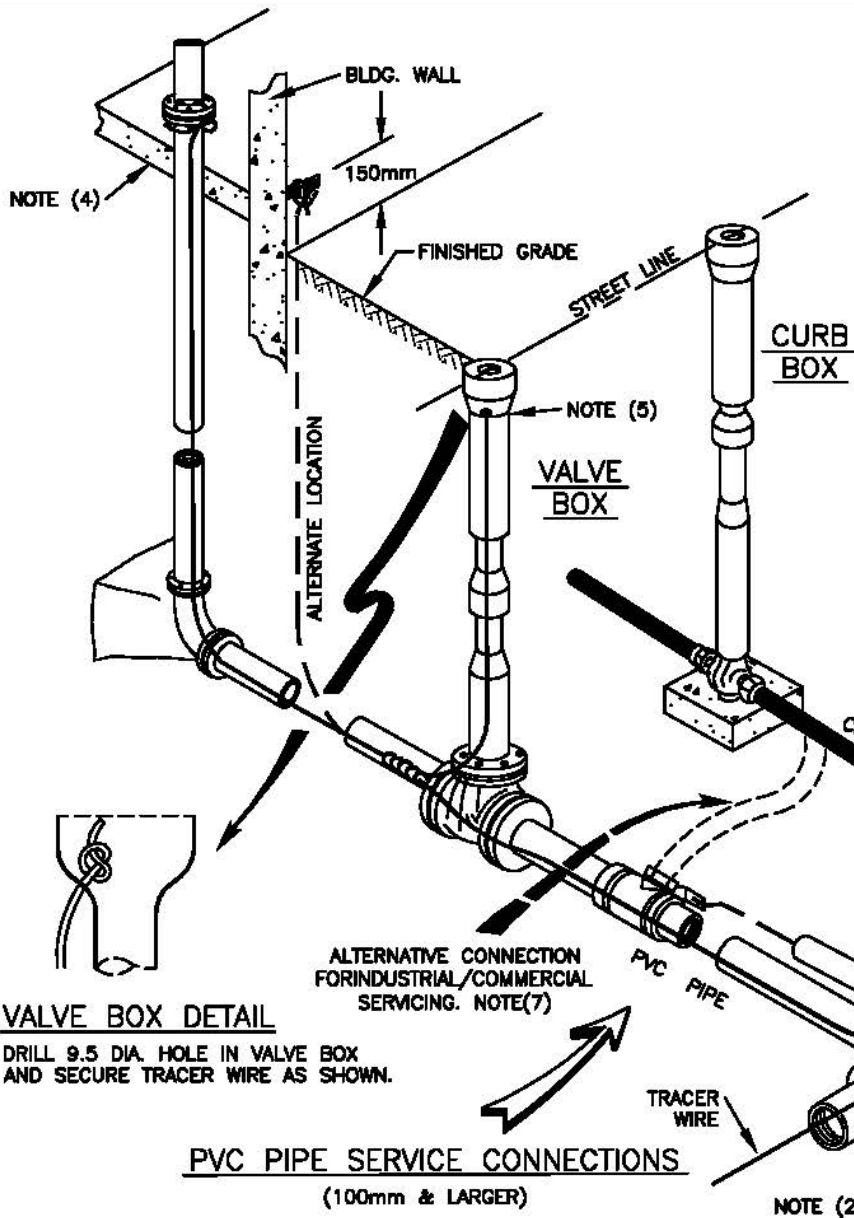
NOTES:

1. ALL BLOW OFFS TO BE INSTALLED AT RIGHT ANGLES TO THE WATERMAIN UNLESS APPROVED OTHERWISE.
2. DETAILS ARE FOR INSTALLATIONS ON D.I. (HYPROTEC) WATERMAIN. SEE 4-54b FOR ADDITIONAL DETAILS FOR INSTALLATIONS ON PVC WATERMAIN.
3. REFER TO REGION OF WATERLOO DGSSMS FOR REQUIRED PETROLATUM TAPE SYSTEMS.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No.: R-4	 ENGINEERING
<h1>STANDARD BLOW-OFF</h1>		DESCRIPTION: REVIEWED JAN/2015		
		REV. DATE: JANÉ15	REV. BY.: G.F./C.M.C.	
		APPROVED BY:		<h2>4 - 28</h2>
		CITY ENGINEER		



<p>CITY OF GUELPH STANDARD DRAWING</p> <p>TRACER WIRE DETAILS FOR PVC WATERMAIN</p>	DATE DRAWN : -	REV. No. : R-3	
	DESCRIPTION : REVIEWED JAN/2015		
	REV. DATE : JAN/15	REV. BY. : G.F./C.M.C.	
	APPROVED BY:		
	CITY ENGINEER		

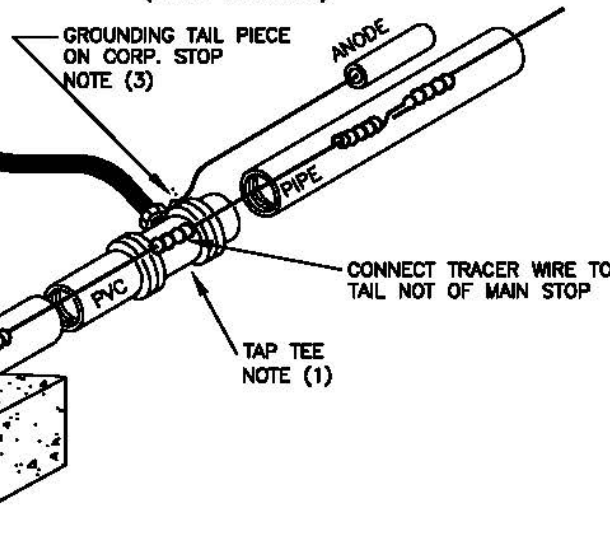


NOTES:

1. PRE-TAPPED PVC MOULDED OR FABRICATED TEES TO BE USED WITH 25mm, 38mm & 50mm COPPER SERVICES.
2. PVC MOULDED TEES - ON 100mm, 150mm & 200mm MAINS. D.I. (HYPROTEC) TEES WITH MECHANICAL JOINTS - ON 250mm & LARGER MAINS.
3. CORROSION PROTECTION FOR COPPER SERVICES TO BE CONNECTED TO CORPORATION STOP.
4. CONNECT TRACER WIRE TO FLANGE BOLT WITH WASHER OR ALTERNATIVELY, STRAP TO OUTSIDE BUILDING WALL.
5. WHEN TAPPING SLEEVE AND VALVE INSTALLED ON MAIN, NO TRACER WIRE ACCESS REQUIRED AT STREET LINE.
6. THIS DETAIL IS TO BE USED IN CONJUNCTION WITH SD-26 AND SD-54A.

COPPER PIPE SERVICE CONNECTIONS

(25mm to 50mm)



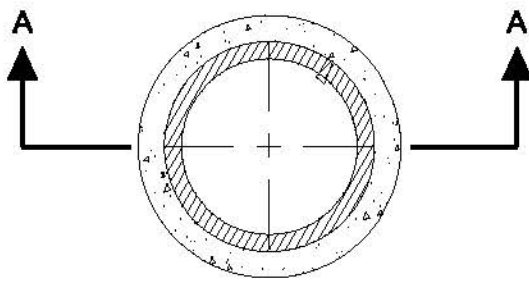
PVC PIPE SERVICE CONNECTIONS

(100mm & LARGER)

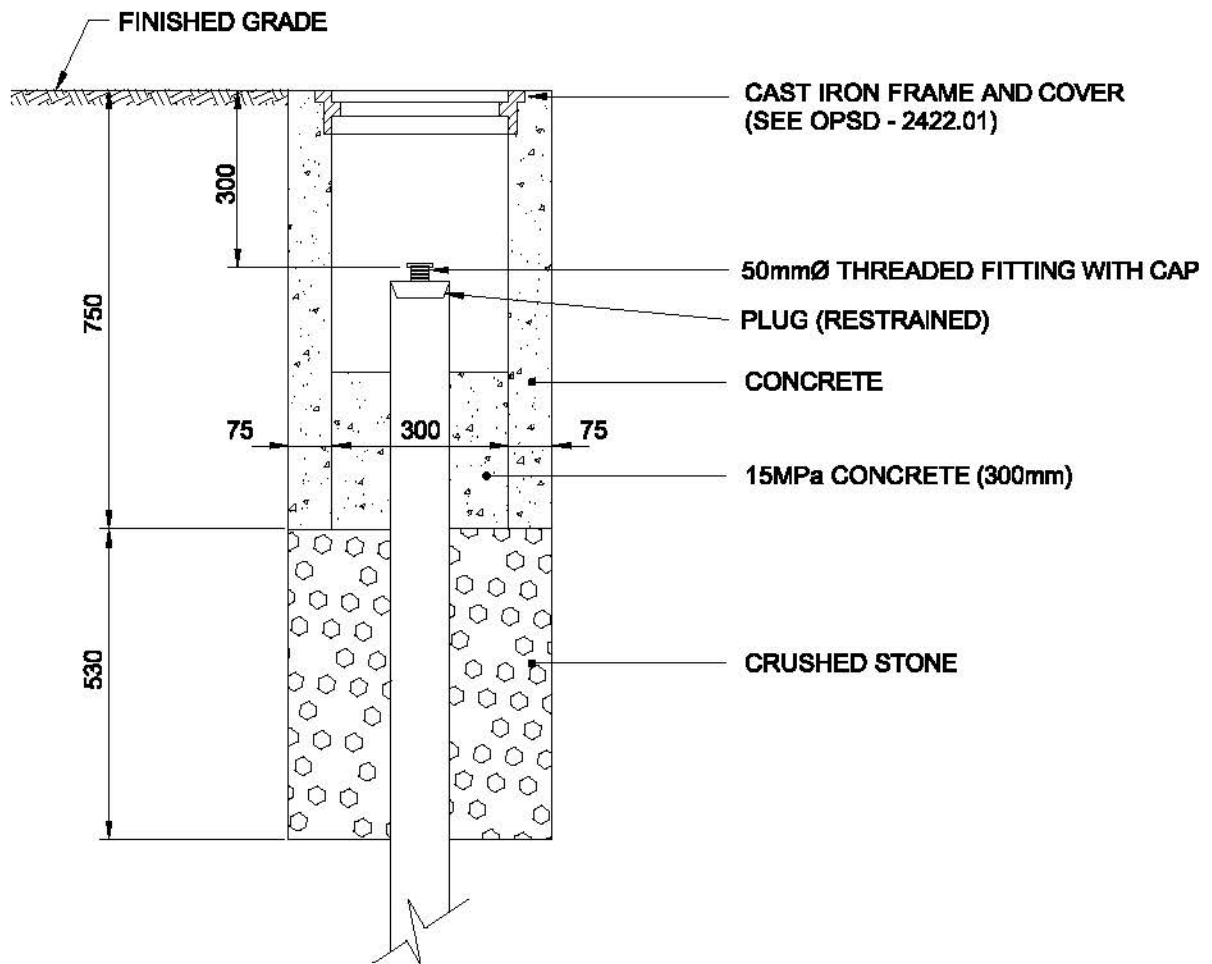
VALVE BOX DETAIL

DRILL 9.5 DIA. HOLE IN VALVE BOX AND SECURE TRACER WIRE AS SHOWN.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: MAR/95	REV. No.: R-5	 ENGINEERING
SERVICE CONNECTION DETAILS FOR PVC WATERMAIN		DESCRIPTION: REVIEWED JAN/2015		
		REV. DATE: JAN/15	REV. BY.: G.F./C.M.C.	
		APPROVED BY:		4 - 54b
		CITY ENGINEER		



PLAN



SECTION A - A

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

CITY OF GUELPH STANDARD DRAWING

**WATERMAIN SWAB EXIT
300mmØ I.D. [DETAIL]**

DATE DRAWN : - REV. No. : R-5

DESCRIPTION : REVIEWED FEB/2005

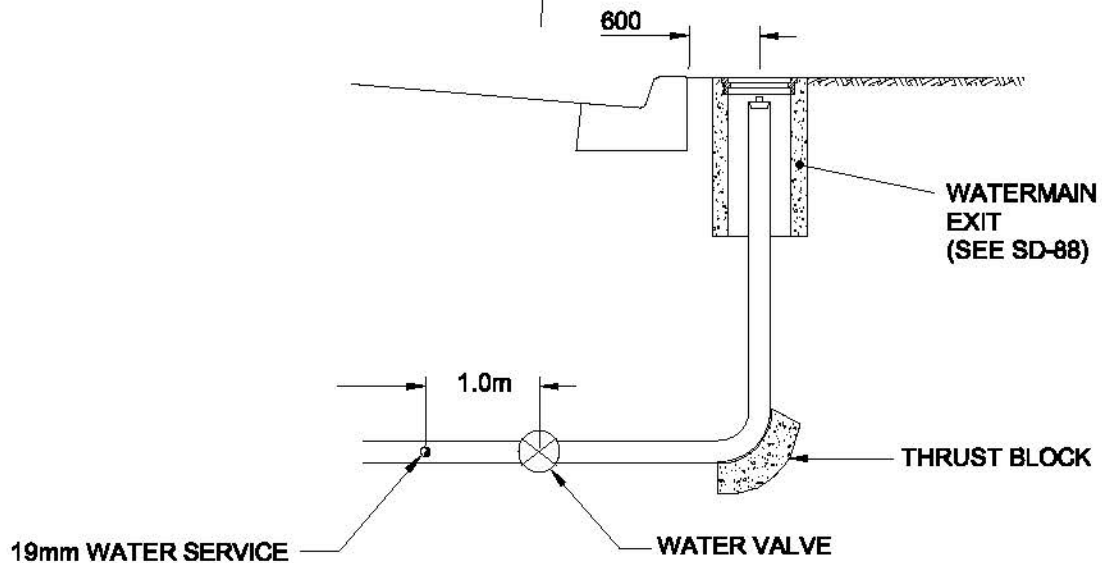
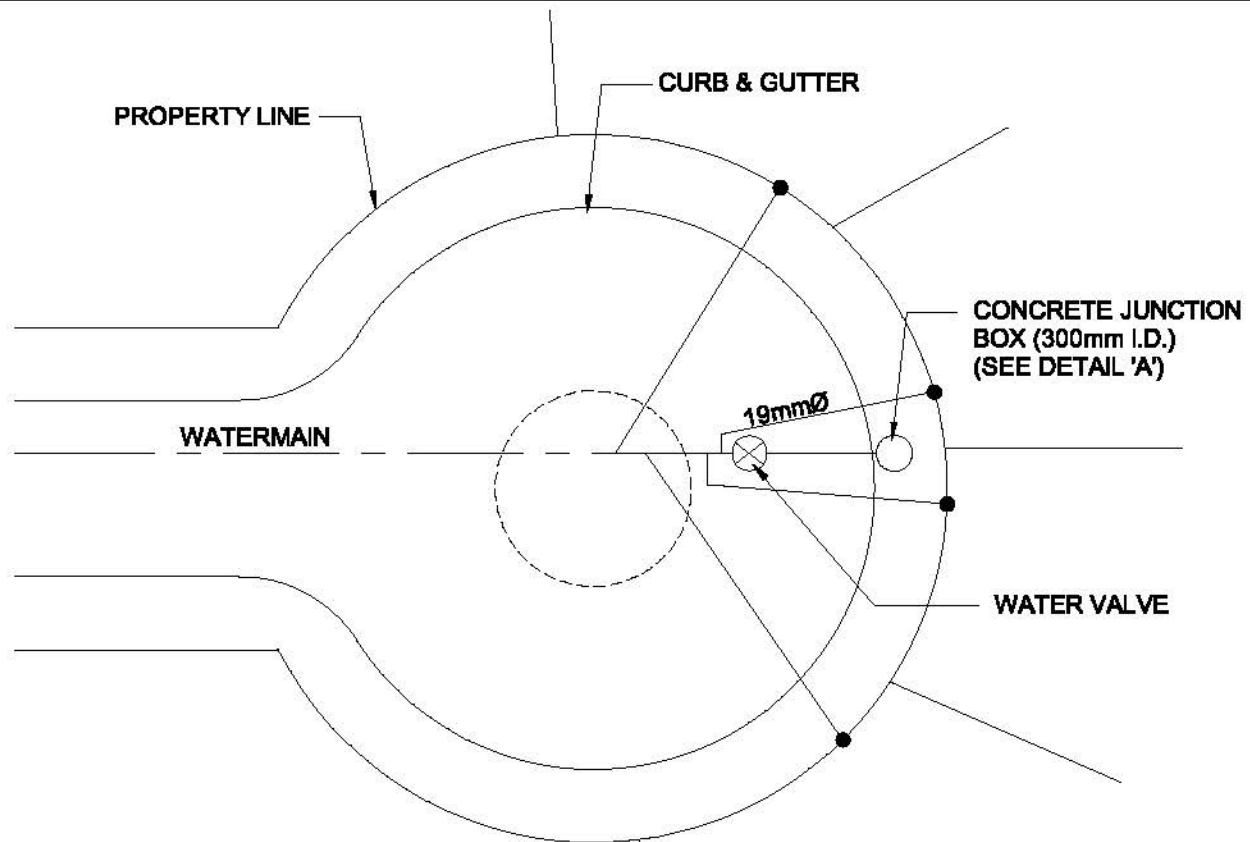
REV. DATE : FEB/05 REV. BY. : G.F./M.E.C.

APPROVED BY: _____
CITY ENGINEER



ENGINEERING

4 - 88



DETAIL 'A'

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
2. PROVIDE RESTRAINT AT ALL JOINTS.
3. ALTERNATE LOCATION FOR SWAB EXIT AT 600mm FROM CURB IN ISLAND SHALL BE USED WHEN POSSIBLE.

CITY OF GUELPH STANDARD DRAWING

WATERMAIN AT CUL-DE-SAC

DATE DRAWN :
- REV. No. :
R-5

DESCRIPTION :
REVIEWED FEB/2005

REV. DATE :
FEB/05 REV. BY. :
G.F./M.E.C.

APPROVED BY:

CITY ENGINEER

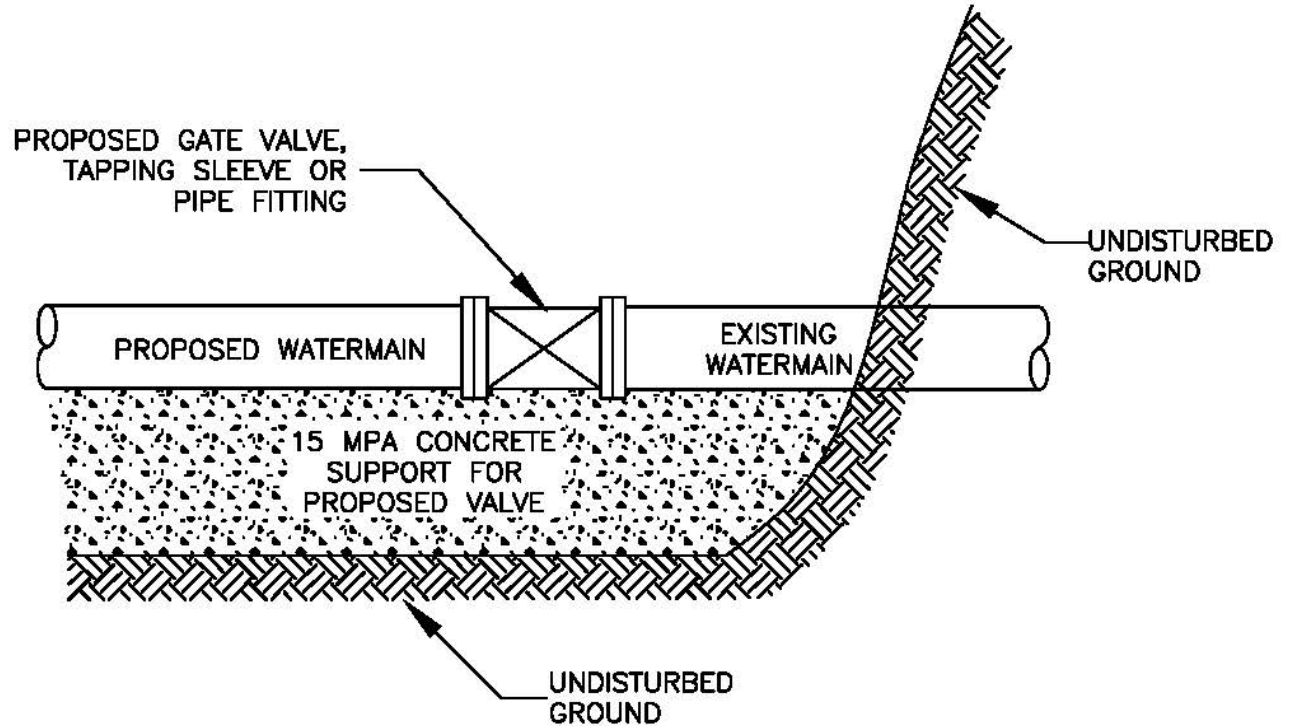


ENGINEERING

4 - 88a

NOTES:

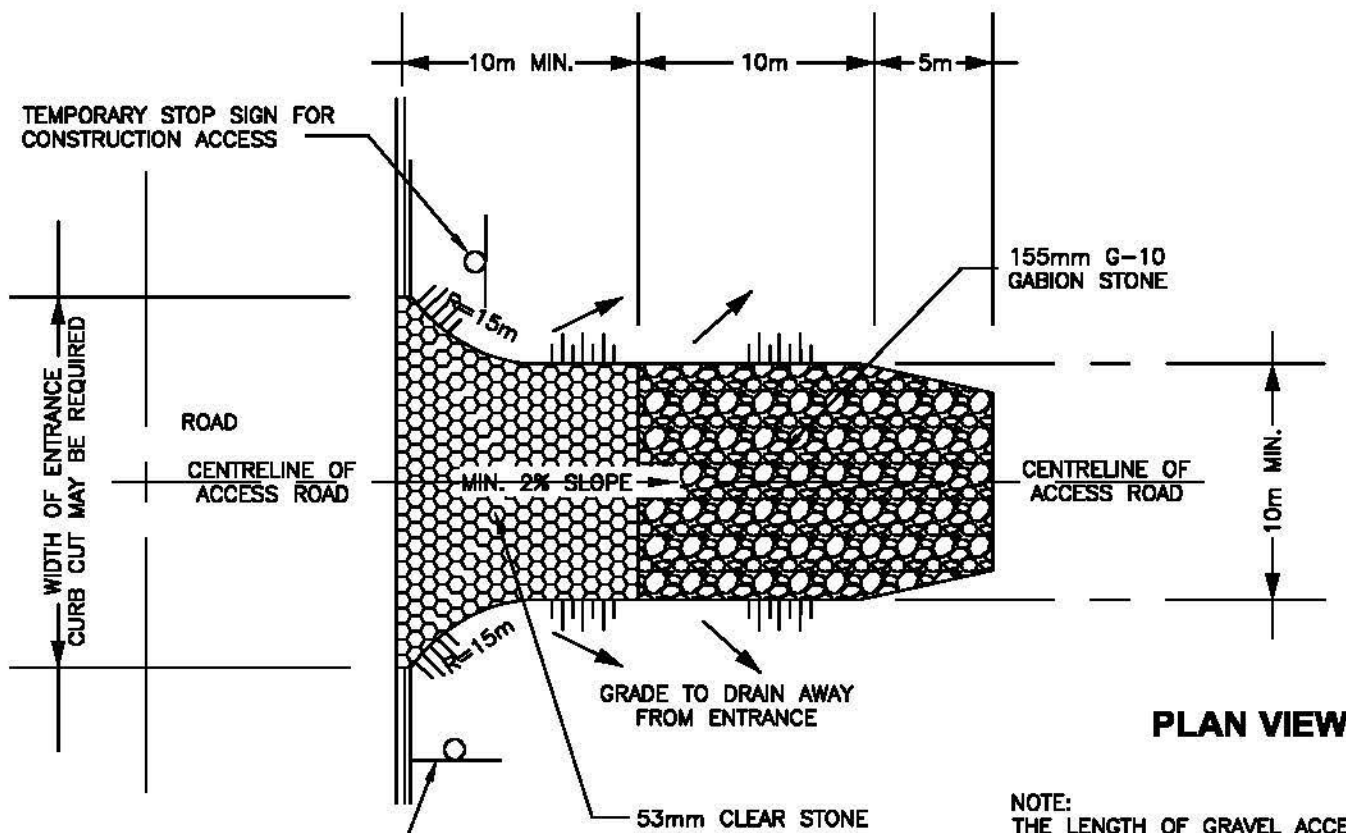
1. PROPOSED GATE VALVE TO BE WRAPPED IN PLASTIC TO PREVENT CONCRETE SUPPORT FROM BONDING TO VALVE.
2. TRACER WIRE AS PER CITY STANDARDS.
3. BACKFILL AS SPECIFIED IN CONTRACT.



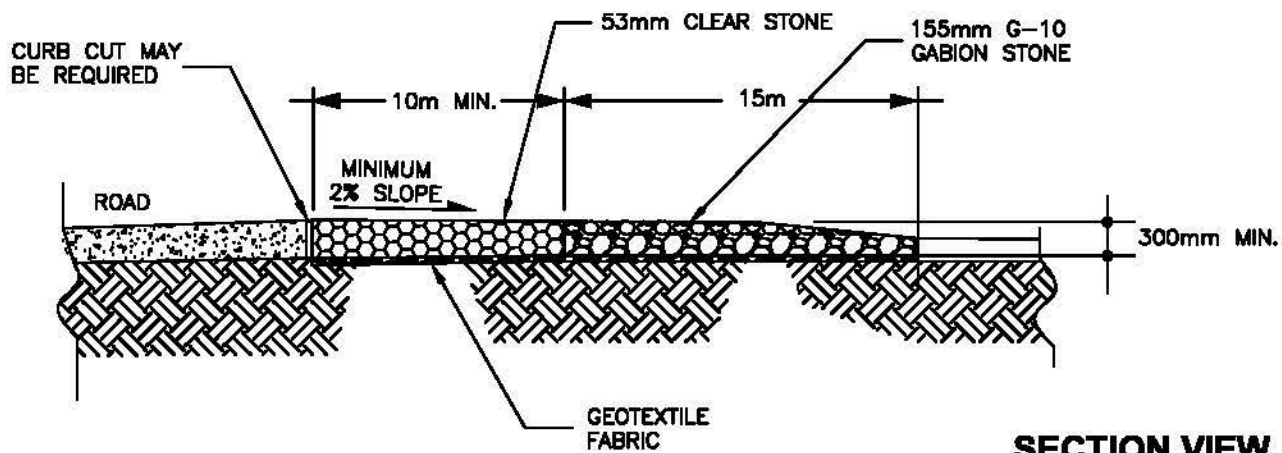
<p>CITY OF GUELPH STANDARD DRAWING</p> <p>VALVE INSTALLATION ON OR CONNECTION TO EXISTING WATERMAIN</p>	DATE DRAWN: JAN/07	REV. No.: R-0	 <p>ENGINEERING</p>
	DESCRIPTION:		
	REV. DATE:	REV. BY.:	
	APPROVED BY:		4 - 91
	CITY ENGINEER		



SECTION 5: ROAD SECTION



PROVIDE TRAFFIC WARNING SIGN ON EXISTING ROADS (ALL APPROACHES) AS PER ONTARIO TRAFFIC MANUAL BOOK 7



NOTE:
MUD MAT TO BE AS WIDE AS THE ENTRY ROAD WAY

CITY OF GUELPH STANDARD DRAWING

**CONSTRUCTION ENTRANCE MUD MAT
DETAIL FOR CITY ROAD ACCESS**

DATE DRAWN: FEB/17 REV. No.:

DESCRIPTION: N.T.S.

REV. DATE: REV. BY.: M.T./C.M.C.

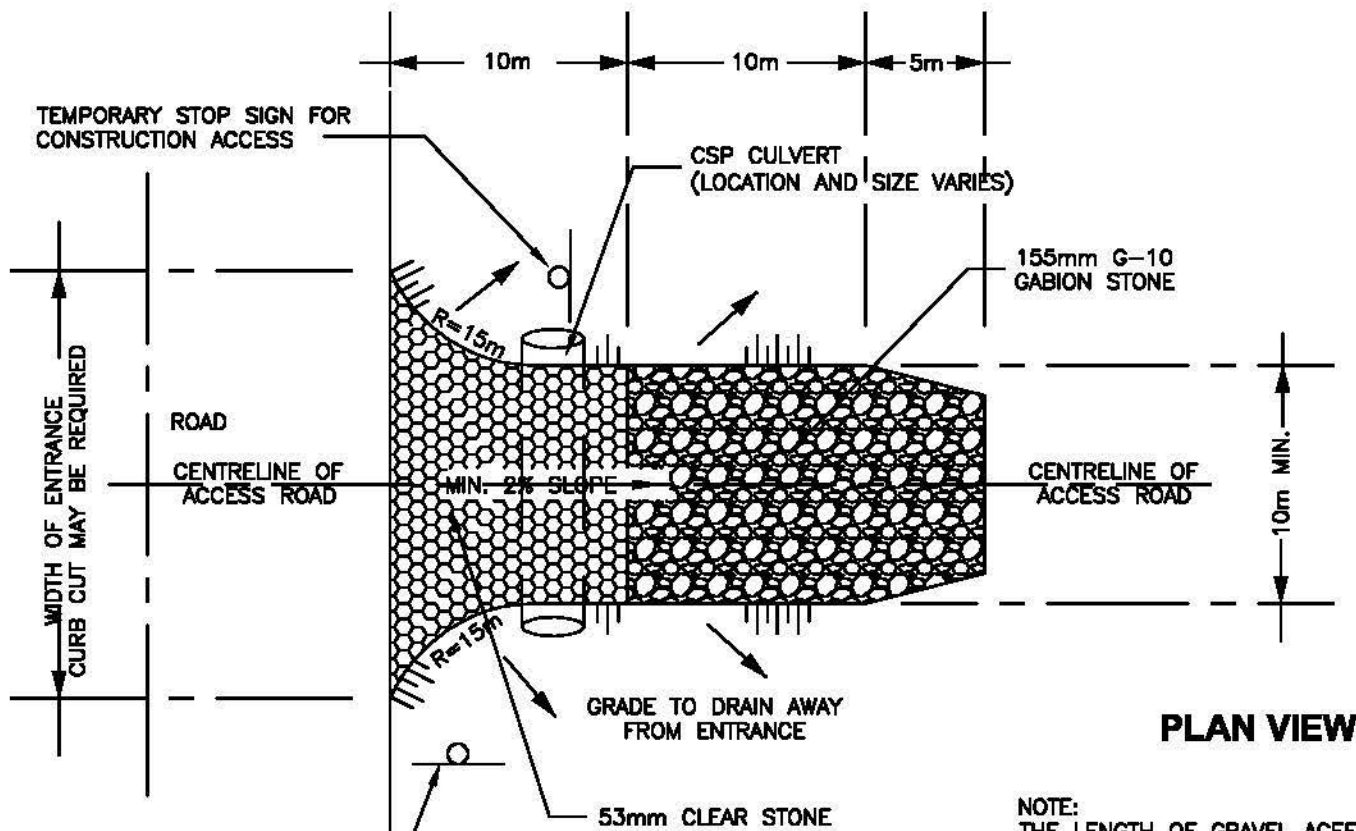
APPROVED BY:

CITY ENGINEER



ENGINEERING

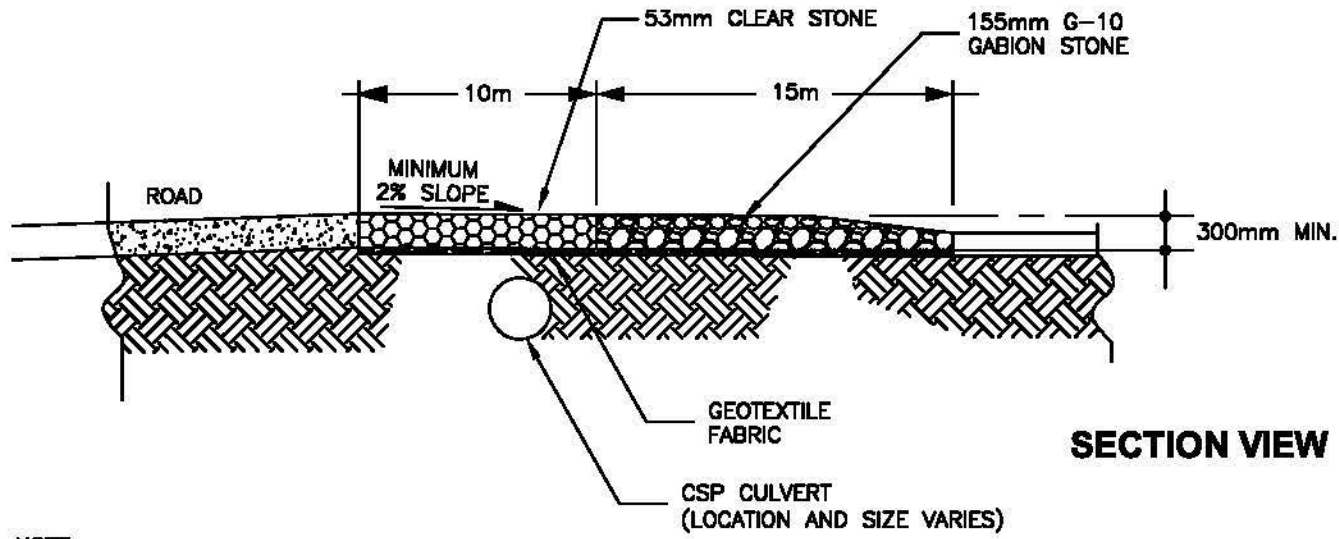
5 - 45



PLAN VIEW

PROVIDE TRAFFIC WARNING SIGN ON EXISTING ROADS (ALL APPROACHES) AS PER ONTARIO TRAFFIC MANUAL BOOK 7

NOTE:
THE LENGTH OF GRAVEL ACCESS ROAD MAY BE INCREASED BY THE CITY ENGINEER.



SECTION VIEW

NOTE:
MUD MAT TO BE AS WIDE AS THE ENTRY ROAD WAY

CITY OF GUELPH STANDARD DRAWING

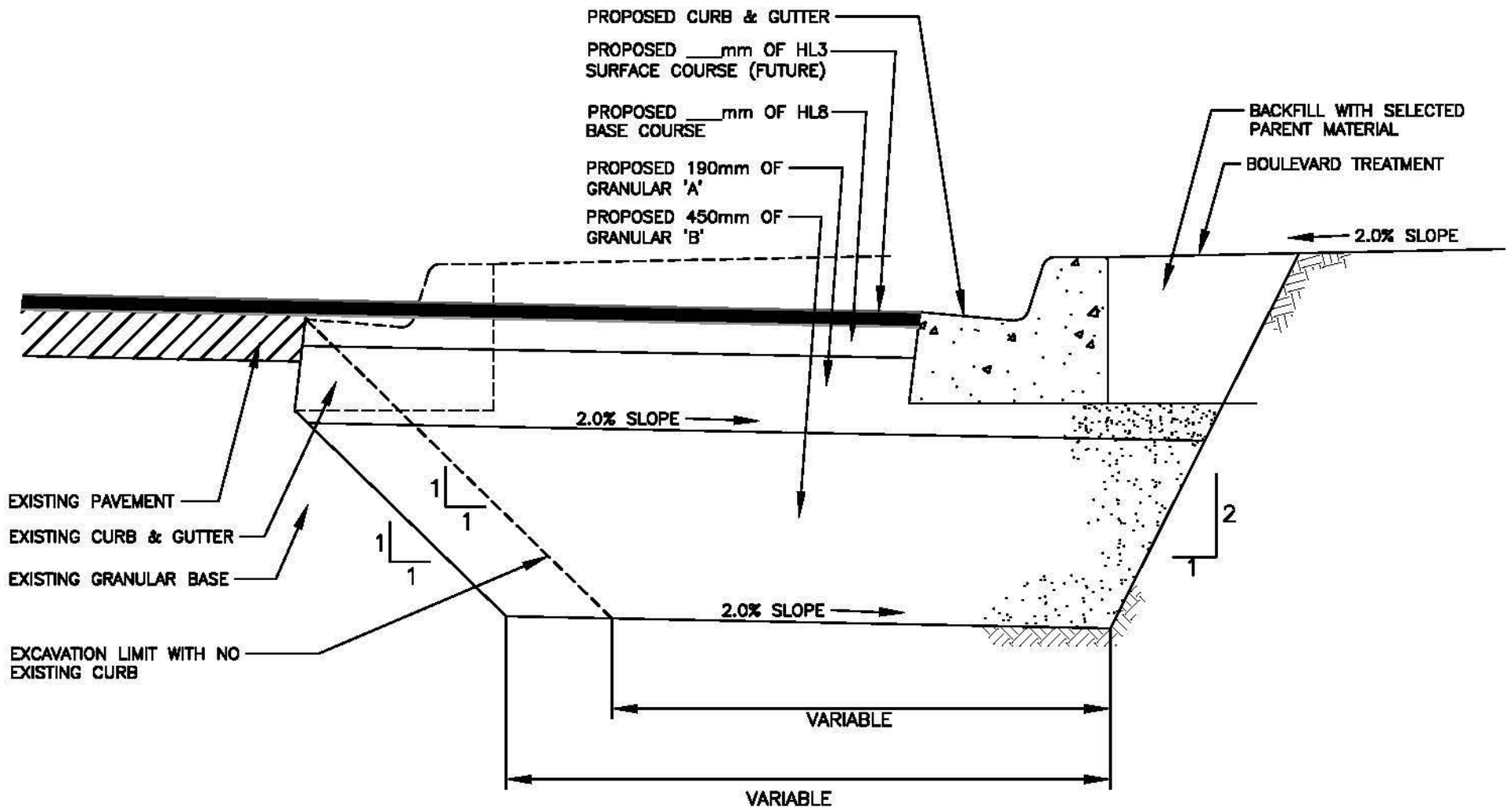
DATE DRAWN: FEB/17	REV. No.:
DESCRIPTION: N.T.S.	
REV. DATE:	REV. BY.: M.T./C.M.C.
APPROVED BY:	
CITY ENGINEER	




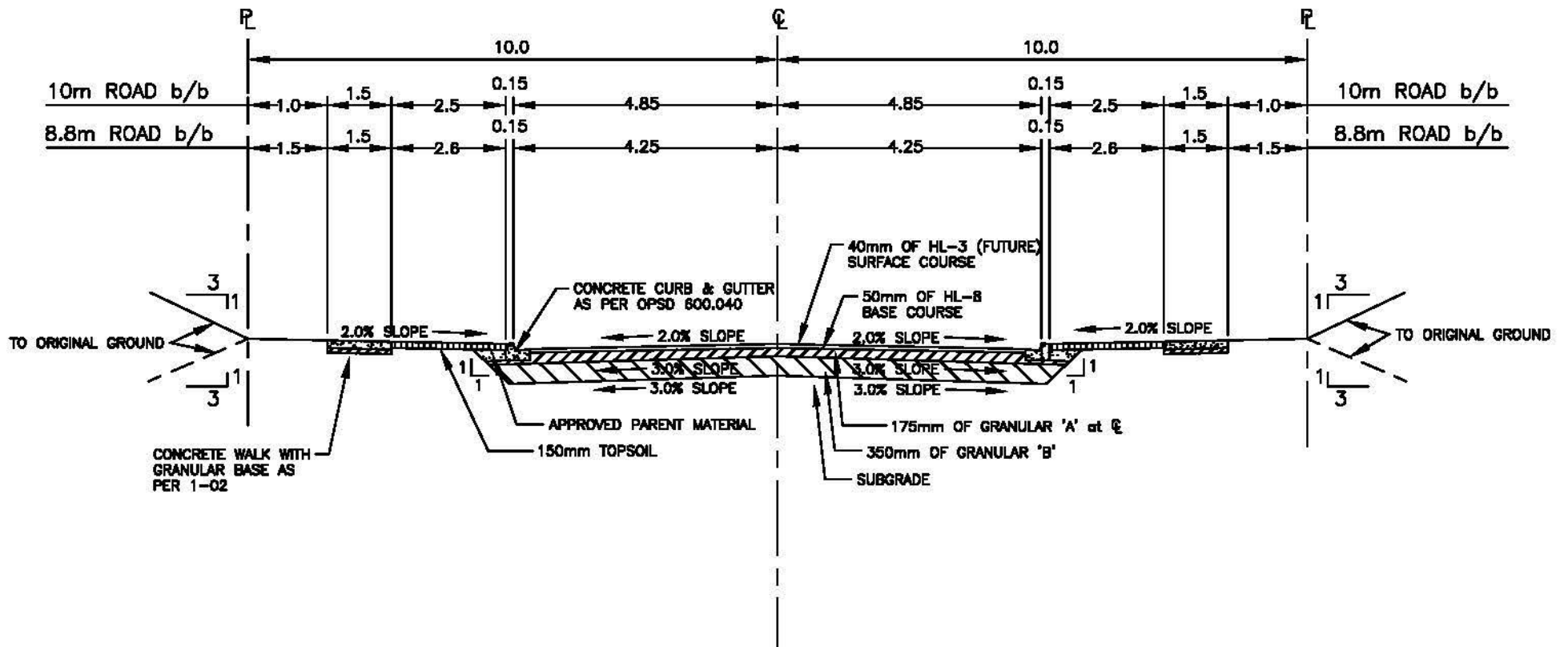
**CONSTRUCTION ENTRANCE MUD MAT
DETAIL FOR RURAL ROAD ACCESS**


ENGINEERING

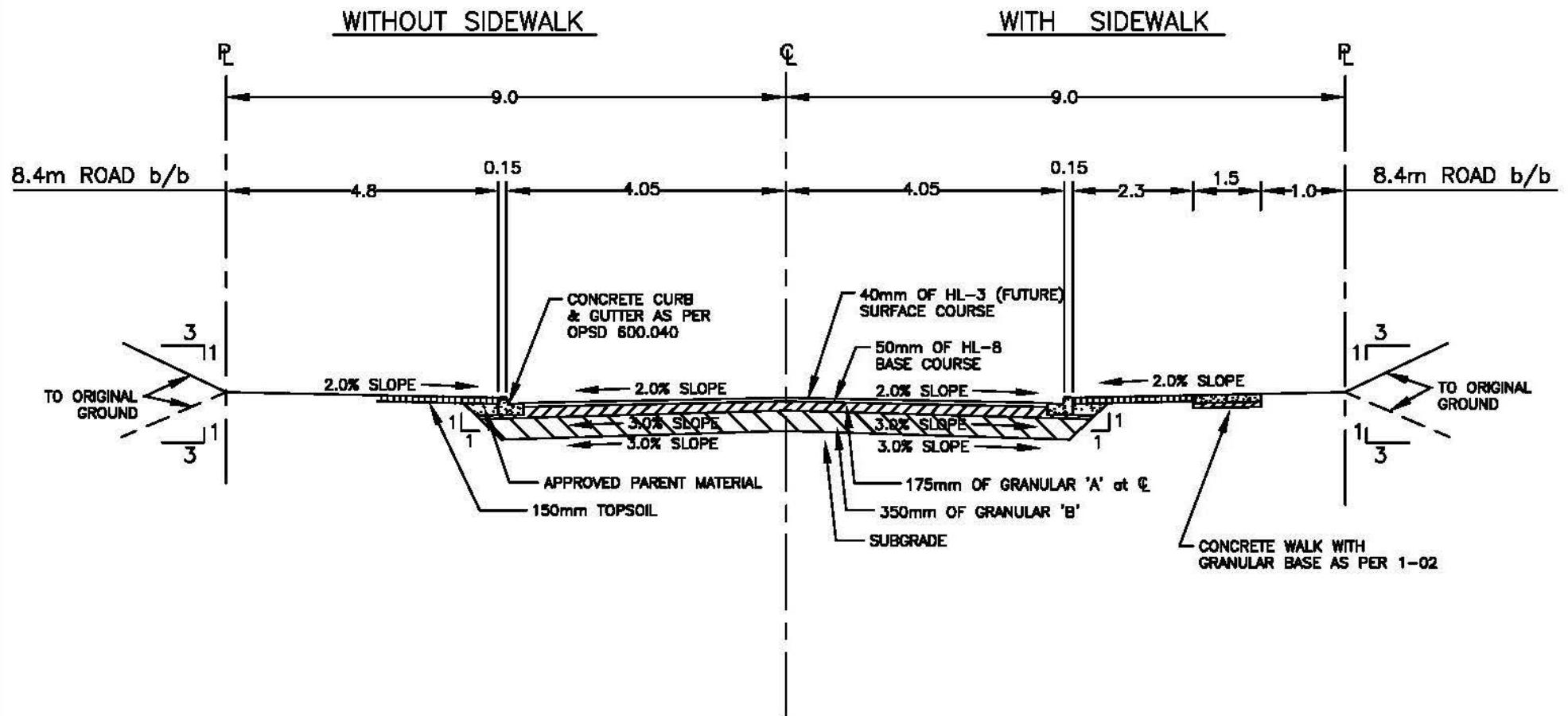
5 - 45a




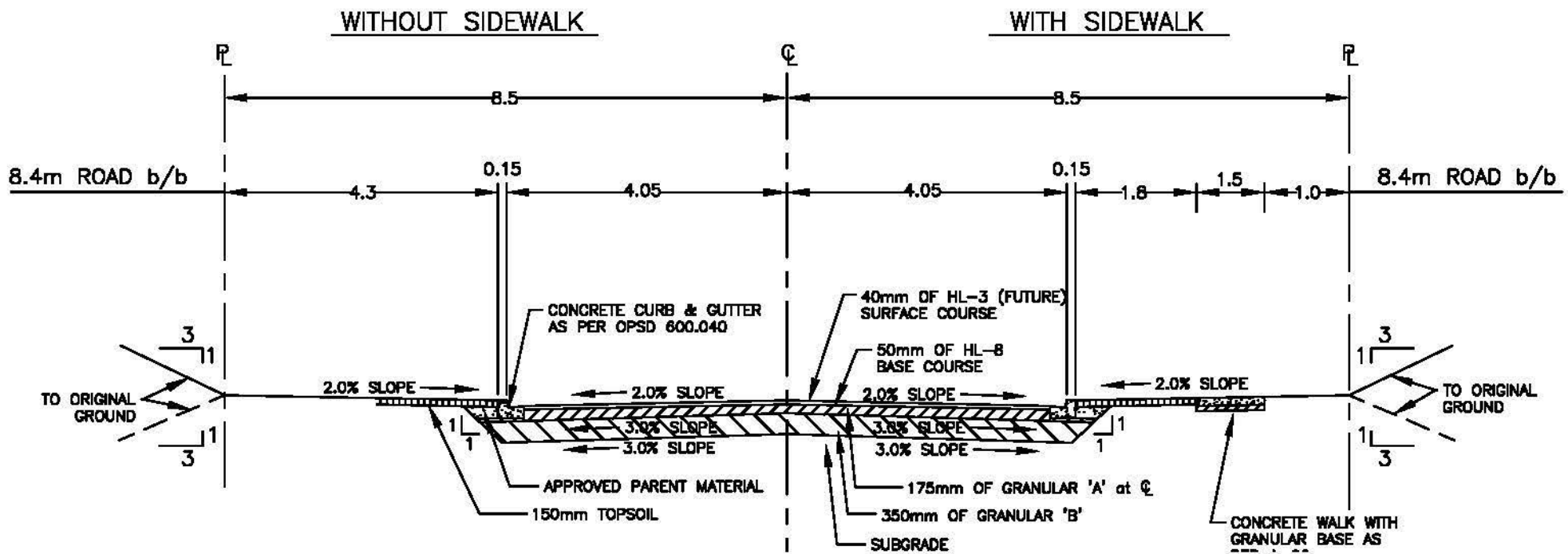
CITY OF GUELPH STANDARD DRAWING PAVEMENT WIDENING DETAIL	DATE DRAWN : -	REV. No. : R-2	 <small>Making a Difference</small>	
	DESCRIPTION: REVIEWED FEB/2005			ENGINEERING
	REV. DATE : FEB/05	REV. BY. : G.F./M.E.C.		
	APPROVED BY: _____			5 - 46
		CITY ENGINEER		




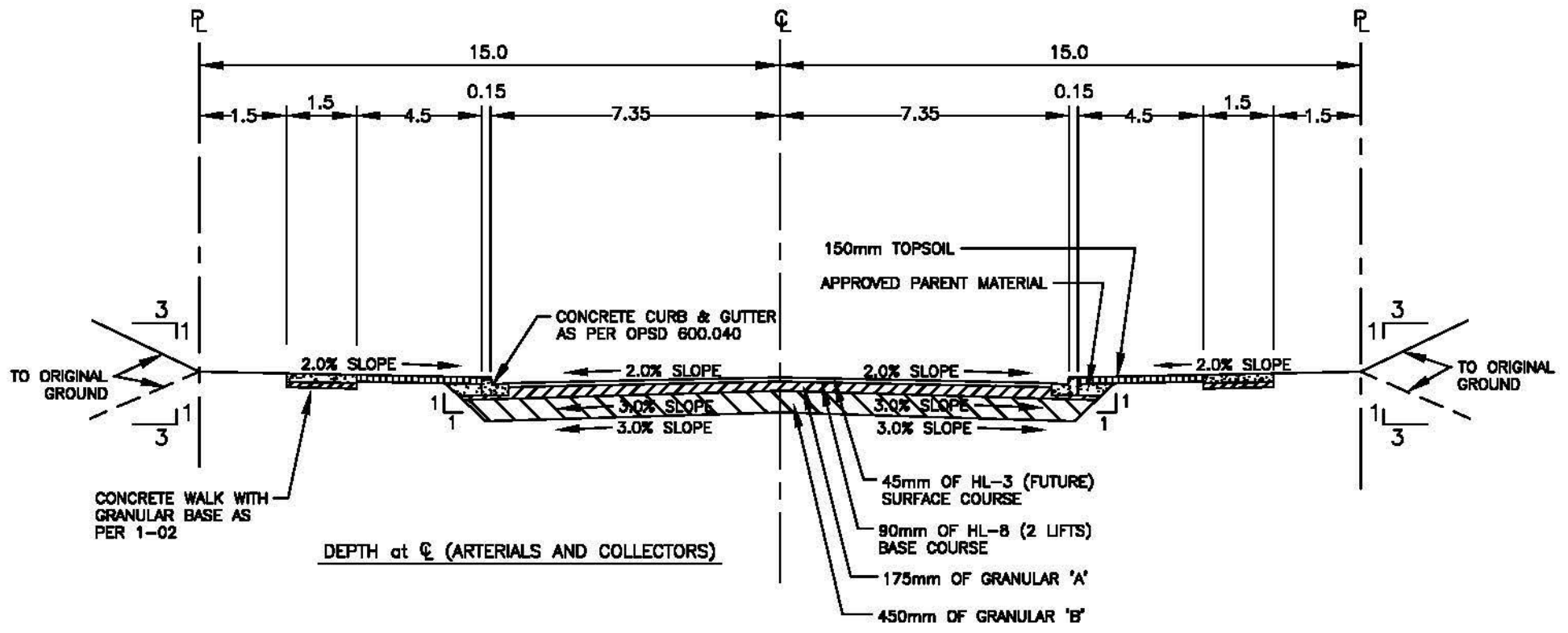
<p>CITY OF GUELPH STANDARD DRAWING</p> <p>TYPICAL CROSS SECTION FOR 10m & 8.8m ROADS - 20m R.O.W.</p>	DATE DRAWN : AUG/88	REV. No. :	 <p>ENGINEERING</p>
	DESCRIPTION : R-11 REVIEWED DEC/2011		
	REV. DATE : DEC/11	REV. BY. : G.F./C.M.C.	
	APPROVED BY:		
		CITY ENGINEER	




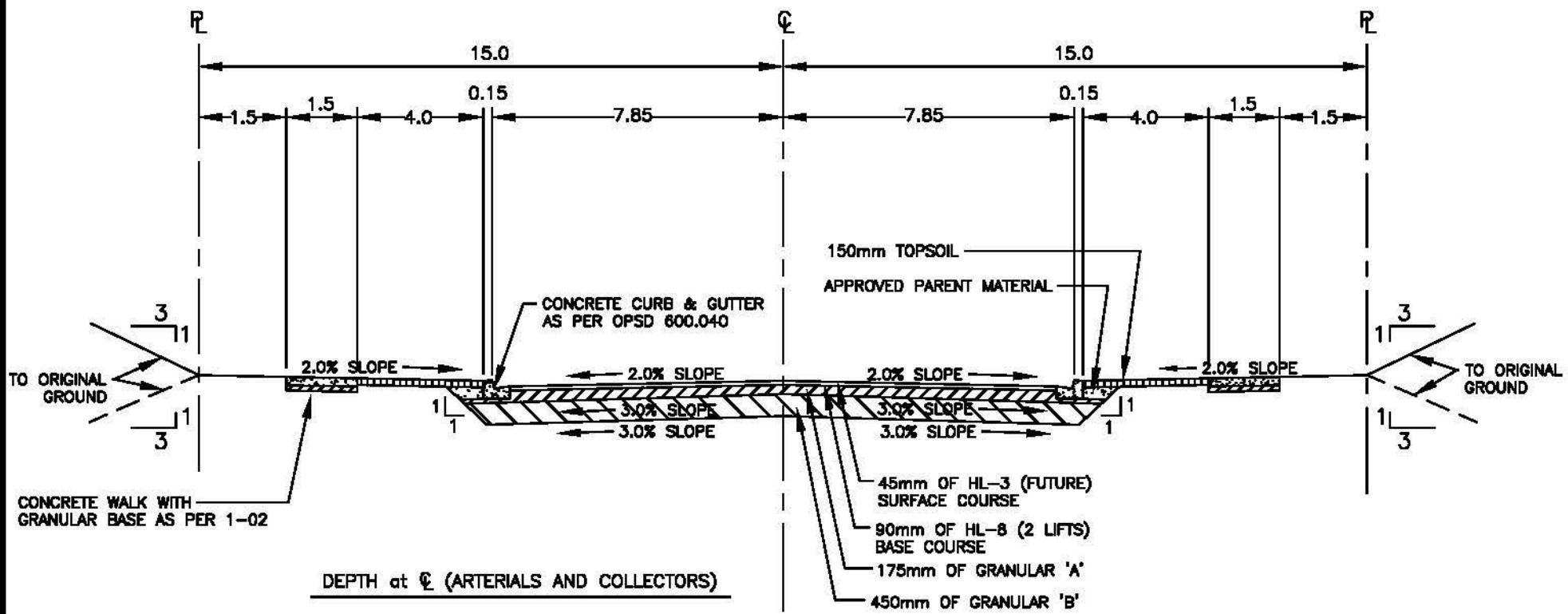
CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : FEB/82	REV. No. : R-14	 Guelph <small>Making a Difference</small>
TYPICAL CROSS SECTION FOR 8.4m ROADS - 18m R.O.W.		DESCRIPTION : REVIEWED DEC/2011		
		REV. DATE : DEC/11	REV. BY. : G.F./C.M.C.	
		APPROVED BY:		CITY ENGINEER



CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : JAN/16	REV. No. :	 Guelph <small>Making a Difference</small>
TYPICAL CROSS SECTION FOR 8.4m ROADS - 17m R.O.W.		DESCRIPTION :		
		REV. DATE :	REV. BY. : T.G./C.M.C.	ENGINEERING
		APPROVED BY:		5 - 48b
		CITY ENGINEER		



CITY OF GUELPH STANDARD DRAWING TYPICAL CROSS SECTION FOR 15m ROADS - 30m R.O.W.	DATE DRAWN : FEB/82	REV. No. : R-12	 Guelph <small>Making a Difference</small>
	DESCRIPTION : REVIEWED DEC/2011		
	REV. DATE : DEC/11	REV. BY. : G.F./C.M.C.	5 - 49
	APPROVED BY:		
	CITY ENGINEER		



CITY OF GUELPH STANDARD DRAWING

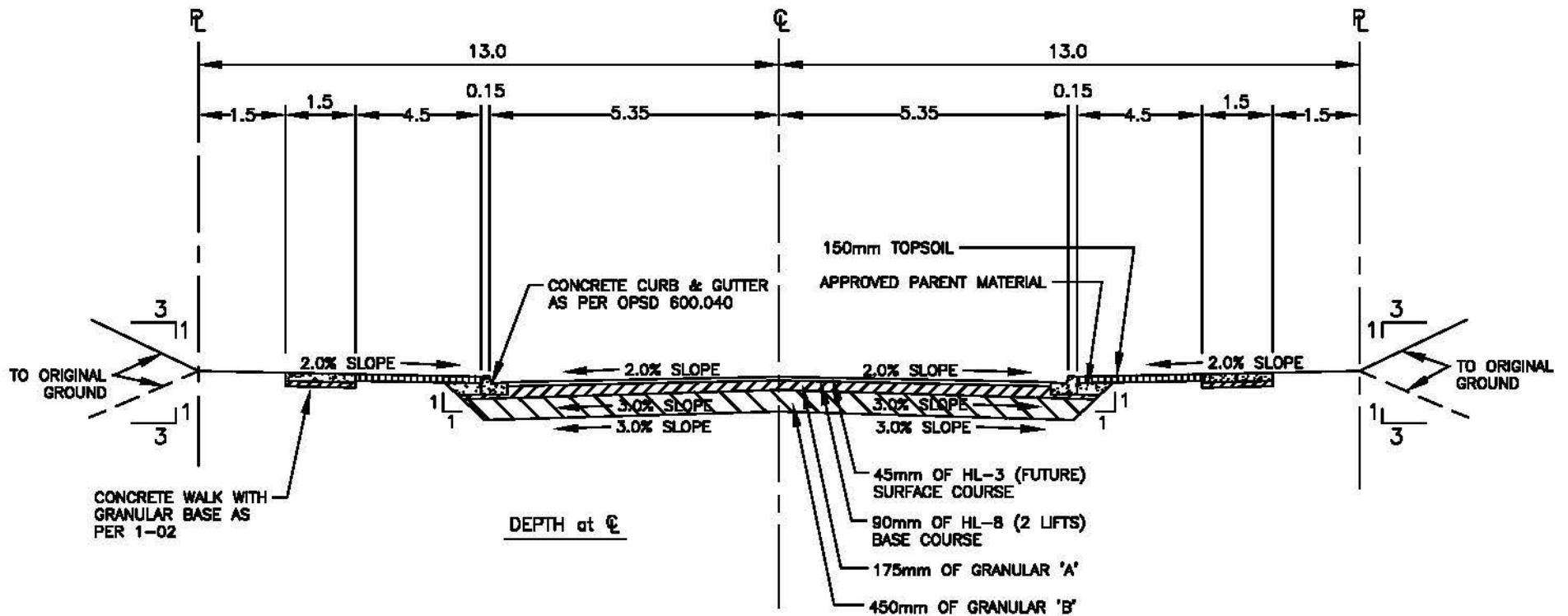
**TYPICAL CROSS SECTION FOR
16m ROADS - 30m R.O.W.**


DATE DRAWN : FEB/82	REV. No. : R-13
DESCRIPTION : REVIEWED DEC/2011	
REV. DATE : DEC/11	REV. BY. : G.F./C.M.C.
APPROVED BY:	
CITY ENGINEER	

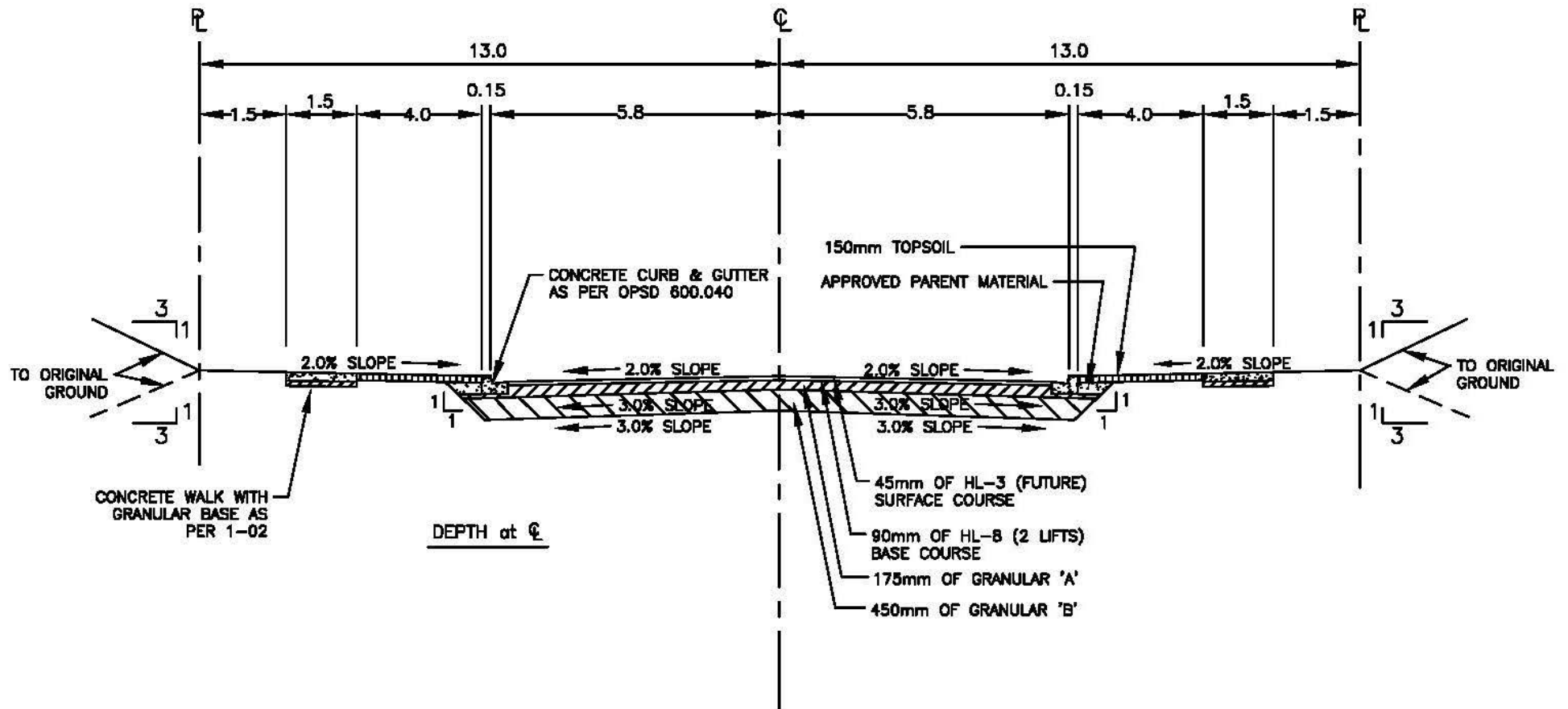
City of Guelph
Making a Difference

ENGINEERING

5 - 49a



<p>CITY OF GUELPH STANDARD DRAWING</p> <p>TYPICAL CROSS SECTION FOR</p> <p>11m ROADS - 26m R.O.W.</p>	DATE DRAWN: JUN/97	REV. No.: R-7	
	DESCRIPTION: REVIEWED DEC/2011		
	REV. DATE: DEC/11	REV. BY.: G.F./C.M.C.	<p>5 - 49b</p>
	APPROVED BY:		



CITY OF GUELPH STANDARD DRAWING

**TYPICAL CROSS SECTION FOR
12m ROADS - 26m R.O.W.**

DATE DRAWN:
FEB/82

REV. No.:
R-6

DESCRIPTION:
REVIEWED DEC/2011

REV. DATE:
DEC/11

REV. BY.:
G.F./C.M.C.

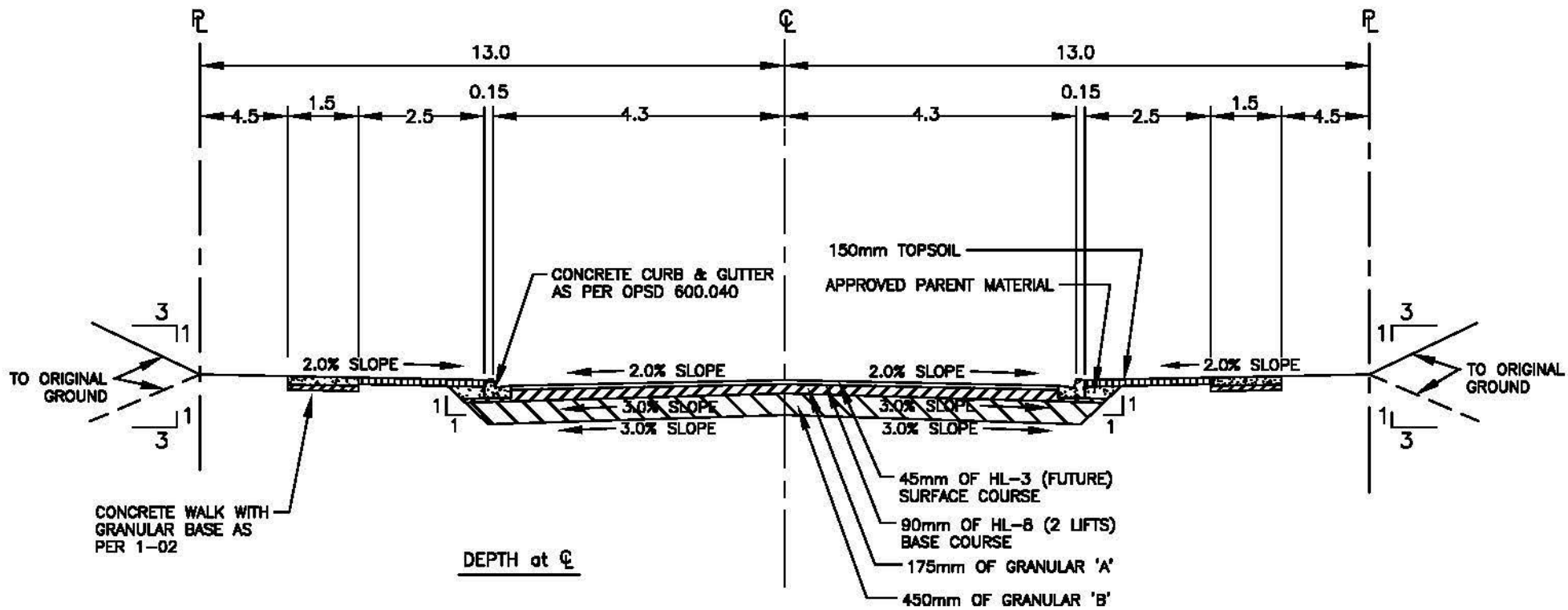
APPROVED BY:


CITY ENGINEER

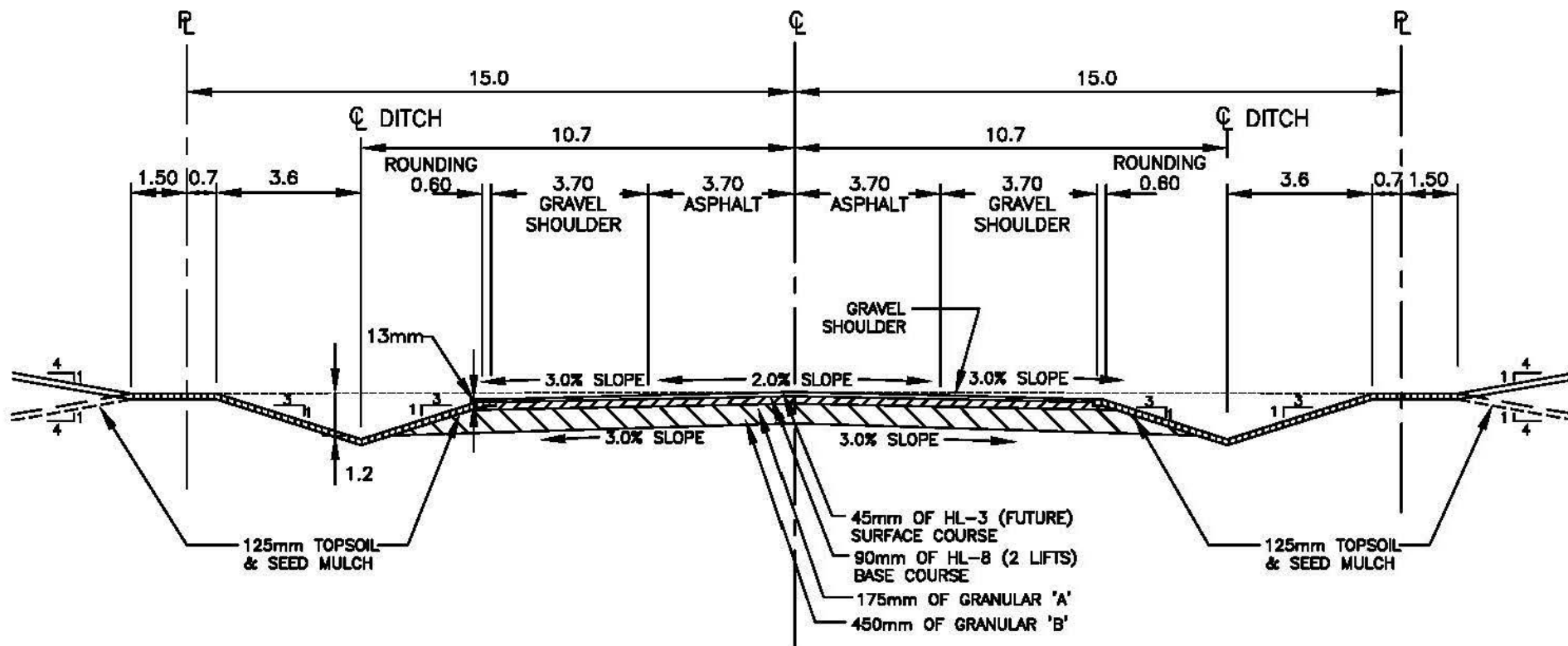



ENGINEERING

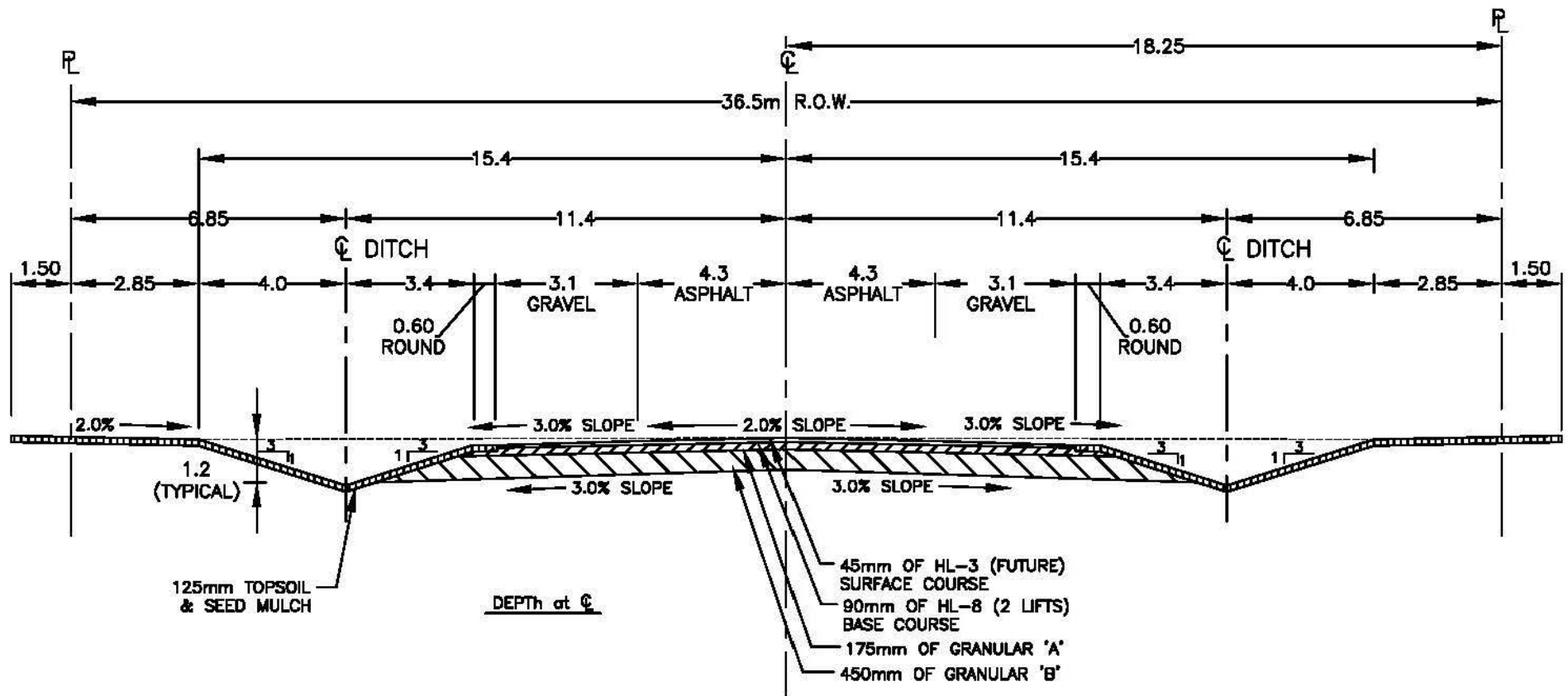
5 - 49bb



CITY OF GUELPH STANDARD DRAWING TYPICAL CROSS SECTION FOR 9m COLLECTOR - 26m R.O.W. AT GREENWAYS	DATE DRAWN: FEB/82	REV. No.: R-8	 ENGINEERING	
	DESCRIPTION: REVIEWED DEC/2011	REV. DATE: DEC/11		REV. BY.: G.F./C.M.C.
	APPROVED BY:			5 - 49c
	CITY ENGINEER			



CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: JAN/88	REV. No.: R-6	 <small>Making a Difference</small>
<h1>TYPICAL CROSS SECTION FOR INDUSTRIAL SUBDIVISION ROADS</h1>		DESCRIPTION: REVIEWED DEC/2011		
		REV. DATE: DEC/11	REV. BY.: G.F./C.M.C.	ENGINEERING
		APPROVED BY:		<h2>5 - 50</h2>
		CITY ENGINEER		



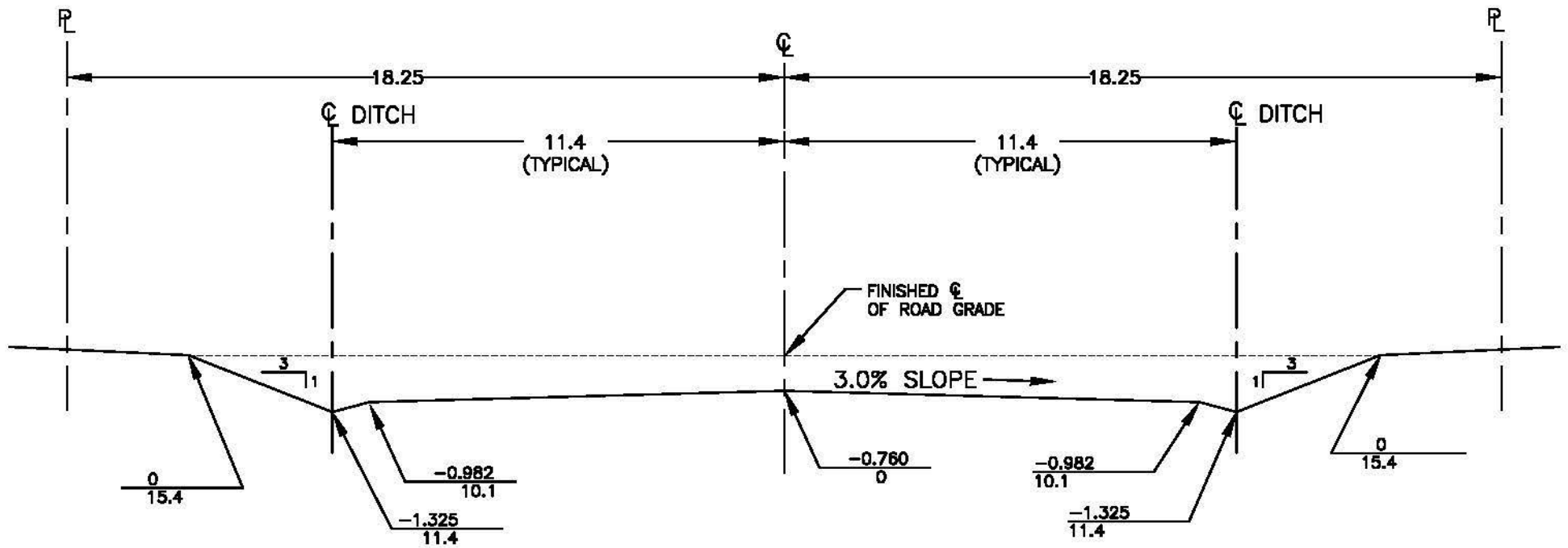
CITY OF GUELPH STANDARD DRAWING	
TYPICAL CROSS SECTION FOR INDUSTRIAL SUBDIVISION ROAD	
8.6m WIDE ASPHALT - 36.5m R.O.W.	


DATE DRAWN: SEP/97	REV. No.: R-5
DESCRIPTION: REVIEWED DEC/2011	
REV. DATE: DEC/11	REV. BY.: G.F./C.M.C.
APPROVED BY:	
CITY ENGINEER	

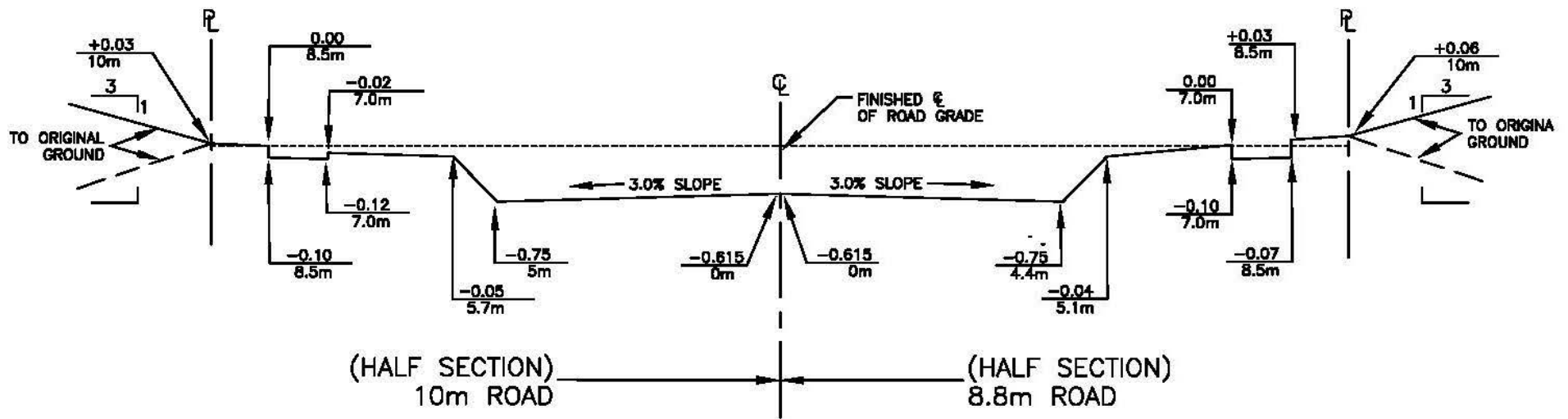
Guelph
City of Guelph


ENGINEERING

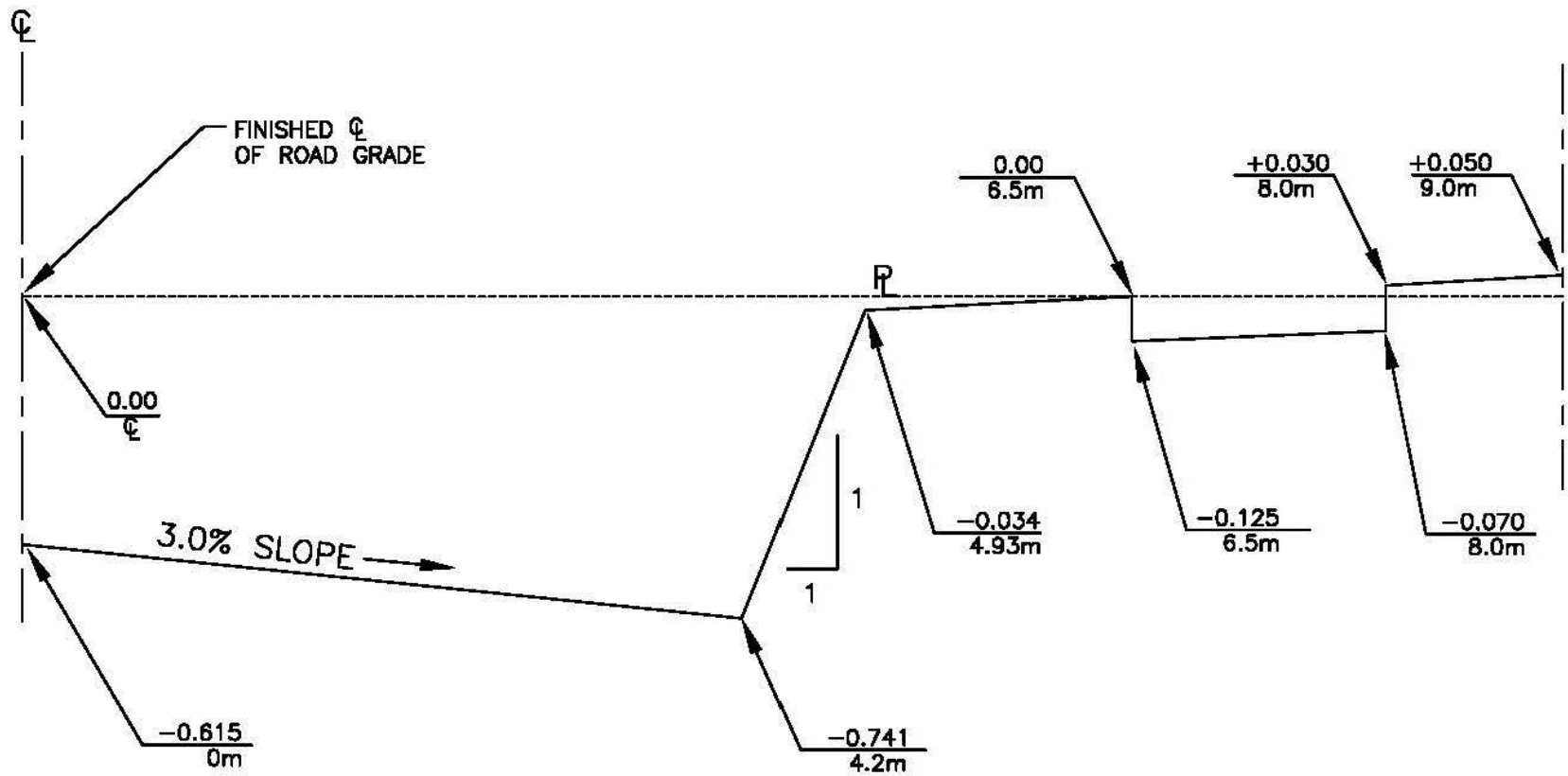
5 - 50a




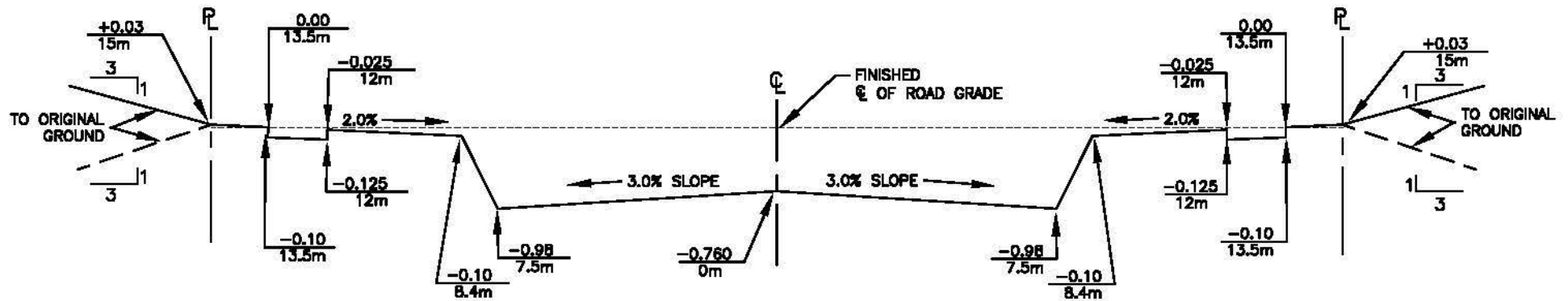
CITY OF GUELPH STANDARD DRAWING GRADING SECTION INDUSTRIAL SUBDIVISION ROAD 8.6m WIDE ASPHALT - 36.5m R.O.W.	DATE DRAWN : -	REV. No. : R-3	 ENGINEERING
	DESCRIPTION : REVIEWED JAN/2010		
	REV. DATE : JAN/10	REV. BY. : G.F./C.M.C.	5 - 50b
	APPROVED BY: CITY ENGINEER		




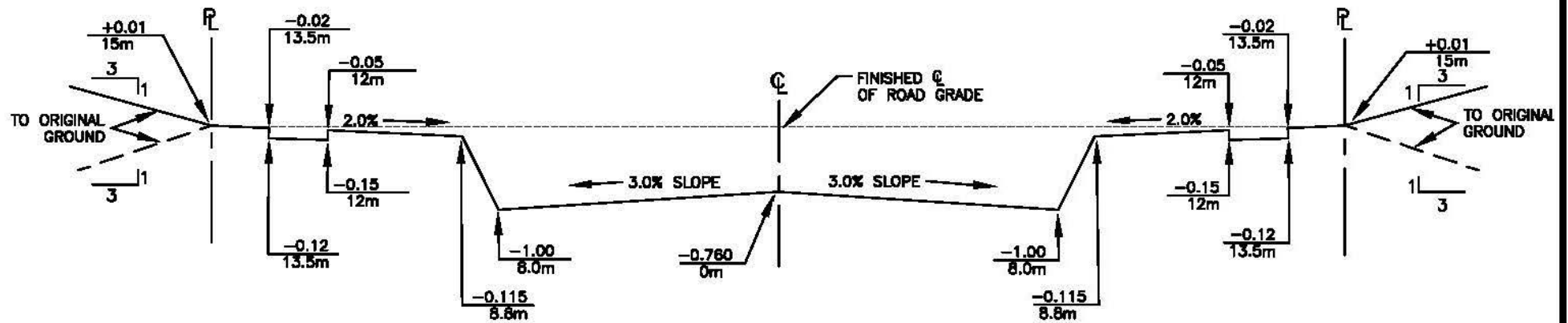
CITY OF GUELPH STANDARD DRAWING GRADING SECTION 10m AND 8.8m ASPHALT ROADS - 20m R.O.W.	DATE DRAWN: -	REV. No.: R-3	 ENGINEERING
	DESCRIPTION: REVIEWED JAN/2010		
	REV. DATE: JAN/10	REV. BY.: G.F./C.M.C.	5 - 62
	APPROVED BY: CITY ENGINEER		




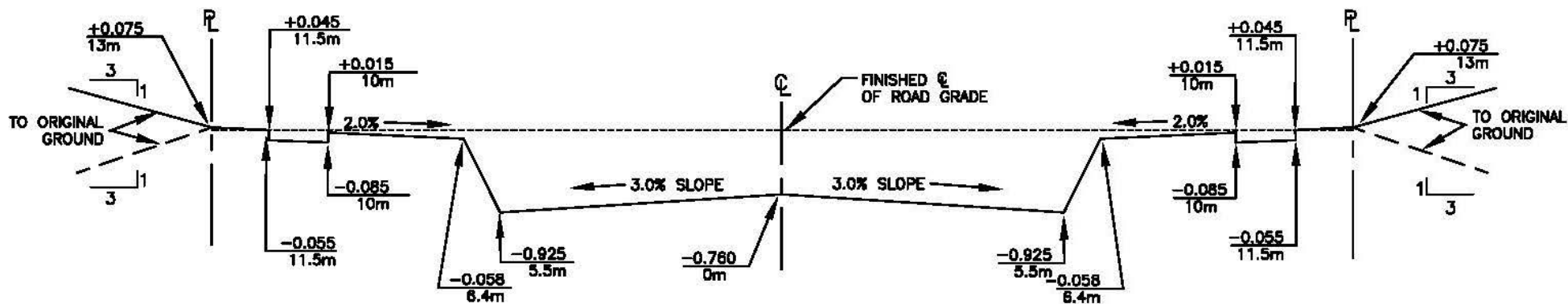
CITY OF GUELPH STANDARD DRAWING GRADING SECTION 10m AND 8.8m ROADS - 20m R.O.W.	DATE DRAWN: -	REV. No.: R-3	 <small>Making a Difference</small>	
	DESCRIPTION: REVIEWED JAN/2010			ENGINEERING
	REV. DATE: JAN/10	REV. BY.: G.F./C.M.C.		
	APPROVED BY: CITY ENGINEER		5 - 62a	



CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No. : R-3	 <small>Making a Difference</small>
<h2 style="margin: 0;">GRADING SECTION</h2> <h3 style="margin: 0;">15m ROADS - 30m R.O.W.</h3>		DESCRIPTION: REVIEWED JAN/2010		
		REV. DATE: JAN/10	REV. BY. : G.F./C.M.C.	
		APPROVED BY:		
		CITY ENGINEER		



<p align="center">CITY OF GUELPH STANDARD DRAWING</p> <p align="center">GRADING SECTION</p> <p align="center">16m ROADS - 30m R.O.W.</p> <p align="center">(ON ROAD BICYCLE ROUTES)</p>		DATE DRAWN: -	REV. No.: R-3	 <p align="center">ENGINEERING</p>
		DESCRIPTION: REVIEWED JAN/2010	REV. DATE: JAN/10	
		APPROVED BY:		5 - 63a
		CITY ENGINEER		



CITY OF GUELPH STANDARD DRAWING

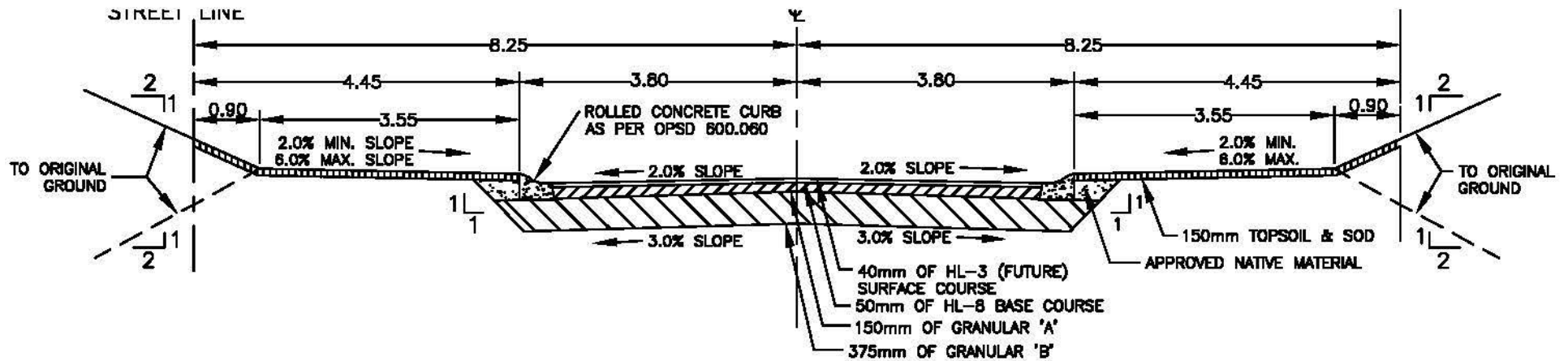
GRADING SECTION
11m ROADS - 26m R.O.W.

DATE DRAWN: -	REV. No.: R-3
DESCRIPTION: REVIEWED JAN/2010	
REV. DATE: JAN/10	REV. BY.: G.F./C.M.C.
APPROVED BY: CITY ENGINEER	

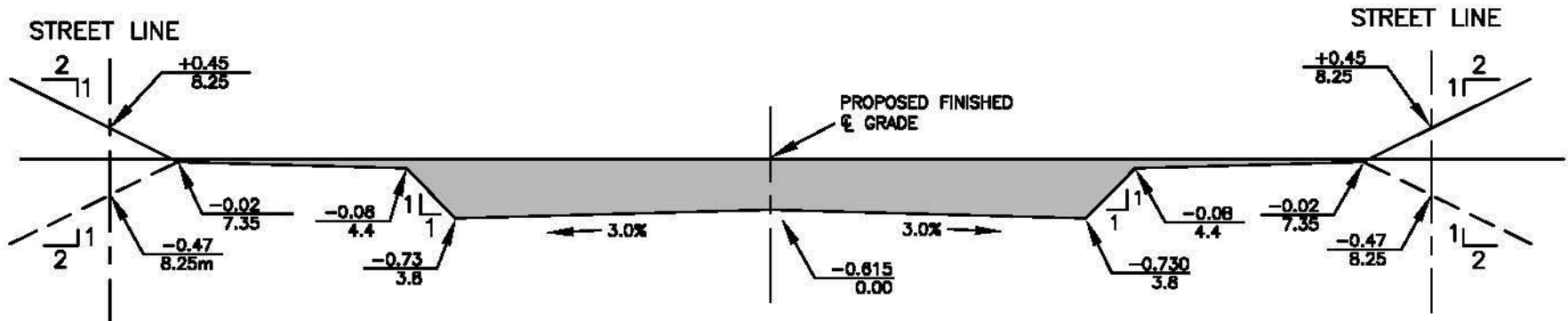


ENGINEERING


5 - 63b

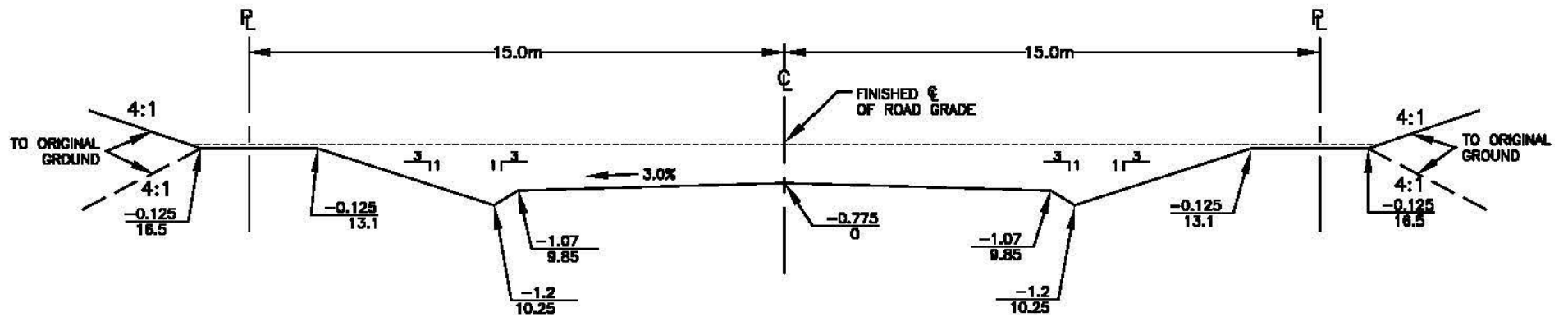


CROSS SECTION



GRADING SECTION

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No.: R-5	
TYPICAL CROSS SECTION AND GRADING SECTION 7.6m ROADS - 16.5m R.O.W.		DESCRIPTION: REVIEWED JAN/2010		
		REV. DATE: JAN/10	REV. BY.: G.F./C.M.C.	ENGINEERING
		APPROVED BY:		5 - 68
CITY ENGINEER				



CITY OF GUELPH STANDARD DRAWING

**TYPICAL GRADING SECTION
FOR INDUSTRIAL ROADS**

DATE DRAWN: - REV. No.: R-3

DESCRIPTION: REVIEWED JAN/2010

REV. DATE: JAN/10 REV. BY.: G.F./C.M.C.

APPROVED BY:

CITY ENGINEER

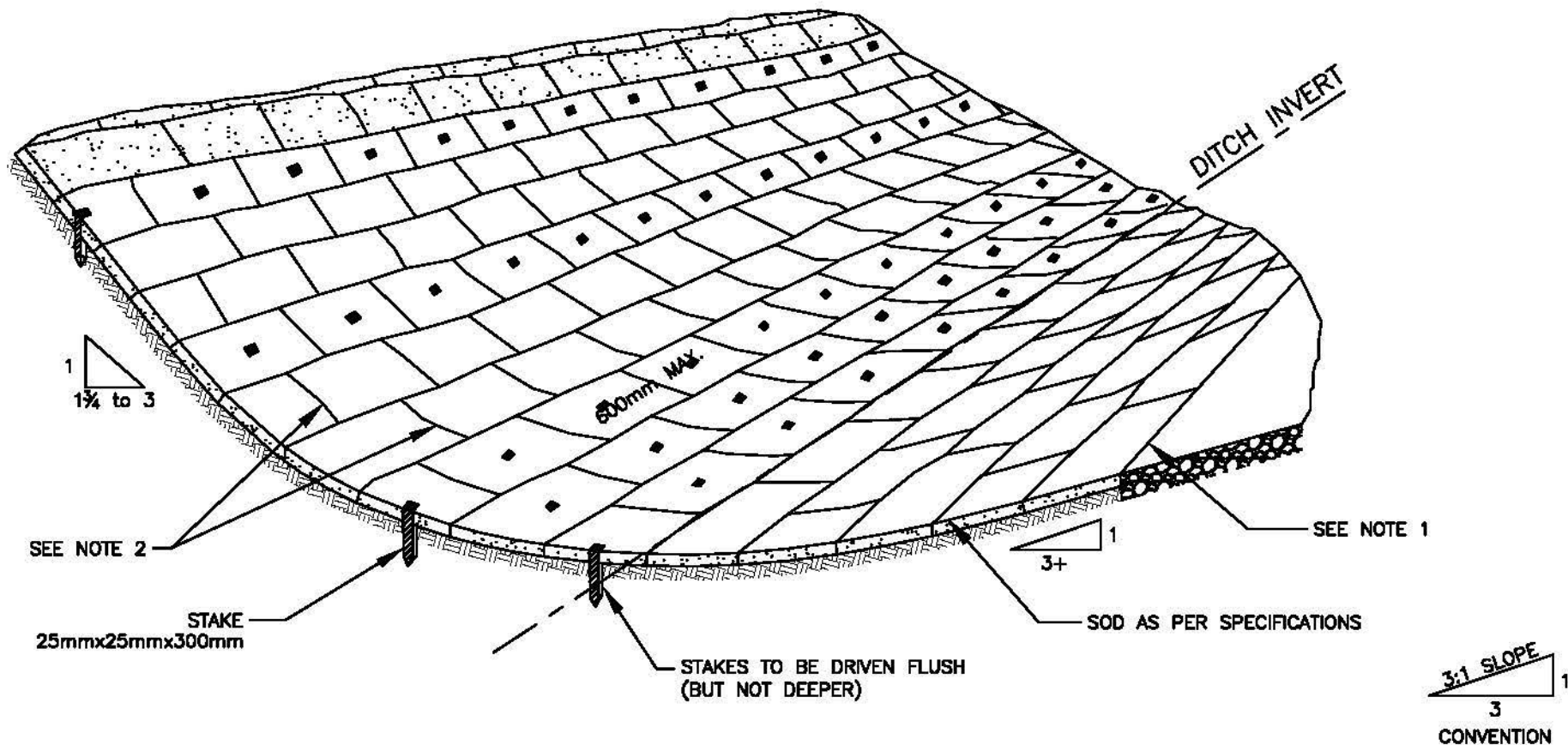


ENGINEERING

5 - 72




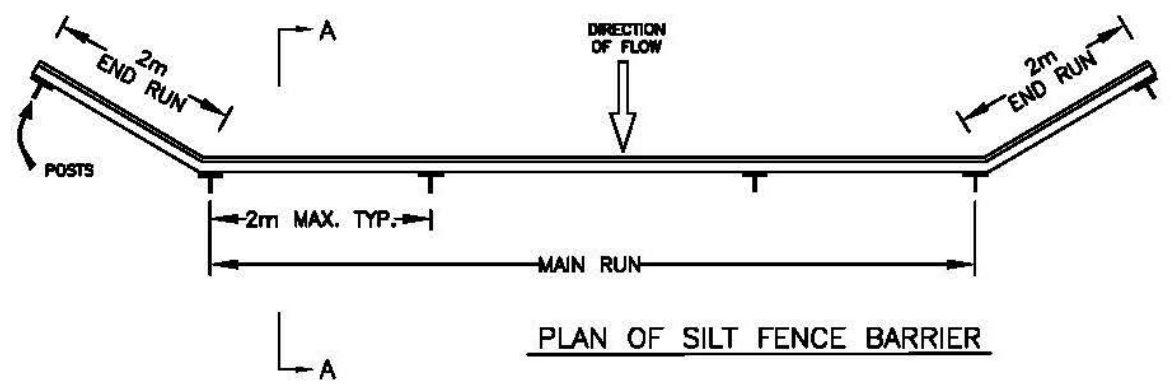
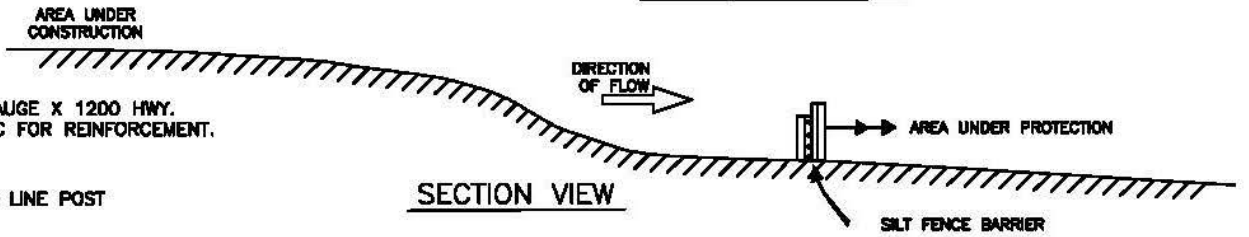
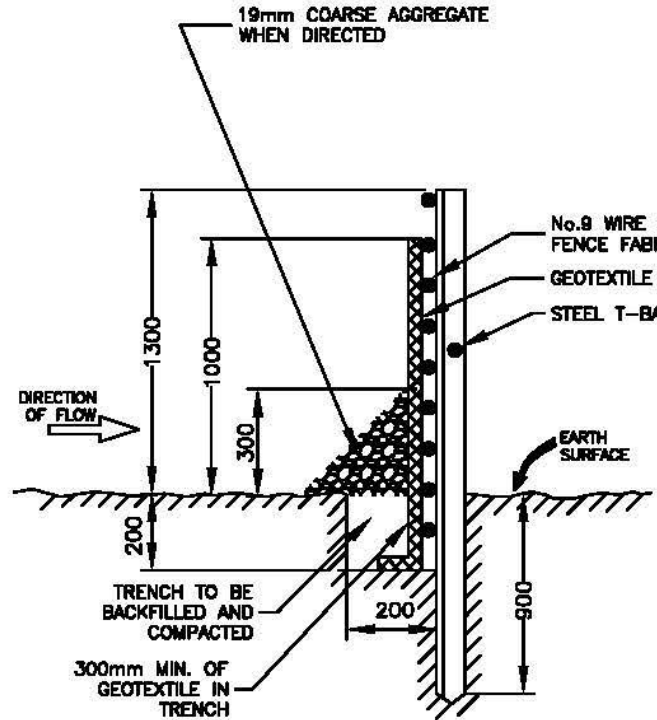
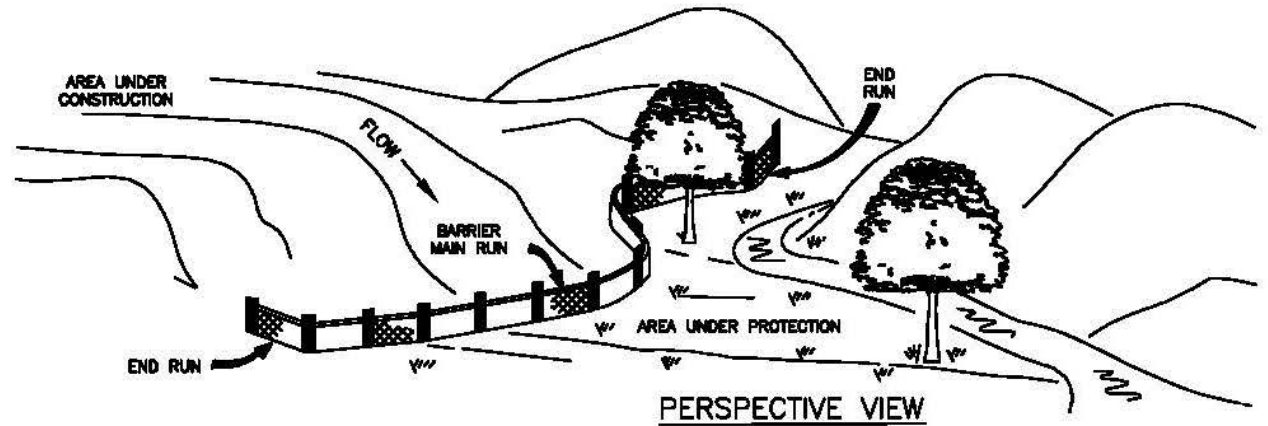
**SECTION 6:
LANDSCAPING
EROSION CONTROL**




NOTES:

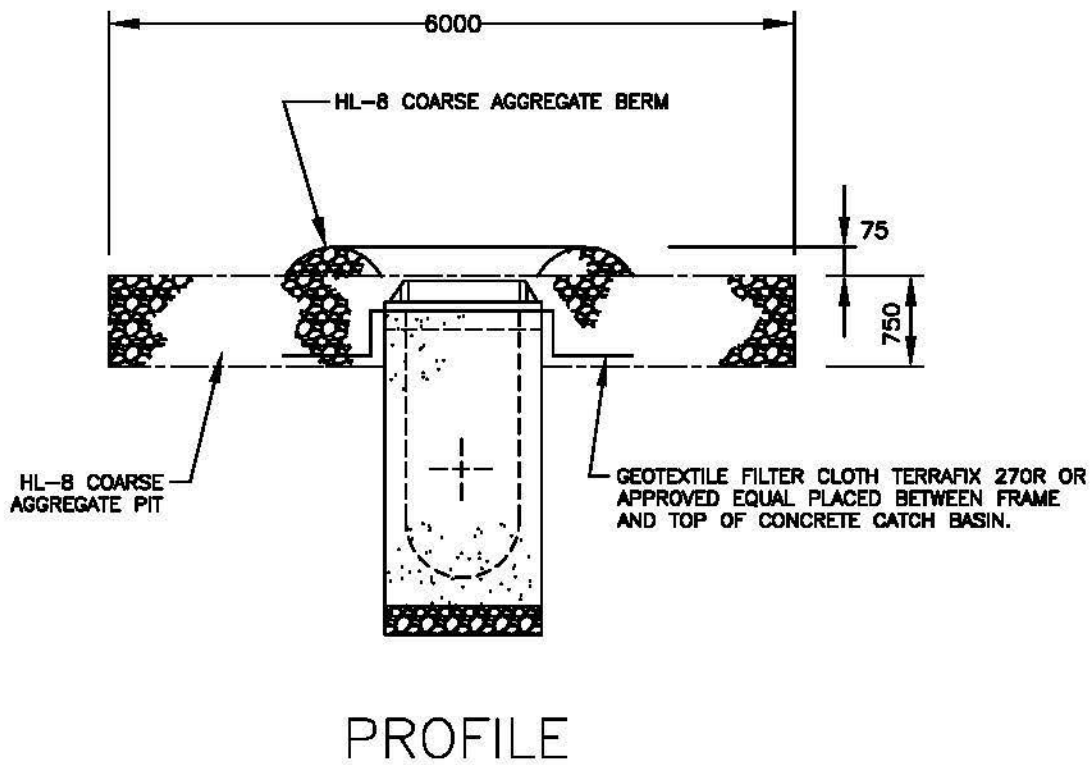
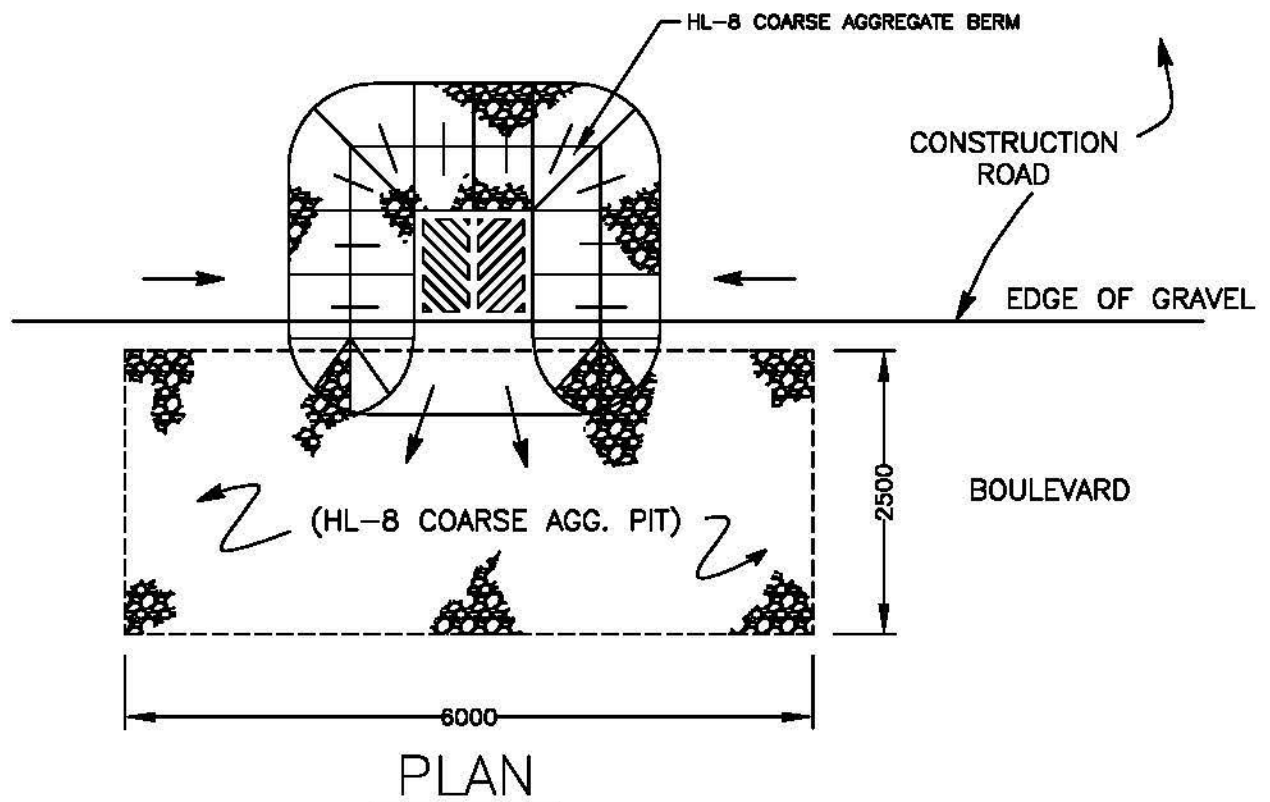
1. SODDING IS TO EXTEND TO EDGE OF SHOULDER ROUNDING AND TO BE COUNTERSUNK TO EXISTING GRADE LEVEL AT EDGES OF SHOULDER AND DITCH TO ALLOW FREE FLOW OF WATER.
2. JOINTS IN ADJACENT ROWS SHALL BE STAGGERED.
3. ON SLOPES FROM 1 1/4:1 TO 3:1 INCLUSIVE, THE BOTTOM THREE ROWS AND EVERY 3rd ROW SHALL BE PEGGED. ON SLOPES STEEPER THAN 13/4 :1 EACH AND EVERY ROW SHALL BE PEGGED. READ IN CONJUNCTION WITH OPSS-571.


CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No.: R-2	 ENGINEERING
SODDING OF SLOPES		DESCRIPTION: REVIEWED FEB/2005		
		REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.	
		APPROVED BY: CITY ENGINEER		6 - 30

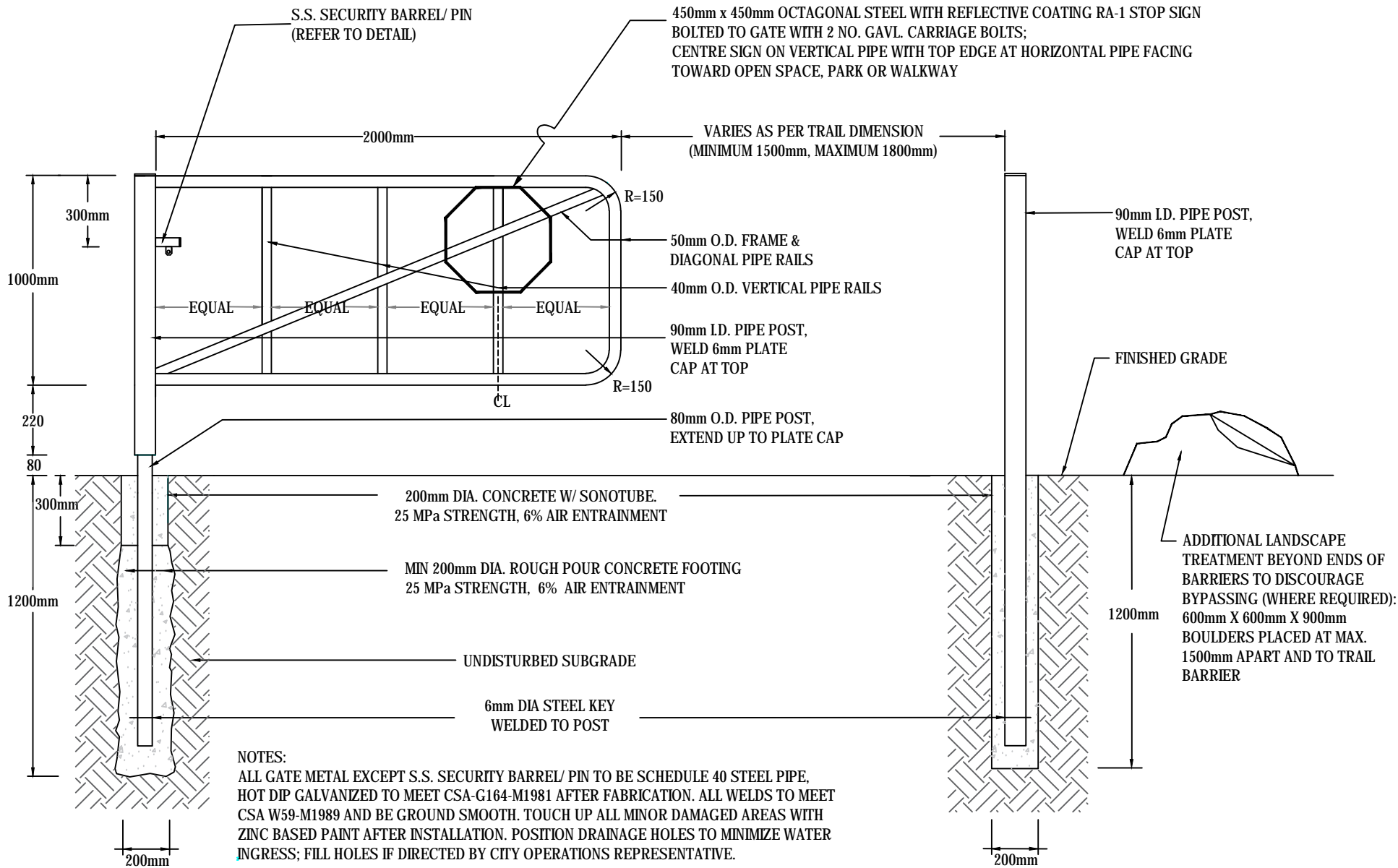


SECTION A-A

<p>CITY OF GUELPH STANDARD DRAWING</p> <p>HEAVY DUTY SILT FENCE BARRIER</p>	DATE DRAWN:	REV. No.:		
	-	R-2		
	DESCRIPTION:			<p>ENGINEERING</p> <p>6 - 74b</p>
	REVIEWED FEB/2005			
	REV. DATE:	REV. BY.:		
FEB/05	G.F./M.E.C.			
APPROVED BY:				
CITY ENGINEER				




CITY OF GUELPH STANDARD DRAWING TEMPORARY EROSION AND SEDIMENT CONTROL AROUND CATCHBASINS	DATE DRAWN: -	REV. No.: R-2	 ENGINEERING
	DESCRIPTION: REVIEWED FEB/2005		
	REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.	6 - 84
	APPROVED BY:		
		CITY ENGINEER	

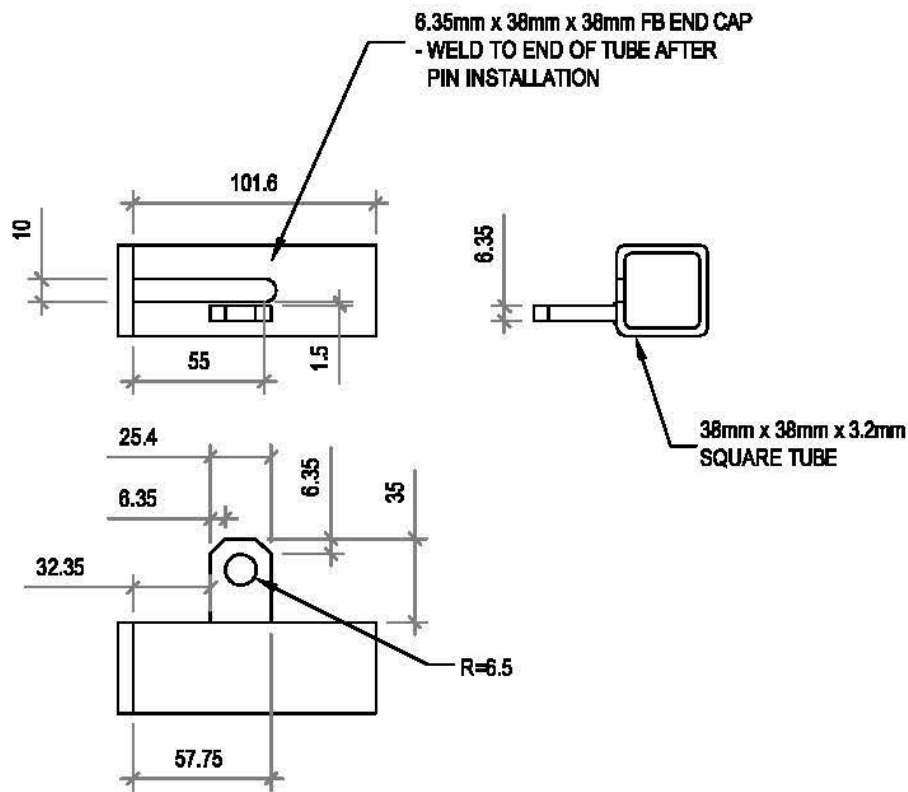


NOTES:
 ALL GATE METAL EXCEPT S.S. SECURITY BARREL/ PIN TO BE SCHEDULE 40 STEEL PIPE, HOT DIP GALVANIZED TO MEET CSA-G164-M1981 AFTER FABRICATION. ALL WELDS TO MEET CSA W59-M1989 AND BE GROUND SMOOTH. TOUCH UP ALL MINOR DAMAGED AREAS WITH ZINC BASED PAINT AFTER INSTALLATION. POSITION DRAINAGE HOLES TO MINIMIZE WATER INGRESS; FILL HOLES IF DIRECTED BY CITY OPERATIONS REPRESENTATIVE.

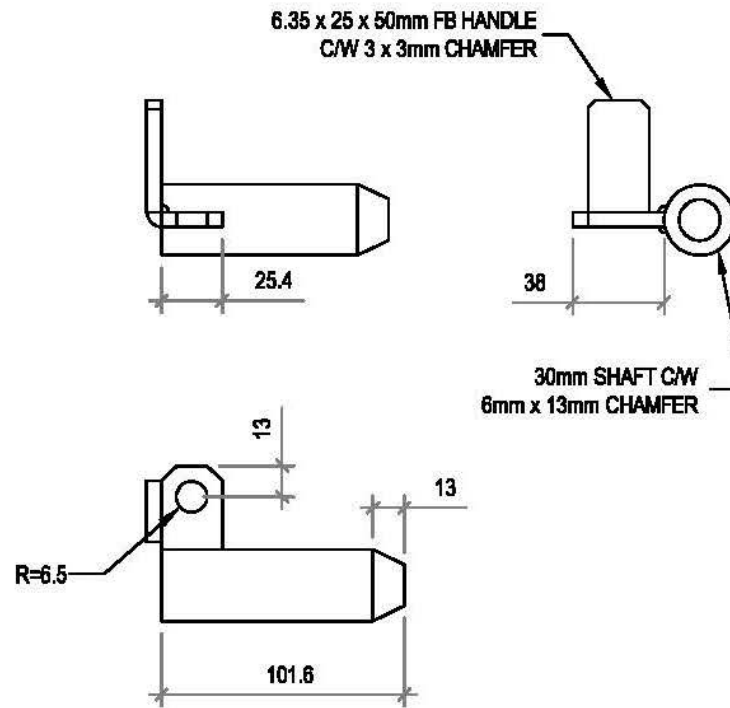
EXACT LOCATION OF GATE AND ANY ADDITIONAL LANDSCAPE TREATMENTS TO BE AS DIRECTED ON SITE BY CITY OPERATIONS REPRESENTATIVE.

Scale: N.T.S.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: JAN/11	REV. No. : R.2	
CITY STANDARD TRAIL BARRIER GATE		DESCRIPTION: REVIEWED FEB/2020		
		REV. DATE : FEB/20	REV. BY. : H.W./J.B.	ENGINEERING
		APPROVED BY:		6-87a
		CITY ENGINEER		




BARREL DETAIL



PIN DETAIL

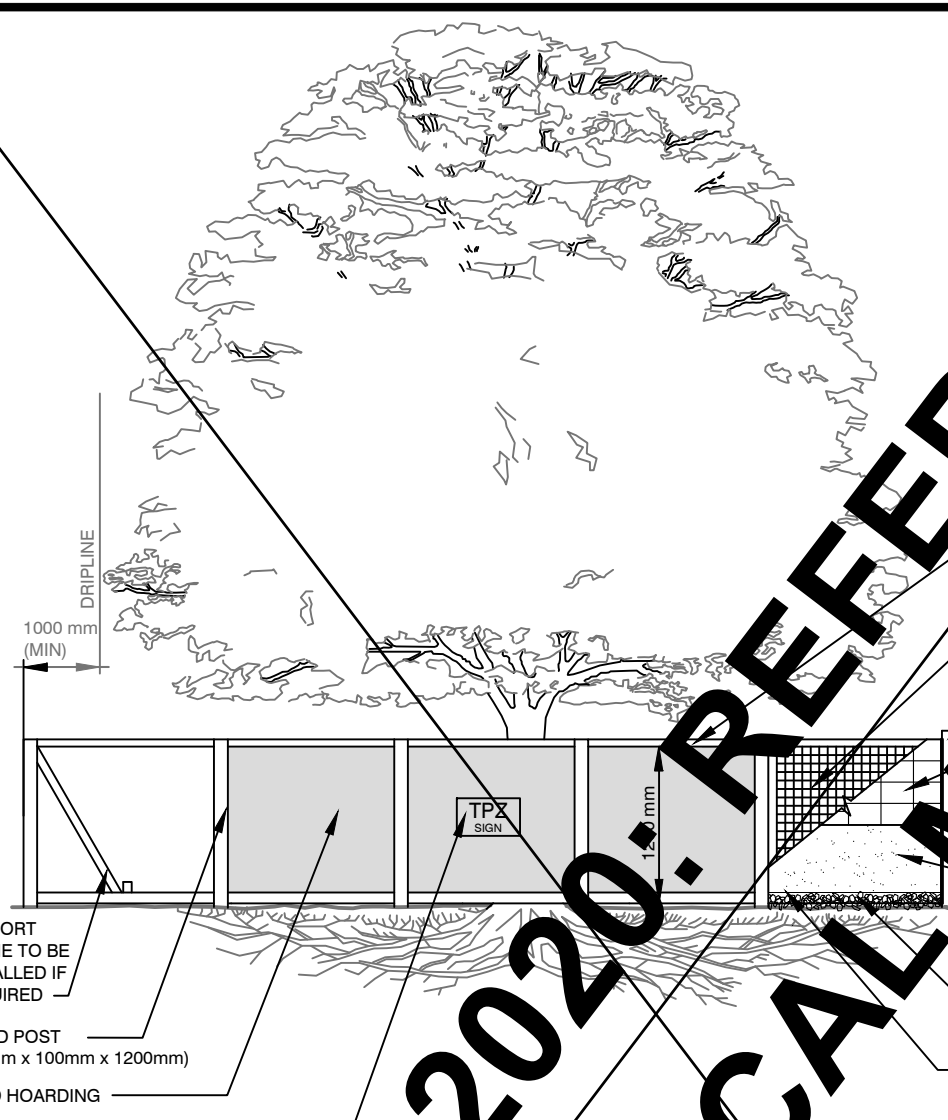
NOTE:
REMOVE GALVANIZING FROM GATE AT BARREL/ PIN WELD AREA AND FULLY COAT WELD SURFACE
WITH ZINC BASED PAINT OVERLAPPING ONTO S.S.

Scale: N.T.S.

CITY OF GUELPH STANDARD DRAWING	DATE DRAWN: AUG/11	REV. No. : R-	
	DESCRIPTION: REVIEWED FEB/2012		
	REV. DATE : FEB/12	REV. BY. : G.F./C.M.C.	ENGINEERING
	APPROVED BY: CITY ENGINEER		6-87b

BARREL DETAIL

DELETED-2020: REFER TO TREE TECHNICAL MANUAL



TPZ FENCE OPTIONS

WOOD FRAME (100mm x 100mm) TOP, BOTTOM AND SUPPORT BRACE

ORANGE CONSTRUCTION FENCE SECURED TO WOOD POST

IRON POST

PANCRE FENCE #948-9 STAND, 1200mm WITH IRON "T" POSTS LOCATED 2400mm O.C.

GEOTEXTILE TO BE ATTACHED TO POST WITH #12 WIRE A MINIMUM OF 600 mm ABOVE GRADE (IF REQUIRED FOR SILTATION CONTROL)

CLEAR STONE FOR USE IN CONJUNCTION WITH GEOTEXTILE

UNDISTURBED ROOT ZONE: ALL EXPOSED ROOTS MUST BE PROPERLY PRUNED AND BACKFILLED.

SUPPORT FRAME TO BE INSTALLED IF REQUIRED

WOOD POST (100mm x 100mm x 1200mm)

SOLID HOARDING

TPZ TO BE CLEARLY IDENTIFIED BY SIGNAGE (REFER TO SPECIFICATIONS)

- TREE PROTECTION BARRIER NOTES:**
1. HOARDING TYPE SHOULD BE DETERMINED IN CONSULTATION WITH THE CITY.
 2. ALL TREE PROTECTION HOARDING SHALL BE IN PLACE AND MUST BE INSPECTED AND APPROVED BY THE CITY PRIOR TO ANY CONSTRUCTION ACTIVITIES.
 3. ALL ARBORICULTURE WORK SUCH AS PRUNING OF BRANCHES AND ROOTS SHALL BE CONDUCTED BY A CERTIFIED ARBORIST.
 4. CONSTRUCTION ACTIVITIES, GRADE CHANGES AND STORAGE OF EQUIPMENT AND MATERIALS ARE NOT ALLOWED WITHIN THE TREE PROTECTION ZONE.

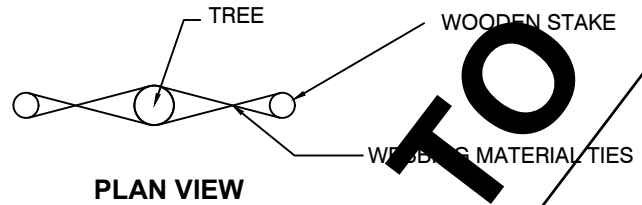
Tree Protection Zones (TPZ)		
Diameter of Trunk Centimetres at 1.4 m above grade (DBH)	Minimum Tree Protection Zone (TPZ) Distance from trunk, measured in metres. ¹	Potential Rooting Area (PRA) for all trees and TPZ for trees in NHS, ² parks, open spaces and other significant natural heritage areas. ¹
<10	1.2	2.4
10-29	1.8	3.6
30-40	2.4	4.8
41-50	3.0	6.0
51-60	3.6	7.2
61-70	4.2	8.4
71-80	4.8	9.6
81-90	5.4	10.8
91-100	6.0	12.0
>100	6 cm per 1 cm DBH	12 cm per 1 cm DBH

Note:
1- Or dripline plus 1 metre, whichever is greater.
2- Natural Heritage System

CITY OF GUELPH STANDARD DRAWING	DATE DRAWN : JAN/11	REV. No. : 3	<p style="font-size: 8pt; margin-top: 5px;">Making a Difference</p>
TREE PROTECTION ZONE (TPZ) FENCE DETAIL	DESCRIPTION : N.T.S.		
	REV. DATE : FEB/16	REV. BY. : C.M.C.	6 - 90a
	APPROVED BY:		

SOIL QUALITY:

SOIL PROFILE AND PLANTING SOIL MUST BE TESTED FOR DRAINAGE, SOIL QUALITY AND pH IN SOIL CONDITION. AMENDEMENT TO POOR QUALITY SOIL SHALL BE DESIGNED IN ACCORDANCE WITH SOIL TEST RECOMMENDATIONS.



PLAN VIEW



SET TRUNK PLUMB.
FULLY PRUNE TO ONLY REMOVE DEAD, BROKEN AND DAMAGED BRANCHES. PRESERVE LIVE BRANCHES. DO NOT CUT LEADER.
TIES SHALL BE WEBBING MATERIAL. TIES SHALL FORM A FIRM LOOP AROUND THE STAKE AND LOOP IN A FIGURE '8' AROUND THE TRUNK OF THE TREE.

2400mm WOODEN STAKES TO BE FREE AND CLEAR OF ALL BRANCHES. WOODEN STAKES SHALL BE ALIGNED IN THE DIRECTION OF THE PREVAILING WIND.

WHITE SPIRAL PLASTIC TREE GUARD

EACH TREE MUST BE PLANTED SUCH THAT THE TRUNK FLARE IS VISIBLE AT THE TOP OF THE ROOT BALL. TREES WHERE THE TRUNK FLARE IS NOT VISIBLE SHALL BE REJECTED. DON'T COVER THE TOP OF ROOT BALL WITH SOIL.

100mm DEPTH (MIN.) COMPOSTED WOOD CHIP MULCH. RING KEPT BACK 100mm FROM TRUNK.

100mm HIGH EARTH SAUCER ALONG PERIMETER OF PLANTING HOLE.

CUT AND REMOVE TOP 1/2 OF BURLAP AND WIRE/BASKET FROM ROOT BALL. DO NOT FOLD BURLAP INTO HOLE. PLACE ROOT BALL ON UNEXCAVATED OR TAMPED SOIL.

SCARIFY SIDES OF PIT

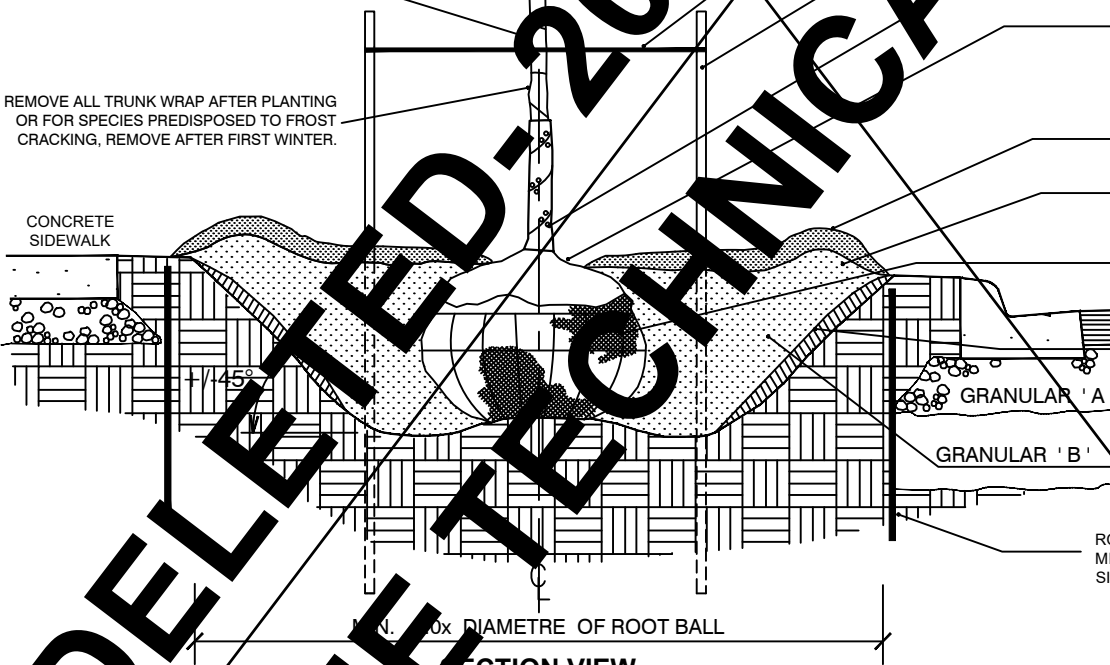
BACKFILL WITH NATIVE TOPSOIL COMBINED WITH SOIL AMENDMENTS AS SPECIFIED BY CONSULTING ARBORIST/ LANDSCAPE ARCHITECT.

ROOT BARRIER 600mm HIGH TO BE LOCATED MIN.150mm FROM CURB ON THE ROAD SIDE AND ADJACENT SIDEWALK.


MARK NORTH SIDE OF TREE IN NURSERY AND PLANT AT SAME ORIENTATION.

REMOVE ALL TRUNK WRAP AFTER PLANTING OR FOR SPECIES PREDISPOSED TO FROST CRACKING, REMOVE AFTER FIRST WINTER.

CONCRETE SIDEWALK



SECTION VIEW


CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : FEB/11	REV. No. : 3	
		DESCRIPTION : N.T.S.		
TREE PLANTING ON PUBLIC BOULEVARD		REV. DATE : FEB/16	REV. BY. : C.M.C.	ENGINEERING
		APPROVED BY:		6 - 90b
		CITY ENGINEER		

DELETED-2020: REFER TO TECHNICAL MANUAL

Schedule A: Tree Protection Zone (TPZ) Information Signage

40 CM MIN.

TREE PROTECTION ZONE (TPZ)



NO

**GRADE CHANGE
DUMPING
STORAGE OF MATERIALS
STORAGE OF EQUIPMENT
UNAUTHORIZED ENTRY
TREE INJURY OR REMOVAL
DISTURBANCE OF ANY KIND**

THIS FENCING MUST NOT BE DAMAGED OR MOVED

CONTACT: name and telephone number of contact
name and telephone number of contact

**City of Guelph - Planning and Building Services;
Engineering and Transportation Services
(519) 837-5616**

60 CM MIN.

Sign Design, Installation and Maintenance:

TPZ information signs shall be constructed from metal, corrugated plastic, Gatorboard or wood, and shall be installed in an appropriate manner such that it will be able to withstand inclement weather conditions. Signage shall be maintained in good condition and in the original location throughout the duration of site development works. Signage shall be clearly legible, with black text on a white background being the preferred design.

Sign Content:

The TPZ information sign shall, at minimum, provide a list of activities prohibited within the TPZ. Such activities shall include, but not be limited to: grade change, dumping, storage of equipment and materials, unauthorized entry by personnel, tree injury or removal, or other disturbance of any kind. The signage shall also note that TPZ fencing shall not be damaged or removed. The signage shall also provide the contact information for the City of Guelph Planning and Building Services; Engineering and Transportation Services and Environmental Services. A City of Guelph corporate logo shall be displayed on the TPZ information sign.

Sign Placement:

TPZ information signs shall be affixed no more than 20.0m apart on each side of tree protection fencing, at a height of no less than 100cm.

Sign Size:

TPZ information signs shall be a minimum of 40cm x 60cm in size

DELETED - 2020 - REFER TO TREE TECHNICAL MANUAL

CITY OF GUELPH STANDARD DRAWING

DATE DRAWN : JAN/11
REV. No. : 2



TREE PROTECTION ZONE (TPZ)
INFORMATION SIGNAGE DETAIL

DESCRIPTION : N.T.S.

REV. DATE : FEB/16
REV. BY. : C.M.C.

ENGINEERING

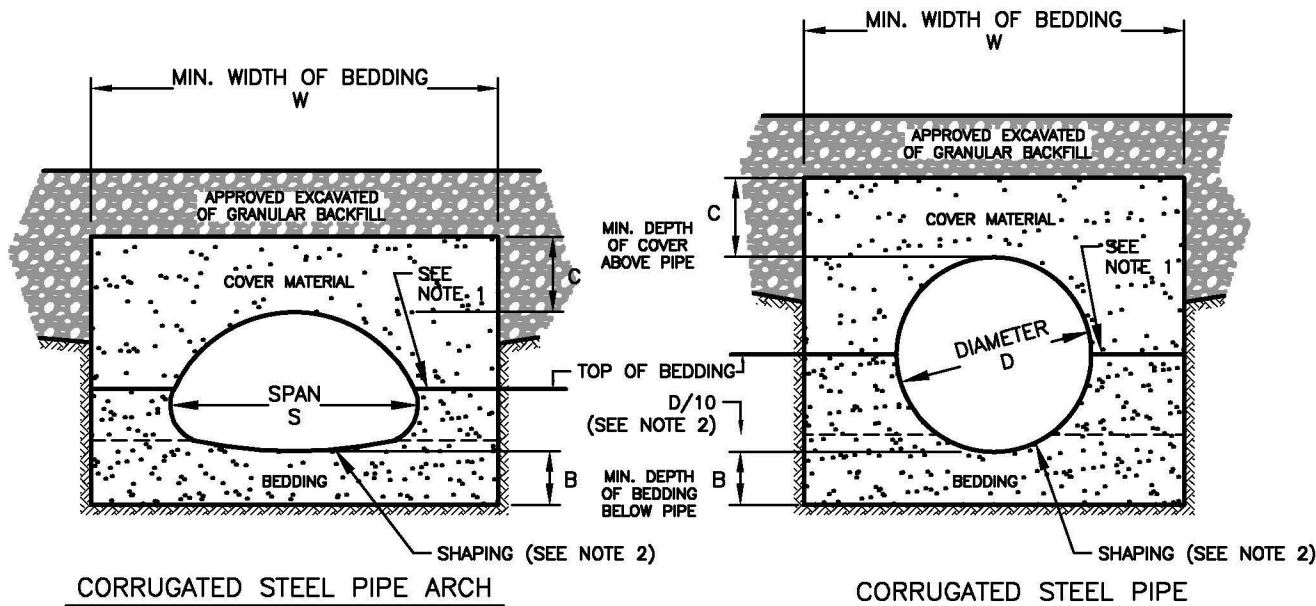
APPROVED BY:

6 - 90c

CITY ENGINEER




SECTION 7: CULVERTS

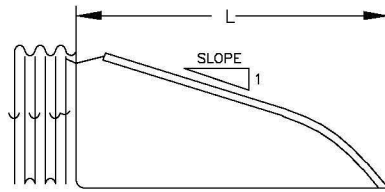


NOTES:

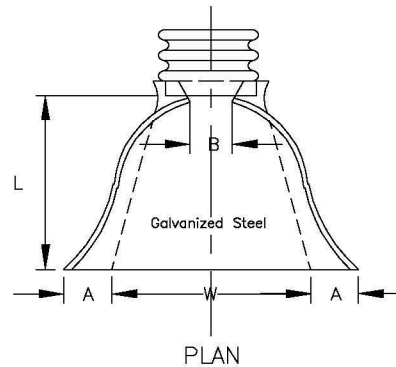
1. BEDDING TO BE TAKEN FROM SPRINGLINE OF PIPE AND TO TOP CORNER RADIUS OF PIPE ARCH.
2. BEDDING TO BE CAREFULLY SHAPED TO RECEIVE THE LOWEST SEGMENT OF PIPE TO A DEPTH EQUAL TO 10% OF THE PIPE DIAMETER; AND IN THE CASE OF PIPE ARCHES, THE LOWEST SEGMENT OF PIPE FORMED BY THE BOTTOM RADIUS.
3. THE UPSTREAM END OF THE PIPE TO BE BEDDED IN CLAY AND PROPERLY COMPACTED TO PREVENT SEEPAGE.
4. BEDDING AND COVER MATERIAL TO BE GRANULAR "A" AND "B" (MODIFIED). STONE SIZE WITHIN 300mm OF THE SURFACE OF THE PIPE SHALL NOT EXCEED 75mm.
5. COMPACTION REQUIREMENTS:
 - a. BEDDING AND COVER MATERIAL - 95%
 - b. GRANULAR BACKFILL - 100%
 - c. EARTH BACKFILL - 95%
6. DEPTH OF COVER MATERIAL PLUS BACKFILL OVER TOP OF PIPE MUST BE 600mm MINIMUM AND PROTECTIVE MATERIAL PROPERLY COMPACTED BEFORE ALLOWING HEAVY CONSTRUCTION EQUIPMENT OVER THE PIPE.

SIZE OF PIPE		B	C	W	GALVANIZED METAL THICKNESS (mm)
D.I.A (C.S.P.)	SPAN (C.S.P.A.)				
1050mm & SMALLER		150.000	300	D+750	2.0
1200 TO 1800		225.000	450	1.67xD	2.8
	1125 & SMALLER	150.000	300	S+750	2.0
	1125 TO 2125	225.000	450	1.67xS	2.8

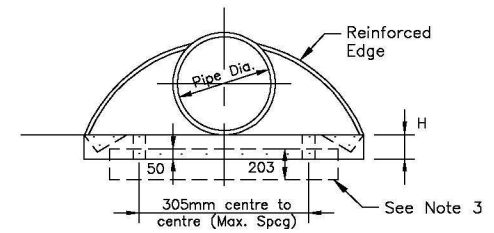
CITY OF GUELPH STANDARD DRAWING BEDDING AND BACKFILLING C.S.P. CULVERTS	DATE DRAWN : -	REV. No. : R-2	
	DESCRIPTION : REVIEWED FEB/2005		
	REV. DATE : JAN/08	REV. BY. : G.F./M.E.C.	ENGINEERING
	APPROVED BY:		7 - 31
	CITY ENGINEER		



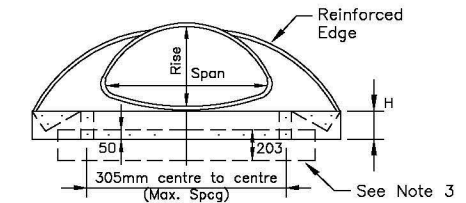
TYPICAL CROSS SECTION



PLAN



ELEVATION



ELEVATION

END SECTIONS FOR C.S.P. PIPE-ARCH

SPAN/ RISE	GALVANIZED METAL THICKNESS (mm)	DIMENSIONS					APPROX. SLOPE	BODY
		A	B (MAX)	H	L	W		
560 x 420	1.6	180		150	585	915	2.5	1 Pc.
680 x 500	1.6	230		150	810	1220	2.5	1 Pc.
800 x 580	--	--	--	--	--	--	--	--
910 x 660	2.0	250		150	990	1525	2.5	1 Pc.
1030 x 740	2.0	305		200	1170	1905	2.5	1 Pc.
1150 x 820	2.8	330		230	1345	2160	2.5	2 Pc.
1390 x 970	2.8	455		305	1600	2285	2.5	2 Pc.
1630 x 1120	2.8	455		305	1780	2590	2.25	2 Pc.
1880 x 1260	2.8	455		305	1955	3200	3	3 Pc.

NOTES:

1. ALL 3 pc. BODIES TO HAVE 2.9mm SIDES AND 3.5mm CENTRE PANELS. MULTIPLE PANEL BODIES TO HAVE LAP SEAMS TIGHTLY JOINED BY GALVANIZED RIVETS OR BOLTS.
2. FOR 1500mm THRU 2100mm SIZES, REINFORCED EDGES TO BE SUPPLEMENTED WITH GALVANIZED STIFFENER ANGLES. THE ANGLES TO BE ATTACHED BY GALVANIZED NUTS AND BOLTS
3. GALVANIZED TOE PLATE TO BE PROVIDED WHEN SPECIFIED AND TO BE THE SAME THICKNESS AS THE END SECTION.
4. FOR C.S.P. BEDDING DETAILS, SEE 7-31.

END SECTIONS FOR C.S.P. CIRCULAR PIPE

PIPE DIAMETRE	GALVANIZED METAL THICKNESS (mm)	DIMENSIONS					APPROX. SLOPE	BODY
		A	B (MAX)	H	L	W		
300	1.6	150	140	150	535	610	2.5	1 Pc.
400	1.6	180	260	150	660	760	2.5	1 Pc.
500	1.6	200	390	150	790	915	2.5	1 Pc.
600	1.6	250	300	150	1040	1220	2.5	1 Pc.
800	2.0	305	525	200	1295	1525	2.5	1 Pc.
900	2.0	355	440	230	1525	1830	2.5	2 Pc.
1000	2.8	405	350	280	1750	2135	2.5	2 Pc.
1200	2.8	460	625	305	1980	2285	2.25	2 Pc.
1400	2.8	460	850	305	2135	2590	2.0	2 Pc.
1600	2.8	460	1075	305	2210	2895	1.75	3 Pc.
1800	2.8	460	975	305	2210	3200	1.33	3 Pc.
2400	2.8	460	1980	305	2210	3505	1.16	3 Pc.

CITY OF GUELPH STANDARD DRAWING

**CORRUGATED STEEL PIPE
END SECTION DETAILS**

DATE DRAWN :
-

REV. No. :
R-2

DESCRIPTION :
REVIEWED FEB/2005

REV. DATE :
JAN/08

REV. BY. :
G.F./M.E.C.

APPROVED BY:

CITY ENGINEER



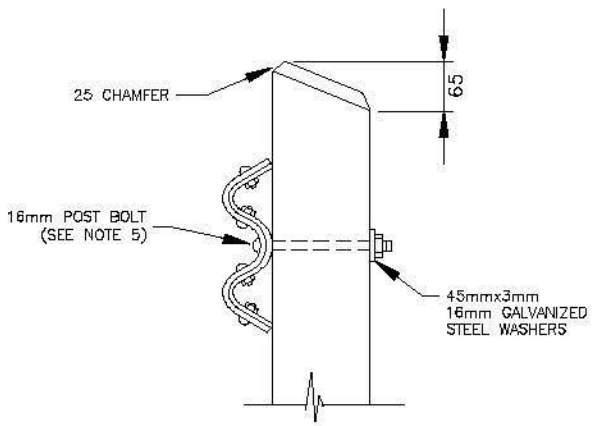
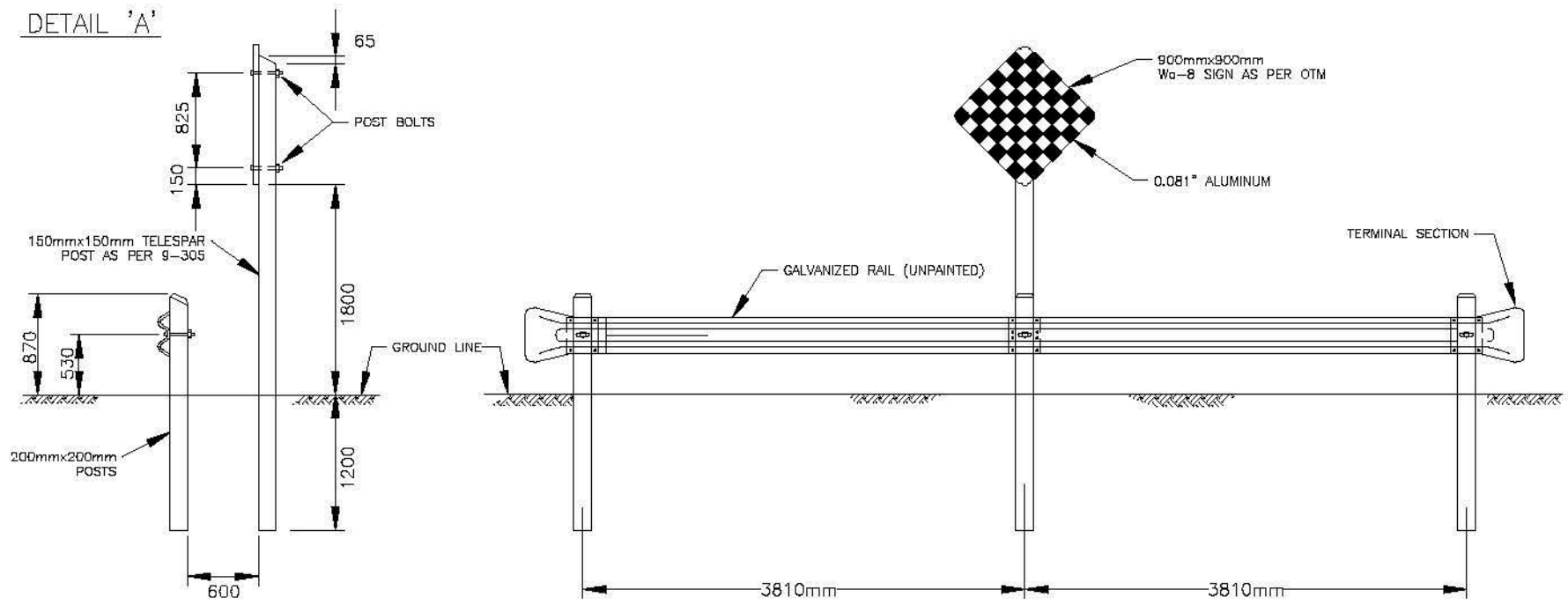
ENGINEERING

7 - 40




**SECTION 8:
GUIDERAILS / BOLLARDS
FENCE / SIGNS**

DETAIL 'A'

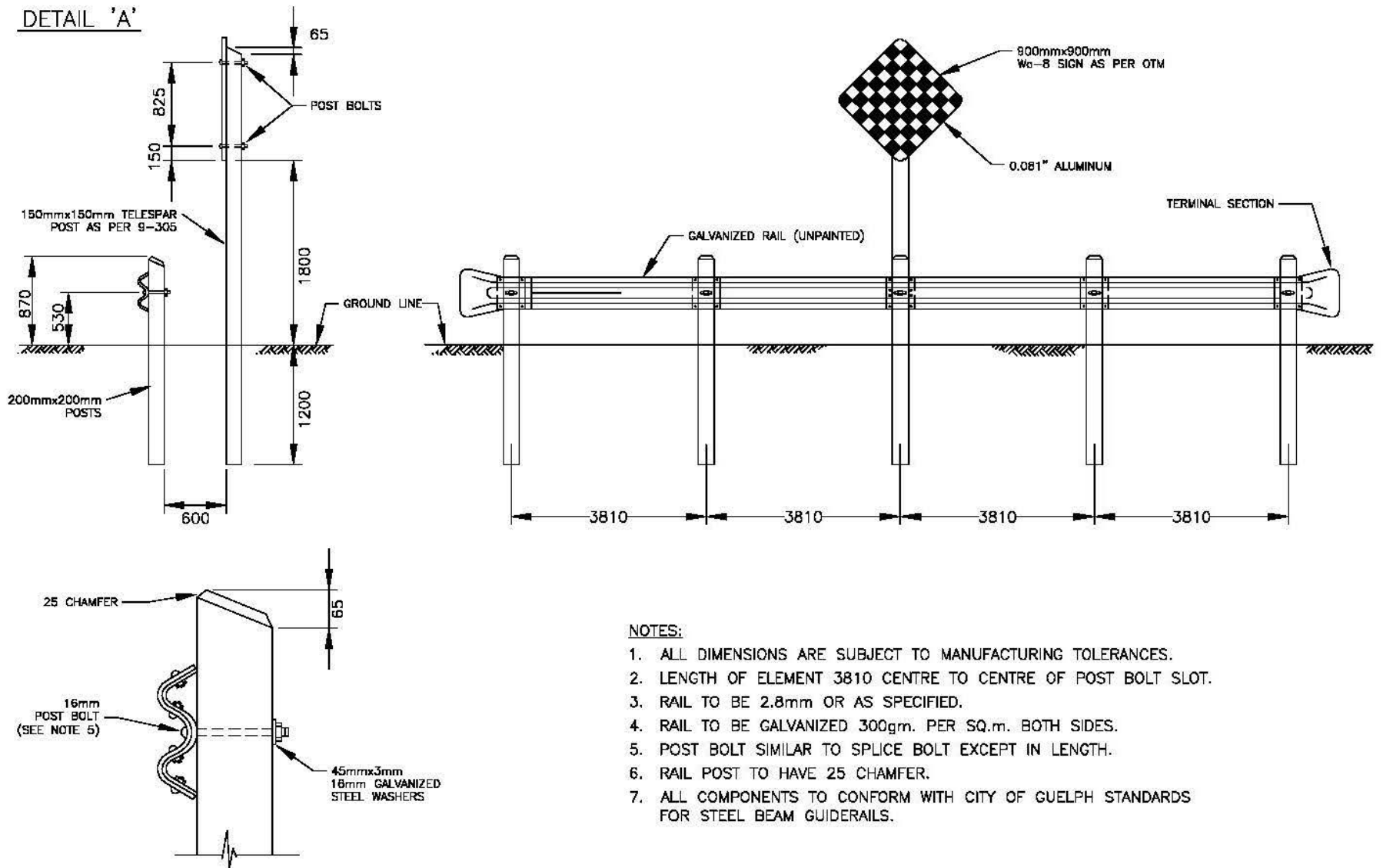


NOTES:

1. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
2. LENGTH OF ELEMENT 3810 CENTRE TO CENTRE OF POST BOLT SLOT.
3. RAIL TO BE 2.8mm OR AS SPECIFIED.
4. RAIL TO BE GALVANIZED 300gm. PER SQ.m. BOTH SIDES.
5. POST BOLT SIMILAR TO SPLICE BOLT EXCEPT IN LENGTH.
6. RAIL POST TO HAVE 25 CHAMFER.
7. ALL COMPONENTS TO CONFORM WITH CITY OF GUELPH STANDARDS FOR STEEL BEAM GUIDERAILS.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN : -	REV. No. : R-3	 ENGINEERING
<h1>DEAD END SIGN AND BARRICADE DETAIL</h1>		DESCRIPTION : REVIEWED JAN/2011		
		REV. DATE : JAN/11	REV. BY. : G.F./C.M.C.	
		APPROVED BY:		<h2>8 - 32</h2>
		CITY ENGINEER		

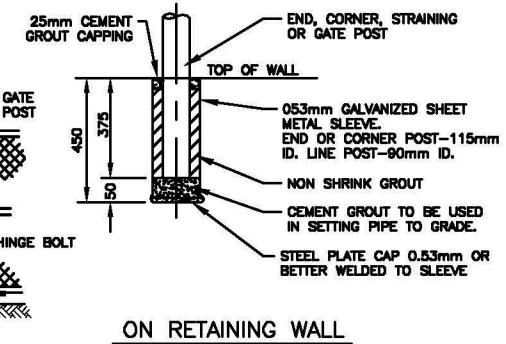
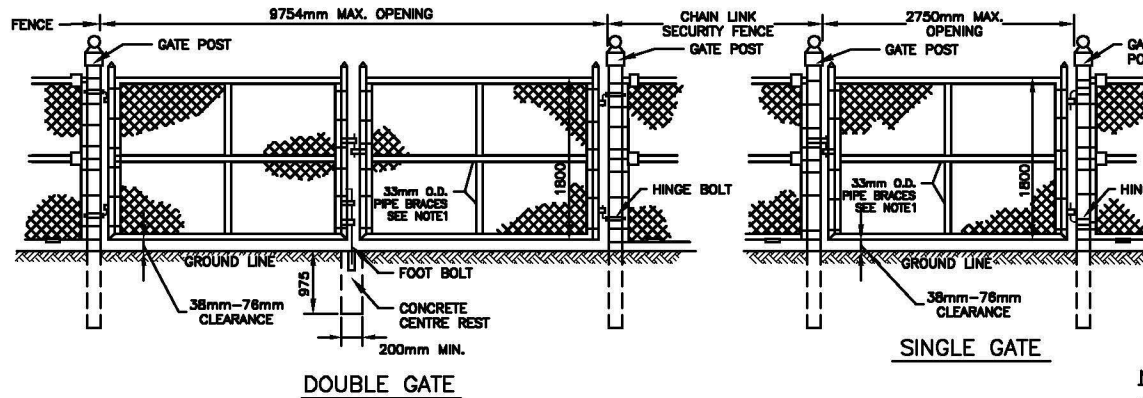
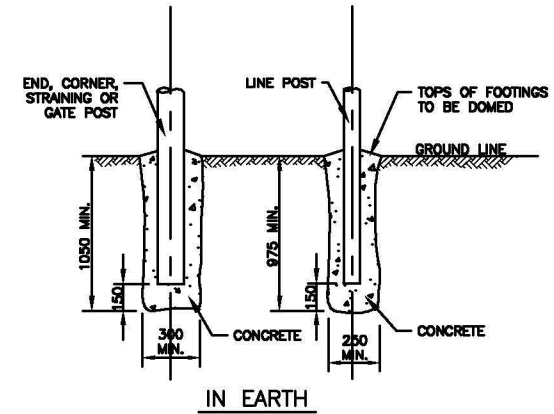
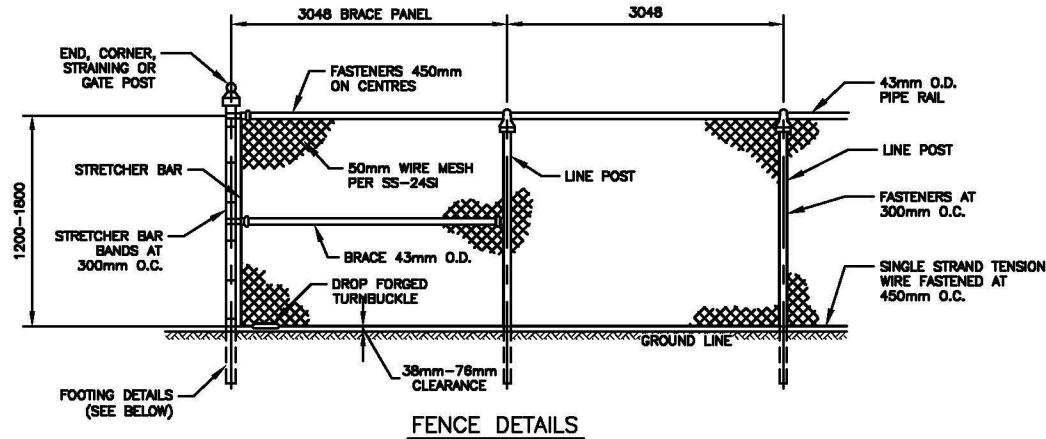
DETAIL 'A'



NOTES:

1. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
2. LENGTH OF ELEMENT 3810 CENTRE TO CENTRE OF POST BOLT SLOT.
3. RAIL TO BE 2.8mm OR AS SPECIFIED.
4. RAIL TO BE GALVANIZED 300gm. PER SQ.m. BOTH SIDES.
5. POST BOLT SIMILAR TO SPLICE BOLT EXCEPT IN LENGTH.
6. RAIL POST TO HAVE 25 CHAMFER.
7. ALL COMPONENTS TO CONFORM WITH CITY OF GUELPH STANDARDS FOR STEEL BEAM GUIDERAILS.

<p>CITY OF GUELPH STANDARD DRAWING</p> <p>DEAD END SIGN AND BARRICADE (4 LANE ARTERIAL ROAD)</p>	DATE DRAWN: Jan/88	REV. No.: R-3	
	DESCRIPTION: REVIEWED JAN/2011		
	REV. DATE: JAN/11	REV. BY.: G.F./C.M.C.	8 - 32a
	APPROVED BY:		

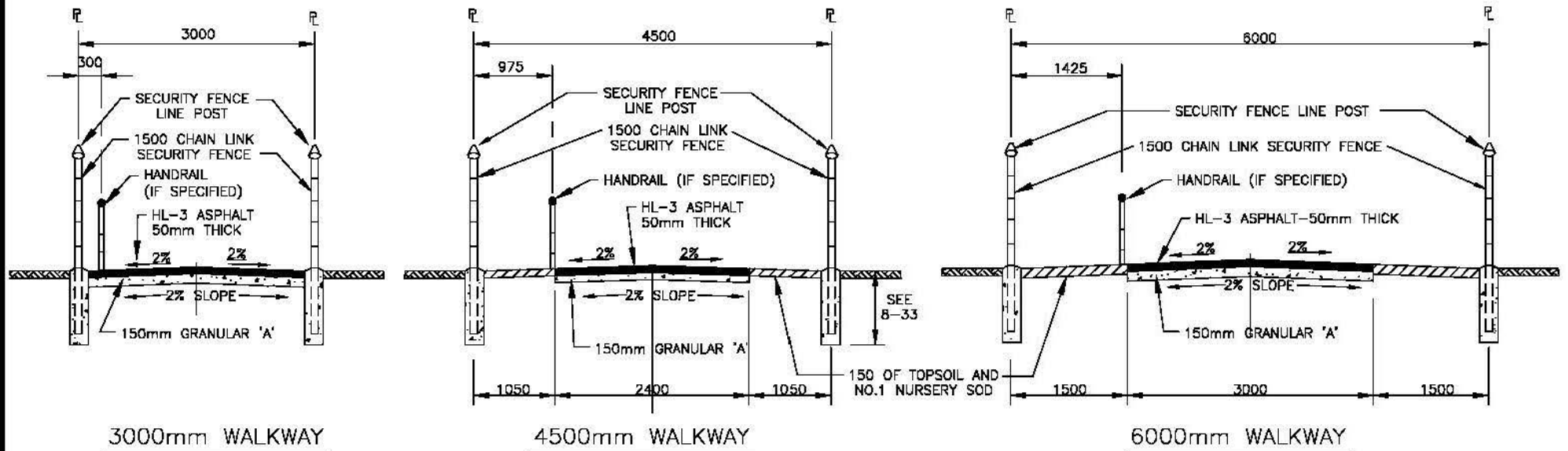


NOTES:

1. FOR FABRIC WIDTH OF 1800mm, INSTALL KNUCKLED EDGE AT BOTTOM AND BARBED EDGE AT TOP. FOR FABRIC WIDTH OF 1200mm AND 1500mm, INSTALL KNUCKLED EDGE AT TOP.
2. PIPE BRACES:
3. GATE LEAVES UP TO 1800mm WIDE - HORIZONTAL BRACE ONLY
GATE LEAVES OVER 1800mm WIDE - BOTH HORIZONTAL AND VERTICAL BRACES
4. TO BE READ IN CONJUNCTION WITH SS-24 SI.

DESCRIPTION	O.D.	POST DETAILS					
		LENGTH					
		FABRIC WIDTH 1800		FABRIC WIDTH 1500		FABRIC WIDTH 1200	
		STAND.	RET. WALLS	STAND.	RET. WALLS	STAND.	RET. WALLS
LINE POST	60	2667	2172	2362	1867	2057	1562
END, CORNER, STRAINING & GATE POST WITH OPENINGS 5500mm MAXIMUM	90	2896	2324	2591	2019	2286	1715
GATE POST OPENINGS - 99754mm MAXIMUM	115	2896	--	2591	--	2286	--

CITY OF GUELPH STANDARD DRAWING	DATE DRAWN : -	REV. No. : R-2	 Guelph <small>Making a Difference</small>
CHAIN LINK SECURITY FENCE	DESCRIPTION : REVIEWED FEB/2005		
	REV. DATE : FEB/05	REV. BY. : G.F./M.E.C.	ENGINEERING
	APPROVED BY:		8 - 33
	CITY ENGINEER		

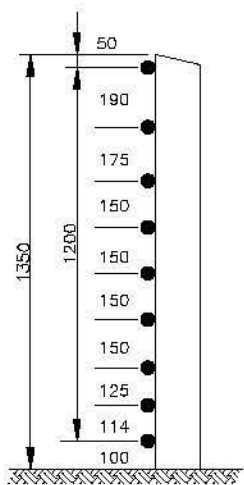
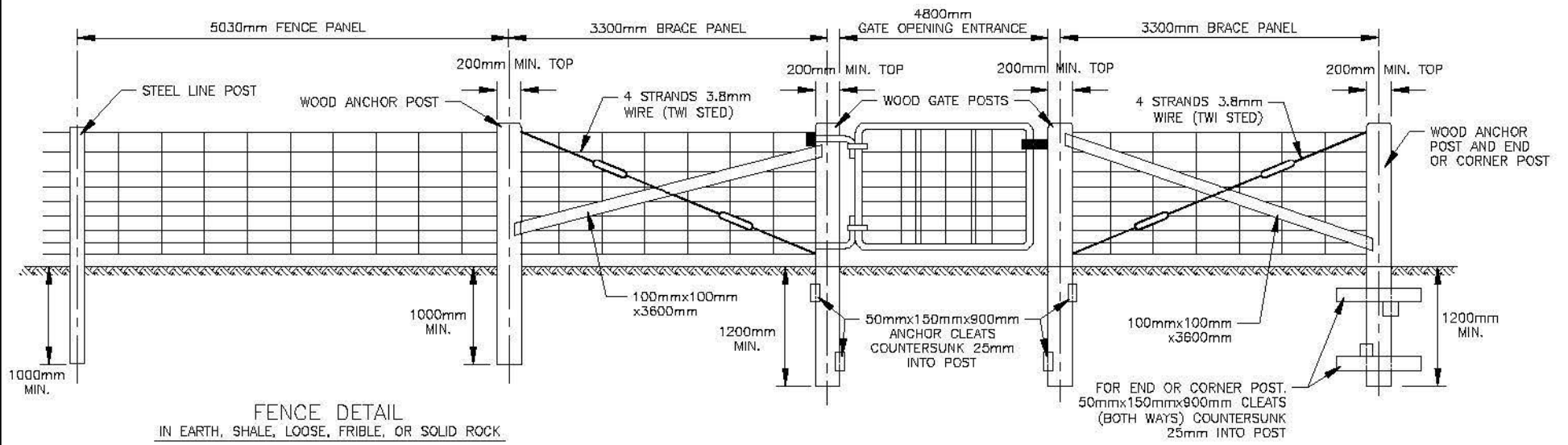


TYPICAL CROSS SECTIONS

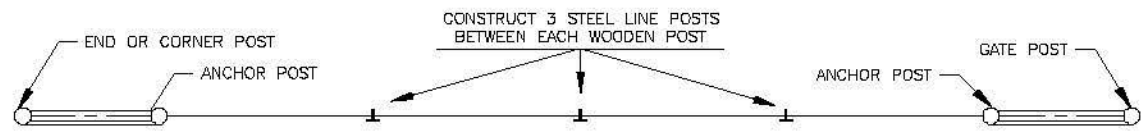
NOTES:

1. CONCRETE WALKWAY NOT TO BE CONSTRUCTED UNTIL AFTER THE INSTALLATION OF WALKWAY LIGHTING. 450mm x 450mm BAY TO BE CONSTRUCTED AT EACH LIGHT STANDARD.
2. ALL FENCE INSTALLATION TO CONFORM WITH SD-33 AND SPECIFICATIONS FOR CHAIN LINK SECURITY FENCE.
3. ALL TOPSOIL AND SOD TO CONFORM TO SPECIFICATIONS FOR PLACING TOPSOIL AND SOD.
4. ALL EARTHWORKS AND GRANULAR TO CONFORM TO SPECIFICATIONS FOR EXCAVATION AND GRANULAR BASE.
5. ALL ASPHALT TO CONFORM TO SPECIFICATIONS FOR ASPHALT PAVEMENT.
6. MANHOLE FRAME AND COVERS IN WALKWAY TO BE FLUSH WITH PAVEMENT.
7. FENCE MESH TO BE MOUNTED ON INSIDE FACE OF WALKWAY.
8. WALKWAY FENCE TO TERMINATE 600mm FROM INTERSECTING WALK.

CITY OF GUELPH STANDARD DRAWING	DATE DRAWN : -	REV. No. : R-5	<p style="font-size: x-small; margin: 0;">Making a Difference</p>
PEDESTRIAN WALKWAY	DESCRIPTION : REVIEWED JAN/2015		
	REV. DATE : JAN/15	REV. BY. : G.F./C.M.C.	8 - 34
	APPROVED BY: CITY ENGINEER		




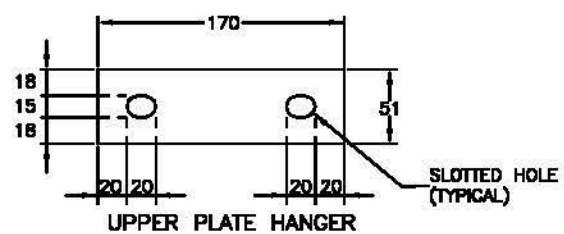
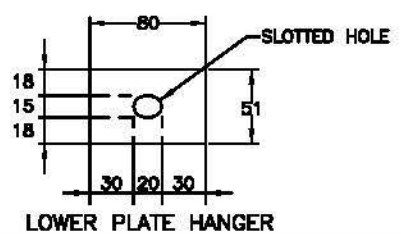
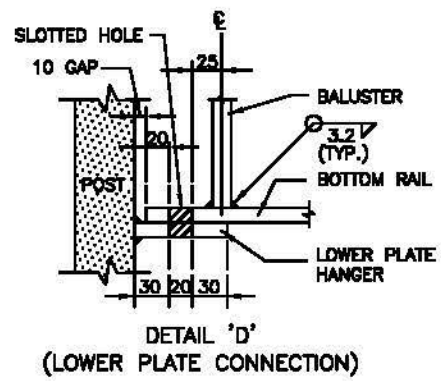
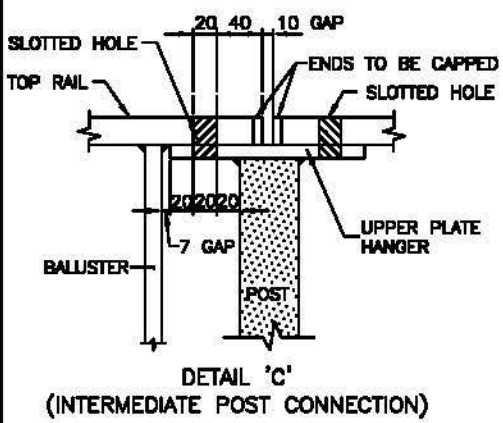
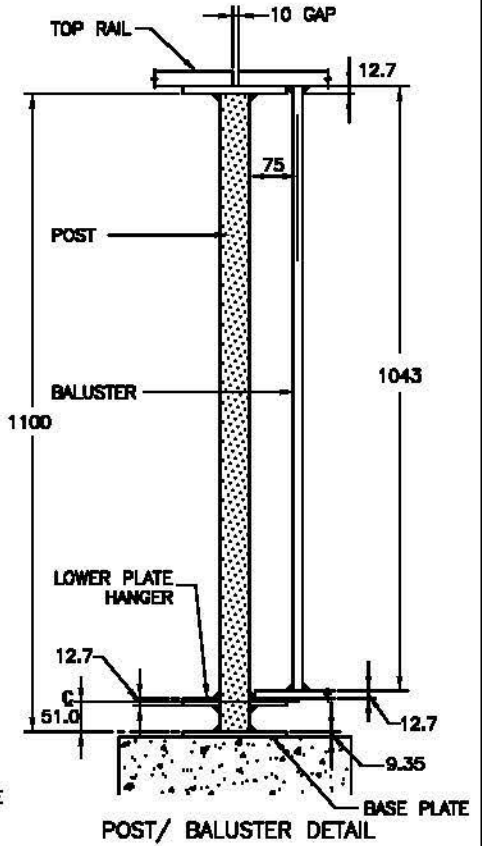
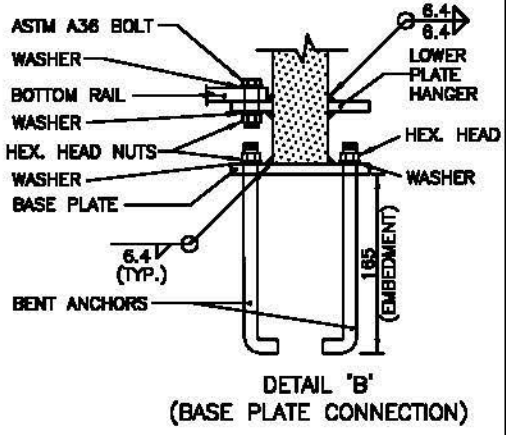
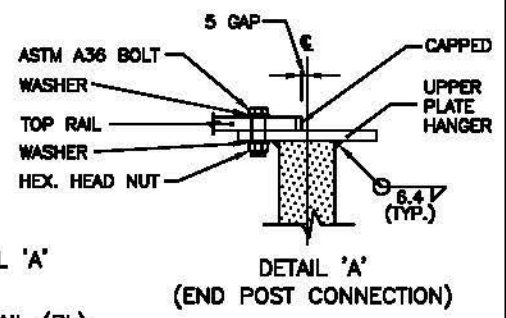
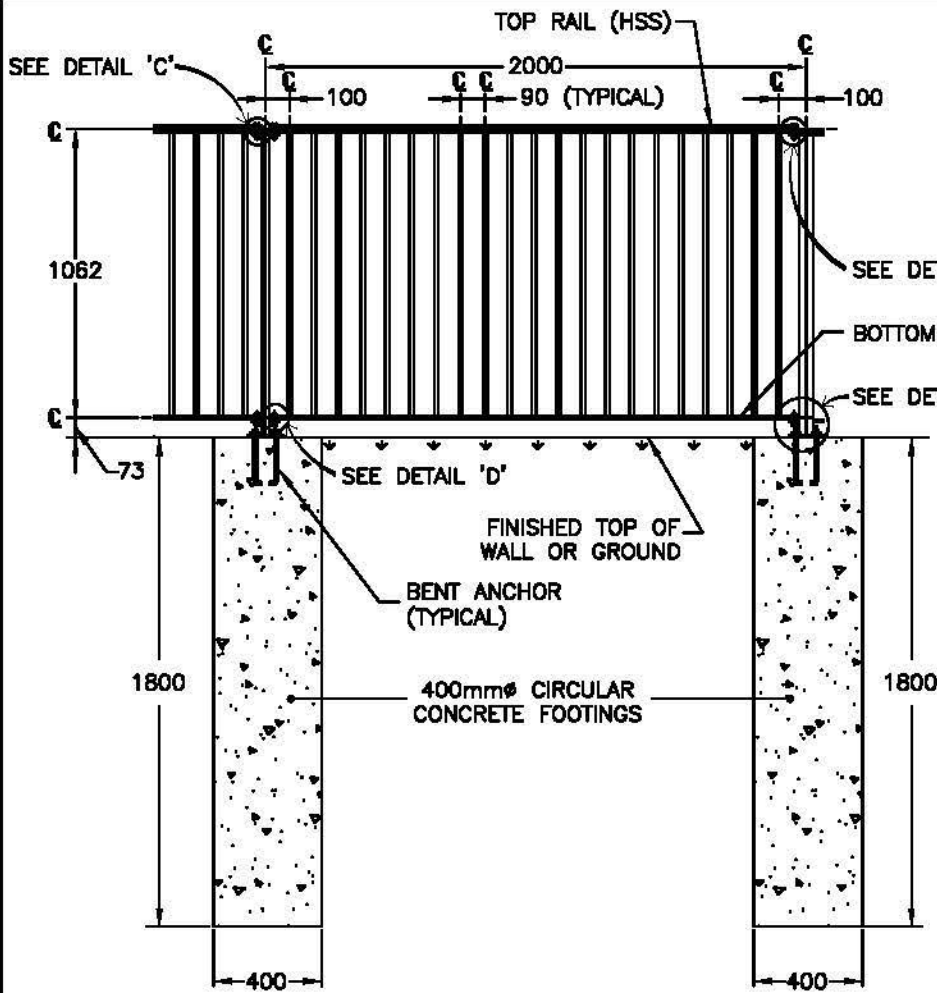
WIRE SPACING



TOP VIEW SECTION OF FENCE

- NOTES:**
1. POST TOPS TO BE SAWN OFF TO 0.6mm PITCH, HIGH SIDE TO BE NEXT TO THE WIRE.
 2. POST LENGTHS:
 LINE POSTS - 2400mm MINIMUM
 END, CORNER ANCHOR AND GATE POSTS - 2600mm MINIMUM
 3. STANDARD POST SPACING:
 STEEL POST TO STEEL OR WOODEN POST - 5030mm.
 RATIO OF STEEL POSTS TO WOODEN POST SHALL BE 3:1 UNLESS OTHERWISE INDICATED.

CITY OF GUELPH STANDARD DRAWING		DATE DRAWN: -	REV. No.: R-2	 ENGINEERING
STANDARD HIGHWAY AND FARM FENCE DETAILS		DESCRIPTION: REVIEWED FEB/2005		
		REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.	
		APPROVED BY: CITY ENGINEER		8 - 35



CITY OF GUELPH STANDARD DRAWING

PEDESTRIAN GUARD

(PAGE 1 OF 2)

DATE DRAWN: OCT/01	REV. No.: R-2
DESCRIPTION: REVIEWED FEB/2005	
REV. DATE: FEB/05	REV. BY.: G.F./M.E.C.
APPROVED BY:	
CITY ENGINEER	

City of Guelph
Making a Difference

ENGINEERING

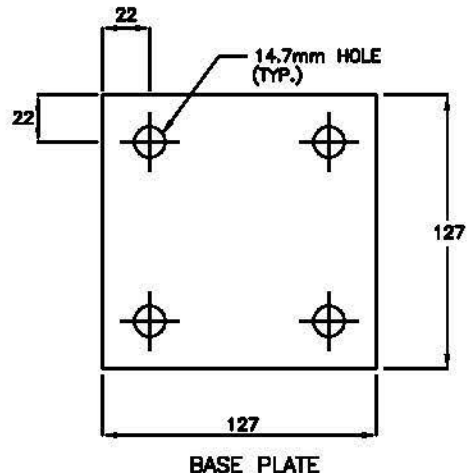
8 - 86A

BILL OF MATERIALS

ELEMENT	MATERIAL DESCRIPTION (mm)	SPECIFICATIONS
Posts	HSS 51x51x6.4 L = 1100	CAN/CSA-G40.21-M92, GRADE 350W, CLASS C Hot Dipped Galvanized: CSA G164-M81
Top Rail	HSS 51x25x3.2 L = 1990	CAN/CSA-G40.21-M92, GRADE 350W, CLASS C (Ends to be capped) Hot Dipped Galvanized: CSA G164-M81
Bottom Rail	PL 12.7x50.8x1930	CAN/CSA-G40.21-M92, GRADE 350W Hot Dipped Galvanized: CSA G164-M81
Baluster (21 Per Panel)	Square Bar 15.8x15.8x1043 (5/8"x5/8"x41 1/16")	CAN/CSA-G40.21-M92, GRADE 350W Hot Dipped Galvanized: CSA G164-M81
Upper Plate Hanger	PL 12.7x50.8x170 (1/2"x2"x6 5/8")	CAN/CSA-G40.21-M92, GRADE 350W Hot Dip Galvanized: CSA G164-M81
Lower Plate Hanger	PL 12.7x50.8x80 (1/2"x2"x3 1/8")	CAN/CSA-G40.21-M92, GRADE 350W Hot Dip Galvanized: CSA G164-M81
Upper Hanger Bolts, Nuts and Washers	Ø = 12.7 (1/2") L = 88.9 (3 1/2") Thread = 38.1 (1 1/2")	ASTM A36 Hot Dip Galvanized: CSA G164-M81 Nuts: Hex. Head
Lower Hanger Bolts, Nuts and Washers	Ø = 12.7 (1/2") L = 69.9 (2 3/4") Thread = 25.4 (1")	ASTM A36 Hot Dipped Galvanized: CSA G164-M81 Nuts: Hex. Head
Base Plate	PL 9.35x127x127 (3/8"x5"x5")	CAN/CSA-G40.21-M92, GRADE 350W Hot Dipped Galvanized: CSA G164-M81
Anchor Bolts, Nuts and Washers	Bent Anchor Ø = 12.7 (1/2") L = 203.2 (8") Thread = 38.1 (1 1/2") Embedment = 165.1 (6 1/2")	ASTM A36 Hot Dipped Galvanized: CSA G164-M81 Nuts: Hex. Head
Welds:		
Base Plate Connection	6.4 (1/4")	CAN3-S16.1-M89, CSA W59-M89
Upper Plate Hanger Connection	6.4 (1/4")	E480 XX electrodes
Lower Plate Hanger Connection	6.4 (1/4")	(Fillet welds to be all the way around each member)
Baluster	3.2 (1/8")	
Footings	Concrete Ø = 400 L = 1800	OPSS 1350 - 32 mpa 7.0% ±1.5% air entrainment 75mm slump

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
2. DESIGNED IN ACCORDANCE WITH ONTARIO BUILDING CODE 1997.
3. REQUIRED FOR RETAINING WALL EXCEEDING 1000mm IN EXPOSED HEIGHT ADJACENT TO PUBLIC PROPERTY OR PRIVATE PROPERTY TO WHICH THE PUBLIC IS ADMITTED.
4. ALL ELEMENTS (POSTS, RAILS, BALUSTERS AND HANGERS) SHALL BE HOT DIPPED GALVANIZED IN ACCORDANCE TO CSA G164-M81.



CITY OF GUELPH STANDARD DRAWING

PEDESTRIAN GUARD

(PAGE 2 OF 2)

DATE DRAWN: OCT/01 REV. No.: R-2

DESCRIPTION:
REVIEWED FEB/2005

REV. DATE: FEB/05 REV. BY.: G.F./M.E.C.

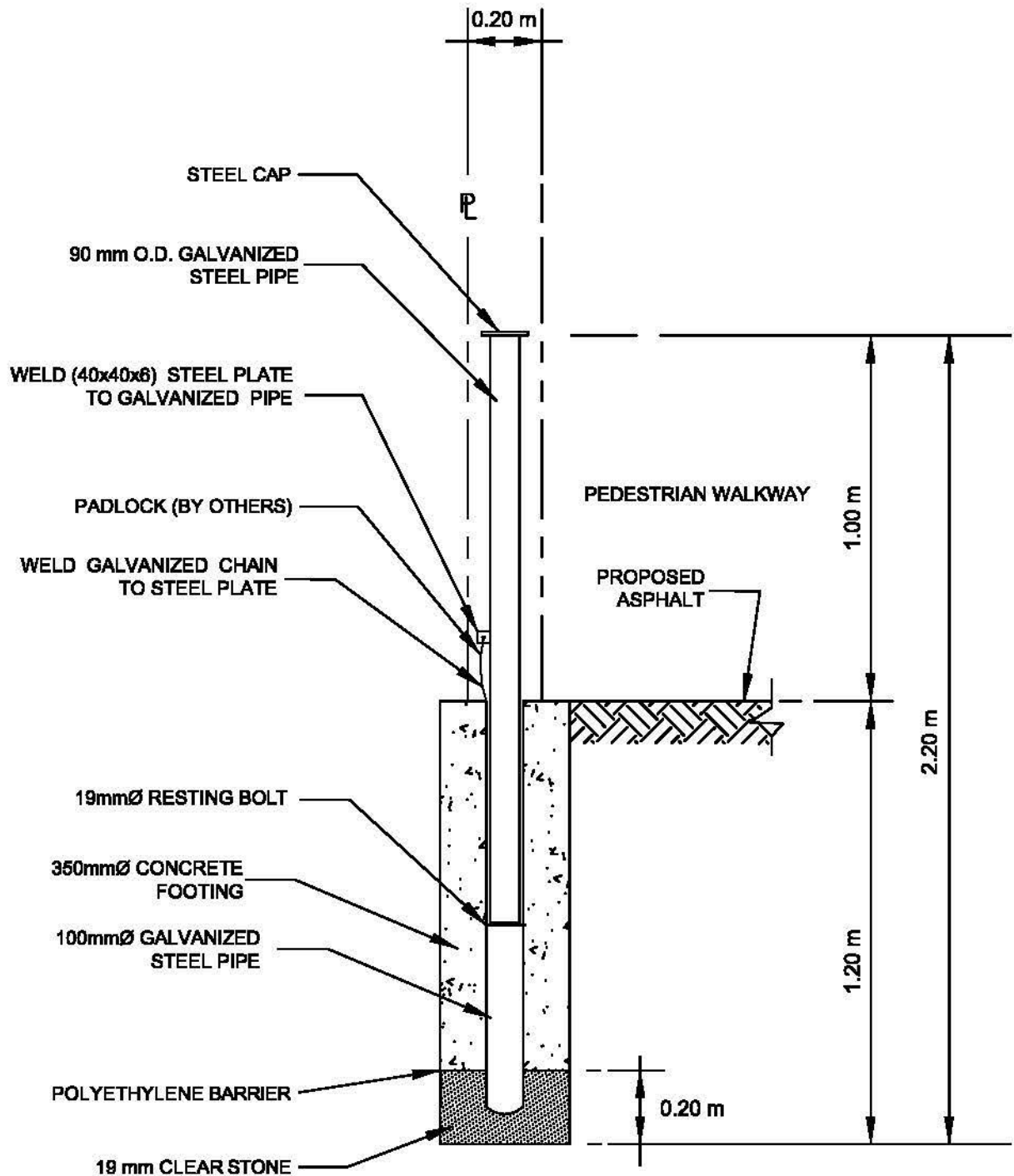
APPROVED BY:

CITY ENGINEER



ENGINEERING

8 - 86B



NOTE: ENTIRE BOLLARD SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.

CITY OF GUELPH STANDARD DRAWING

DATE DRAWN: JAN/03 REV. No.: R-5



DESCRIPTION: REVIEWED FEB/2005

REV. DATE: FEB/05 REV. BY.: G.F./M.E.C.

ENGINEERING

REMOVABLE BOLLARD DETAIL

APPROVED BY:

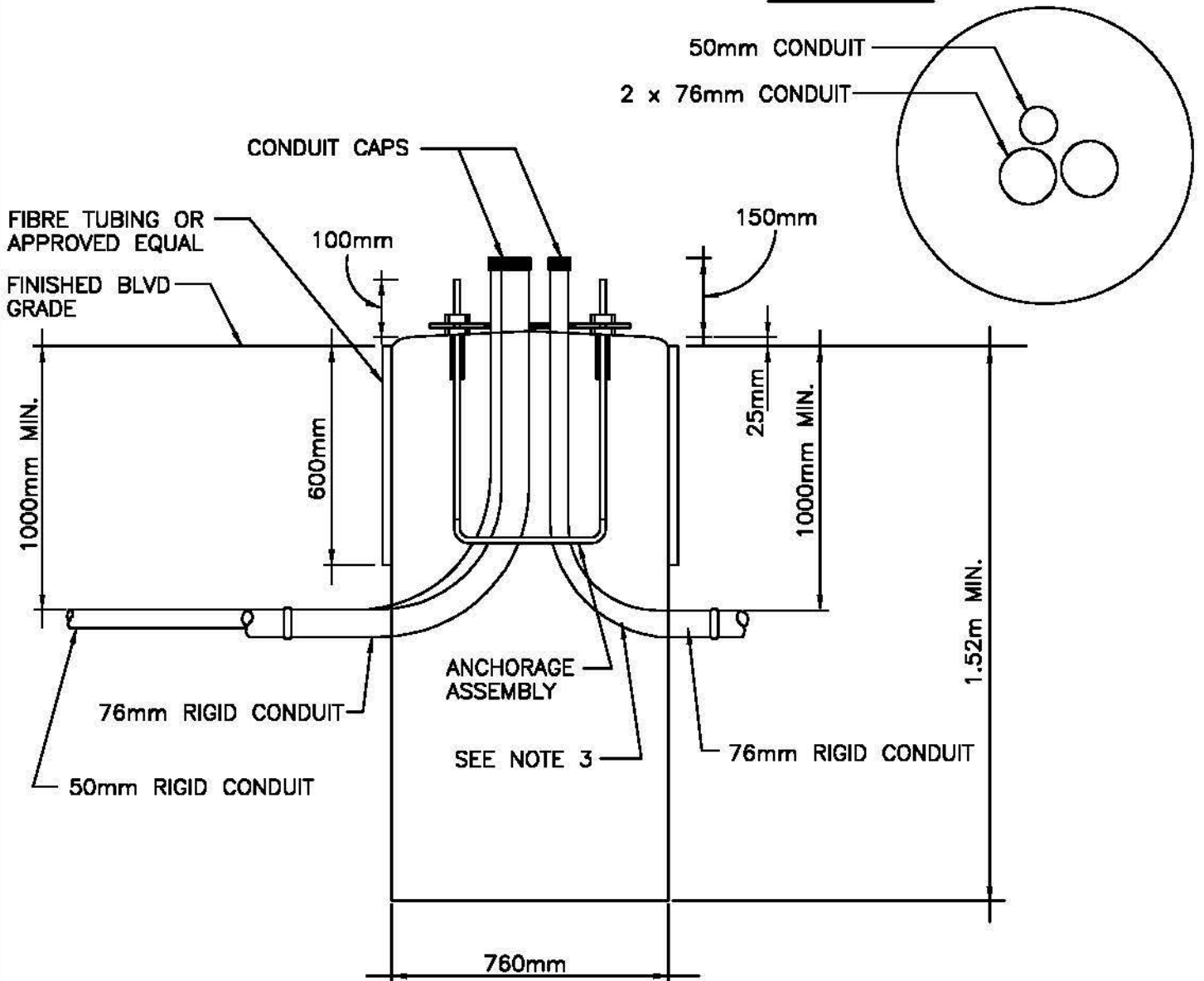
8 - 89

CITY ENGINEER



SECTION 9: TRAFFIC

TOP VIEW:



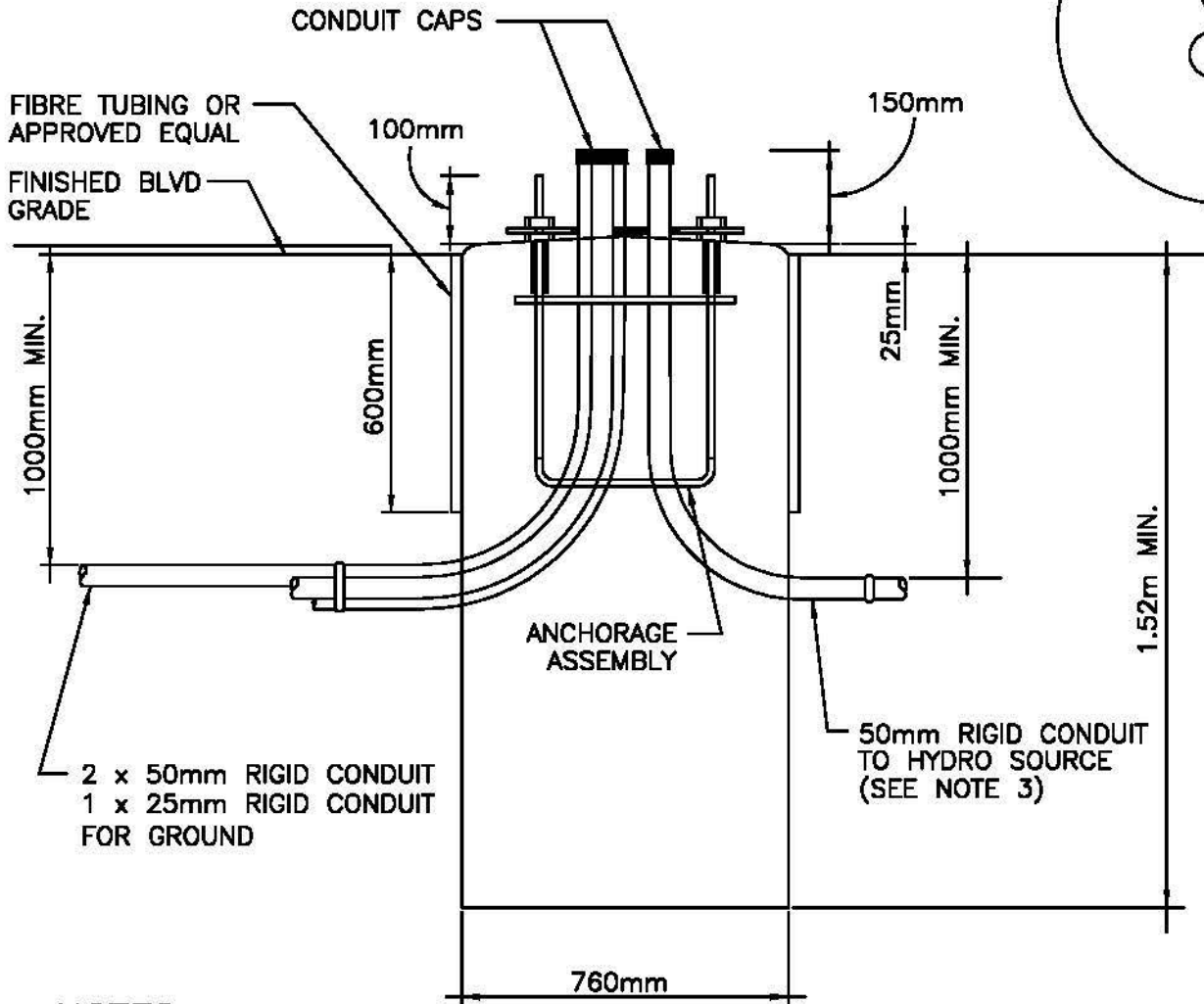
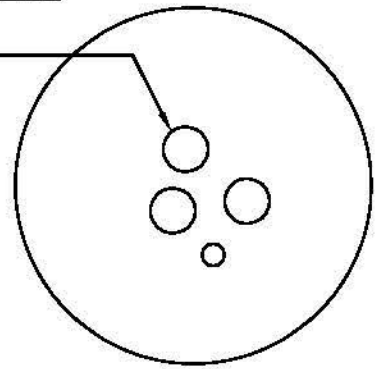
NOTES:

1. 25MPa CONCRETE IN FOUNDATION SHALL BE PLACED AGAINST UNDISTURBED GROUND (AUGER OR HAND DIG).
2. TOP OF FOUNDATION SHALL BE TAPERED FROM CENTRE OUTWARDS TO ALLOW RUN-OFF AND HAND TROWELLED SMOOTH - NO GROOVES. CONDUIT PIPE WITH CORRESPONDING CONDUIT CAPS FOR ALL CONDUITS, ALL AS SHOWN ABOVE.
3. RIGID CONDUIT ELBOWS SHALL BE 90°, 330mm RADIUS FOR 76mm CONDUIT, 240mm RADIUS FOR 50mm CONDUIT. STUB ANY UNUSED CONDUIT TOWARDS HANDWELL.
4. POLE BASE INSTALLATION TO INCLUDE ANCHORAGE ASSEMBLY, 1-50mm AND 2-76mm CONDUIT PIPE WITH CORRESPONDING CONDUIT CAPS FOR ALL CONDUITS, ALL AS SHOWN ABOVE.
5. SOLVENT WELD CAPS (SCEPTER OR EQUAL) OF THE PROPER SIZE SHALL BE PLACED ON ENDS OF ALL UNUSED RIGID PVC CONDUIT.

CITY OF GUELPH STANDARD DRAWING	DATE: 02/05/05	 ENGINEERING
CONCRETE FOUNDATION FOR TRAFFIC CONTROL SIGNAL POLES	APPROVED BY:	
	CITY ENGINEER	
	REVISION: R-3	
	DATE: 08/03/08	9 - 201

TOP VIEW:

3 x 50mm RIGID CONDUIT
1 x 25mm RIGID CONDUIT



NOTES:

1. 25MPa CONCRETE IN FOUNDATION SHALL BE PLACED AGAINST UNDISTURBED GROUND (AUGER OR HAND DIG).
2. TOP OF FOUNDATION SHALL BE TAPERED FROM CENTRE OUTWARDS TO ALLOW RUN-OFF AND HAND TROWELLED SMOOTH – NO GROOVES. CONDUIT PIPE WITH CORRESPONDING CONDUIT CAPS FOR ALL CONDUITS, ALL AS SHOWN ABOVE.
3. RIGID CONDUIT ELBOWS SHALL BE 90°, 240mm RADIUS FOR 50mm CONDUIT.
4. PEDESTAL BASE INSTALLATION TO INCLUDE ANCHORAGE ASSEMBLY, 1-25mm & 3-50mm CONDUIT PIPE WITH CORRESPONDING CONDUIT CAPS FOR ALL CONDUITS, ALL AS SHOWN ABOVE.
5. SOLVENT WELD CAPS (SCEPTER OR EQUAL) OF THE PROPER SIZE SHALL BE PLACED ON ENDS OF ALL UNUSED RIGID PVC CONDUIT.

CITY OF GUELPH STANDARD DRAWING

DATE: Y7/MO/DAY
13/01/22



**CONCRETE FOUNDATION FOR
POWER PEDESTALS**

APPROVED BY:

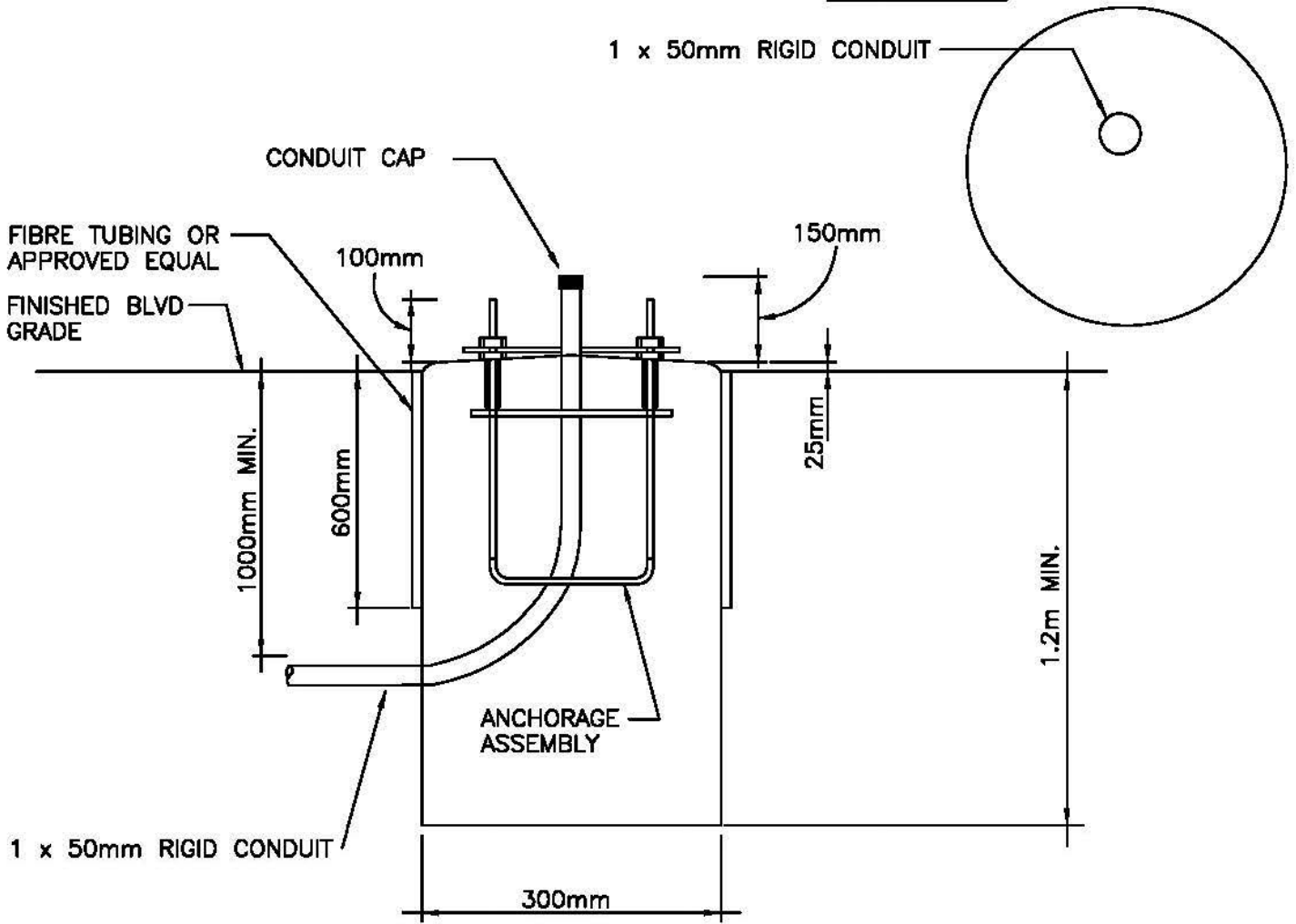
CITY ENGINEER

ENGINEERING

REVISION: _____
DATE: Y7/MO/DAY

9 - 201a

TOP VIEW:



NOTES:

1. 25MPa CONCRETE IN FOUNDATION SHALL BE PLACED AGAINST UNDISTURBED GROUND (AUGER OR HAND DIG).
2. TOP OF FOUNDATION SHALL BE TAPERED FROM CENTRE OUTWARDS TO ALLOW RUN-OFF AND HAND TROWELLED SMOOTH – NO GROOVES. CONDUIT PIPE WITH CORRESPONDING CONDUIT CAP FOR CONDUIT, AS SHOWN ABOVE.
3. RIGID CONDUIT ELBOWS SHALL BE 90°, 240mm RADIUS FOR 50mm CONDUIT.
4. CONCRETE BASE INSTALLATION TO INCLUDE ANCHORAGE ASSEMBLY AND 1-50mm CONDUIT PIPE. ANCHOR ASSEMBLY SENTINEL POLE & TRAFFIC EQUIPMENT LIMITED PART: 3/4-2B-190.
5. SOLVENT WELD CAPS (SCEPTER OR EQUAL) OF THE PROPER SIZE SHALL BE PLACED ON ENDS OF ALL UNUSED RIGID PVC CONDUIT.

CITY OF GUELPH STANDARD DRAWING

DATE: YY/MO/DAY
13/12/09



**CONCRETE FOUNDATION FOR
PEDESTRIAN PUSH BUTTON POLES**

APPROVED BY:

CITY ENGINEER

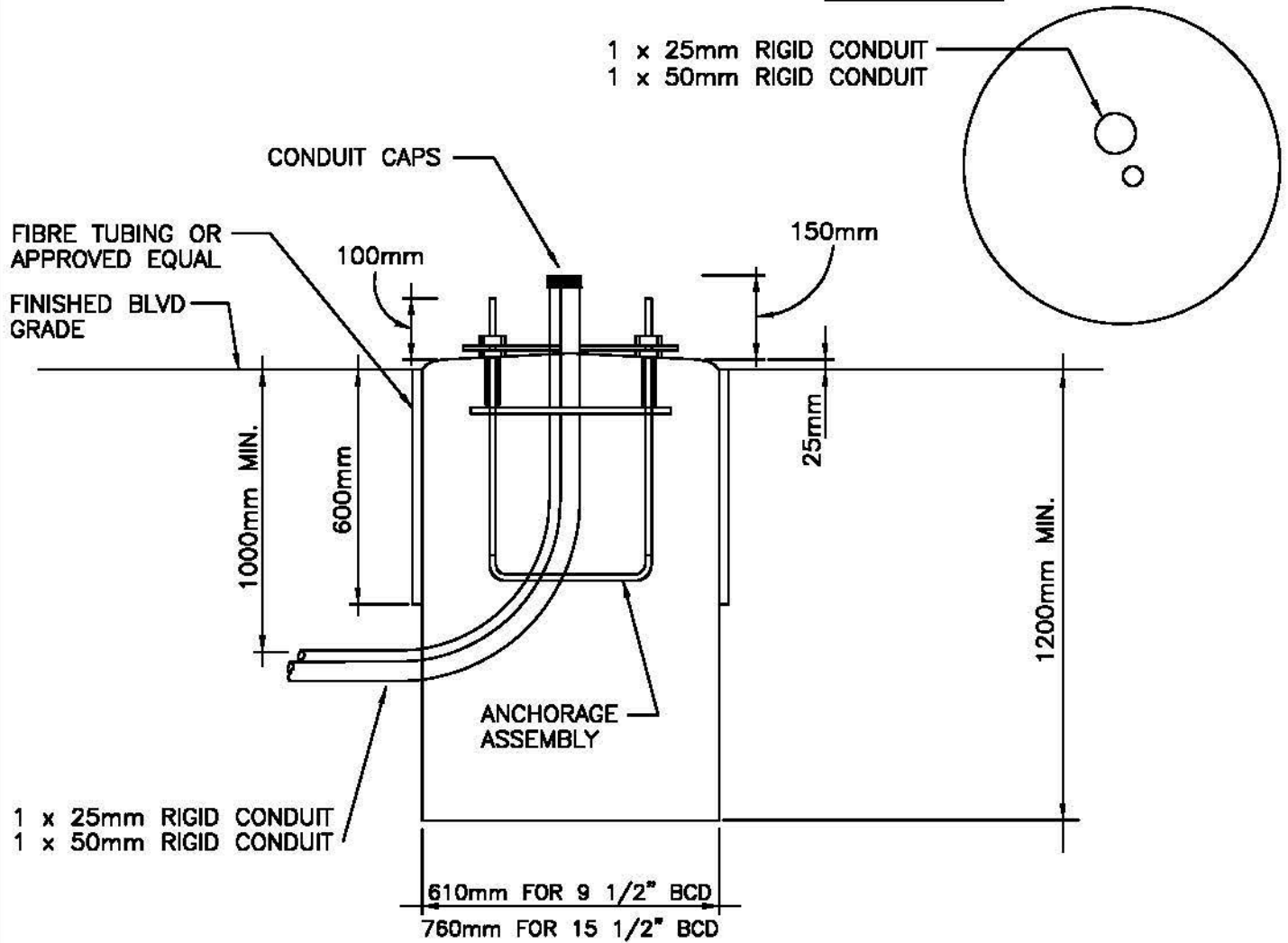
ENGINEERING

REVISION: _____

DATE: YY/MO/DAY

9 - 201b

TOP VIEW:

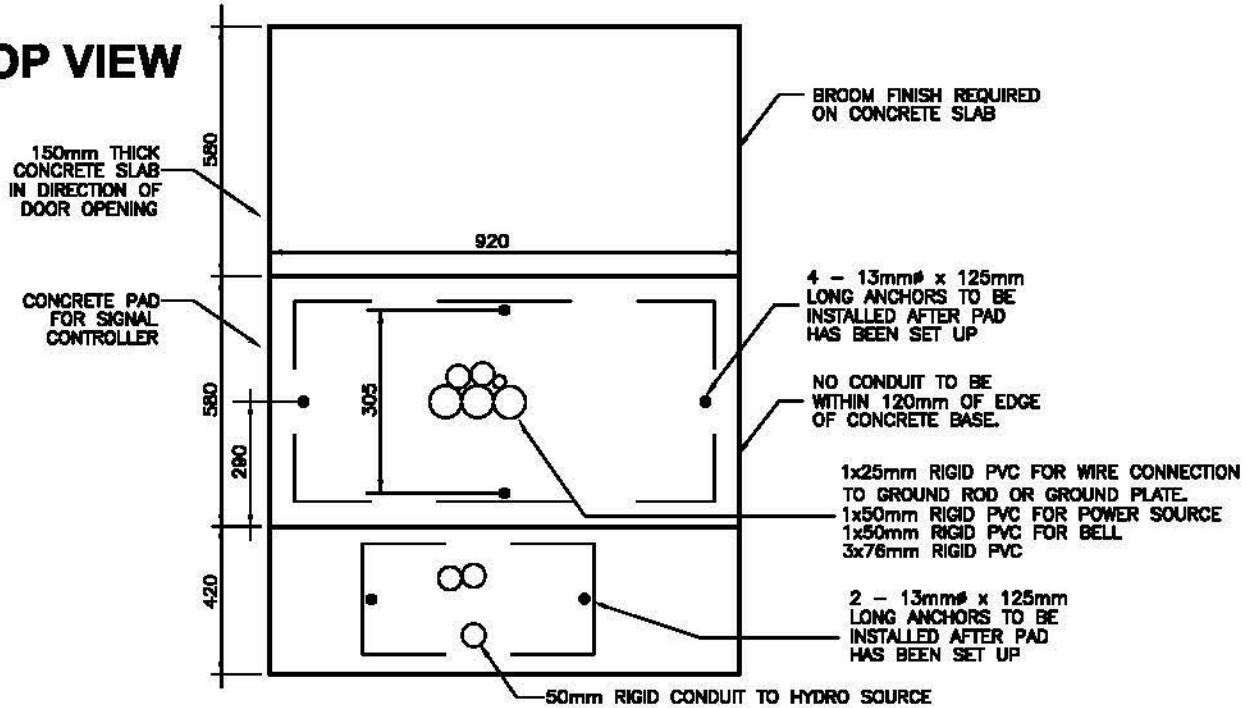


NOTES:

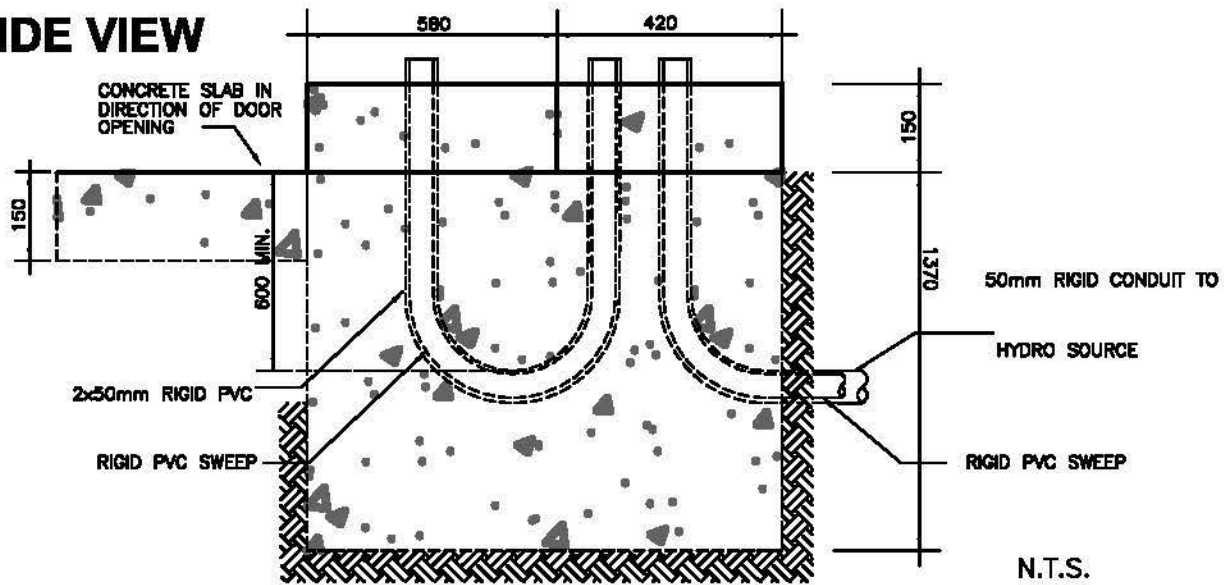
1. 25MPa CONCRETE IN FOUNDATION SHALL BE PLACED AGAINST UNDISTURBED GROUND (AUGER OR HAND DIG).
2. TOP OF FOUNDATION SHALL BE TAPERED FROM CENTRE OUTWARDS TO ALLOW RUN-OFF AND HAND TROWELLED SMOOTH – NO GROOVES. CONDUIT PIPE WITH CORRESPONDING CONDUIT CAP FOR CONDUIT, AS SHOWN ABOVE.
3. RIGID CONDUIT ELBOWS SHALL BE 90°, 240mm RADIUS FOR CONDUITS.
4. CONCRETE BASE INSTALLATION TO INCLUDE ANCHORAGE ASSEMBLY AND 1–25mm AND 1–50mm CONDUIT PIPE.
5. SOLVENT WELD CAPS (SCEPTER OR EQUAL) OF THE PROPER SIZE SHALL BE PLACED ON ENDS OF ALL UNUSED RIGID PVC CONDUIT.

CITY OF GUELPH STANDARD DRAWING	DATE: <small>YY/MO/DAY</small> 13/12/09	 Guelph <small>Making a Difference</small>
CONCRETE FOUNDATION FOR SCHOOL ZONE BEACON SIGNS	APPROVED BY: _____ CITY ENGINEER	
	REVISION: _____	9 - 201c
	DATE: <small>YY/MO/DAY</small>	

TOP VIEW



SIDE VIEW



NOTES:

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED.
2. CONCRETE TO BE 25MPa AT 28 DAYS.
3. ENSURE ALL CONDUIT IS A MINIMUM 120mm FROM EDGE OF CONTROLLER BASE.
4. CONCRETE BASE SHALL BE LEVEL.
5. ALL RIGID PVC PIPE SHALL MEET OR EXCEED CSA STANDARD C22.2 NO. 211.2.
6. FINISHED GRADE TO BE LEVEL.
7. WATERPROOF SILICONE TO BE PLACED AROUND BASE OF SIGNAL CONTROLLER.

CITY OF GUELPH STANDARD DRAWING

DATE: 18/08/19

APPROVED BY: S.A

CITY ENGINEER

REVISION: R-6

DATE: 18/08/19

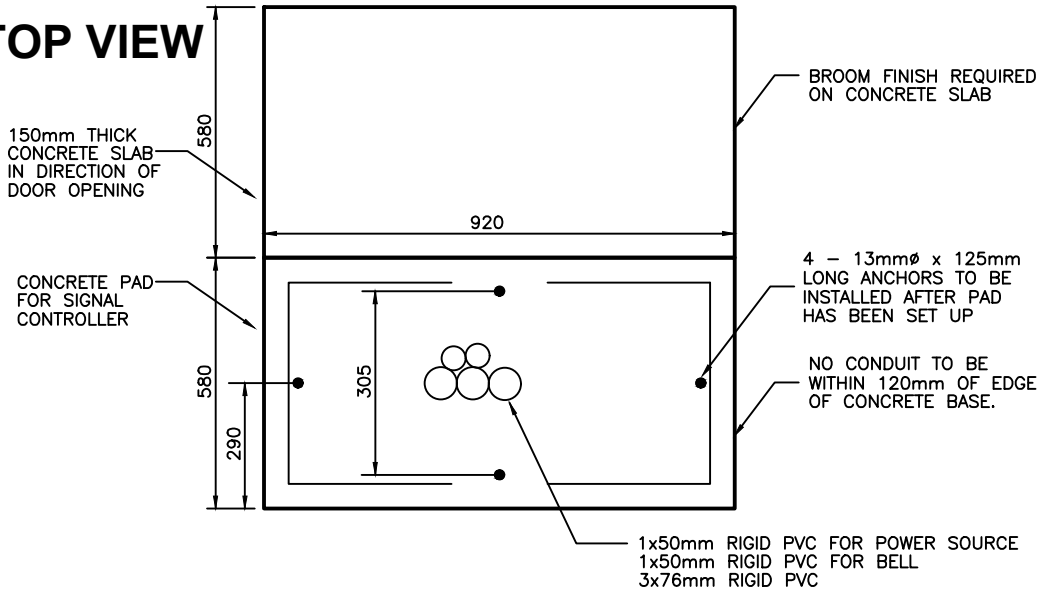


ENGINEERING

9 - 201d

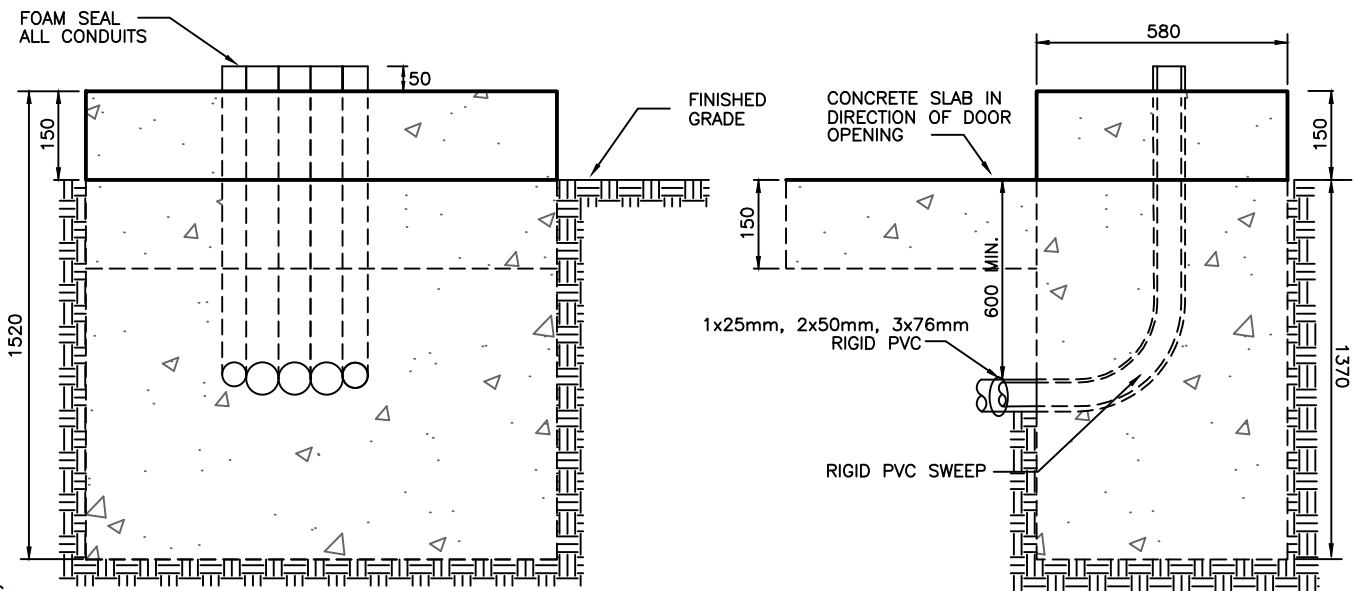
CONCRETE MOUNTING PAD FOR TRAFFIC CONTROLLER CABINET AND POWER PEDESTALS

TOP VIEW



FRONT VIEW

SIDE VIEW



NOTES:

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED.
2. CONCRETE TO BE 25MPa AT 28 DAYS.
3. INCLUDE 3x76mm, 2x50mm AND 1x25mm RIGID PVC IN CONTROLLER BASE.
4. ENSURE ALL CONDUIT IS A MINIMUM 120mm FROM EDGE OF CONTROLLER BASE.
5. FORM CONSTRUCTED WITH 19mm PLYWOOD & BRACED AROUND TOTAL AREA TO PREVENT WARPING.
6. ALL ANCHOR BOLTS 19mm x 450mm (4 REQUIRED).
7. CONCRETE BASE SHALL BE LEVEL.
8. ALL RIGID PVC PIPE SHALL MEET OR EXCEED CSA STANDARD C22.2 NO. 211.2.
9. FINISHED GRADE TO BE LEVEL.
10. WATERPROOF SILICONE TO BE PLACED AROUND BASE OF SIGNAL CONTROLLER.
11. 580mm x 920mm x 150mm CONCRETE SLAB TO BE POURED AT GRADE LEVEL.

N.T.S.

CITY OF GUELPH STANDARD DRAWING

DATE: YY/MO/DAY
02/05/03



CONCRETE MOUNTING PAD FOR TRAFFIC CONTROLLER CABINET

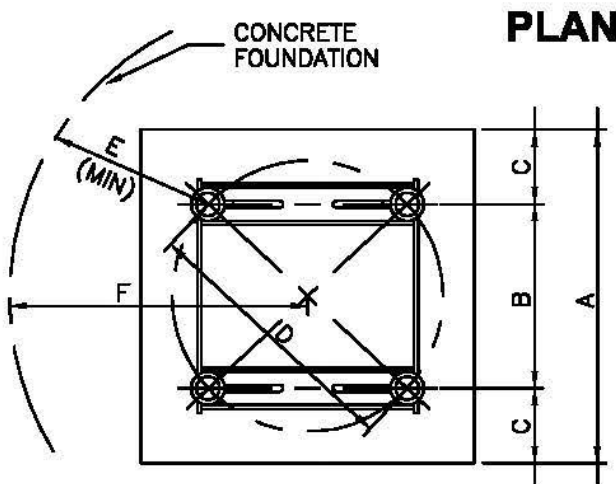
APPROVED BY:

CITY ENGINEER

ENGINEERING

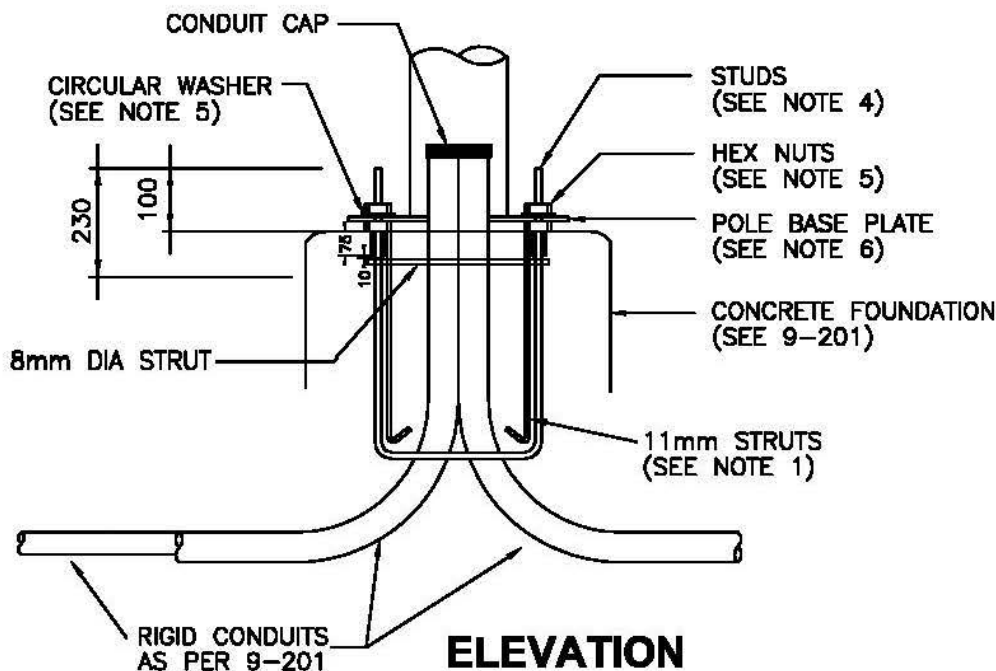
REVISION: **R-7**
DATE: YY/MO/DAY
19/12/20

9 - 204



TEMPLATE & POSITIONING

BASE SECTION	STUD DIAMETER	A mm	B mm	C mm	D mm	E mm	F mm
5	32mm	381	279	50	395	150	380
6	32mm	432	318	50	450	150	380



NOTES:

1. ANCHORAGE ASSEMBLY STRUTS AND COILS SHALL BE MADE OF SAE 10-20 STEEL AND SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH CSA STANDARD G-164.
2. ALL STUDS TO BE GREASED ALONG ENTIRE LENGTH PRIOR TO POURING OF CONCRETE.
3. A SETTING TEMPLATE SHALL BE PROVIDED FOR ACCURATE POSITIONING OF THE ANCHOR WITHIN THE FORM. CENTRE OF ANCHORAGE ASSEMBLY SHALL COINCIDE WITH CENTRE OF CONCRETE FOUNDATION. TOLERANCES SHALL BE IN ACCORDANCE TO COLUMN 'E' NOTED ABOVE.
4. STUDS SHALL BE 250mm LONG, A.S.T.M. SPEC. A4140 STEEL A-193 GRADE B-7 FULLY THREADED WITH SQUARE HEAD.
5. STEEL HEX NUTS AND HARDENED STEEL WASHERS SHALL BE IN ACCORDANCE WITH A.S.T.M. SPEC. A325, AND SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH CSA STANDARD G-164.
6. PLATE THICKNESS 16mm FOR NO. 5 BASE, 16mm FOR NO. 6 BASE.

CITY OF GUELPH STANDARD DRAWING

DATE: YY/MO/DAY
02/05/03



ANCHORAGE ASSEMBLY AND INSTALLATION

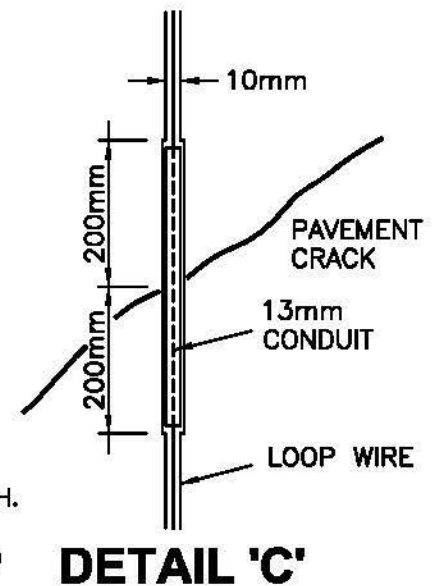
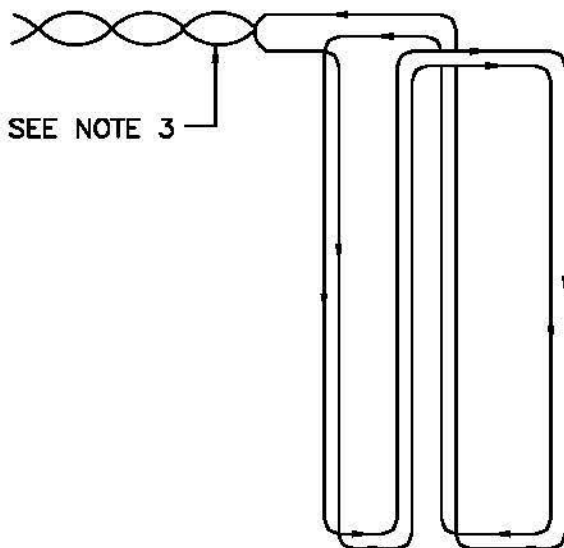
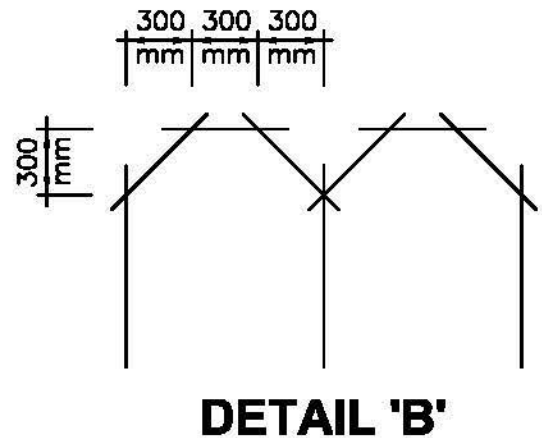
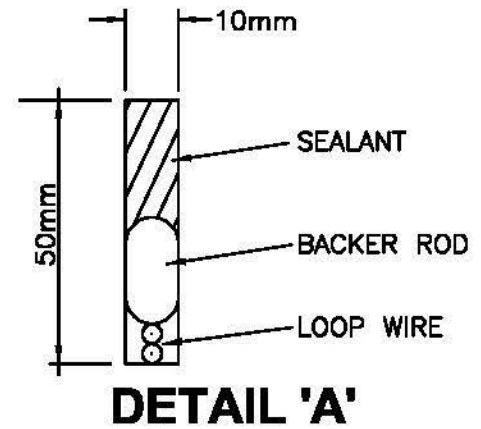
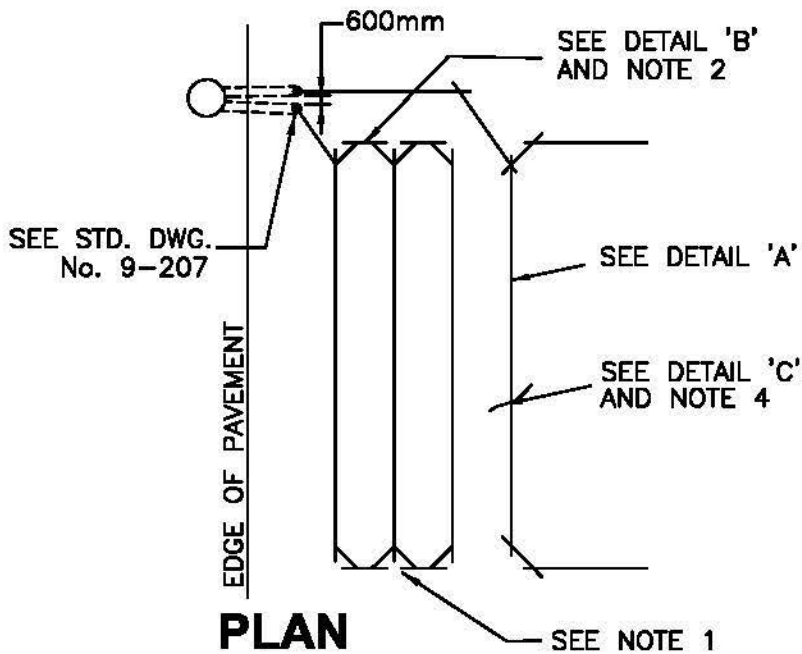
APPROVED BY:

CITY ENGINEER

ENGINEERING

REVISION: **R-3**
YY/MO/DAY
19/01/22

9 - 205



NOTES:

1. LOOP LENGTH, WIDTH & LOCATION OF LOOP & HANDWELL AS SHOWN ON THE CONTRACT DRAWING & AS CONFIRMED IN THE FIELD BY THE ENGINEER.
2. OVERSHOOT SAWCUT ON CORNERS AS REQUIRED TO OBTAIN FULL SLOT DEPTH.
3. LEAD IN WIRES TO BE TWISTED 9 TURNS PER METRE.
4. SLOTS CUT ACROSS TRENCHES, UNEVEN PAVEMENT OR PAVEMENT CRACKS TO BE TREATED IN ACCORDANCE WITH DETAIL 'C'.

CITY OF GUELPH STANDARD DRAWING

TYPICAL QUADRUPLE LOOP

DATE: 02/06/05

APPROVED BY:

CITY ENGINEER

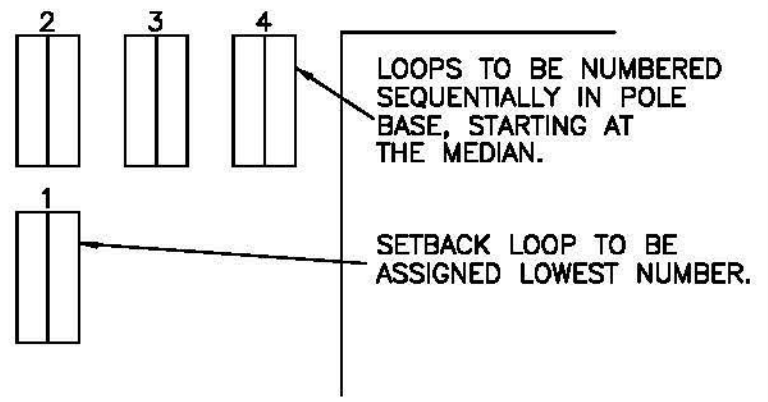
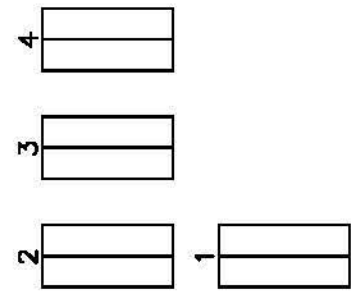
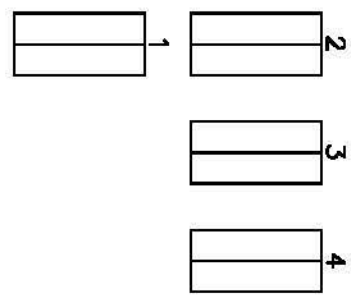
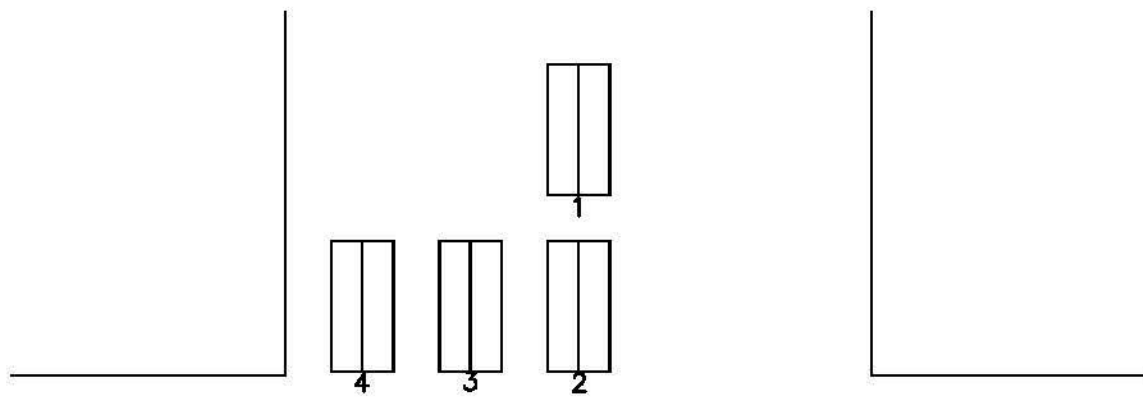
REVISION: **R-1**

DATE: 07/11/21



ENGINEERING

9 - 206



NOTES:
 1. PHASING TAPE OR FIELD WIRING TAG ACCEPTABLE.

CITY OF GUELPH STANDARD DRAWING

**LOOP IDENTIFICATION
 DETAIL**

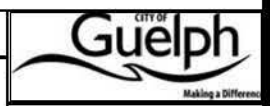
DATE: 08/11/25

APPROVED BY:

CITY ENGINEER

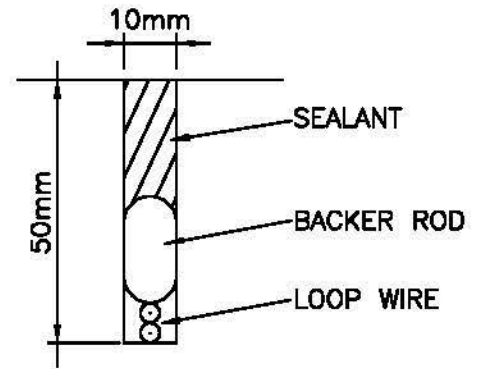
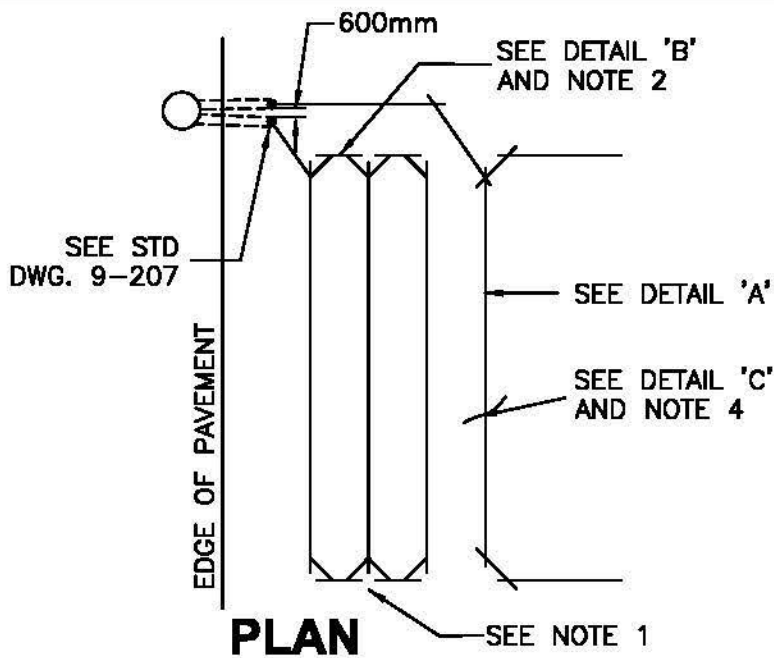
REVISION:

DATE: 11/01/17

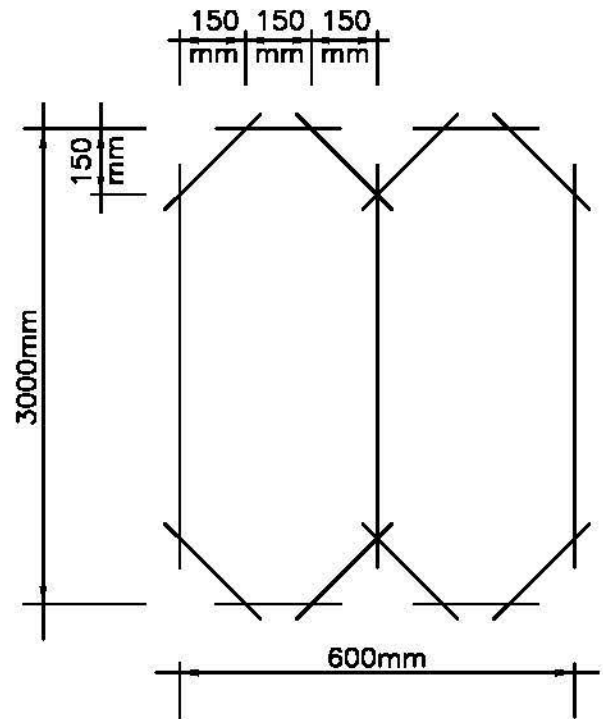
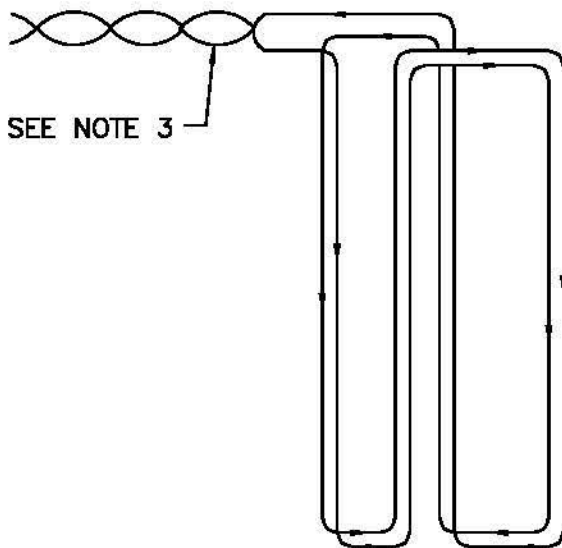


ENGINEERING

9 - 206a



DETAIL 'A'



DETAIL 'B'

METHOD OF WINDING

NOTES:

1. LOOP LENGTH, WIDTH & LOCATION OF LOOP & HANDWELL AS SHOWN ON THE CONTRACT DRAWING & AS CONFIRMED IN THE FIELD BY THE ENGINEER.
2. OVERSHOOT SAWCUT ON CORNERS AS REQUIRED TO OBTAIN FULL SHOT DEPTH.
3. LEAD IN WIRES TO BE TWISTED 9 TURNS PER METRE.
4. SLOTS CUT ACROSS TRENCHES, UNEVEN PAVEMENT CRACKS TO BE TREATED IN ACCORDANCE WITH DETAIL 'C'.

CITY OF GUELPH STANDARD DRAWING

**TYPICAL QUADRUPLE LOOP -
FOR BICYCLES**

DATE: 12/01/19

APPROVED BY:

CITY ENGINEER

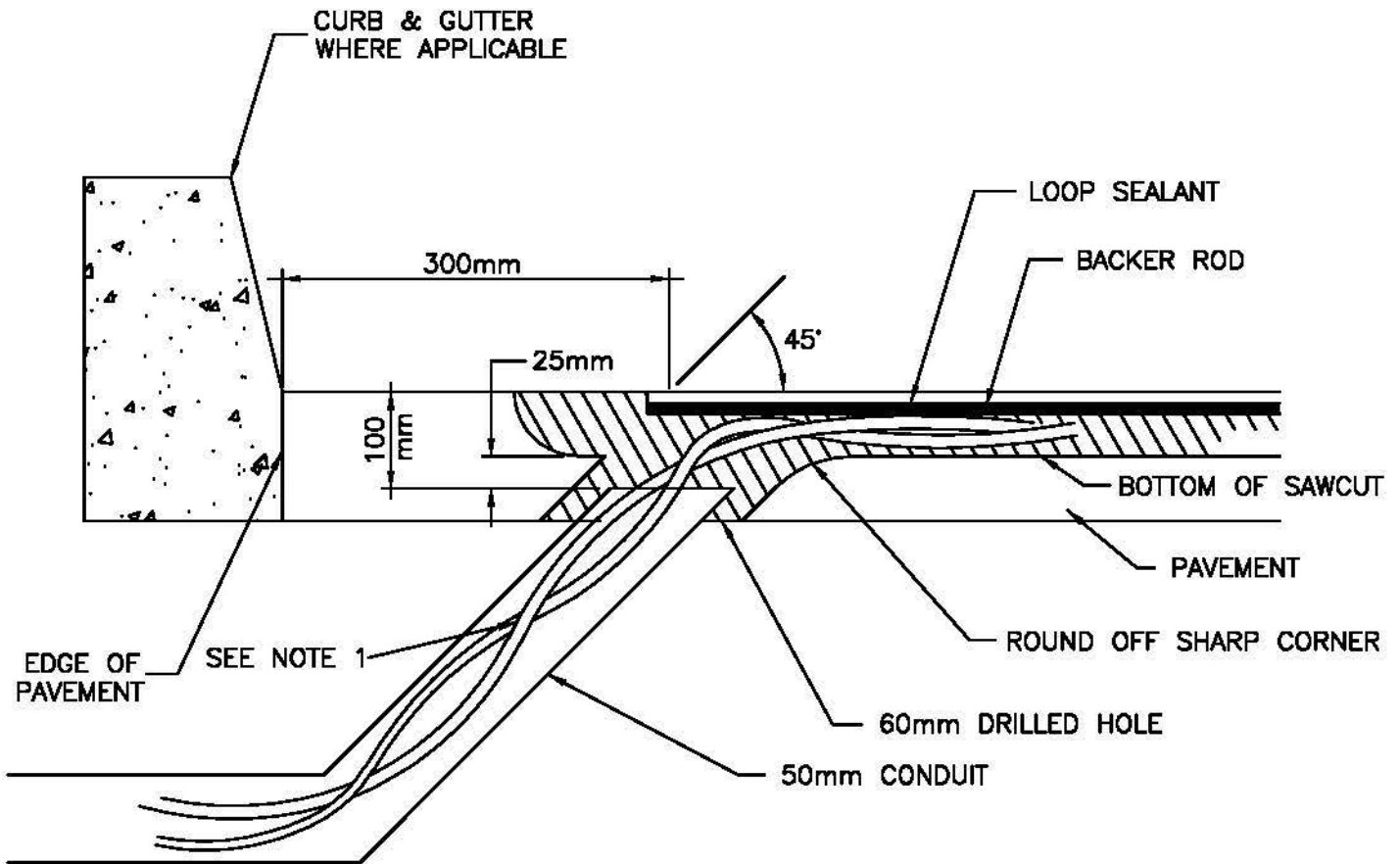
REVISION:

DATE:



ENGINEERING

9 - 206b



NOTES:

1. LEAD IN WIRES TO BE TWISTED 9 TURNS PER METRE.
2. CONDUIT TO BE PLACED MINIMUM 25mm BELOW SAWCUT OR 75mm BELOW ASPHALT SURFACE.

CITY OF GUELPH STANDARD DRAWING

DATE: 02/06/07



APPROVED BY:

CITY ENGINEER

ENGINEERING

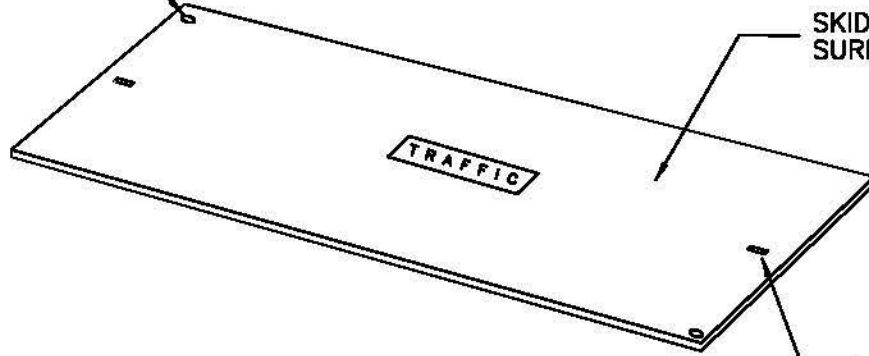
REVISION: **R-2**

DATE: 08/11/25

9 - 207

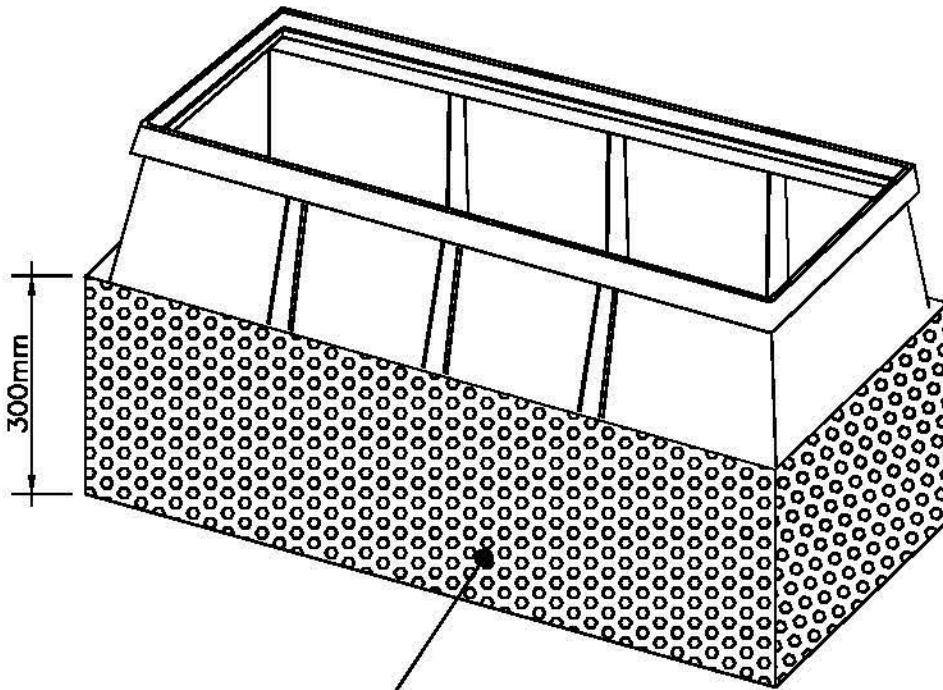
**LOOP LEAD IN
INSTALLATION DETAIL**

(2) 1/2 SS HOLD DOWN BOLTS



SKID RESISTANT SURFACE

SLOT FOR COVER LIFT-OFF



300mm

19mm SIZE CRUSHED STONE

NOTES:

1. 300mm OF 19mm SIZE CRUSHED STONE PLACED UNDER TRAFFIC HANDWELL.
2. HANDWELL SIZES:
 330mm X 610mm (USED FOR INTERCONNECT)
 432mm X 762mm (USED AT INTERSECTIONS, OTHER THAN AT CONTROLLER CORNER)
 610mm X 914mm (USED ONLY AT CONTROLLER CORNER)
3. "TRAFFIC" TEXT MUST APPEAR ON HANDWELL LID.
4. TOP OF HANDWELL TO BE AT FINISHED GRADE.

CITY OF GUELPH STANDARD DRAWING

TRAFFIC HANDWELL

DATE: 02/05/03

APPROVED BY:

CITY ENGINEER

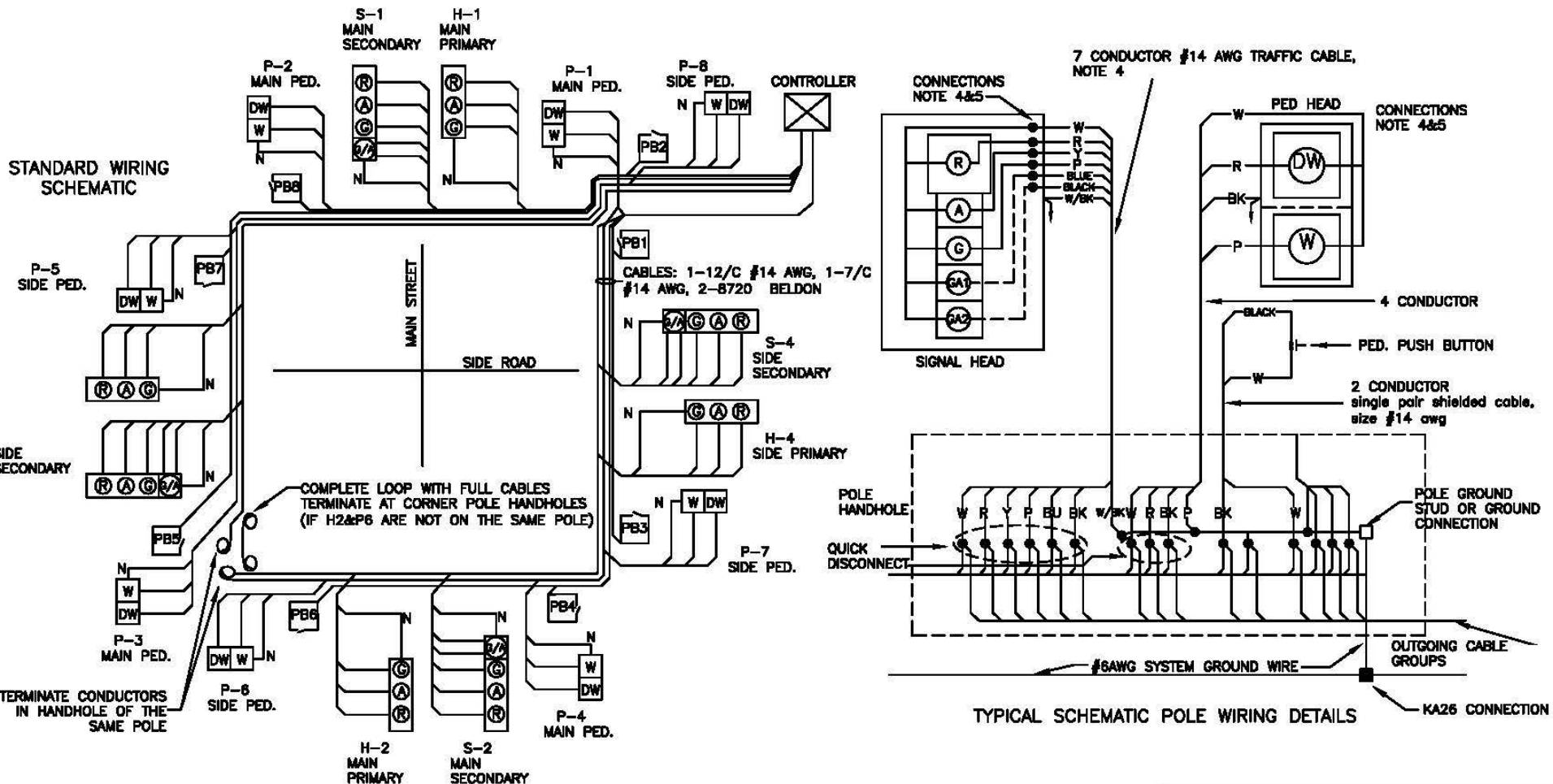
REVISION: **R-3**

DATE: 08/11/25



ENGINEERING

9 - 209



- 12 AND 7 CONDUCTOR, #14AWG SIGNAL CABLE AS PER IMSA STANDARD No. 19-1C-2001 SHALL BE RUN COMPLETELY AROUND THE INTERSECTION AND SHALL BE BROUGHT UP INTO THE HANDHOLE OF EACH POLE. ALL CONNECTIONS TO BE MADE AT ABOVE GROUND ELEVATION AT THE POLE HANDHOLE.
- SIGNAL HEAD AND PUSH BUTTON CONNECTIONS SHALL BE MADE AS SHOWN IN DETAIL.
- WHERE ADDITIONAL FUNCTIONS ARE REQUIRED, ADDITIONAL 7 CONDUCTOR CABLE SHALL BE RUN TO THE POLES CONCERNED.
- ALL SIGNAL HEAD RISER CABLES (FROM THE POLE HANDHOLES) SHALL BE 7 CONDUCTOR CABLE, WITH UNUSED CONDUCTORS TERMINATED WITH INSULATED SPRING TYPE CONNECTORS.
- ALL PEDESTRIAN HEAD RISER CABLES (FROM THE POLE HANDHOLES) SHALL BE 4 CONDUCTOR CABLE, WITH UNUSED CONDUCTORS TERMINATED WITH INSULATED SPRING TYPE CONNECTORS.
- ALL HANDHOLE CONNECTIONS AND TERMINATIONS SHALL BE MADE WITH INSULATED SPRING TYPE CONNECTORS, MARR No.33 OR EQUAL, BUNDLE ALL GROUPS OF CONNECTORS NEATLY IN POLE HANDHOLE. LEAVE 1500mm LOOPS OF EACH CABLE COILED IN THE NEAREST HANDWELL AND 500mm IN EACH POLE.
- ALL CONDUCTORS DESIGNATED AS GROUND SHALL BE GROUNDED AT THE POLE GROUND STUD. A #6 RWU90 (GREEN) SYSTEM GROUND WIRE SHALL BE RUN CONTINUOUSLY THROUGH THE SYSTEM AND CONNECTED TO EACH POLE GROUND STUD AND FIELD GROUND RODS OR GROUND PLATES.
- CONDUCTORS CROSSING THE MAIN STREET FIRST SHALL BE MARKED WITH BLUE PHASING TAPE. CONDUCTORS CROSSING THE SIDE STREET FIRST SHALL BE MARKED WITH RED PHASING TAPE.
- BELDON CABLES SHALL BE MARKED WITH ONE WRAP PHASING TAPE FOR MAIN STREET PUSH BUTTON AND TWO WRAPS PHASING TAPE FOR SIDE STREET PUSH BUTTONS.
- CAMERA/RADAR CABLES SHALL BE MARKED WITH ONE WRAP PHASING TAPE FOR MAIN STREET DETECTOR AND TWO WRAPS PHASING TAPE FOR SIDE STREET DETECTORS.
- Quick connect fittings are to be installed between the power and LED connections in all new pedestrian head installations
- All wire joints in traffic signal heads are to be made in the amber LED section of the head

CITY OF GUELPH STANDARD DRAWING

STANDARD TYPICAL TRAFFIC SIGNAL WIRING DETAILS

DATE: Y/Y/M/D DAY
04/03/11

APPROVED BY:

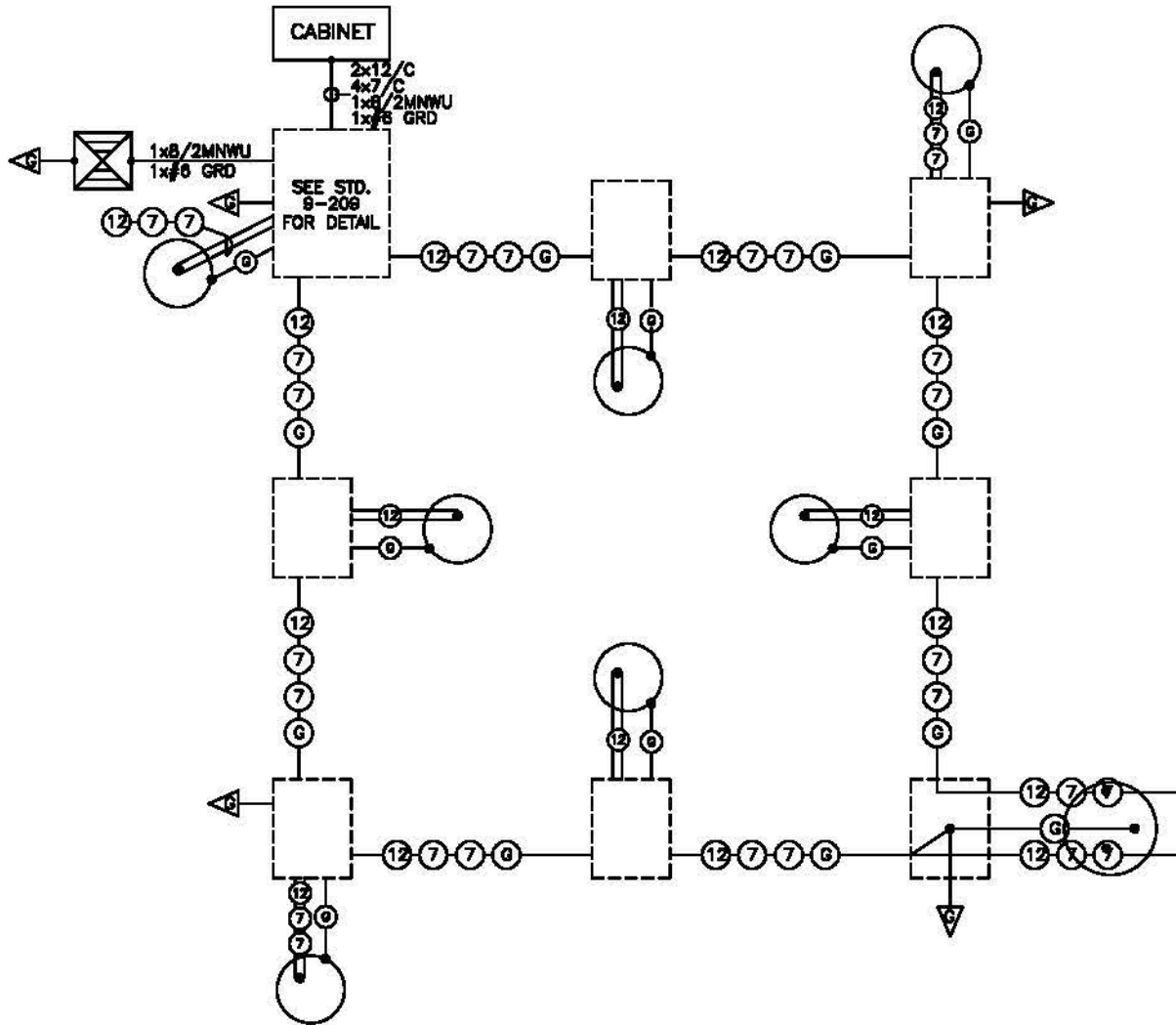
REVISION: **R-6**

DATE: Y/Y/M/D DAY
19/12/20

CITY OF Guelph
Making a Difference

ENGINEERING

9 - 210



NOTES:

1. AT POWER SOURCE IF USING GROUND PLATE - ONLY ONE GROUND PLATE IS REQUIRED
2. AT POWER SOURCE IF USING GROUND RODS - TWO GROUND RODS REQUIRED WITH 3m SEPARATION.
3. REFER TO CONTRACT DRAWING(S) FOR WIRING INFORMATION FOR COMMUNICATION, DETECTION, PRE-EMPTION AND STREET LIGHTING.
4. BLUE CABLE GROUP CROSSES MAIN STREET (PHASE 2 OR 6) FIRST.
5. RED CABLE GROUP CROSSES SIDE STREET (PHASE 4 OR 8) FIRST.
6. ONE WRAP FOR PEDESTRIAN HEAD CABLE, TWO WRAPS FOR PUSH BUTTON CABLE.

LEGEND

- CABLE CONNECTION
- HANDWELL
- ⊗ POWER SOURCE
- ⊙ GROUND WIRE
- ⊕ 12 CONDUCTOR CABLE
- ⊖ 7 CONDUCTOR CABLE
- ⊔ GROUND ELECTRODE

CITY OF GUELPH STANDARD DRAWING

**STANDARD TYPICAL TRAFFIC CONTROL
SIGNAL SCHEMATIC WIRING DIAGRAM**

DATE: YY/MO/DAY
04/03/11

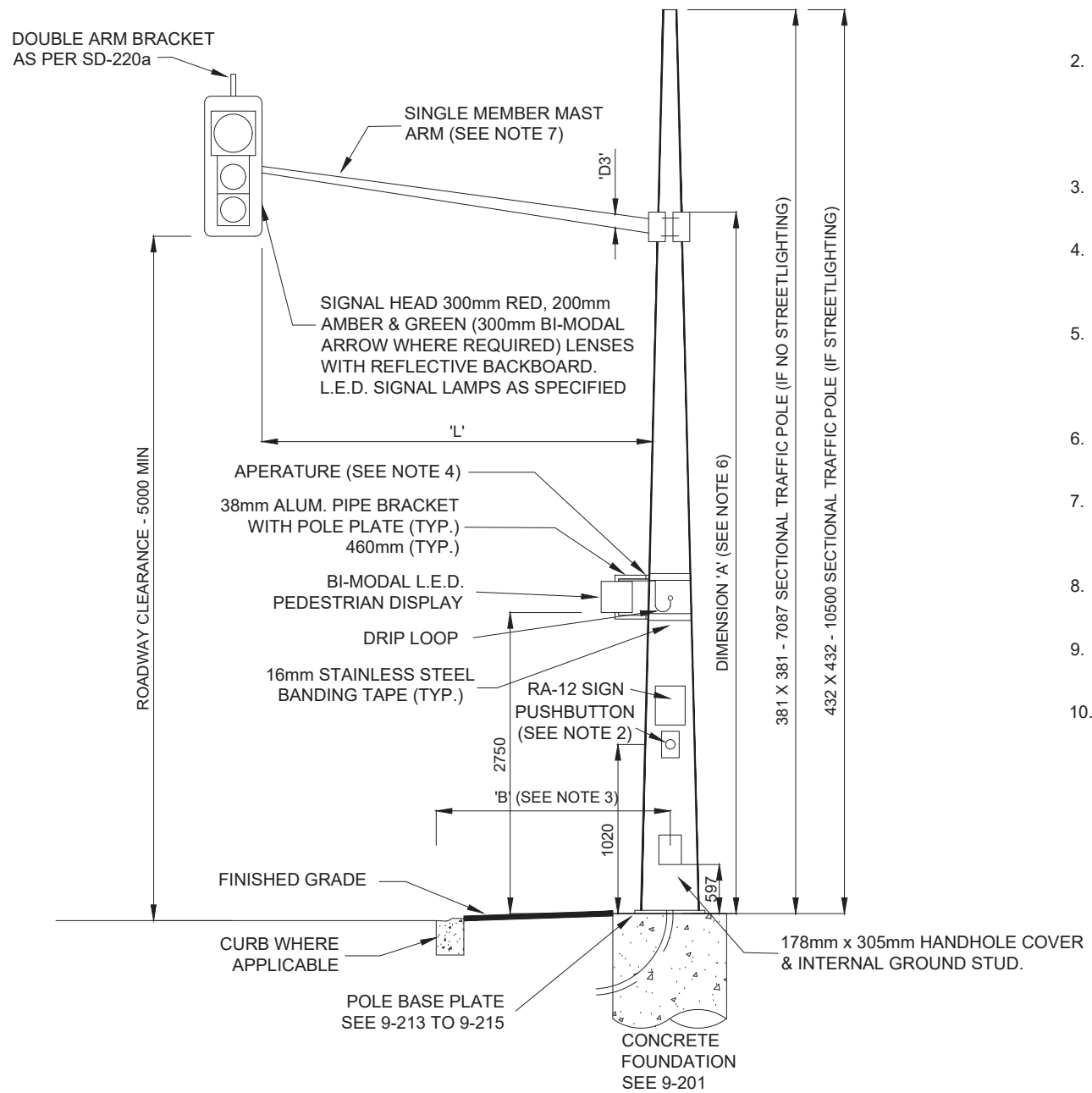
APPROVED BY:

REVISION: **R-2**
DATE: YY/MO/DAY
13/01/25




ENGINEERING

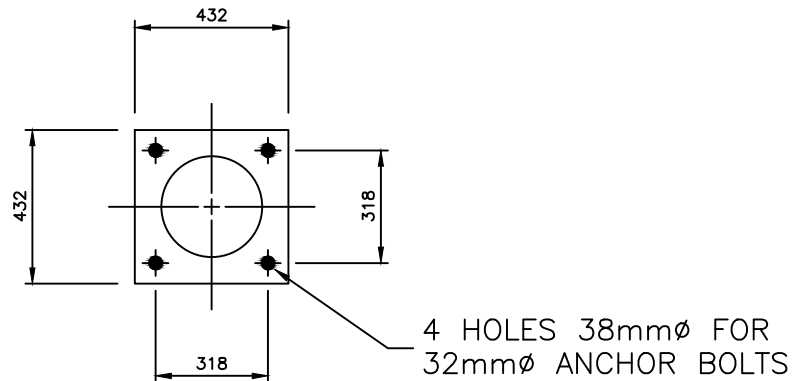
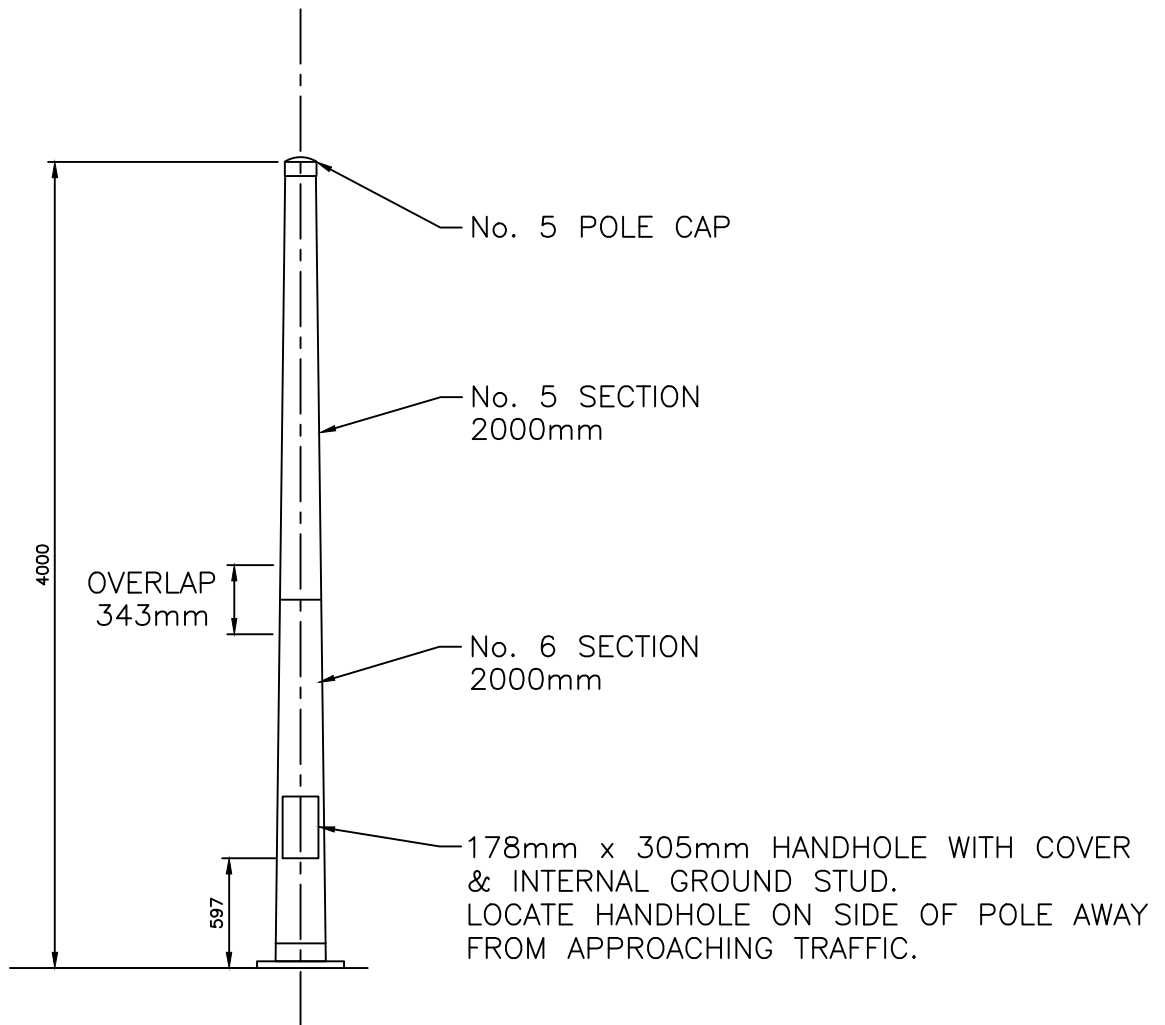
9 - 211



NOTE: All dimensions in millimetres

1. CONNECT #6 RWU90 (GREEN) GROUND WIRE BETWEEN THE POLE GROUND STUD AND THE SYSTEM GROUND IN THE NEAREST HANDWELL.
2. PUSHBUTTONS SHALL BE INSTALLED WITH 2 - #12 STAINLESS STEEL SELF TAPPING SCREWS. PUSHBUTTON ORIENTATION SHALL BE DETERMINED IN THE FIELD (TO BE ALIGNED WITH CORRESPONDING CROSSWALK).
3. DIMENSION 'B' SHALL BE SET AS INDICATED ON THE LAYOUT PLANS.
4. ALL APERTURES TO BE FIELD DRILLED, DE-BURRED TREATED ZINC PAINT, AND FITTED WITH RUBBER GROMMETS.
5. SIGNAL HEAD ORIENTATION AND AIMING SHALL BE SHOWN ON THE LAYOUT PLANS, AIMING SHALL BE ADJUSTED TO SUIT LOCAL CONDITIONS AS APPROVED BY THE PROJECT MANAGER.
6. DIMENSION 'A' VARIES WITH ARM LENGTH, IT SHALL BE SET TO GIVE PROPER ROADWAY CLEARANCE.
7. SINGLE MEMBER MAST ARMS SHALL BE GALVANIZED STEEL COMPLETE WITH WELDED POLE FACE PLATES AND ADJUSTABLE BACK PLATES.
- 8.
9. "PEDESTRIAN CROSSING INSTRUCTION" SIGN REQUIRED ON EACH CORNER. LOCATIONS TO BE DETERMINED IN THE FIELD.
10. PEDESTRIAN HEAD WIRING MUST ENTER THE HEAD THROUGH THE TOP POLE ARM, AND WIRING CONNECTIONS ARE TO BE MADE IN THE LOWER SECTION OF THE PEDESTRIAN HEAD.

CITY OF GUELPH STANDARD DRAWING	
STANDARD TYPICAL TRAFFIC SIGNAL EQUIPMENT MOUNTING DETAIL	
DATE:	YY/MO/DAY 04/03/11
APPROVED BY:	 ENGINEERING
REVISION:	
	YY/MO/DAY 19/12/12
9 - 212	



BASE DETAIL

CITY OF GUELPH STANDARD DRAWING

DATE: YY/ MO/ DAY
04/03/11



**TYPICAL TRAFFIC SIGNAL POLE (0.4m)
STEEL SECTIONAL -
USED FOR MOUNTING PEDESTRIAN HEADS**

APPROVED BY:

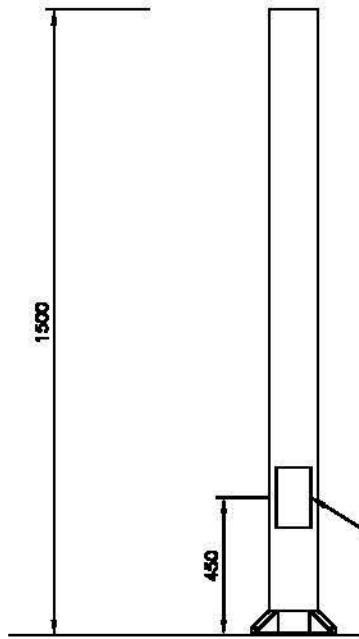
ENGINEERING

REVISION: **R-3**

DATE: YY/ MO/ DAY
19/12/12

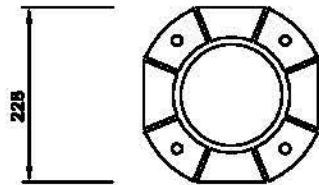
9 - 213

CLOSED TOP



65mm x 127mm HANDHOLE WITH COVER
& INTERNAL GROUND STUD.
LOCATE HANDHOLE ON SIDE OF POLE
OPPOSITE OF ANY PUSHBUTTON.

190mm ϕ BOLT



ALUMINUM BASE CASTING

CITY OF GUELPH STANDARD DRAWING

DATE: Y/Y/MQ/ DAY
13/12/09



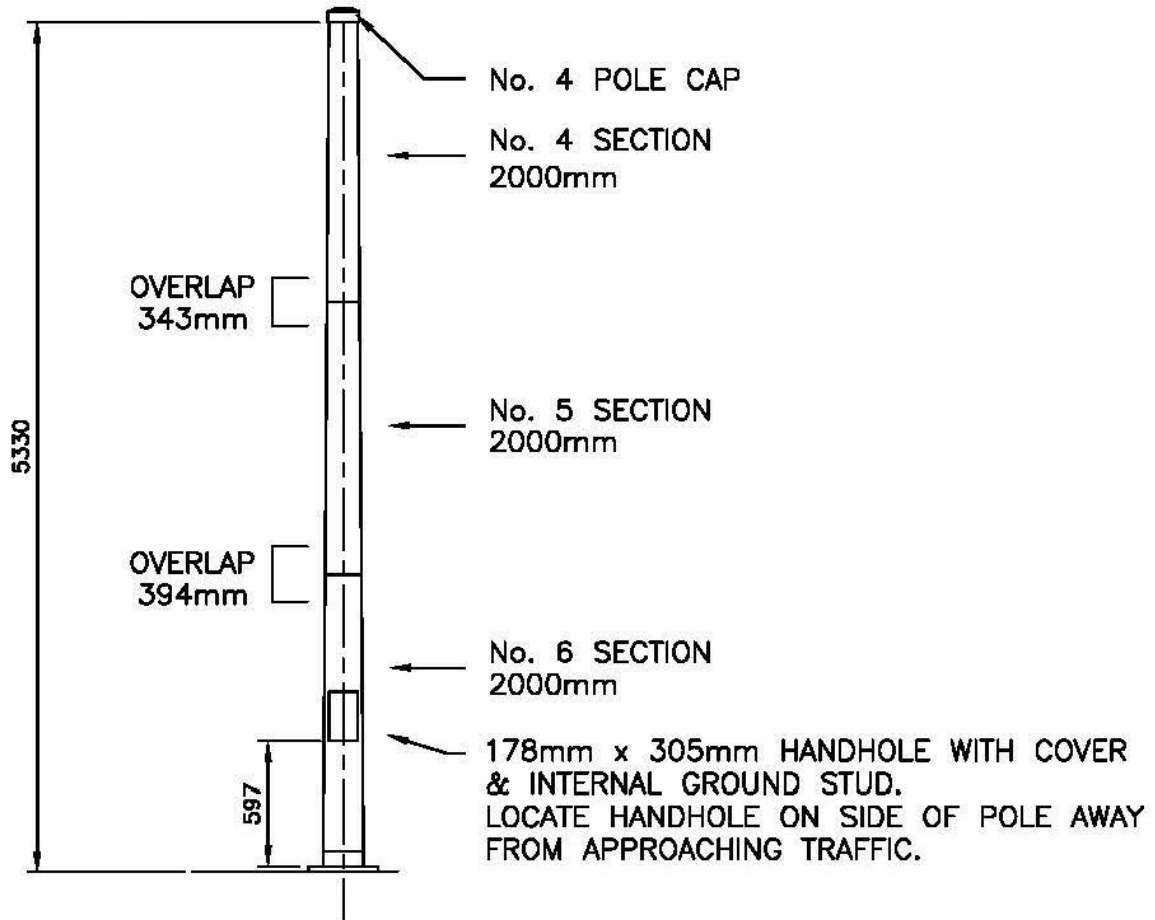
APPROVED BY:

ENGINEERING

**ALUMINUM POLE FOR
PEDESTRIAN PUSH BUTTONS**

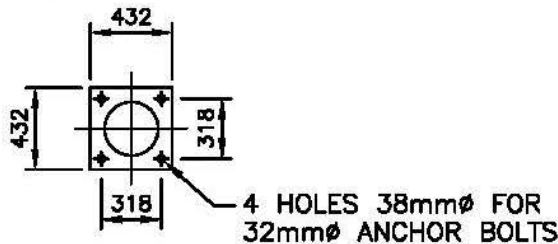
REVISION: _____
DATE: Y/Y/MQ/ DAY

9 - 213a



NOTE: EACH OVERLAP TO BE PINNED.

BASE DETAIL



CITY OF GUELPH STANDARD DRAWING

**TYPICAL TRAFFIC SIGNAL POLE (5.3m)
STEEL SECTIONAL**

DATE: YY/MO/DAY
13/01/16

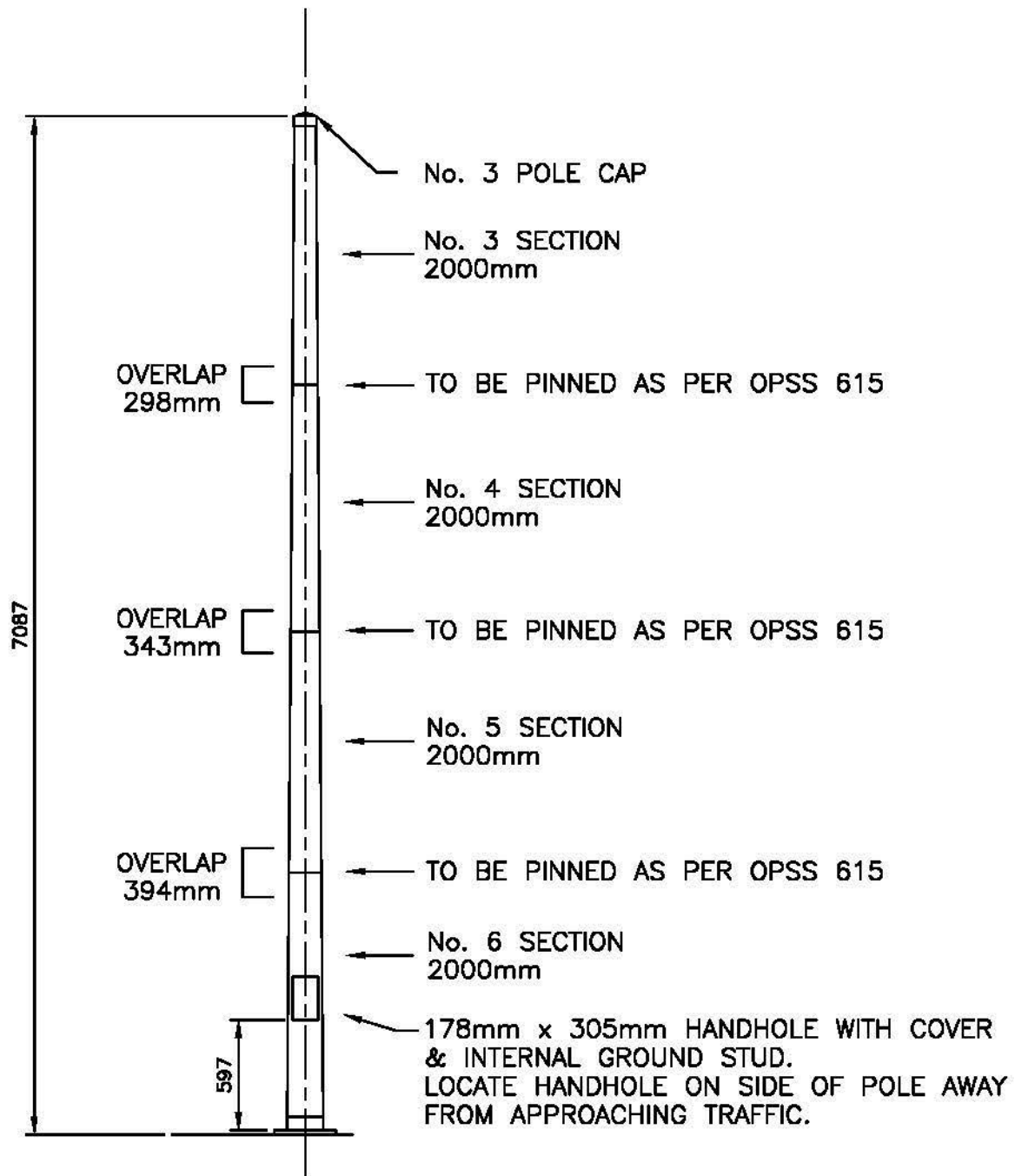
APPROVED BY:

REVISION: **R-1**
DATE: YY/MO/DAY
17/04/10

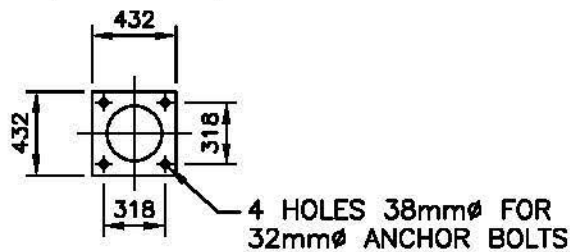


ENGINEERING

9 - 213b



BASE DETAIL



CITY OF GUELPH STANDARD DRAWING

DATE: Y/Y/MQ/DAY
04/03/11



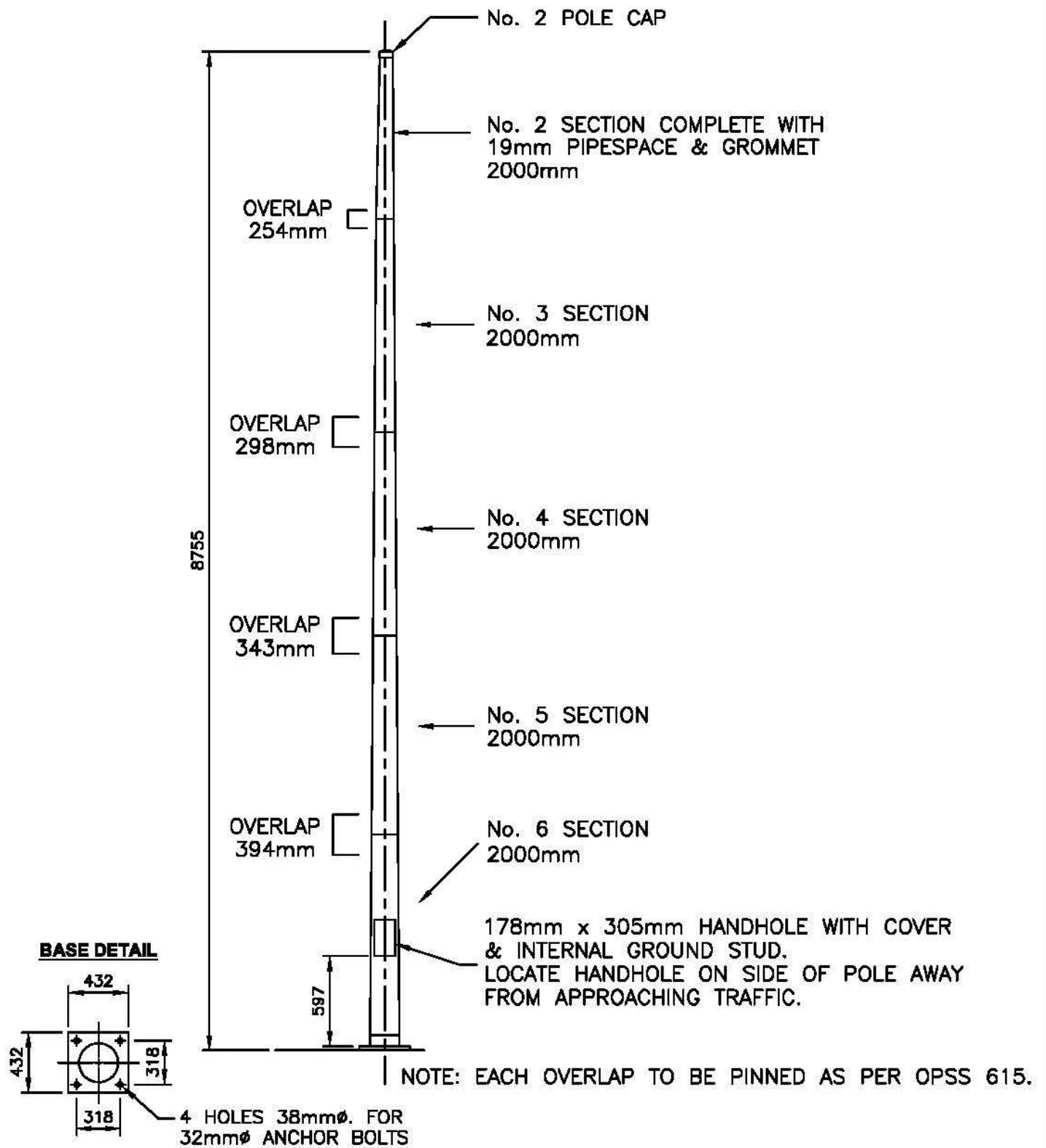
**TYPICAL TRAFFIC SIGNAL POLE (7.01m)
SS25R712B STEEL SECTIONAL**

APPROVED BY:

ENGINEERING

REVISION: **R-2**
Y/Y/MQ/DAY
DATE: 17/04/10

9 - 214



CITY OF GUELPH STANDARD DRAWING

DATE: YY/MO/DAY
14/10/23



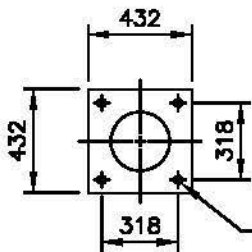
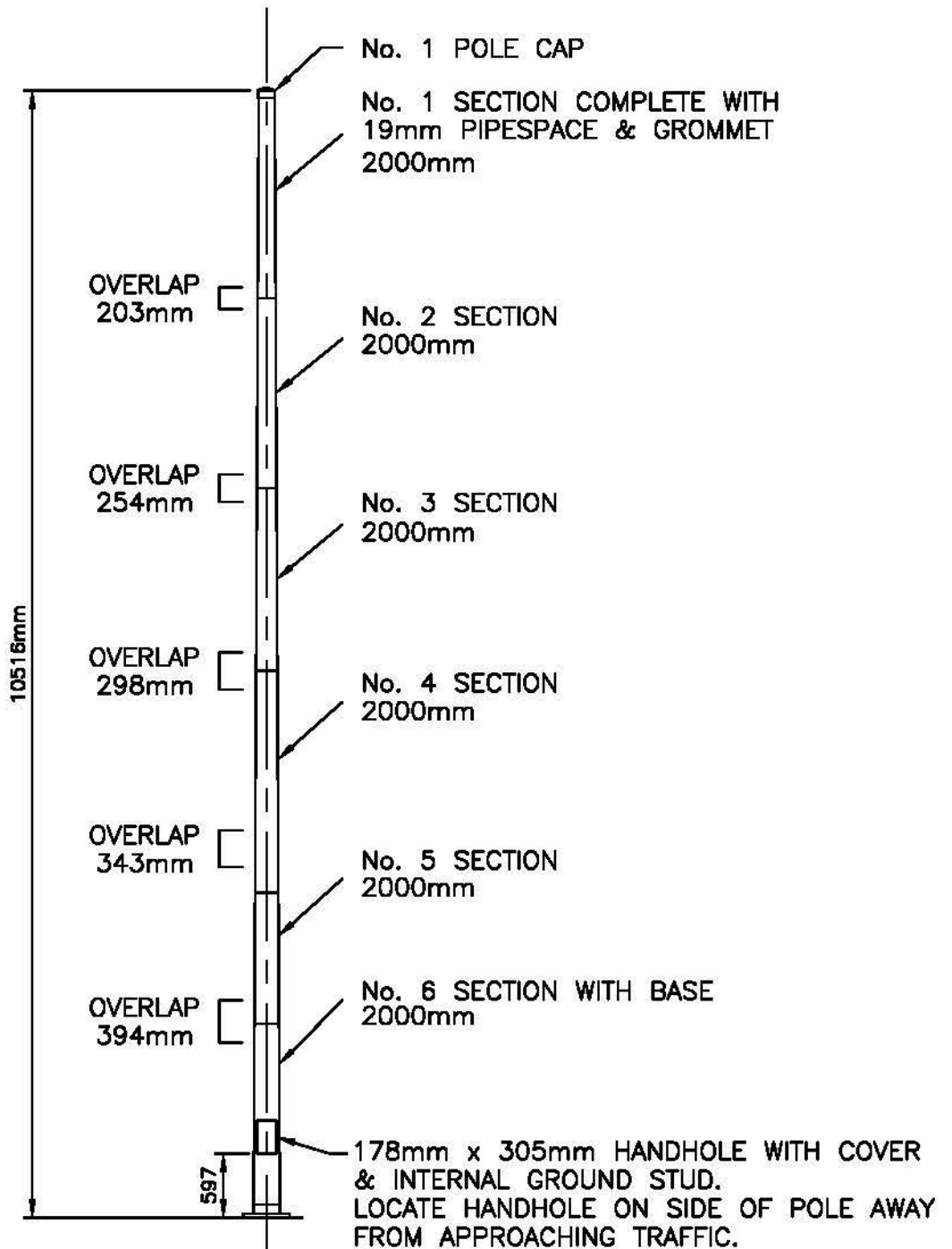
**TYPICAL TRAFFIC SIGNAL POLE (8.75m)
STEEL SECTIONAL**

APPROVED BY:

ENGINEERING

REVISION: **R-1**
DATE: YY/MO/DAY
17/04/10

9 - 214a



4 HOLES 38mm ϕ FOR
32mm ϕ ANCHOR BOLTS

BASE DETAIL

NOTE: EACH OVERLAP TO BE PINNED AS PER OPSS 615.

CITY OF GUELPH STANDARD DRAWING

**TYPICAL TRAFFIC SIGNAL POLE (10.5m)
STEEL SECTIONAL**

DATE: YY/MO/DAY
04/03/11

APPROVED BY:

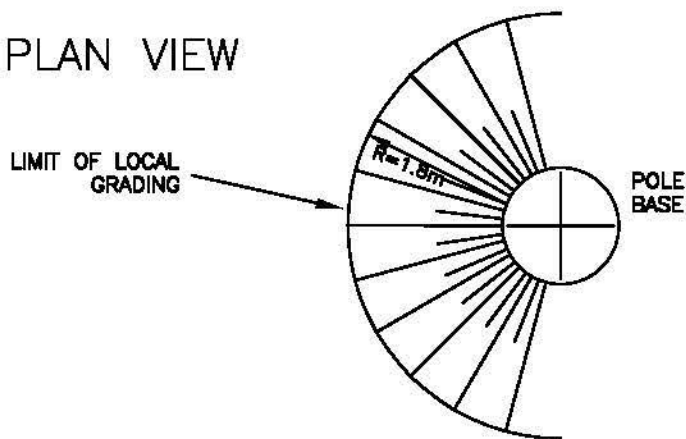
REVISION: **R-2**
DATE: YY/MO/DAY
12/01/18



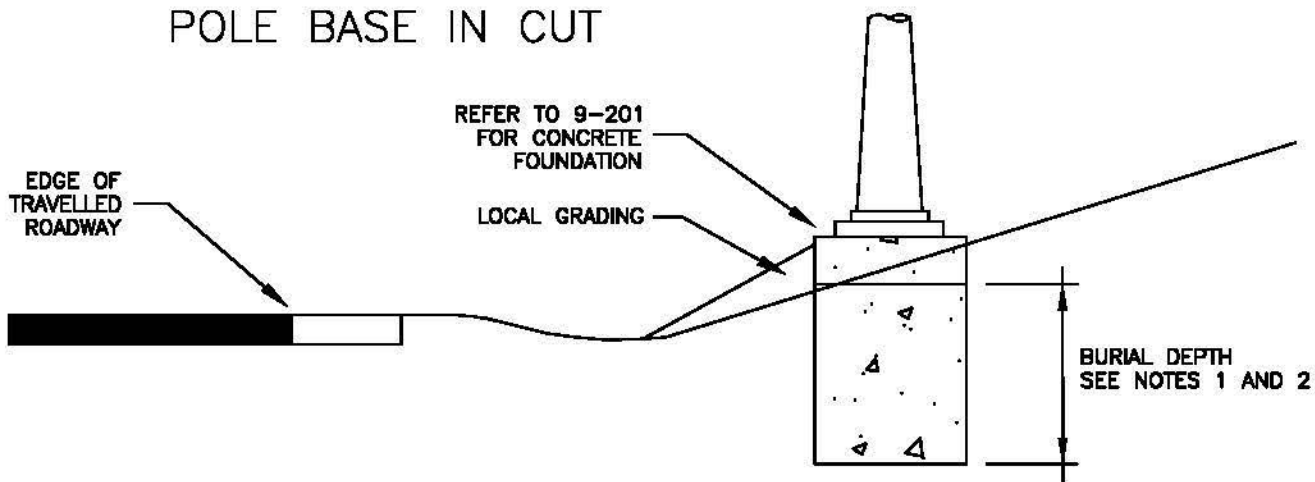
ENGINEERING

9 - 215

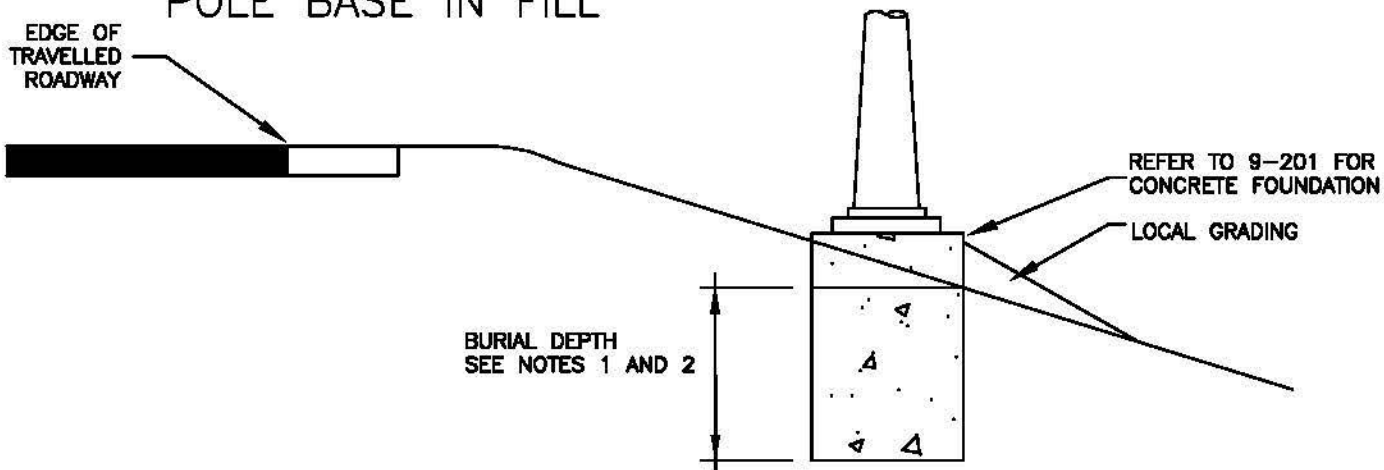
PLAN VIEW



POLE BASE IN CUT



POLE BASE IN FILL



NOTES:

1. BURIAL DEPTH SHALL BE MEASURED FROM THE LOWEST GRADE ELEVATION AT CONCRETE POLE BASE.
2. FOR BURIAL DEPTH SEE APPROPRIATE STANDARD.
3. NOT TO SCALE

CITY OF GUELPH STANDARD DRAWING

**TYPICAL BASE MOUNTED POLE
PLACED IN SLOPES**

DATE: YY/MO/DAY
06/03/11

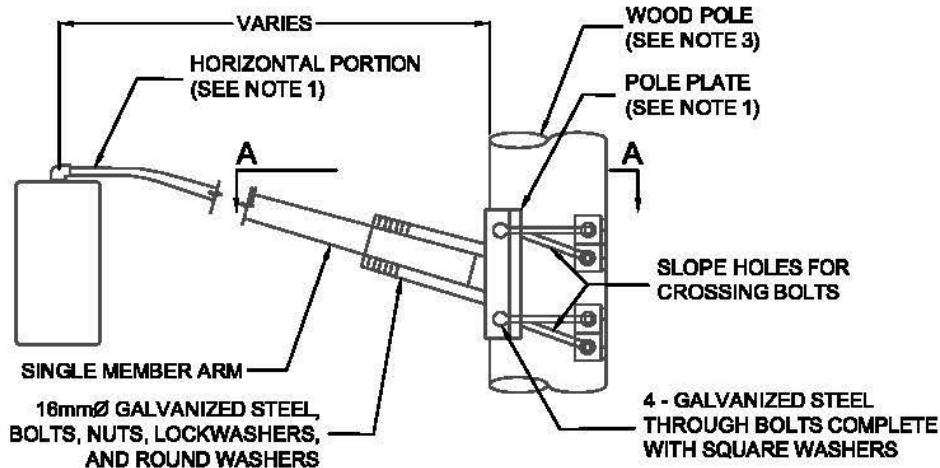
APPROVED BY:

REVISION: **R-2**
DATE: YY/MO/DAY
07/11/21

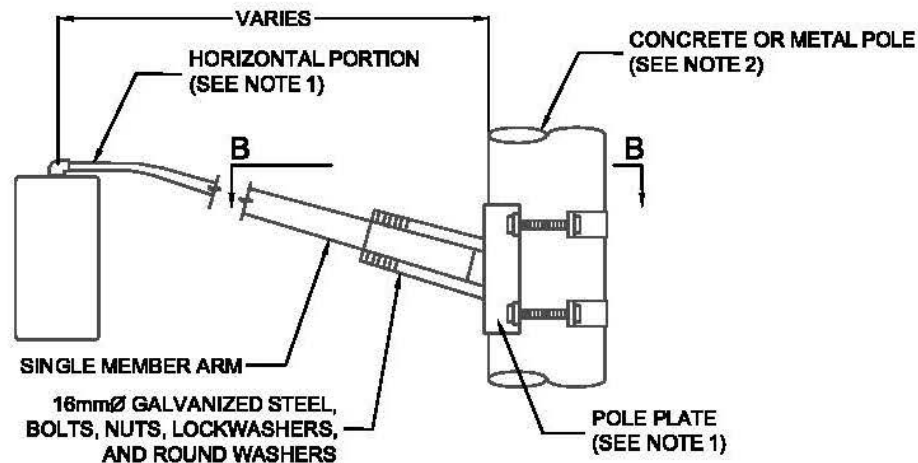


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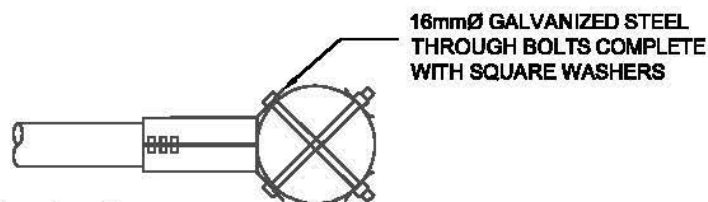
9 - 216



GENERAL ARRANGEMENT

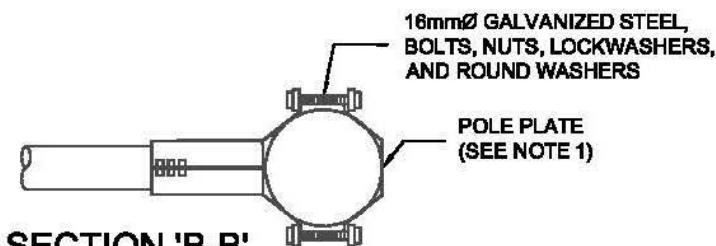


GENERAL ARRANGEMENT



SECTION 'A-A'

**ATTACHMENT "TYPE 2"
THROUGH BOLTS
(SEE NOTE 3)**



SECTION 'B-B'

**ATTACHMENT "TYPE 1"
'U' CLAMPS
(SEE NOTE 2)**

NOTES:

1. POLE PLATE BOLTS TO BE ADJUSTED SO THAT HORIZONTAL PORTION OF ARM IS LEVEL.
2. ATTACHMENT "TYPE 1" SHALL BE USED FOR ALL CONCRETE AND METAL POLES.
3. ATTACHMENT "TYPE 2" SHALL BE USED FOR ALL WOOD POLES.
4. FOR BRACKETS OF 1.2m TO 5.5m LENGTH USING "TYPE 2" ATTACHMENT, USE 18Ømm THROUGH BOLTS WITH 50mm x 50mm SQUARE WASHERS.
5. FOR BRACKETS 6.1m AND 6.7m LENGTH USING "TYPE 2" ATTACHMENT, USE 20Ømm THROUGH BOLTS WITH 75mm x 75mm SQUARE WASHERS.
6. METAL REINFORCEMENT AT THE BOTTOM OF THE POLE PLATE REQUIRED IF SPECIFIED BY THE COMMISSIONER.
7. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.

CITY OF GUELPH STANDARD DRAWING		
ALUMINUM SINGLE MEMBER TRAFFIC SIGNAL MAST ARM ATTACHMENT DETAILS		
DATE:	YY/MO/DA 06/02/01	 Guelph <small>Making a Difference</small>
APPROVED BY:		
REVISION:	R-	ENGINEERING
DATE:	YY/MO/DA 06/02/01	9 - 217

BRACKET FOR ROUND OR OCTAGONAL POLE MOUNTING, STEEL OR CONCRETE

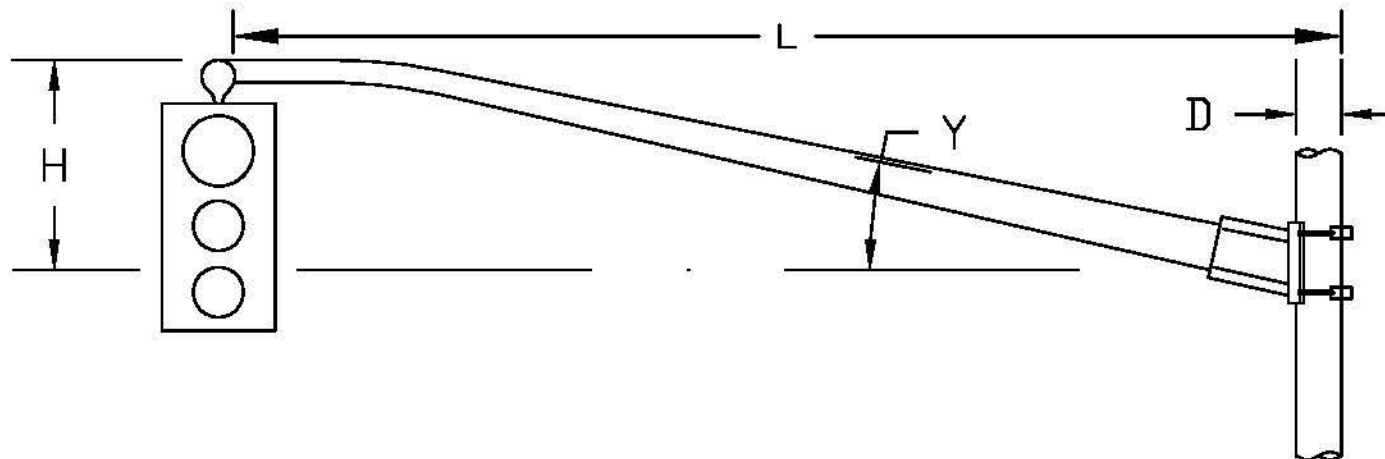
ARM LENGTH 'L'		RISE 'H'	ARM SIZE	ANGLE 'Y'	TENDON	DIMENSION 'D' FOR ROUND OR OCTAGONAL, STEEL OR CONCRETE POLE				
METERS	FEET	mm	mm	DEGREES	mm	102mm - 125mm	126mm - 151mm	152mm - 176mm	177mm - 203mm	204mm - 254mm
1.2	4	539.4	102 x 60	25	INCL.	TR 4 SMA-45	TR 4 SMA-56	TR 4 SMA-67	TR 4 SMA-78	TR 4 SMA-81
1.8	6	609.6	102 x 60	25	INCL.	TR 6 SMA-45	TR 6 SMA-56	TR 6 SMA-67	TR 6 SMA-78	TR 6 SMA-81
2.4	8	838.2	102 x 60	25	INCL.	TR 8 SMA-45	TR 8 SMA-56	TR 8 SMA-67	TR 8 SMA-78	TR 8 SMA-81
3.0	10	609.6	127 x 60	15	INCL.	--	TR 10 SMA-56	TR 10 SMA-67	TR 10 SMA-78	TR 10 SMA-81
3.7	12	838.2	127 x 60	15	INCL.	--	TR 12 SMA-56	TR 12 SMA-67	TR 12 SMA-78	TR 12 SMA-81
4.6	15	1066.8	127 x 60	15	INCL.	--	TR 15 SMA-56	TR 15 SMA-67	TR 15 SMA-78	TR 15 SMA-81
5.5	18	914.4	152 x 76	10	60 x 102	--	--	TR 18 SMA-67	TR 18 SMA-78	TR 18 SMA-81
6.1	20	1066.8	152 x 76	10	60 x 102	--	--	TR 20 SMA-67	TR 20 SMA-78	TR 20 SMA-81

BRACKET FOR WOOD POLE MOUNTING

DIM 'L'	POLE DIAMETER		DIM 'H'	WALL THICKNESS (mm)		ATTACHMENT FITTINGS #
	203mm - 254mm	254mm - 356mm				
1.2	203mm - 254mm	254mm - 356mm	533.4	3.175		A
1.8	203mm - 254mm	254mm - 356mm	609.6	3.175	25 101.6-60.3 dia.	A
2.4	203mm - 254mm	254mm - 356mm	838.2	3.175	25 101.6-60.3 dia.	A
3.0	203mm - 254mm	254mm - 356mm	609.6	3.175	15 127.0-60.3 dia.	A
3.7	203mm - 254mm	254mm - 356mm	838.2	3.175	15 127.0-60.3 dia.	A
4.6	203mm - 254mm	254mm - 356mm	1066.8	4.775	15 127.0-60.3 dia.	A
5.5	--	254mm - 356mm	914.4	4.775	10 152.4-60.3 dia.	B
6.1	--	254mm - 356mm	1066.8	4.775	10 152.4-60.3 dia.	B

■ ATTACHMENT FITTINGS NOT INCLUDED.

- A. CONTRACTOR TO SUPPLY 4- $\frac{3}{8}$ "(15.88mm) DIA. THROUGH BOLTS OR 1 THROUGH BOLT & 4- $\frac{3}{8}$ "(15.88mm) DIA. LAG SCREW.
- B. CONTRACTOR TO SUPPLY 4- $\frac{3}{4}$ "(19.05mm) DIA. THROUGH BOLTS.



CITY OF GUELPH STANDARD DRAWING

ALUMINUM SINGLE MEMBER TRAFFIC SIGNAL MAST ARM MOUNTING DETAILS

DATE: YY/MO/DAY
07/10/05

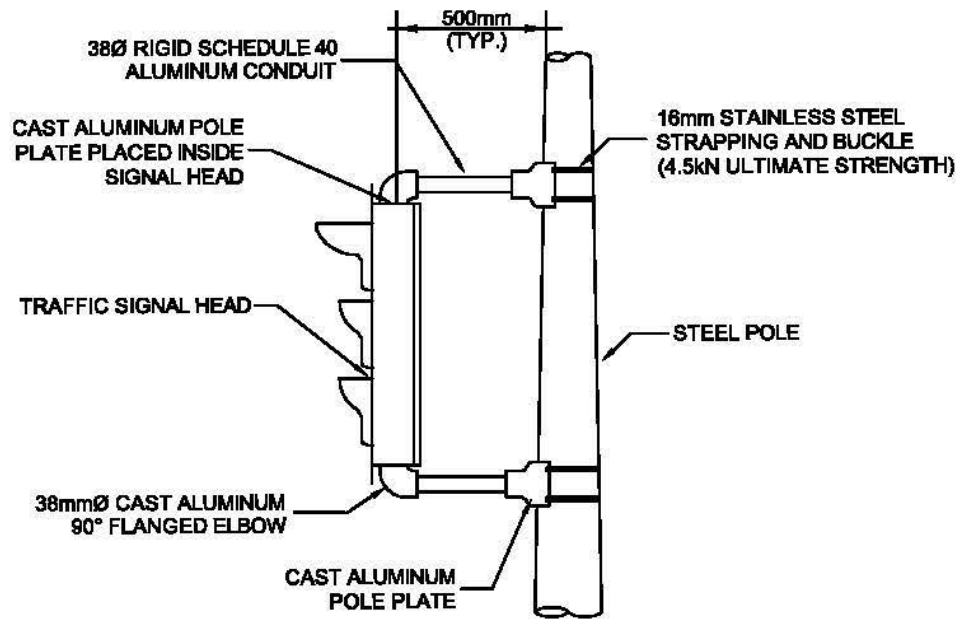
APPROVED BY:



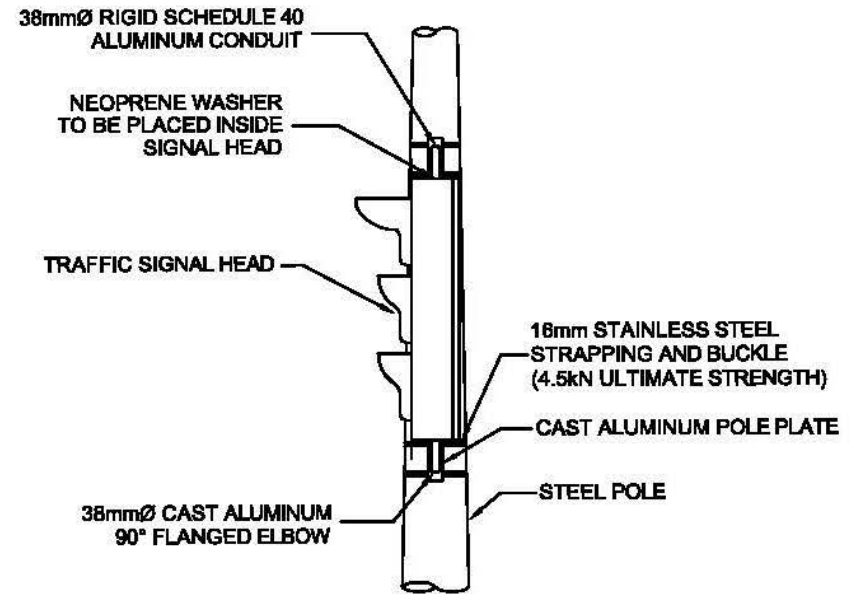
ENGINEERING

REVISION: R-
DATE: YY/MO/DAY

9 - 217a



TYPICAL TRAFFIC SIGNAL HEAD
(FRONT MOUNTING)
DETAIL "A"



TYPICAL TRAFFIC SIGNAL HEAD
(SIDE MOUNTING)
DETAIL "B"

NOTES:

1. ALL DIMENSIONS ARE EXPRESSED IN mm UNLESS OTHERWISE NOTED.
2. ALL TRAFFIC SIGNAL HEADS ARE TO BE MOUNTED A MINIMUM OF 5.0m ABOVE THE PAVEMENT. WHEN SPECIAL HEADS ARE SPECIFIED AND THE MINIMUM HEIGHT CANNOT BE OBTAINED, THE HEADS ARE TO BE MOUNTED AT THE MAXIMUM HEIGHT POSSIBLE.
3. THE FRONT AND SIDE MOUNTING DETAILS ALSO APPLY TO FOUR (4) SECTION HEADS.
N.T.S.

CITY OF GUELPH STANDARD DRAWING

**TRAFFIC SIGNAL
HEAD VERTICAL
BRACKET MOUNTING
DETAIL**

DATE: YY/MO/DAY
06/02/01

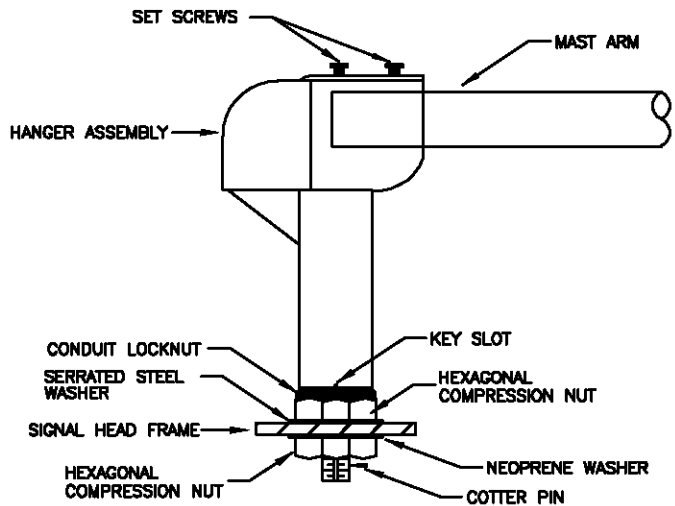
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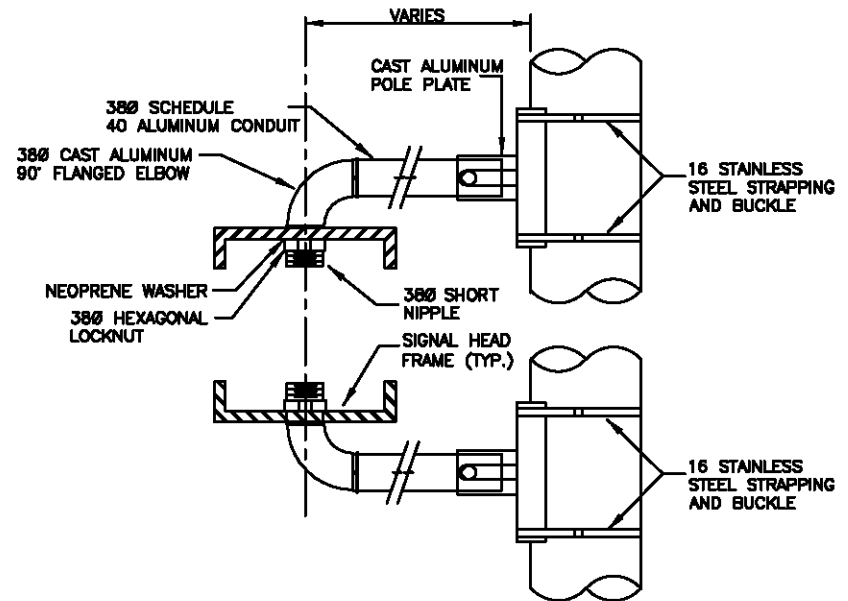
ENGINEERING

REVISION: **R-2**
YY/MO/DAY
DATE: 07/11/22

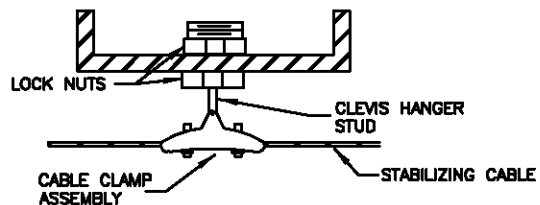
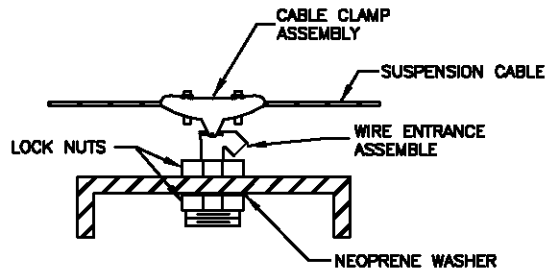
9 - 218



HANGER DETAIL




**DOUBLE ARM BRACKET DETAIL
(VERTICAL BRACKET)**

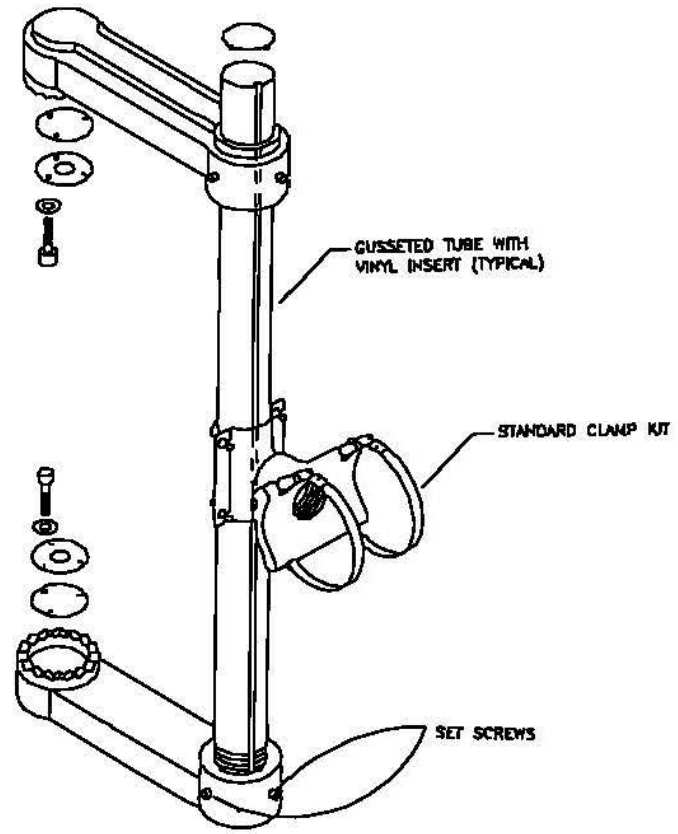


CABLE MOUNTING DETAIL

NOTES:
1. ALL DIMENSIONS EXPRESSED IN mm UNLESS OTHERWISE NOTED.

N.T.S.

CITY OF GUELPH STANDARD DRAWING		 ENGINEERING
TYPICAL TRAFFIC SIGNAL HEAD MOUNTING DETAIL		
DATE:	04/03/11	9 - 219
APPROVED BY:		
REVISION:	R-2	
DATE:	07/12/05	



**DOUBLE ARM BRACKET DETAIL
(MAST ARM BRACKET)**

- NOTES:**
 1. ALL DIMENSIONS EXPRESSED IN mm UNLESS OTHERWISE NOTED.
 2. VERSA BRACKETS TO BE INSTALLED AS CLOSE TO CENTER POINT OF BRACKET AS POSSIBLE.

N.T.S.

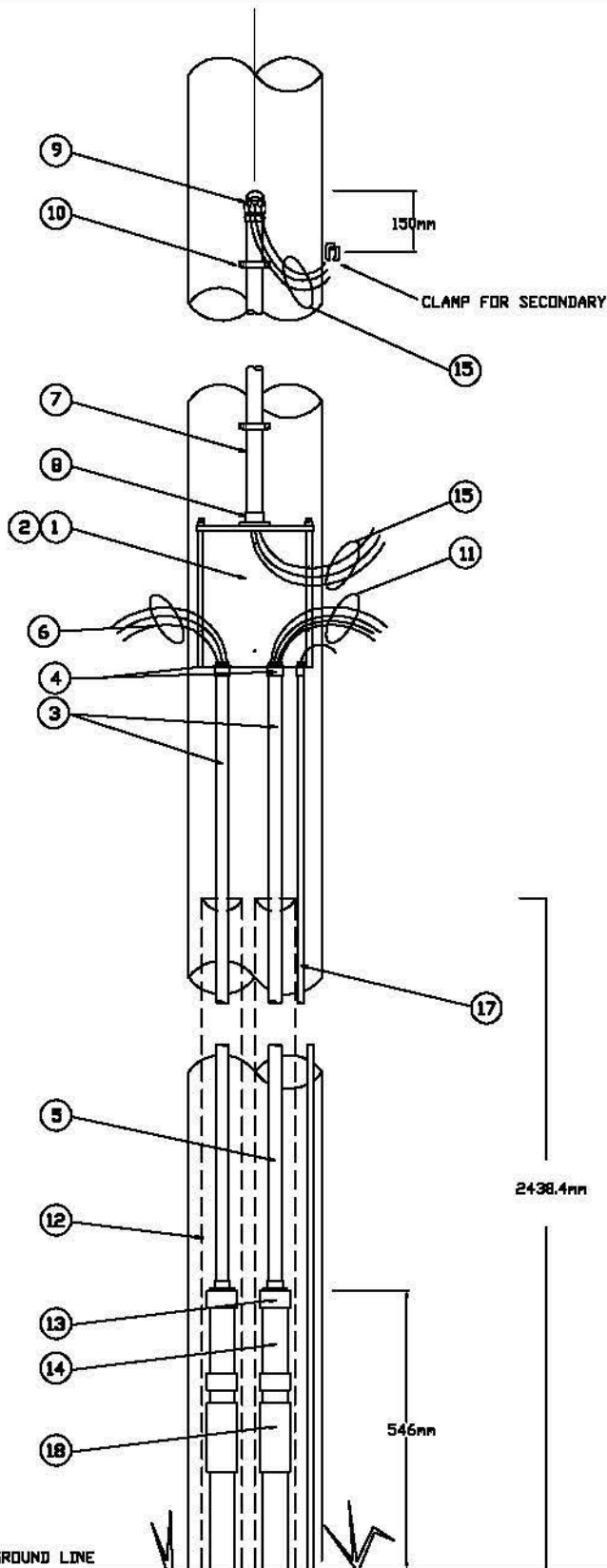
CITY OF GUELPH STANDARD DRAWING	
TYPICAL TRAFFIC SIGNAL HEAD MOUNTING DETAIL	
DATE:	YY/MO/DAY 11/01/07
APPROVED BY:	
ENGINEERING	
REVISION:	
DATE:	YY/MO/DAY 17/10/17
9 - 220a	

MATERIAL LISTING

ITEM	DESCRIPTION
1	ENCLOSURE, SQUARE D #CQ018M100RB100
2	BREAKER, 100A 2 POLE MAIN, SQUARE D
3	25mm (1") RIGID PVC CONDUIT
4	25mm (1") TERMINAL ADAPTER
5	25mm (1") CONDUIT HUB
6	#6 RWU90 GREEN and 2-#8 RWU90 (BLACK, WHITE)
7	32mm (1 1/4") RIGID PVC CONDUIT
8	32mm (1 1/4") CONDUIT HUB
9	32mm (1 1/4") SERVICE ENTRANCE FITTING (WEATHERHEAD)
10	32mm (1 1/4") CONDUIT STRAP
11	#8 RWU90 (GREEN, RED, BLACK, WHITE)
12	2438.4mm (8') GALVANIZED METAL U-CONDUIT GUARD
13	50mm (2") TERMINAL ADAPTER
14	50mm (2") RIGID PVC CONDUIT
15	#3 T-90 (BLACK, RED, WHITE)
16	32mm (1 1/4") COUPLER (AS REQUIRED, NOT SHOWN)
17	13mm (1/2") RIGID PVC CONDUIT w/ #8 T-75 GREEN
18	EXPANSION JOINT

- NOTES -

- 1) ALL MATERIAL SUPPLIED BY CONTRACTOR UNLESS OTHERWISE SPECIFIED.
- 2) WEATHERHEAD TO BE MOUNTED 305mm BELOW SECONDARY CIRCUIT.
- 3) POWER PANEL TO BE MOUNTED 4180mm (13'8") FROM FINISHED GRADE.
- 4) PROVIDE MAIN SERVICE ENTRANCE GROUNDING IN ACCORDANCE WITH THE ELECTRICAL SAFETY CODE.
- 5) ALSO REFER TO SD-221a.
- 6) SERVICE CONDUITS INSTALLED AT WOOD POLES MUST BE PLACED AT SIDE OF POLE THAT IS AWAY FROM TRAFFIC FLOW.



CITY OF GUELPH STANDARD DRAWING

**TRAFFIC SIGNAL
& STREETLIGHTING POWER SUPPLY**

DATE: YY/MO/DAY
03/08/01

APPROVED BY:

REVISION: **R-04**
DATE: YY/MO/DAY
17/10/17



ENGINEERING

9 - 221

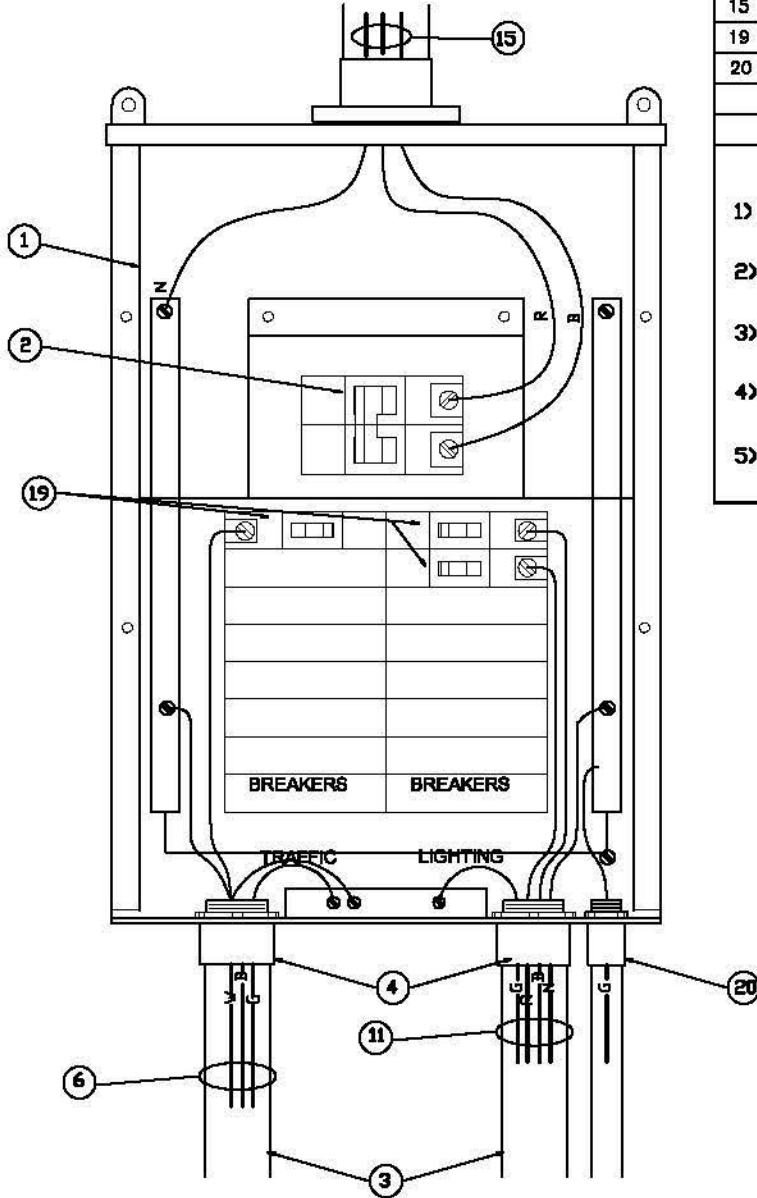
MATERIAL LISTING

ITEM	DESCRIPTION
1	ENCLOSURE, SQUARE D #CQ018M100RB100
2	BREAKER, 100A 2 POLE MAIN, SQUARE D
3	25mm (1") RIGID PVC CONDUIT
4	25mm (1") TERMINAL ADAPTER
6	#8 RWJ90 GREEN and 2-#8 RWJ90 (BLACK, WHITE)
11	#8 RWJ90 (GREEN, RED, BLACK, WHITE)
15	#3 T-90 (BLACK, WHITE, RED)
19	BREAKER, 30A SINGLE POLE, SQUARE D #Q0130
20	13mm (1/2") TERMINAL ADAPTER

- NOTES -

- 1) ALL MATERIAL SUPPLIED BY CONTRACTOR UNLESS OTHERWISE SPECIFIED.
- 2) WEATHERHEAD TO BE MOUNTED 305mm BELOW SECONDARY CIRCUIT.
- 3) MAIN PANEL TO BE MOUNTED 4180mm (13'8") FROM FINISHED GRADE.
- 4) PROVIDE MAIN SERVICE ENTRANCE GROUNDING IN ACCORDANCE WITH THE ELECTRICAL SAFETY CODE.
- 5) ALSO REFER TO SD-221

MAIN SERVICE ENTRANCE PANEL WIRING



CITY OF GUELPH STANDARD DRAWING

**TRAFFIC SIGNAL
& STREETLIGHTING POWER SUPPLY**

DATE: YW/MO/DAY
06/03/01

APPROVED BY:

REVISION: **R-3**

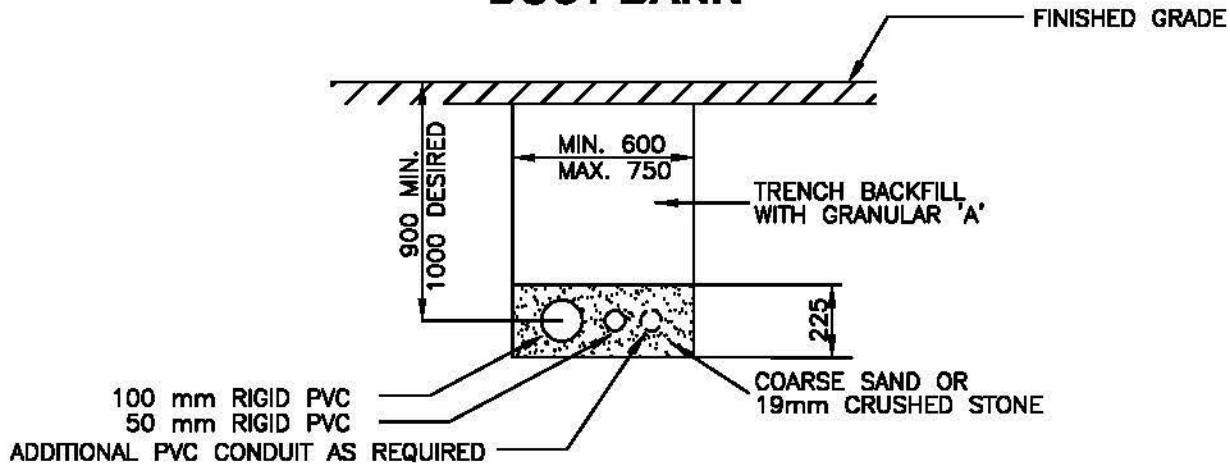
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14/11/24



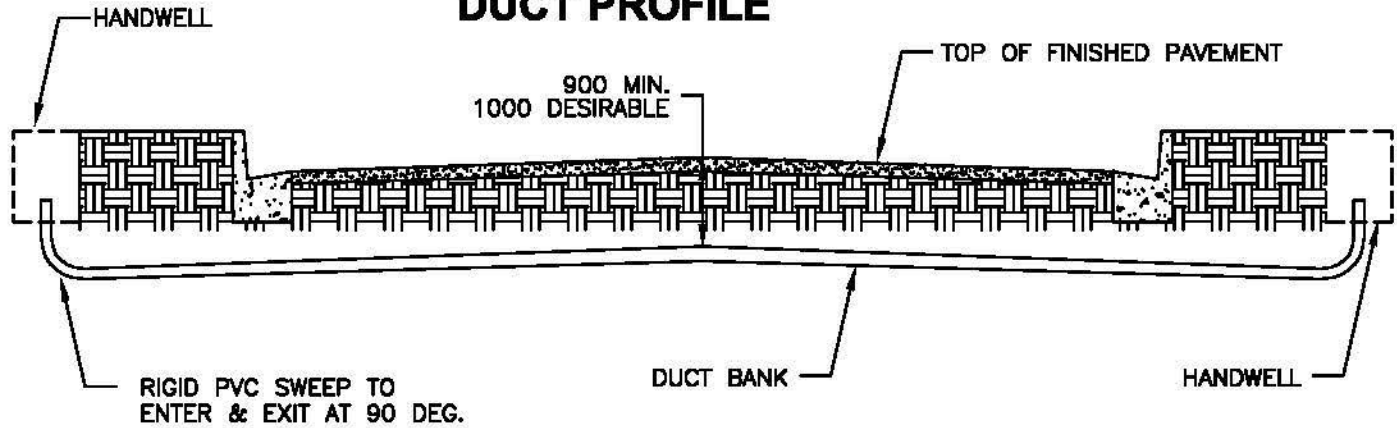
ENGINEERING

9 - 221a

DUCT BANK



DUCT PROFILE



NOTES:

- A. CAUTION TAPE TO BE PLACED ABOVE RIGID PVC AS REQUIRED BY ESA.
- B. ALL DIMENSIONS IN mm UNLESS OTHERWISE SHOWN.

CITY OF GUELPH STANDARD DRAWING

DATE: Y/Y/M/DAY
07/01/06



APPROVED BY:

CITY ENGINEER

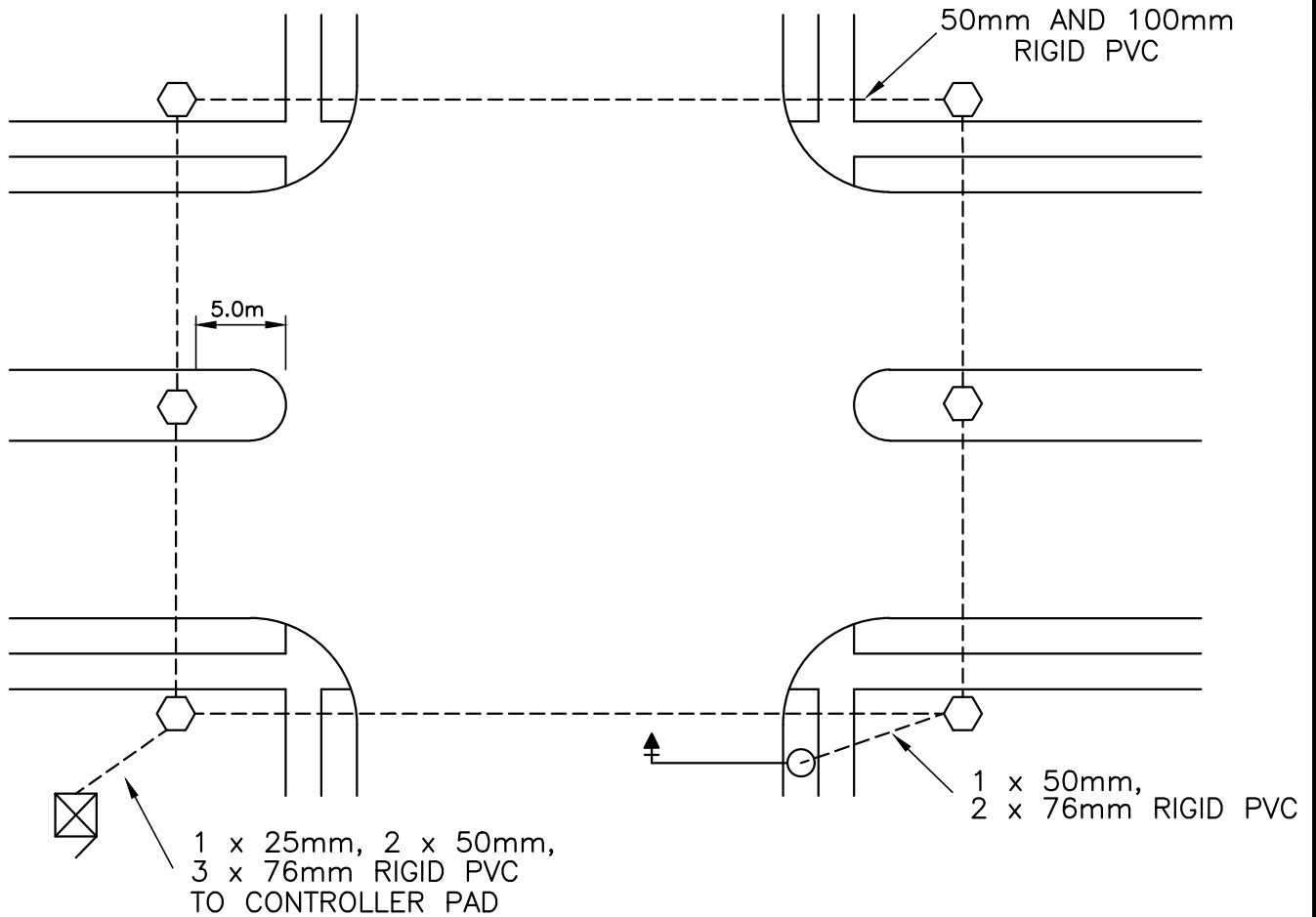
ENGINEERING

RIGID PVC CONDUIT BANK AND PROFILE FOR TRAFFIC SIGNALS

REVISION: R-

DATE: Y/Y/M/DAY

9 - 222



NOTES:

1. 1/2 INCH MULE TAPE TO BE PLACED IN EACH DUCT AS WELL AS #6 GROUND WIRE.
2. HANDWELLS TO BE OFFSET A MINIMUM OF 0.50m FROM SIDEWALK WHERE POSSIBLE.
3. SPLICED WIRING CONNECTIONS ARE NOT PERMITTED IN HANDWELLS.
4. ADDITIONAL RIGID PVC MAY BE REQUIRED FOR ONTERCONNECT AND RAILWAY PRE-EMPTION. REFER TO TRAFFIC SIGNAL PLAN FOR EXACT RIGID PVC CONDUIT REQUIREMENTS.
5. HANDWELL SIZES WILL BE SPLICED ON THE TRAFFIC SIGNAL PLAN.

CITY OF GUELPH STANDARD DRAWING

TYPICAL TRAFFIC CONDUIT LAYOUT FOR SIGNALIZED INTERSECTIONS

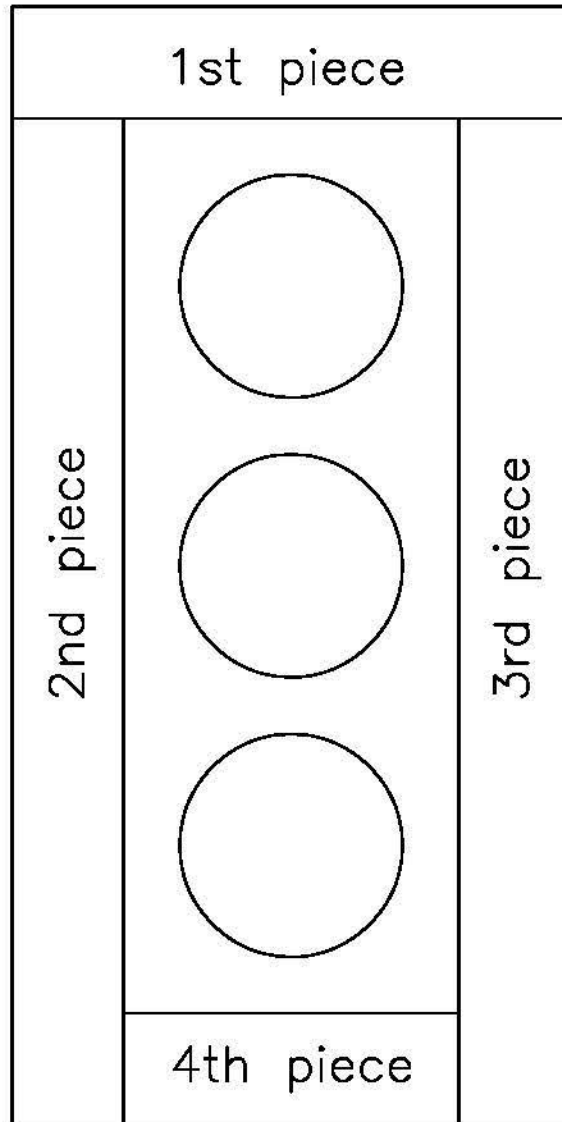
DATE: YY/ MO/ DAY
07/01/05

APPROVED BY:

REVISION: **R-5**
DATE: YY/ MO/ DAY
19/12/20



9 - 223



NOTES:

1. REFLECTIVE TAPE TO BE INSTALLED PRIOR TO INSTALLATION IN FIELD.
2. ENSURE THE SURFACE IS CLEAN AND FREE OF DUST, GREASE OR DIRT.
3. THE TAPE IS TO BE APPLIED WHEN THE SURROUNDING AIR TEMPERATURE IS 10 DEGREES CELCIUS OR GREATER.
4. PIECES SHOULD BE BUTTED TOGETHER AND NOT OVERLAPPED.
5. TRIM ANY AND ALL EDGES WITH A SHARP KNIFE.

CITY OF GUELPH STANDARD DRAWING

DATE: YY/MO/DAY
09/11/25



**REFLECTIVE MARKING TAPE
SIGNAL HEAD DETAIL**

APPROVED BY:

CITY ENGINEER

ENGINEERING

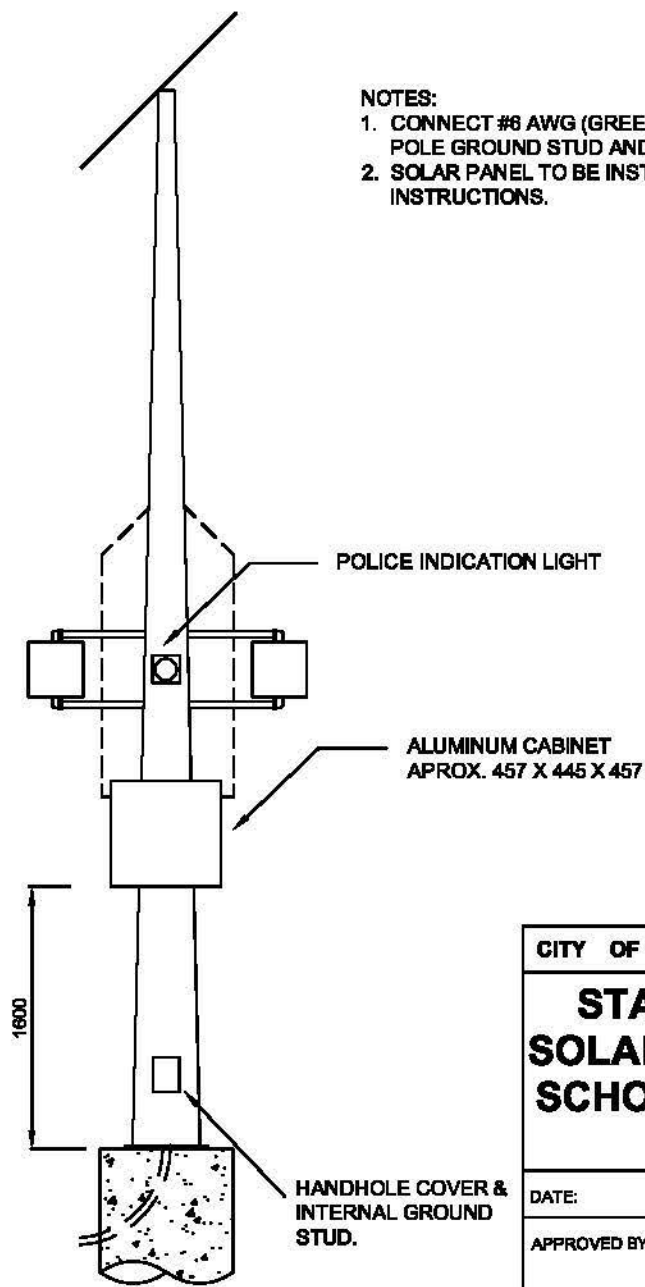
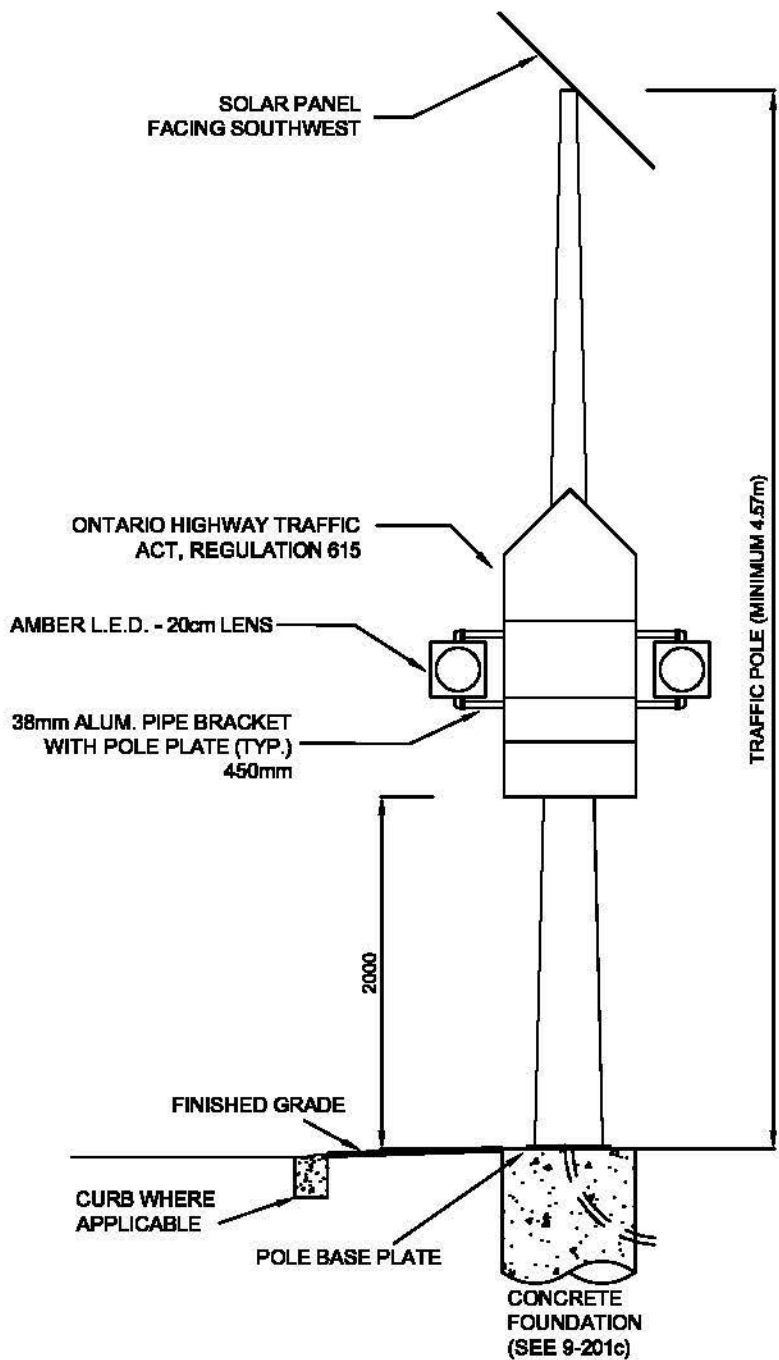
REVISION:

DATE: YY/MO/DAY

9 - 224

FRONT

BACK



NOTES:

1. CONNECT #8 AWG (GREEN) GROUND WIRE BETWEEN THE POLE GROUND STUD AND GROUND PLATE.
2. SOLAR PANEL TO BE INSTALLED AS PER MANUFACTURER'S INSTRUCTIONS.

CITY OF GUELPH STANDARD DRAWING

**STANDARD TYPICAL
SOLAR FLASHING 40km/h
SCHOOL ZONE SIGNAGE
DETAIL**

DATE: YY/MO/DAY
13/12/10

APPROVED BY:

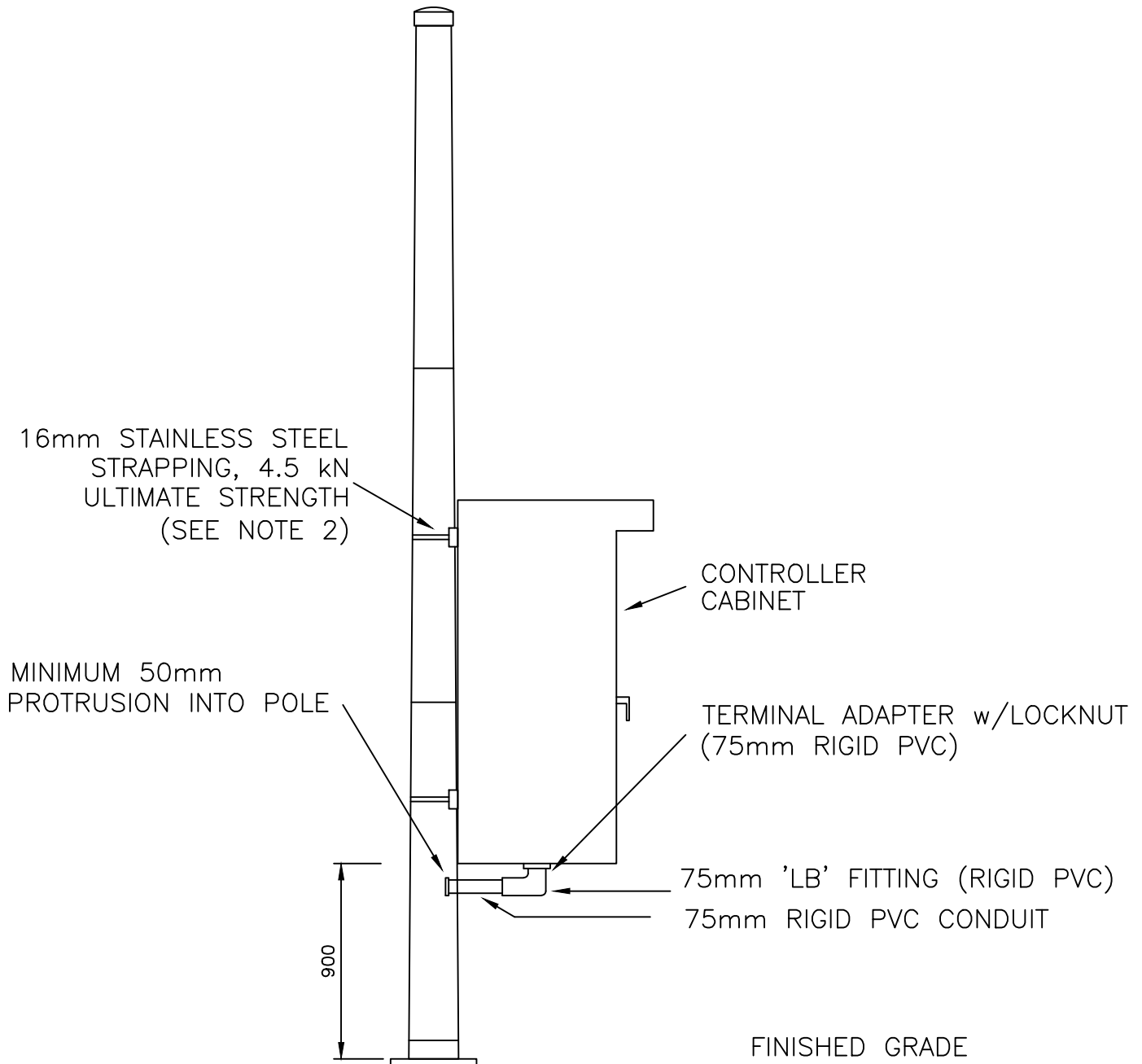
REVISION: YY/MO/DAY



ENGINEERING


9 - 225

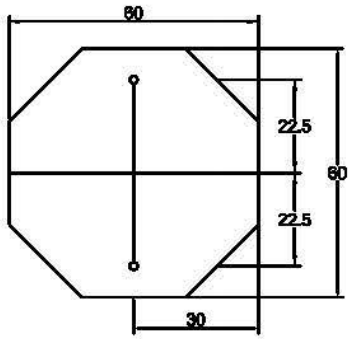
NOTE: ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED.



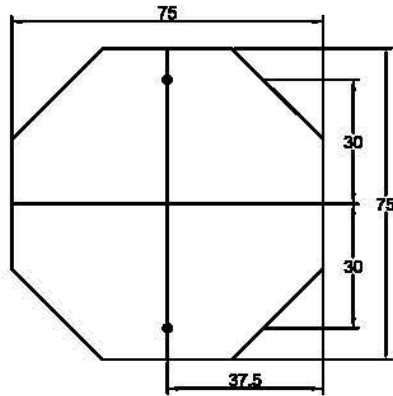
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES
2. MINIMUM TWO (2) STRAPS REQUIRED FOR FOUR PHASE CABINET.
MINIMUM SIX (6) STRAPS REQUIRED FOR EIGHT PHASE CABINET.
3. IN 4 PHASE TRAFFIC CABINET 50mm 'LB' FITTING (RIGID PVC) IS PERMISSIBLE

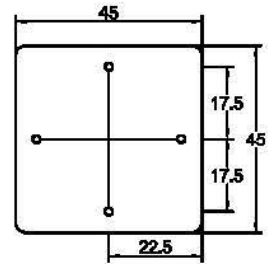
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	<p>APPROVED BY: _____</p>	
<p align="center">POLE MOUNTED TRAFFIC SIGNAL CONTROLLER CABINET INSTALLATION</p>	<p>REVISION: 1.1</p>	<p align="center">9 - 226</p>
	<p>DATE: YY/ MO/ DAY 20/01/27</p>	



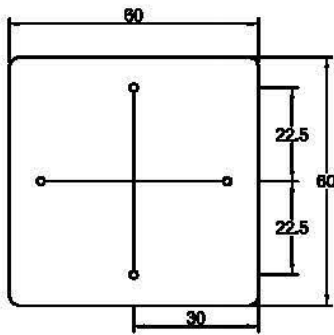
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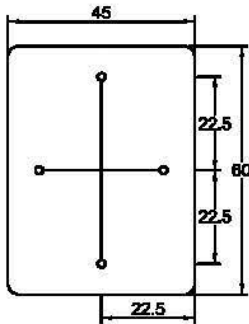
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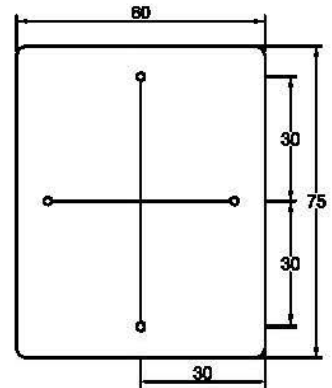
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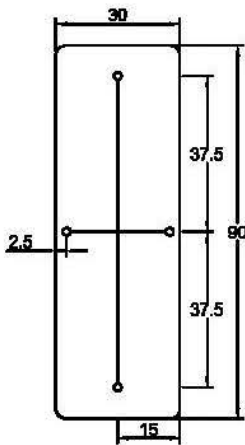
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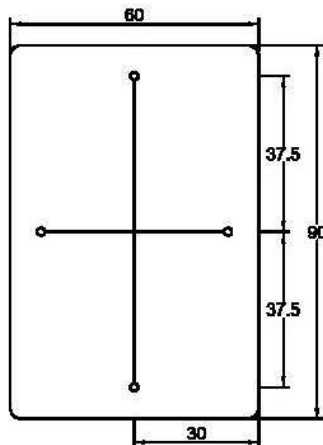
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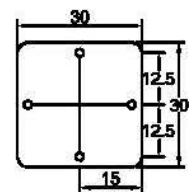
73105



73110



73115



73120

ALL DIMENSIONS IN CM.

CITY OF GUELPH STANDARD DRAWING

SIGN BLANKS

DATE: YY/MO/DAY
11/01/13

APPROVED BY:

CITY ENGINEER

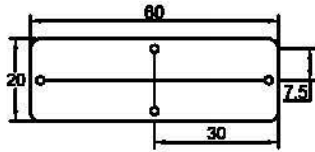
REVISION:

DATE: YY/MO/DAY

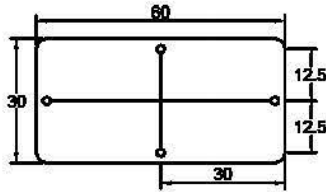


ENGINEERING

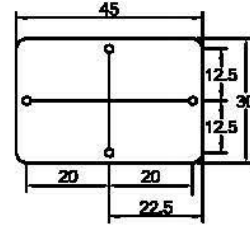
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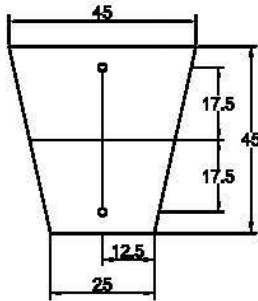
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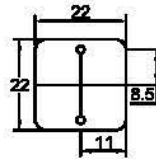
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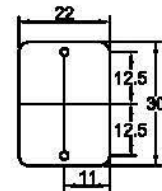
73165



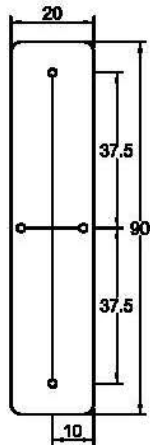
73170



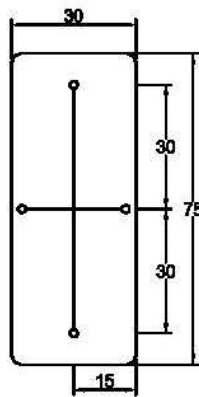
73176



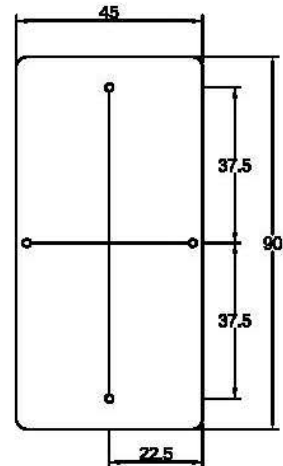
73177



73180



73185



73190

ALL DIMENSIONS IN CM.

CITY OF GUELPH STANDARD DRAWING

SIGN BLANKS

DATE: YY/MO/DAY
11/01/13

APPROVED BY:

CITY ENGINEER

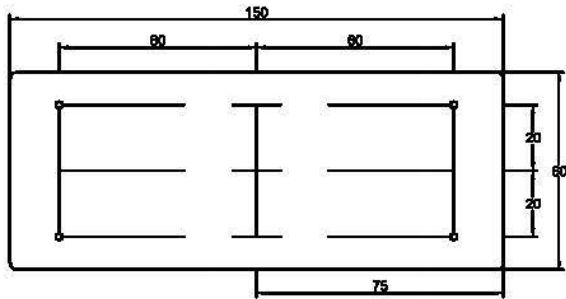
REVISION:

DATE: YY/MO/DAY

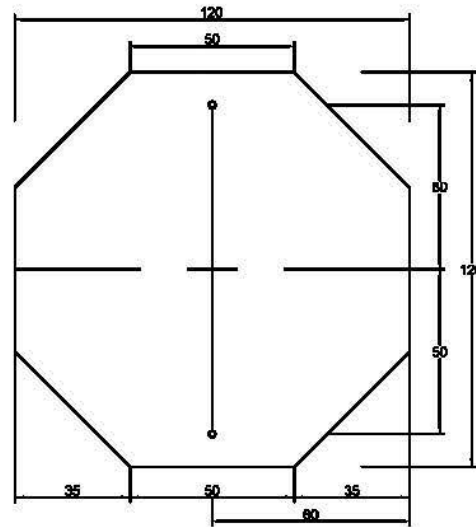


ENGINEERING

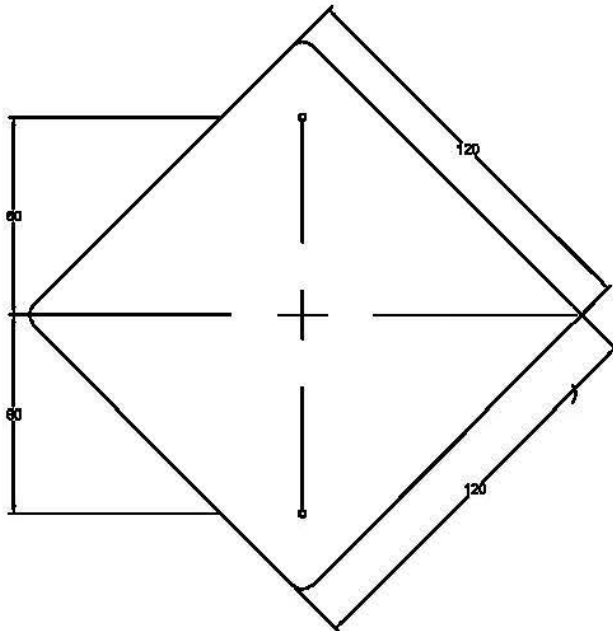
9 - 301



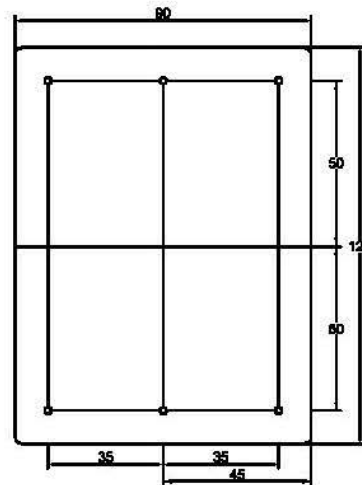
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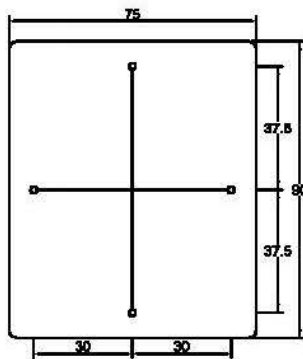
73205



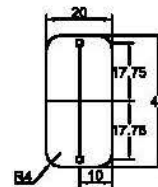
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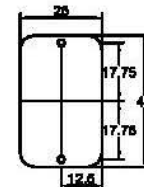
73220



73227



ELC GRID "A"



ELC GRID "B"

ALL DIMENSIONS IN CM.

CITY OF GUELPH STANDARD DRAWING

SIGN BLANKS

DATE: YY/MO/DAY
11/01/13

APPROVED BY:

CITY ENGINEER

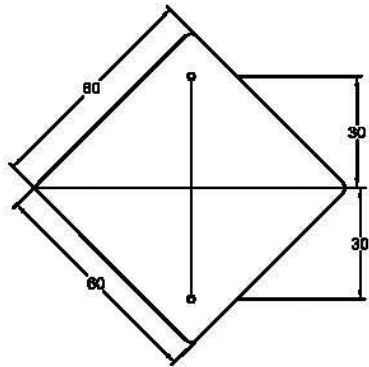
REVISION:

DATE: YY/MO/DAY

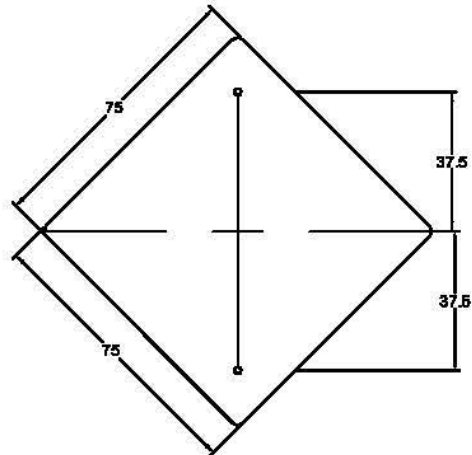


ENGINEERING

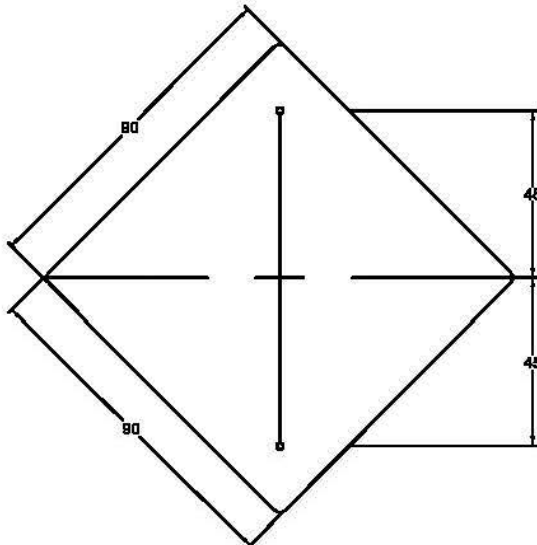
9 - 301



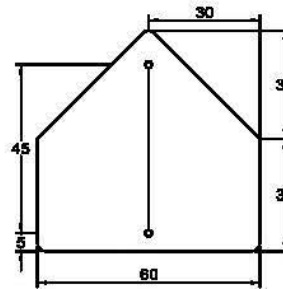
73125



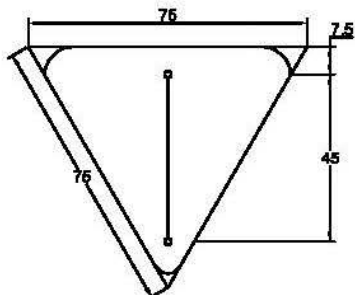
73130



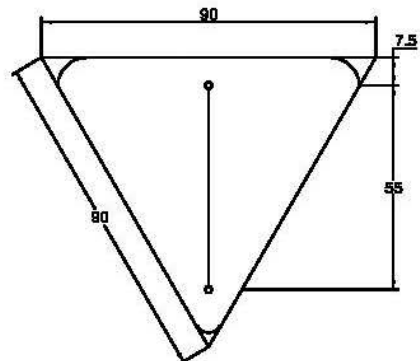
73135



73140



73145



73150

ALL DIMENSIONS IN CM.

CITY OF GUELPH STANDARD DRAWING

SIGN BLANKS

DATE: YY/MO/DAY
11/01/13

APPROVED BY:

CITY ENGINEER

REVISION:

DATE: YY/MO/DAY



ENGINEERING

9 - 301



**START
TO
CROSS**



FLASHING

**DO NOT START TO CROSS
FINISH CROSSING
IF STARTED**



SOLID

**DO NOT CROSS
PUSH BUTTON
WAIT FOR WALK SIGNAL**

SIZE: 22cm X 22cm

COLOUR:

LETTERING AND BORDER - BLACK

"WALK" SYMBOL - BLACK. BORDER - BLACK

"FLASHING HAND" SYMBOL - RED REFLECTIVE. BORDER - BLACK

"SOLID HAND" SYMBOL - RED REFLECTIVE. BORDER - BLACK

SHEETING:

WHITE - TYPE I ENGINEERING GRADE

CITY OF GUELPH STANDARD DRAWING

**DATE: YY/MO/DAY
11/01/13**



**PEDESTRIAN CROSSING
INSTRUCTION SIGN**

APPROVED BY:

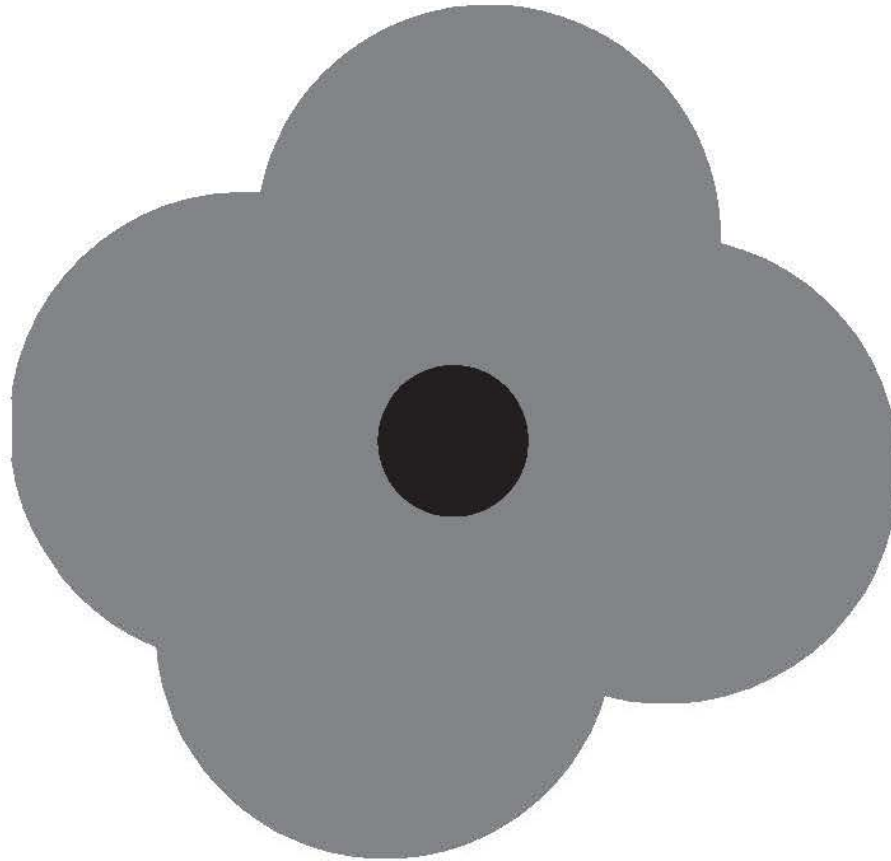
CITY ENGINEER

ENGINEERING


REVISION: YY/MO/DAY

DATE: YY/MO/DAY

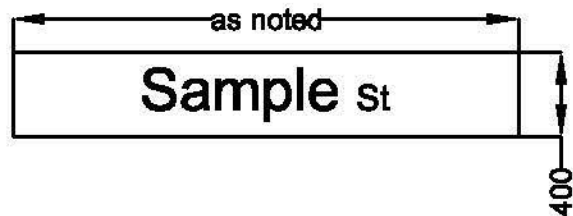
9 - 302



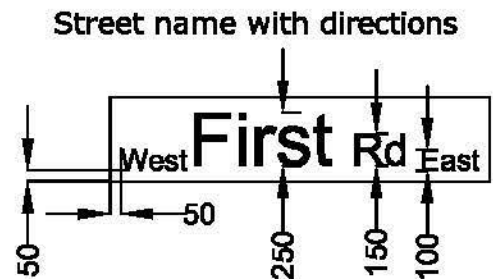
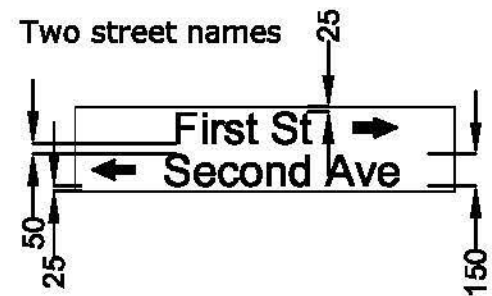
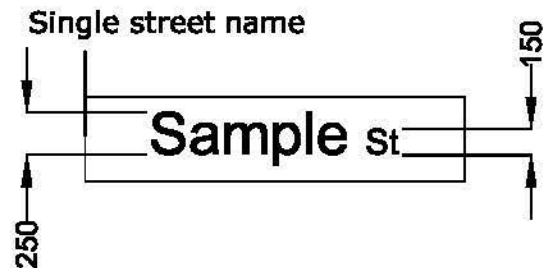
NOTES:
 COLOUR: RED NON-REFLECTIVE PETALS (106mm DIAMETER)
 BLACK NON-REFLECTIVE CIRCULAR CENTRE (18mm DIAMETER)
 POPPY DESIGN – ACTUAL SIZE

CITY OF GUELPH STANDARD DRAWING	DATE: YY/MO/DAY 11/01/13	
<p style="text-align: center;">POPPY DESIGN STREET NAME SIGN</p>	APPROVED BY: CITY ENGINEER	ENGINEERING
	REVISION: <input type="text"/>	9 - 303
	DATE: YY/MO/DAY	

Sign Blank



Letter Height



NOTES:

1. ALL MEASUREMENTS IN MILLIMETRES
2. BACKGROUND - 3M SAPPHERE BLUE TYPE I ENGINEERING GRADE REFLECTIVE SHEETING
3. LETTERING - WHITE TYPE I ENGINEERING GRADE SHEETING.
4. FONT - CLEARVIEW HWY 5-W
5. BRACKET: SENTINEL POLE & EQUIPMENT PART: VSMB-48 or VSMB-72 (DEPENDING ON LENGTH OF SIGN)

CITY OF GUELPH STANDARD DRAWING

OVERSIZE STREET NAME SIGN

DATE: 11/01/13

APPROVED BY:

CITY ENGINEER

REVISION: R-1

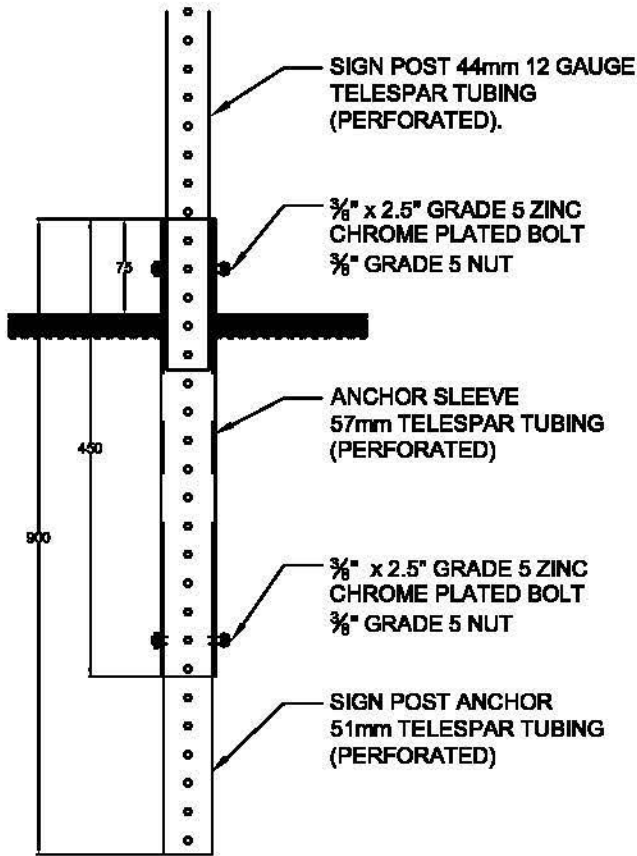
DATE: 13/01/25



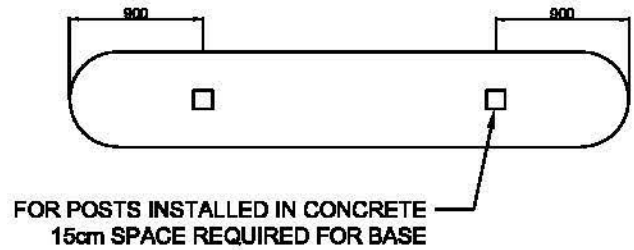
ENGINEERING

9 - 304

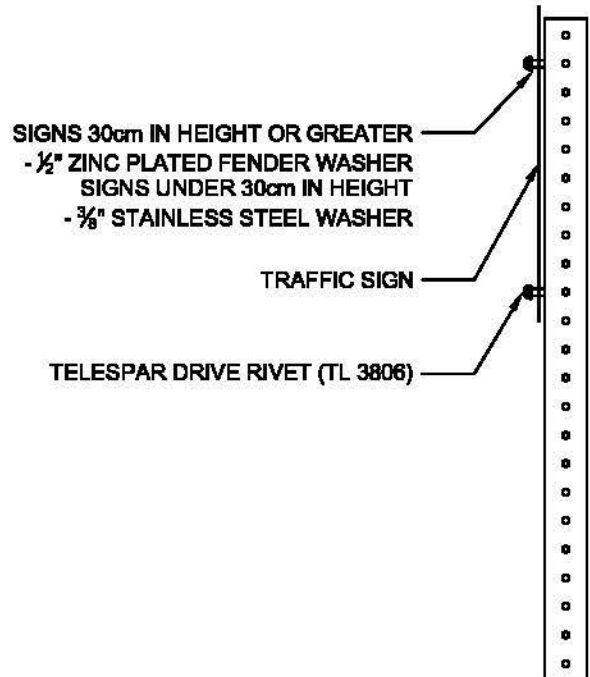
DETAIL 'A'



DETAIL 'B'



DETAIL 'C'



NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED.
2. THREE (3) HOLES ON ANCHOR SLEEVE TO BE ABOVE GRADE.
3. ANCHOR SLEEVE AND SIGN POST ANCHOR INSTALLED IN CONCRETE TO BE WRAPPED IN NON-POROUS MATERIAL BELOW GRADE.
4. DETAIL 'B' IS TYPICAL PLACEMENT FOR 'KEEP RIGHT' SIGNING ON A TRAFFIC ISLAND. IF A TRAFFIC SIGNAL POLE IS ERECTED BETWEEN LESS THAN 3m FROM THE END OF ISLAND, SIGNING SHALL BE MOUNTED ON TRAFFIC SIGNAL POLE.
5. ALL TRAFFIC SIGNS SHALL BE MOUNTED ON TELES PAR POST (EXCEPT WHERE CO-USAGE OF UTILITY OR TRAFFIC POLES IS POSSIBLE).

CITY OF GUELPH STANDARD DRAWING

TELES PAR INSTALLATION DETAIL

DATE: **11/01/13**

APPROVED BY:

CITY ENGINEER

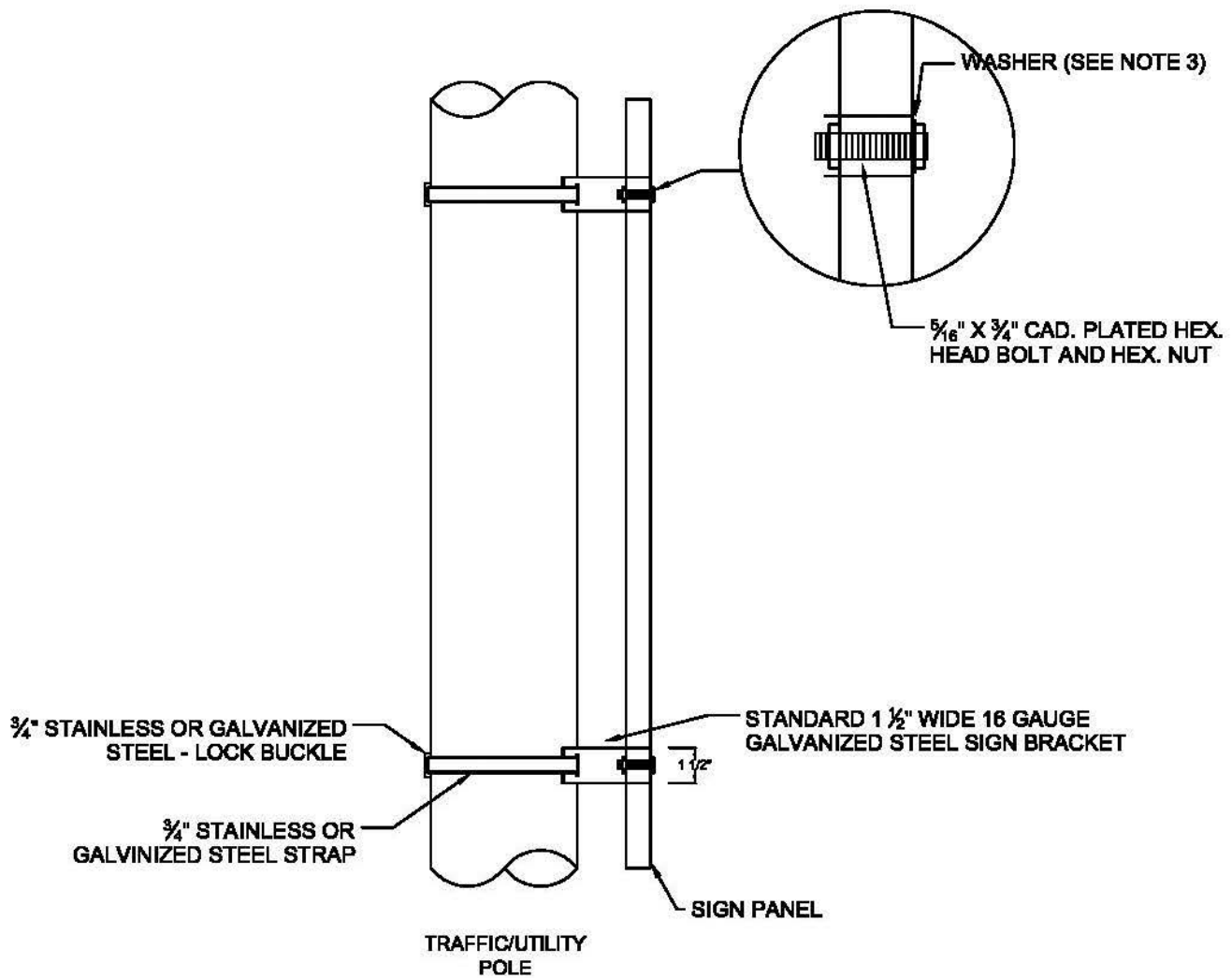
REVISION: **R-1**

DATE: **14/01/28**



ENGINEERING

9 - 305



NOTES:

1. USE 2 CLAMPS FOR SIGNS LESS THAN 122cm (48") IN HEIGHT.
2. USE 3 CLAMPS FOR SIGNS MORE THAN 122cm (48") IN HEIGHT.
3. FOR SIGNS 30cm IN HEIGHT OR GREATER USE $\frac{1}{2}$ " ZINC PLATED FENDER WASHER.
FOR SIGNS 30cm IN HEIGHT OR LESS USE $\frac{3}{8}$ " STAINLESS STEEL WASHER.

CITY OF GUELPH STANDARD DRAWING

DATE: YY/MO/DAY
11/01/18



SIGN MOUNTING BRACKETS

APPROVED BY:

CITY ENGINEER

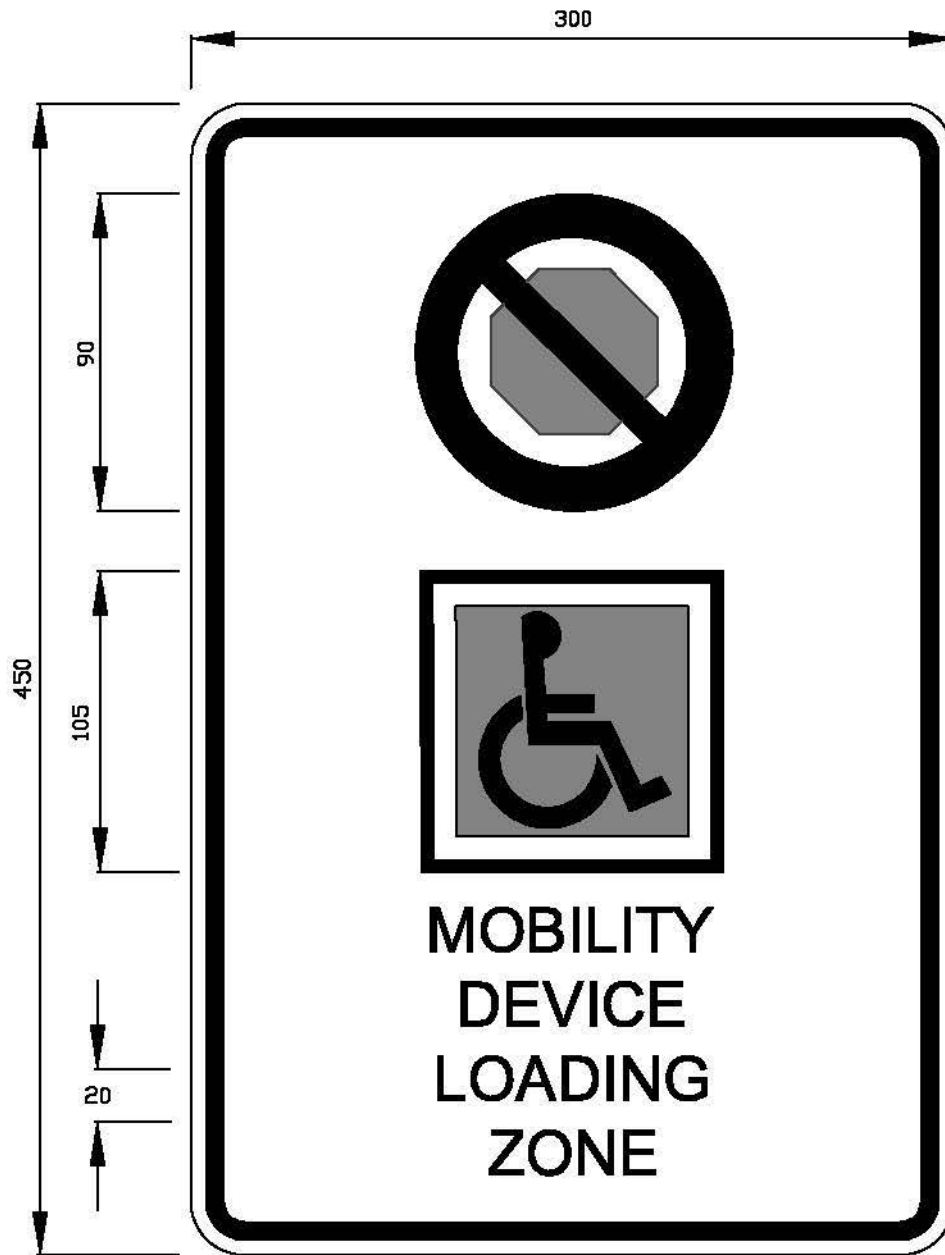
ENGINEERING

REVISION:

DATE:


YY/MO/DAY

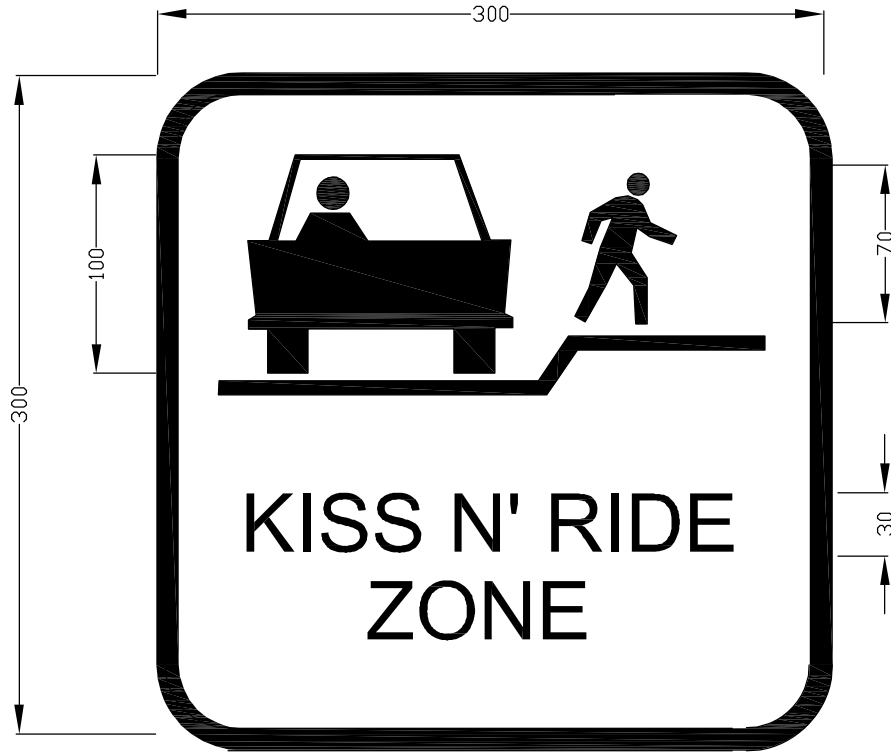
9 - 306



NOTES:


1. ALL MEASUREMENTS IN MILLIMETRES
2. BACKGROUND - WHITE TYPE I ENGINEERING GRADE SHEETING
3. NO STOPPING - BLACK NON-REFLECTIVE
4. INTERDICTIONARY SYMBOL - RED REFLECTIVE
5. WHEEL CHAIR SYMBOL - 3M SAPPHIRE BLUE TYPE I ENGINEERING GRADE SHEETING
6. FONT - HELVETICA BOLD CONDENSED. BLACK NON-REFLECTIVE

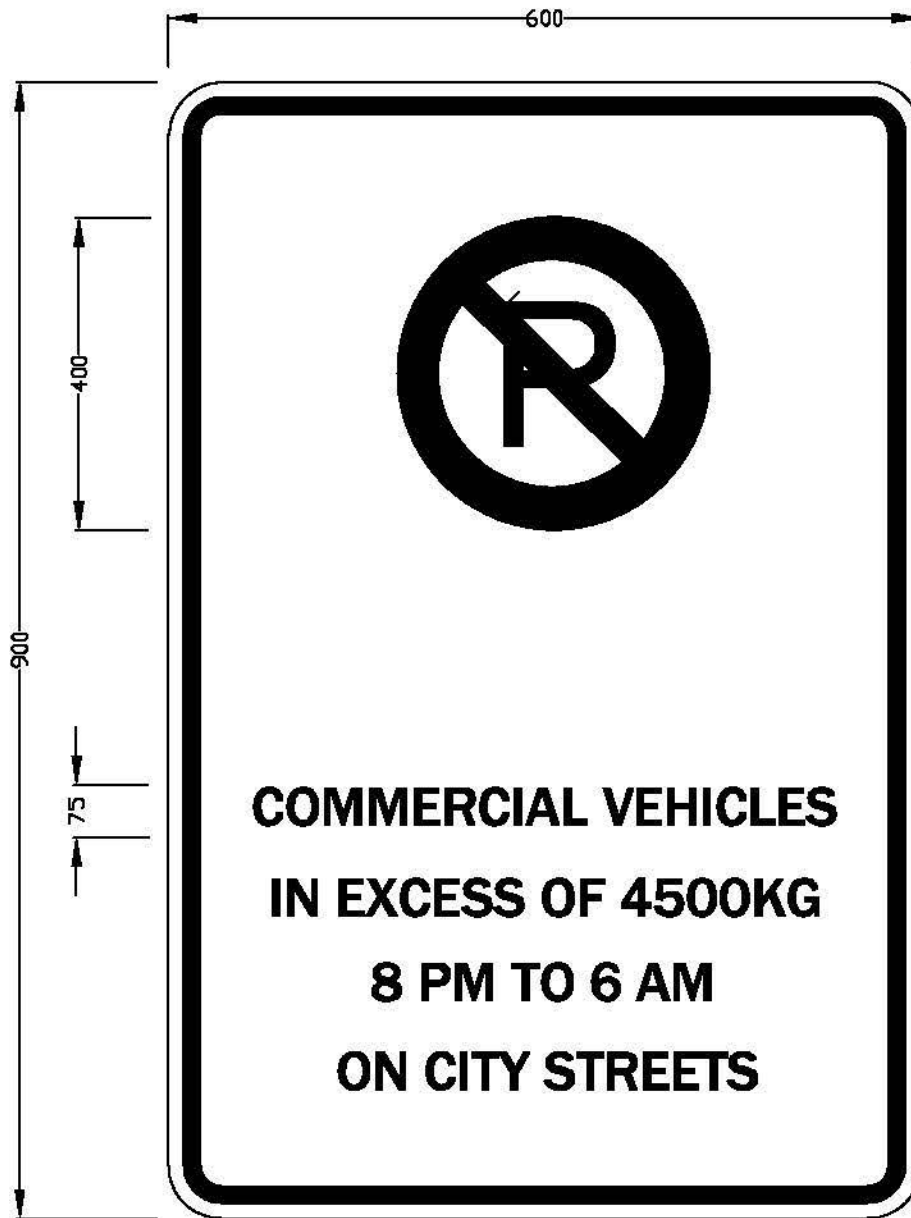
CITY OF GUELPH STANDARD DRAWING	DATE: YY/ MO/ DAY 14/12/02	 <small>Making a Difference</small>
<p style="text-align: center;">MOBILITY DEVICE LOADING ZONE - SIGN DETAIL</p>	APPROVED BY: _____	
	REVISION: _____	9 - 307
	DATE: YY/ MO/ DAY	



NOTES:


- ALL MEASUREMENTS IN MILLIMETRES
- BACKGROUND - 3M SAPPHIRE BLUE TYPE I ENGINEERING GRADE SHEETING
- SYMBOLS & TEXT - WHITE REFLECTIVE
- FONT - HIGHWAY GOTHIC 'C' BLACK NON-REFLECTIVE
- CAR SYMBOL AS PER Wc-5
- PEDESTRIAN SYMBOL AS PER Wc-7 REVERSED

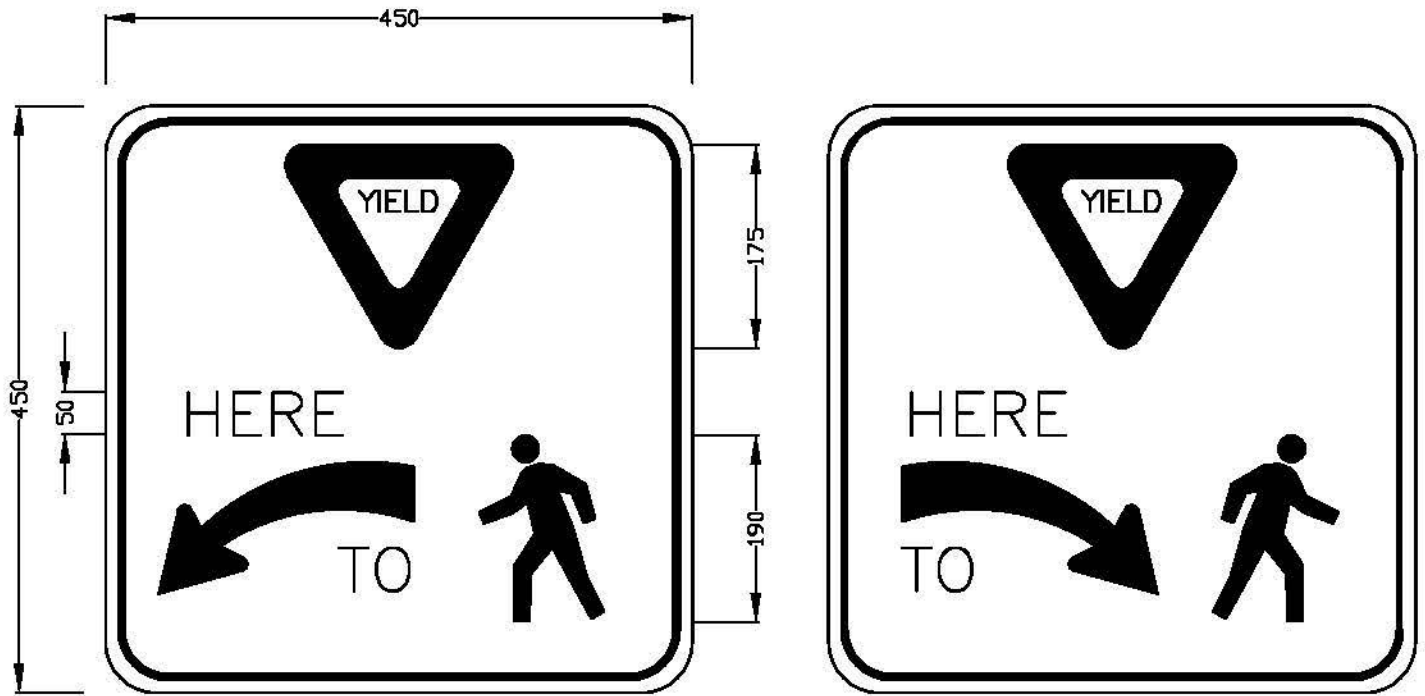
<p>CITY OF GUELPH STANDARD DRAWING</p>	<p>DATE: <small>YY/ MO/ DAY</small> 14/12/02</p>	
<p align="center">KISS N' RIDE ZONE - SIGN DETAIL</p>	<p>APPROVED BY: _____</p>	<p align="center">ENGINEERING</p>
	<p>REVISION: _____</p>	<p align="center">9 - 308</p>
	<p>DATE: <small>YY/ MO/ DAY</small></p>	



NOTES:

- ALL MEASUREMENTS IN MILLIMETRES
- BACKGROUND - WHITE TYPE I ENGINEERING GRADE SHEETING
- NO PARKING 'P' - BLACK NON-REFLECTIVE
- INTERDICTIONARY SYMBOL - RED REFLECTIVE
- FONT - HIGHWAY GOTHIC 'C' BLACK NON-REFLECTIVE

<p>CITY OF GUELPH STANDARD DRAWING</p>	<p>DATE: YY/MO/DA 14/12/02</p>	
<p>COMMERICAL VEHICLES PARKING - SIGN DETAIL</p>	<p>APPROVED BY: _____</p>	<p>ENGINEERING</p>
	<p>REVISION: _____ DATE: YY/MO/DA</p>	<p>9 - 309</p>



NOTES:

- ALL MEASUREMENTS IN MILLIMETRES
- BACKGROUND - WHITE TYPE I ENGINEERING GRADE SHEETING
- SYMBOLS & TEXT - BLACK NON-REFLECTIVE, EXCEPT "YIELD" RED RETROFLECTIVE
- FONT - HIGHWAY GOTHIC 'C'
- PEDESTRIAN SYMBOL AS PER Wc-7
- ARROW SYMBOL R10-6 REDUCED 50%

CITY OF GUELPH STANDARD DRAWING

DATE: YY/MO/DA
14/12/02



**YIELD HERE TO PEDESTRIANS
- SIGN DETAIL**

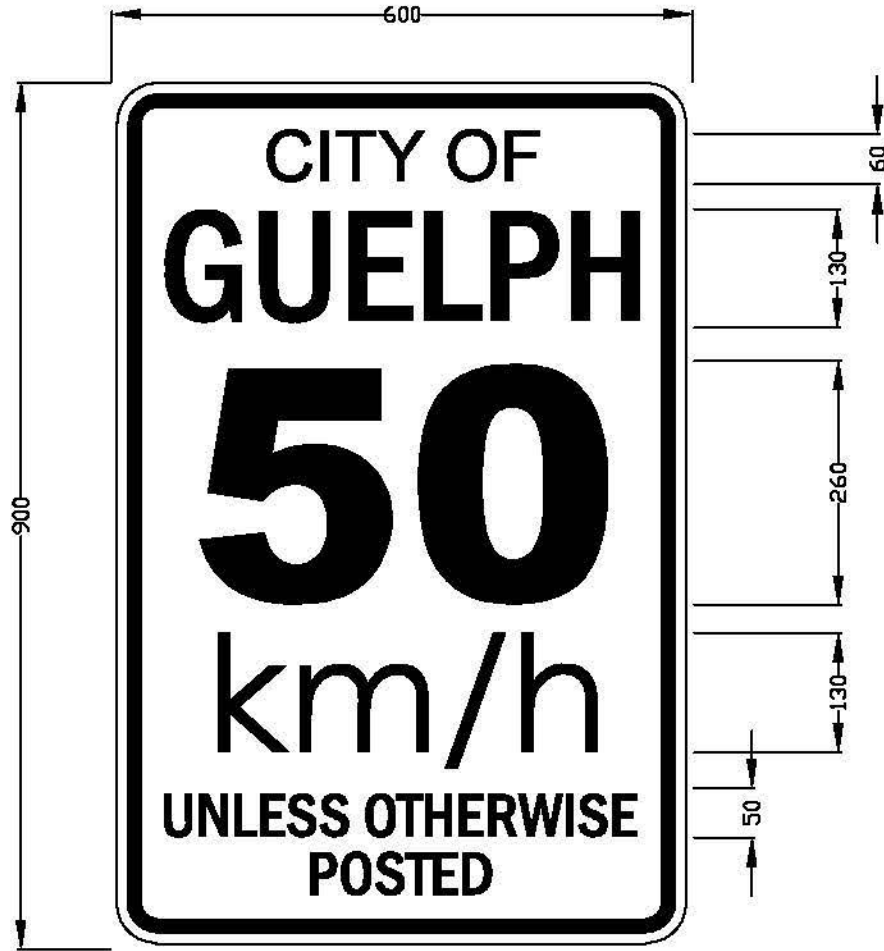
APPROVED BY:

REVISION: _____

DATE: YY/MO/DA

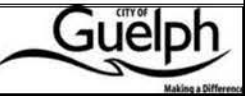
ENGINEERING

9 - 310



NOTES:


- ALL MEASUREMENTS IN MILLIMETRES
- BACKGROUND - WHITE TYPE I ENGINEERING GRADE SHEETING
- TEXT - 3275 BLUE 3M TYPE I ENGINEERING GRADE SHEETING
- FONT - HELVETICA BOLD CONDENSED

<p>CITY OF GUELPH STANDARD DRAWING</p>	<p>DATE: YY/MO/DA 14/12/04</p>	
<p>CITY OF GUELPH SPEED LIMIT - SIGN DETAIL</p>	<p>APPROVED BY: _____</p>	<p>ENGINEERING</p>
	<p>REVISION: _____</p>	<p>9 - 311</p>
	<p>DATE: YY/MO/DA</p>	

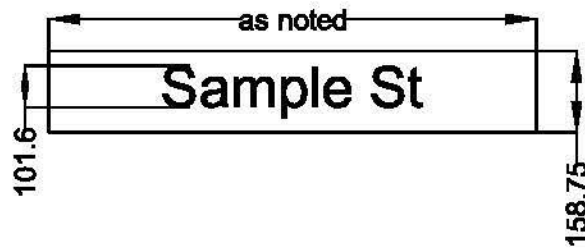


NOTES:

- ALL MEASUREMENTS IN MILLIMETRES
- BACKGROUND - WHITE TYPE I ENGINEERING GRADE SHEETING
- FONT - HELVETICA BOLD CONDENSED. BLACK NON-REFLECTIVE
- FINE AMOUNT MAY VARY. WILL BE SPECIFIED.


<p>CITY OF GUELPH STANDARD DRAWING</p>	<p>DATE: YY/MO/DA 14/12/02</p>	
<p>FOR ENFORCEMENT CALL - SIGN DETAIL</p>	<p>APPROVED BY: _____</p>	<p>ENGINEERING</p>
	<p>REVISION: _____</p>	<p>9 - 312</p>
	<p>DATE: YY/MO/DA</p>	

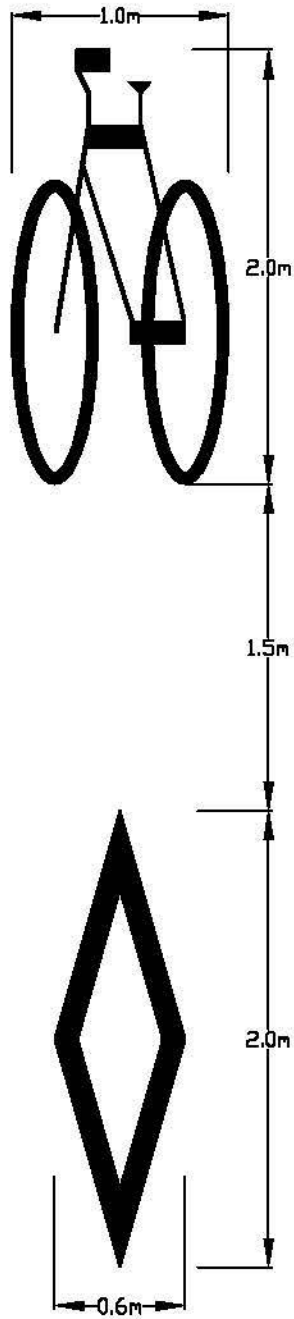
Sign Blank



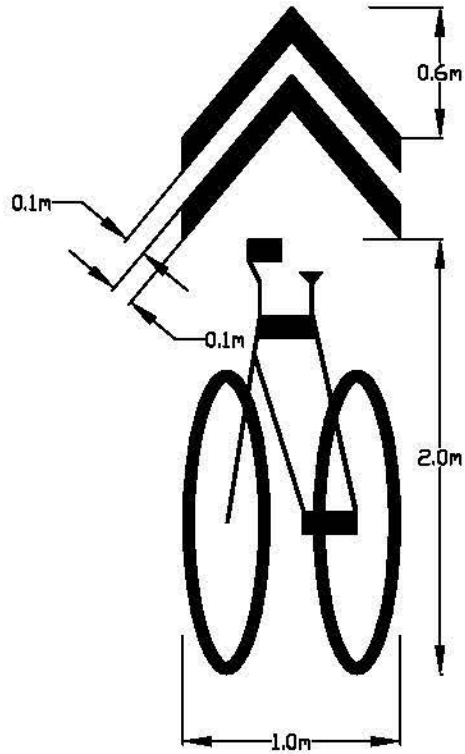
Notes:

1. ALL MEASUREMENTS IN MILLIMETRES
2. BACKGROUND - 3M SAPHIRE BLUE TYPE I ENGINEERING GRADE REFLECTIVE SHEETING
3. LETTERING - WHITE TYPE I ENGINEERING GRADE SHEETING.
4. FONT - HIGHWAY GOTHIC SERIES C (MIXED CASE)

CITY OF GUELPH STANDARD DRAWING	DATE: YY/MO/ DAY 17/11/08	
STREET NAME SIGN	APPROVED BY: _____ CITY ENGINEER	
		REVISION: DATE: YY/MO/ DAY 17/11/08



Bicycle Lane Pavement Marking



Sharrow Pavement Marking

NOTES:

1. SYMBOLS ARE WHITE.
2. SYMBOLS TO BE CENTRED WITHIN BICYCLE LANE.

CITY OF GUELPH STANDARD DRAWING

DATE: YY/MO/DA
15/03/03



**PAVEMENT MARKING DETAIL -
BICYCLE w/DIAMOND AND
BICYCLE w/SHARROW**

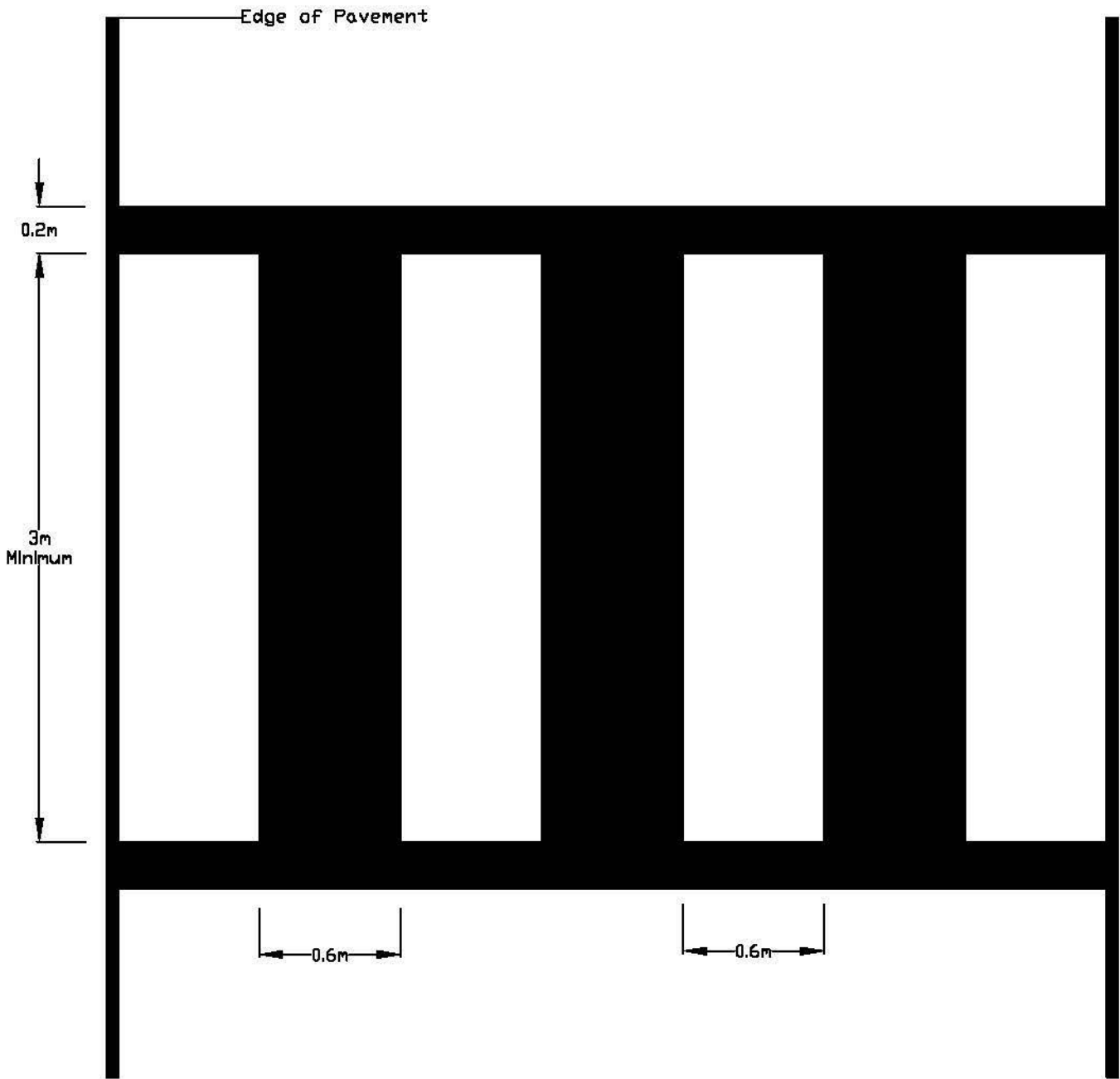
APPROVED BY:

REVISION: YY/MO/DA

DATE: YY/MO/DA


ENGINEERING

9 - 401

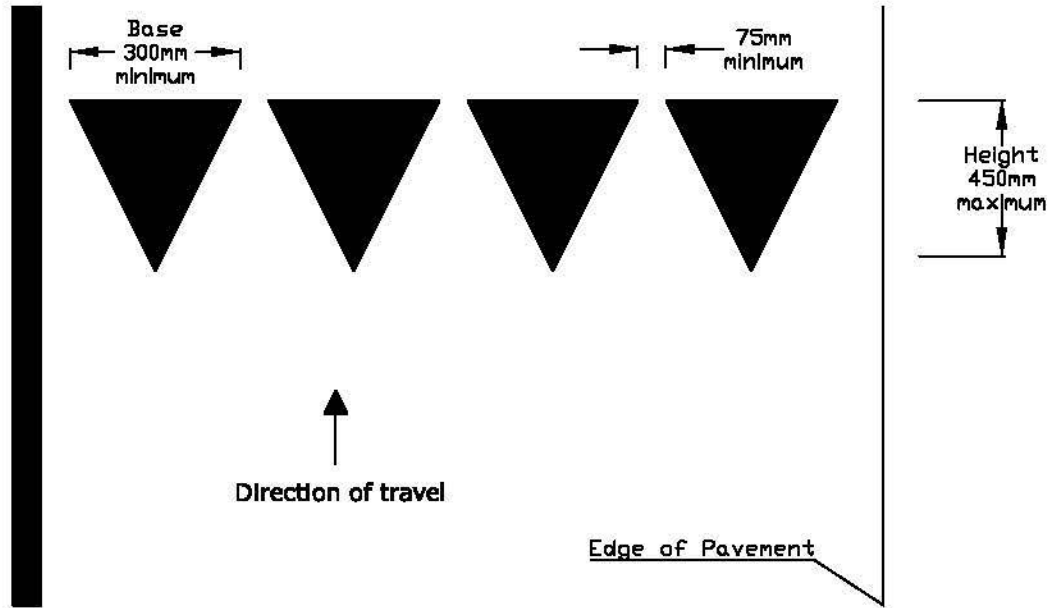


Notes:

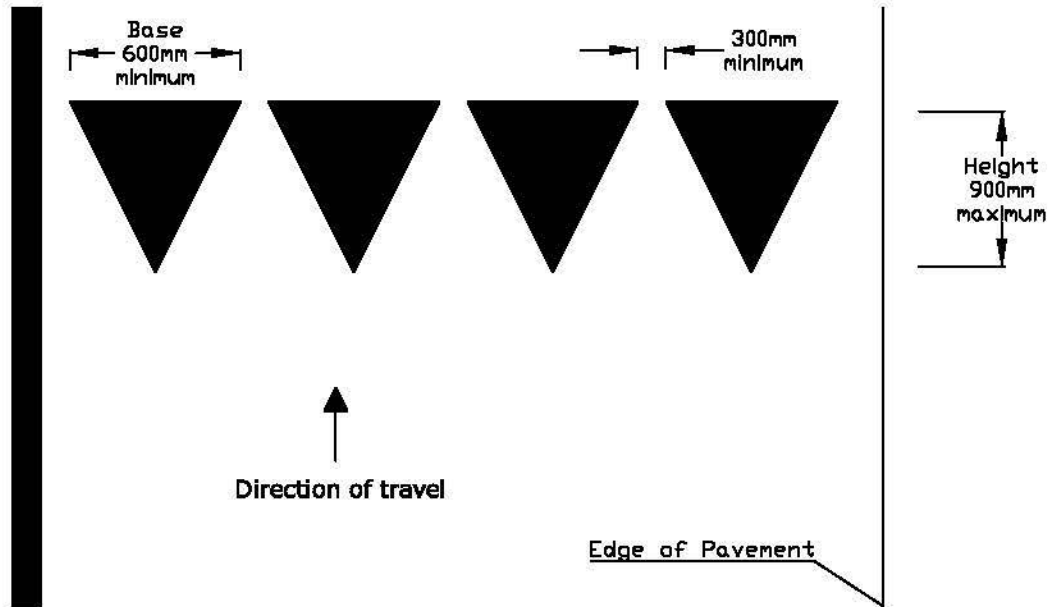
1. LADDERS ARE WHITE.
2. MARKINGS ARE TO BE DONE IN THERMOPLASTIC PAVEMENT MARKING MATERIAL.

CITY OF GUELPH STANDARD DRAWING	DATE: YY/MO/DAY 17/10/13	 <p>ENGINEERING</p>
<p align="center">PAVEMENT MARKING DETAIL - LADDER CROSSWALK</p>	APPROVED BY: _____	
	REVISION: _____	
	DATE: YY/MO/DAY	
		<p align="center">9 - 402</p>

Minimum



Maximum



Notes:

1. TRIANGLE HEIGHT IS EQUAL TO 1.5 TIMES THE BASE DIMENSION.
2. DIMENSIONS WILL VARY BASED ON THE ROAD GEOMETRY AND VEHICULAR SPEEDS AND VOLUMES.
3. MARKINGS ARE WHITE.
4. MARKINGS ARE TO BE DONE IN THERMOPLASTIC PAVEMENT MARKING MATERIAL.

CITY OF GUELPH STANDARD DRAWING

**PAVEMENT MARKING DETAIL -
YIELD TO PEDESTRIAN LINE**

DATE: YY/MO/DAY
17/10/13

APPROVED BY:

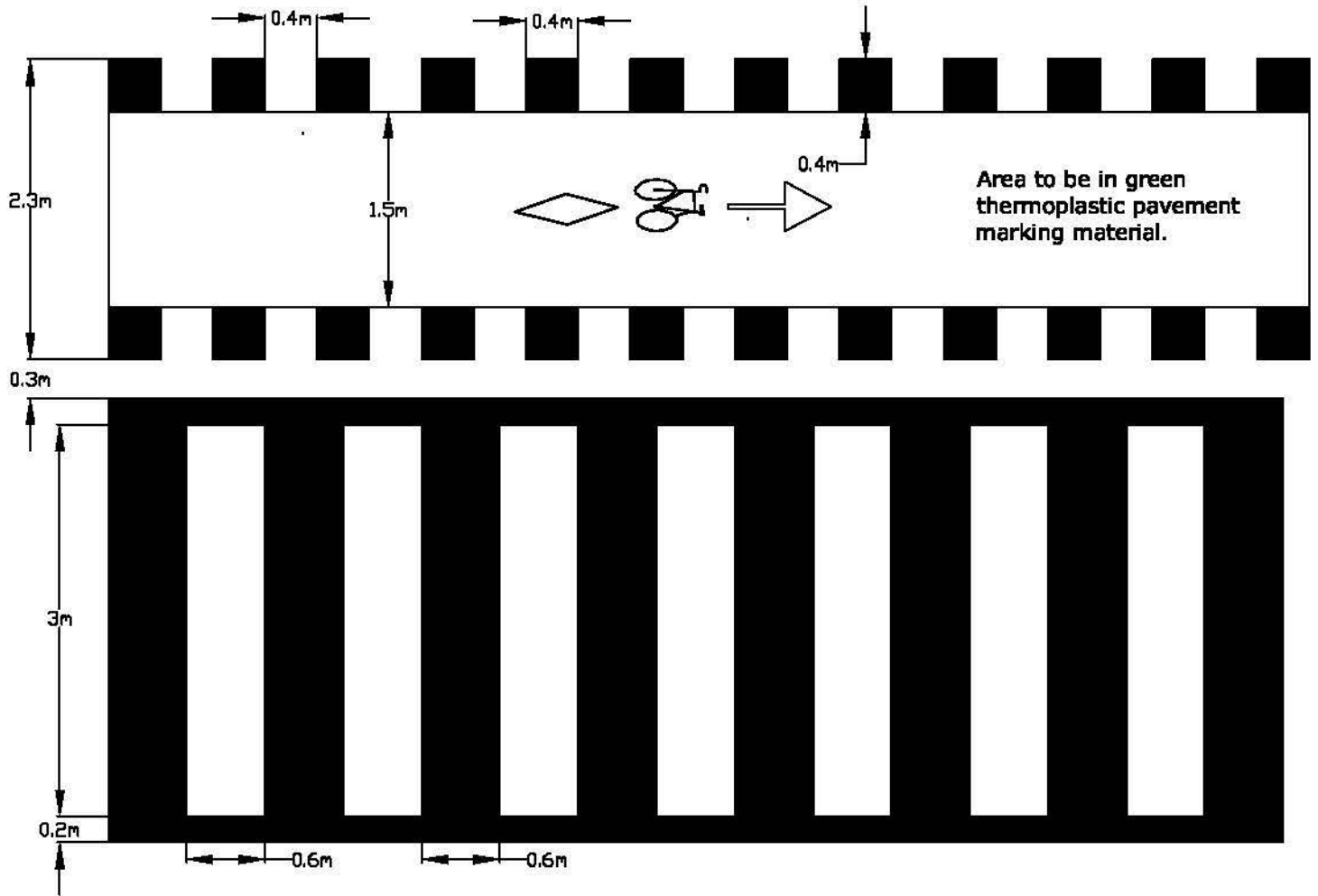
REVISION:

DATE: YY/MO/DAY



ENGINEERING

9 - 403



Notes:

1. ALL MARKINGS ARE WHITE, UNLESS OTHERWISE NOTED.
2. ALL MARKINGS ARE TO BE DONE IN THERMOPLASTIC PAVEMENT MARKING MATERIAL.
3. BICYCLE LANE PAVEMENT MARKINGS ARE TO BE AS PER FIGURE 4.26 IN THE ONTARIO TRAFFIC MANUAL BOOK 18 CYCLING FACILITIES.
4. THERE IS TO BE ONE BICYCLE LANE PAVEMENT MARKING PER CROSSING.

CITY OF GUELPH STANDARD DRAWING

DATE: YV/MO/DAY
18/02/01



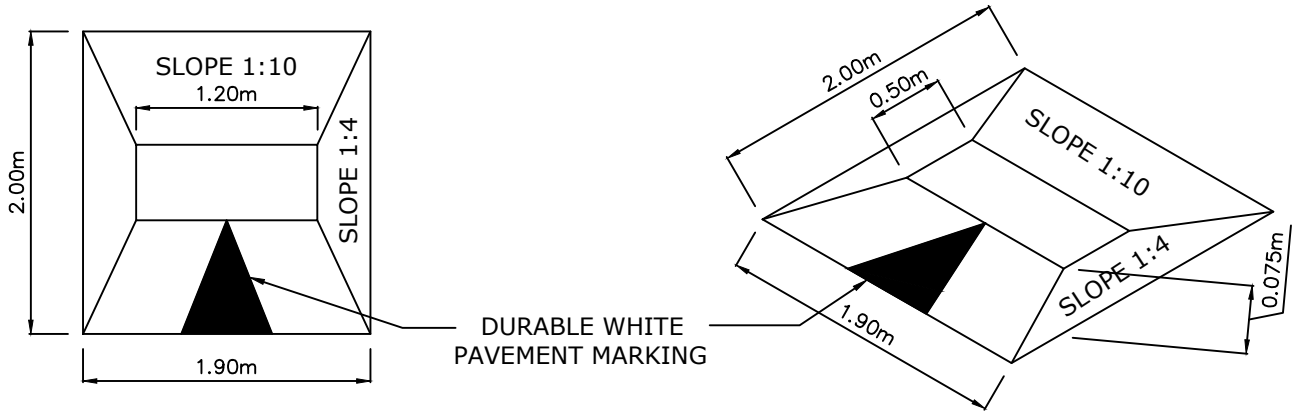
**PAVEMENT MARKING DETAIL -
SEPARATED CROSSRIDE (2.3M WIDTH)**

APPROVED BY:

ENGINEERING

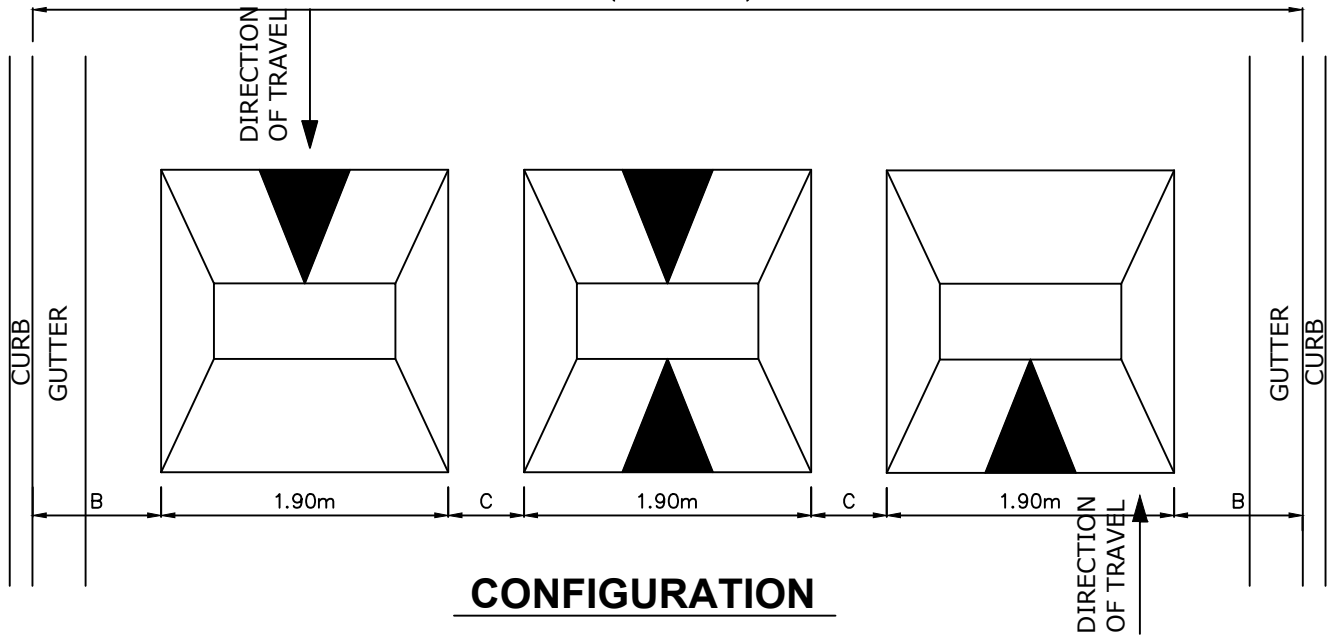
REVISION: _____
DATE: YV/MO/DAY

9 - 404



DIMENSIONS

A (ROAD WIDTH)



CONFIGURATION

GENERAL LAYOUT			
ROAD WIDTH A	No. OF CUSHIONS	DIMENSIONS *	
		B	C
8.0m	3	0.75m	0.40m
9.0m	3	1.10m	0.55m
10.0m	3	0.60m	0.40m
11.0m	4	1.00m	0.46m

* -TO BE CONFIRMED BY TRANSPORTATION ENGINEERING

CITY OF GUELPH STANDARD DRAWING

SPEED CUSHION DESIGN

DATE: YY/MO/ DAY
19/11/26

APPROVED BY:

REVISION:

DATE: YY/MO/ DAY



ENGINEERING

9 - 405